Reflections on International Relief Work

Original Research
Interprofessional Education in a Gross Anatomy Course

Systematic Review
Alcohol and Community-based Violence

Commentary
Antimicrobial Resistance as a Public Health Concern
FROM THE EDITORS
3 Preface
K. Huth, J. Lukovic

ORIGINAL RESEARCH
4 Evaluation of a Pilot Student-Run General Surgery Lecture Series at McMaster University
T. Chan, A.N. Rajaee, L. Parkes, E. Parvez, J. Hoogenes, S. Basi, K. Li, M. Guirguis, N. Gill, M. Kowalczuk

11 Dissecting Through Barriers: Findings from a Pilot Study on the Effect of Interprofessional Education in a Gross Anatomy Course
S. Chan, K. Tsui, L. De Meester, V. Lacharite, G. Oomen, B. Wainman, P. Solomon

16 Pharyngitis in the Emergency Department: An Evaluation of the McIsaac Clinical Decision Rule in Practice
E. Aaronson, N. Ludwig, I. Price

LITERATURE, THE ARTS & MEDICINE
21 Perspectives on Palliative Care
K. Huth, J. Sproat

23 For Jim
P. Dillon

24 “Chasing Daylight” – Excerpts from a Homily
Rev. J. Lougheed

25 Lessons from a Palliative Patient
T. Hoppe

26 The Moment
A. Jakda

27 Struggles with a “Benign” Brain Tumour
B. Rieger

CLINICAL REVIEW
29 Alcohol and Community-Based Violence: A Systematic Review of Evidence and Control Policies
C. Heung, J. LeMar, B. Rempel

35 Effect of Preoperative MRI on Lumpectomy Re-Operation Rates in Breast Cancer
A. Bang, S. Dason

39 Evaluation and Management of Ischemic Stroke
L. Lu

45 Learning Anatomy for Use Beyond the Classroom: A Guide for Medical Students
L. De Meester

49 Sleep Apnea
M. Au, S. Banglawala, A. Banglawala, R. Ng

COMMENTARY
71 From Awareness to Advocacy: Empowering Healthcare Professionals to Address the Social Determinants of Health
K. Huth, D. Raphael

74 Patient Advocacy in a Social Healthcare System
A. Mulloy

CASE REPORT
77 Intrusive Thoughts in a Boy: A Case of Intermittent Explosive Disorder
W. Ng, J. Mejia

80 Primary Squamous Cell Carcinoma of the Ovary
E. Mahe, M. Sur

CLINICAL QUIZ
84 The Red Eye
S. Chan, J. Teichman

LITERATURE, THE ARTS & MEDICINE
88 The Connections Within
Greg McRoberts

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ON THE COVER: “Tuning In” by Nathan Ng
Nathan Ng is currently a second-year student at the Ontario College of Art and Design (OCAD) studying Graphic Design. His illustration reflects on the responsibility of physicians to advocate for patient health in the broadest sense.
Professionals in health-related fields are called to be lifelong learners, recognizing that new research continuously amends our understanding of disease processes and their management. Beyond the biomedical, our learning must encompass the unique challenges that affect our patients, shaped by the communities with which they identify. Our cover image (Ng) and a commentary on international relief work (Zubairi) encourage us to redefine the borders of our responsibility as healthcare providers. This year’s issue of the *McMaster University Medical Journal* (MUMJ) takes a broad look at the social and political context of health and disease, as we consider how to reflect its significance in our training.

One of our goals is to encourage learners to reflect on the social determinants of health. We feature an interview with Dr. Dennis Raphael, professor of health policy at York University and author of many works on the topic. *MUMJ* was also excited to collaborate with the Community Health Initiative for Medical Education (CHIME) for this year’s essay contest. The result of these efforts is a thoughtful discussion on how to incorporate socioeconomic variables into the medical curriculum (Raphael) and in the allocation of healthcare resources (Mulloy).

A number of our authors consider the role of public health initiatives in addressing systemic barriers to health. The impact of social context on alcohol-related violence is illuminated in a systematic review, along with suggestions for health policy changes to mitigate these destructive patterns (Heung et al.). One commentary offers lessons from the listeriosis outbreak, highlighting the infection control measures needed to protect vulnerable populations (Birk-Urovitz). Another essay discusses the implications of antimicrobial resistance (Tilak). Use of a clinical decision rule to guide the prescription of antibiotics in the emergency department is one strategy to slow the spread of resistant bacterial strains, while upholding judicious use of healthcare resources (Aaronson et al.).

How do future healthcare professionals learn to serve their patients on both an individual and population level? McMaster’s innovative approach to education fosters the lifelong learning needed to care for a community with diverse needs. Students take it upon themselves to develop norms in interprofessional teams (Chan S et al.), and also strive to shape their peers’ education through initiatives like a general surgery lecture series (Chan T et al.). Reading and contributing to academic journals is another way to connect with one’s colleagues. In this issue of *MUMJ*, McMaster trainees have authored clinical reviews of the diagnosis and management of sleep apnea (Au et al.) and stroke (Lu), as well as presenting interesting case reports (Mahe & Sur, Ng & Mejia).

Ultimately, patient values should guide our learning objectives, if we have the insight to ascertain them. This year’s Literature, the Arts and Medicine section features creative pieces by people experiencing palliative care (Huth & Sproat). The authors crystallize our awareness of how one’s psychosocial, cultural and spiritual milieu bears upon the experience of disease. Readers are also encouraged to develop their awareness of unique patient needs in a commentary on intellectual disability (Benassi).

We are excited to see *MUMJ* expanding, with an editorial board of 14 students and 20 faculty advisors selecting 19 articles for publication. We hope to continue to broaden our scope, by embracing a holistic approach to medicine and increasing interprofessional involvement in the Journal. Thank you to the authors, editors and our advisors for enabling us to publish articles that reflect the diverse interests and values of the McMaster healthcare community.

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Editor-in-Chief
Michael G. DeGroote School of Medicine, Class of 2011

Jelena Lukovic
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Evaluation of a Pilot Student-run General Surgery Lecture Series at McMaster University

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ABSTRACT
Current evidence suggests that exposure to general surgery in clerkship can change misconceptions and highlight positive aspects of the field. Yet residency decisions often antedate a medical student’s entry into surgical clerkship. Ways to facilitate earlier exposure in the pre-clerkship period have not been well-studied. The purpose of this study was to evaluate the effect of a didactic lecture series on student interest in general surgery and to provide guidance for future projects. We hypothesized that a lecture series delivered by medical students, in collaboration with staff surgeons, would increase interest in general surgery amongst pre-clerkship students. Seventy first- and second-year students of the Michael G. DeGroote School of Medicine (McMaster University) attended the six-week series and 34 attendees completed an evaluation form at the final session. Of the respondents, 35% (first year: 54%, n=7; second year: 25%, n=5) indicated that their interest in general surgery increased after this lecture series. First- and second-year students differed in their learning objectives: second-year students desired more in-depth teaching of procedures, while first-year students preferred a broader, simplified approach. Many students requested lengthening and broadening the series in subsequent years to include surgical subspecialties. We conclude that a lecture series is an easily implemented and effective method of providing knowledge, facilitating student-surgeon interaction and generating interest in general surgery in pre-clerkship medical students.

BACKGROUND
Despite significant increases in the number of students admitted to medical schools across Canada each year, general surgery residency programs have not maintained a corresponding increase in their applicant pool. The Canadian Residency Matching Service (CaRMS) reports that, from 1997 to 2010, the percentage of Canadian medical graduates selecting general surgery as their first choice specialty has varied between 3.9-5.6%, with a statistically significant decline between 1996 and 2001. Minor et al. have suggested that this decline has decreased the competitiveness of the specialty as well as the quality of the applicant pool. In 2009, 17 (16.3%) of 104 general surgery residency spots across Canada were left unfilled. There has been a similar decline in interest in general surgery in the United States, with a 6.0% decline in applicants selecting general surgery as first choice specialty between 1984 and 2002. This trend corresponds with a measurable increase in interest in so-called ‘controllable lifestyle’ specialties such as family and internal medicine. A number of studies in Canada and the United States have been sought to identify the reason for these patterns and to test pilot interventions to generate inter-
est in the specialty. Results suggest that the declining interest in general surgery is in part related to the perceived inflexibility of the lifestyle of residents and staff in a demanding specialty. This corresponds with the trend towards putting increasing weight on lifestyle factors when senior medical students are choosing a residency. Yet evidence suggests that surgical mentorship during clerkship has the power to change misconceptions while highlighting positive aspects of the field, such as academic and career opportunities, intellectual challenge, sense of accomplishment and prestige, and financial incentives. Additionally, mounting evidence shows that early preclinical exposure to mentors, skills and cases strongly correlates with student interest in general surgery as a specialty.

NEEDS ASSESSMENT

How does one make the decision to pursue a career in general surgery? Many medical schools, including McMaster University, offer a relatively small focus on general surgery in the pre-clerkship curriculum. Proportionately less time is spent on surgical skill development or surgery-specific learning objectives compared to other specialties. This may be a corollary of the emphasis on primary care. Furthermore, very few general surgeons facilitate problem-based learning (PBL) tutorials or serve as clinical skills preceptors, thereby limiting early exposure to surgical mentors. This fact supports the notion that medical students’ preference towards pursuing non-surgical specialties may be a reflection of their lack of familiarity with surgeons, and of surgery itself. At McMaster University, surgery-specific teaching consists of a brief session in clerkship orientation, with students otherwise able to direct their own learning through electives, external events, and research endeavors.

Currently, 38% of general surgeons in Canada are over 55 years of age. Fostering interest in the field is necessary to attract the workforce that will be required to replace these surgeons as they retire, especially to accommodate the needs of rural communities. In the United States, the number of general surgeons per capita has decreased by more than 25% since 1981, while other surgical subspecialties have not seen the same decline. This has precipitated a need to bolster the workforce by relying on recruitment of international medical graduates. This practice is unsustainable, however, and calls for an increase in the number of surgeons trained locally. In anticipation of a similar shortage in Canada, it is essential to generate interest in those who might pursue general surgery as a career. With growing evidence supporting the effect of early exposure on career selection, and the fact that many residency decisions antedate clerkship, a focus on optimizing surgical curriculum for pre-clerkship students can plausibly increase trainees’ interest in the specialty.

A need to provide early exposure to surgical topics had been previously identified on an informal basis by staff, students, and residents. As well, a qualitative study done at McMaster University suggested a lecture series as a method of early exposure. To address the identified gap in preclinical education at McMaster University, the student-run Surgery Interest Group (SIG), with financial support from the McMaster Department of Surgery, organized and implemented a didactic lecture series. The series covered topics in general surgery while offering the opportunity for interactions with surgical mentors.

GOALS

The three main goals of this lecture series were:

- Provision of knowledge
- Fostering of staff-student interaction and mentorship opportunities
- Increasing interest in surgical topics and general surgery residency

EDUCATIONAL STRATEGIES

Empowerment and involvement of senior medical students

- Peer-to-peer teaching environment
- Interactive, practical, approach-based didactic lectures
- Delivery of expert opinion from staff surgeons of various subspecialties
- Exposure to surgeon role models

METHODS

This exploratory study was designed as a pilot project to inform future educational activities in general surgery. We conducted a series of didactic lectures designed for pre-clerkship students that ran for six consecutive weeks during September and October of 2010. Lecture topic selection was performed via a survey in July 2010 of 57 third-year students (Michael G. DeGroote School of Medicine Class of 2011) who had completed their general surgery clerkship rotation. These students were asked to select the topics they felt would have been most beneficial to learn prior to the rotation. The suggested topic list was generated from headings in Lawrence’s Essentials of General Surgery, a textbook written in accordance with the learning objectives developed by the Canadian Undergraduate Surgical Education Committee. Topics were finalized with further input from two surgical faculty members. The lecture topics were: 1) Perioperative care, 2) Gastrointestinal (GI) bleeding, 3) Small and large bowel obstruction, 4) Biliary tract disease, 5) Breast masses, and 6) Hernias.

Lecturers and Surgeons

Presenters were selected from a group of third-year medical students with an interest in general surgery. Lecturers were paired with a staff general surgeon and were encouraged to collaborate in reviewing the presentations to ensure
content accuracy and coverage of important points. Surgeons were all McMaster faculty members, each with a clinical practice in the given topic. They were selected based on expressed interest in the lecture series and prior involvement in educational events. Surgeons were invited to provide expert opinion, share professional and personal aspects of being a general surgeon and address questions from attendees.

**Participant Recruitment**

Participants were recruited using McMaster’s online medical school community, Medportal. The lecture series was offered to all McMaster medical students, and attendance was on an elective basis. There were no exclusion criteria. Participants were requested to sign up via email in order to anticipate the number of participants as well as collate contact information for follow-up. A convenience sample was used for data collection as this was exploratory research, intended to test-run ways to recruit, retain, and evaluate participants.

**Lectures**

Lectures had the following general outline: clinical case presentation, review of relevant anatomy, differential diagnoses, etiology and pathophysiology, history-taking, physical findings, investigations, and surgical and non-surgical management of the example patient. The topic list was posted on Medportal forums before commencement of the series, with weekly reminders of the topics to be covered in subsequent sessions. Students were encouraged to familiarize themselves with the topics beforehand, though there were no specific assigned readings. All lectures were presented using PowerPoint, and were made available online for downloading after each session. The incorporation of videos and graphics as teaching aids varied between individual lectures and was at the discretion of the presenter. Each lecture was approximately one hour in length, followed by a question-and-answer period with the surgeon. A general surgery trivia question was posted each week to encourage students to read about other topics, with the incentive of a clerkship surgery textbook as a prize.

**Evaluation**

Attendance was taken at each session, and feedback data were gathered via an anonymous written survey at the end of the sixth session. The surveys consisted of participants’ background information (year of medical school, reason for attending the series, specialty they intended on pursuing, number of weeks of surgical electives completed) and evaluations of individual sessions. Participants were asked to evaluate the series as a whole and each individual lecture separately in three domains: 1) characteristics of the lecturer, 2) lecture content and 3) the surgeon. A 4-point Likert scale was used, where 1=“poor” and 4=“excellent”, and space was provided for additional participant comments. Attendees were followed up with via email two months after series completion to comment on a voluntary basis on three components: 1) whether they had since organized surgical electives (or intended to), 2) if they had sought out surgeons for mentorship/research projects, or 3) if they noted application of their new knowledge in both surgical and non-surgical clinical rotations or PBL cases.

**Analysis**

The data were analyzed using descriptive statistics in Excel. For qualitative comments, two reviewers transcribed the comments from surveys and analyzed them for common themes.

**Ethics**

This was a quality improvement project that did not require Research Ethics Board approval. All participants were informed that this lecture series was a pilot project, during which data would be gathered and summarized into a report to guide future research and curriculum planning. All names and contact information gathered through attendance and email sign-up were kept anonymous unless express written consent was obtained to use participants as references.

**RESULTS**

**Participants**

A total of 70 medical students participated in the lecture series, 40% (n=28) were in first year, 57% (n=40) were in second year, and 3% (n=2) were in third year of medical school. On average, there were 38 attendees per session. Of the 34 participants who attended the final session and thus completed the evaluation forms, 35.5% (n=13) were in their first year of medical school, 58.8% (n=20) were in second year, and one participant did not indicate year of study (Table 1).

The most commonly cited reasons for attending the lecture series were general interest in topics (overall: 74%, n=25; first year: 85%, n=11; second year: 70%, n=14) and preparation for clerkship or electives (overall: 68%, n=23), with a greater proportion of second-year students (91%, n=19) listing clerkship and electives as the reason for attending, in comparison to the first-year students (31%, n=4).

Those who had attended three lectures or less cited other commitments (overall: 12%, n=4; first year: 15%, n=2; second year: 10%, n=2) or finding out late (overall: 9%, n=3; first year: 8%, n=1; second year: 10% n=2), while one first-year student specifically commented that they attended fewer lectures because they found the material too difficult to follow. None of the students sampled chose a loss of interest as the reason for attending fewer than three sessions.

Of the respondents, 62% (n=21) of students were considering pursuing general surgery in residency; a larger proportion of second-year students (70%, n=14) versus first-year students (54%, n=7) agreed with this statement. Interestingly, 35% of respondents (first year: 54%, n=7; second year 25%, n=5) indicated that their interest in general surgery increased
after this lecture series. Three first-year students (8.8%, n=3) who had declared interest in pursuing non-surgical specialties such as pediatrics, internal medicine, and family medicine stated that, following this series, they were interested to learn more about general surgery (n=1) and other surgical fields (n=1), and were considering pursuing general surgery in residency (n=1).

**Evaluations**

Students rated lecturers, lecture content and surgeons on a 4-point Likert scale where 1 = “poor” and 4 = “excellent” (Table 2). Lecturers were rated based on 1) knowledge (3.3-3.9, mean=3.7), 2) preparation (3.5-3.9, mean=3.7), 3) ability to answer questions (3.2-3.8, mean=3.6), 4) presentation style and format (3.4-3.8, mean=3.6), and 5) quality of slides (3.5-3.8, mean=3.7). Lecture content was rated based on 1) appropriate depth and difficulty (3.5-3.8, mean=3.7), 2) appropriate breadth (3.4-3.8, mean=3.7), and 3) whether it provided a useful approach to the clinical problem (3.4-3.8, mean=3.7). Surgeons were rated based on 1) insight into field (3.2-3.9, mean=3.7), 2) knowledge (3.3-4.0, mean=3.8), and 3) being personable and approachable (3.7-4.0, mean=3.9). Overall, the lecture ratings ranged between 3.6-3.9 (mean=3.8). Lecturers scored 3.7 when averaged across all domains, and surgeons received overall scores ranging between 3.3-3.9 (mean=3.8).

**Qualitative Feedback**

Students were satisfied with the knowledge gained from the lecture series, and made comments such as, “Very relevant and practical”, “The approach that was taught was extremely useful” and “Very helpful for clerkship.” Students also had positive comments regarding the format of the series including, “Great job at promoting participation” and “Enjoyed the question and answer period, and extremely interactive lecture style.” However, 38.5% (n=5) of first-year students felt the information presented was sometimes difficult to understand, and specifically commented that they would have appreciated having medical acronyms defined.

Students commented on their appreciation for surgeons who were friendly, engaging, approachable, involved in the content of the lecture being delivered, and willing to stay behind to provide insight about career choices. In contrast, surgeons who were perceived as having a “big ego” or who seemed rushed or disinterested were less well-received; a student commented that one such surgeon “put [him] off surgery a little bit.”

Suggestions for improvement included providing slides prior to the session, having third-year medical students describe their experience with the CaRMS process as it relates to general surgery, and providing evaluation forms at the end of each session for more accurate reflection of opinions. Topics that participants would like to see covered in future years include trauma surgery and colorectal cancer. Participants
also expressed the wish to have the series lengthened and broadened to cover other surgical sub-specialties including otolaryngology, neurosurgery, orthopedic surgery and cardiac surgery.

Follow-up Data

Of the 70 participants contacted via email two months after the completion of the series, only 8.5% (n=6) responded. Of these respondents, 83.3% (n=5) were in second year, and 16.7% (n=1) were in first year. In terms of electives, 66.6% (n=4) of the students (first year n=1, second year n=3) had just completed electives in general surgery, urology, and trauma surgery. Notably, the first-year student was in the midst of doing multiple horizontal electives with three of the staff surgeons who participated in the series. The respondents also had plans to pursue other surgical electives, including neurosurgery, urology, and acute care surgery in various academic centers across Canada.

Only two second-year students (33.3% of respondents) commented specifically on their new motivation to seek out mentorship and research projects. One student had organized an enrichment year to complete research in plastic surgery, while another had sought out advice from “numerous residents” regarding elective choices.

Five (83.3%) students commented on the utility of the knowledge gained from the series. Students found the information “tremendously helpful” while on a general surgery rotation in clerkship and remarked that this would have been very beneficial in their first year. Students who had not yet entered a surgical rotation anticipated that they would be using the posted slides as a resource to review material beforehand. Furthermore, one student had uploaded the PowerPoint slides on perioperative fluid management onto a personal electronic device, and has used it multiple times on a surgical rotation.

DISCUSSION

A pre-clerkship didactic lecture series dedicated solely to topics in general surgery has not been previously implemented at McMaster University. The goal in delivering such a lecture series was three-fold: to fill an identified gap in pre-clerkship education, to foster positive student-staff surgeon partnerships, and to garner interest in the specialty. Overall, students described it as a positive experience that inspired or affirmed their interest in general surgery.

A primary goal of the series was to supplement the pre-clerkship curriculum by providing the opportunity to learn about general surgery-specific topics. Students felt the lectures provided knowledge that would be useful for upcoming clinical rotations, which was consistent with the most commonly cited reasons for attending (general interest, 25/34, 73.5%; preparation for clerkship, 23/34, 67.6%). A unique aspect of this initiative was the recruitment of senior medical students to deliver the lectures. This approach not only fostered leadership amongst senior medical students, but also allowed knowledge to be delivered at a level geared specifically towards the learning needs of the attendees. The peer-to-peer format created a comfortable and safe learning environment that encouraged open discussion.

There was a notable difference between the learning objectives of first- and second-year students. While both groups suggested increasing the length of the series, first-year students requested more superficial exposure to a broader range of topics and specialties and sometimes felt as though they had insufficient baseline knowledge to keep up with the pace of the lectures. In contrast, second-year students wanted to delve deeper into surgical procedures and management of clinical problems in preparation for clerkship rotations and electives, and receive practical advice about the CaRMS application process. In the future, material should be tailored to

Table 2. Mean Ratings of Lectures Based on 4-point Likert Scale (1=“poor”, 4=“excellent”)

<table>
<thead>
<tr>
<th>Overall rating</th>
<th>Perioperative Care</th>
<th>GI Bleeds Obstruction</th>
<th>Bowel Obstruction</th>
<th>Biliary Tract</th>
<th>Hernia</th>
<th>Breast Mass</th>
<th>MEAN</th>
</tr>
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<tbody>
<tr>
<td>Lecturer</td>
<td>Knowledge</td>
<td>3.8</td>
<td>3.6</td>
<td>3.7</td>
<td>3.9</td>
<td>3.8</td>
<td>3.7</td>
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<tr>
<td></td>
<td>Preparation</td>
<td>3.8</td>
<td>3.7</td>
<td>3.6</td>
<td>3.8</td>
<td>3.9</td>
<td>3.5</td>
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<td></td>
<td>Ability to answer questions</td>
<td>3.8</td>
<td>3.7</td>
<td>3.7</td>
<td>3.6</td>
<td>3.8</td>
<td>3.2</td>
</tr>
<tr>
<td></td>
<td>Presentation style and format</td>
<td>3.7</td>
<td>3.6</td>
<td>3.4</td>
<td>3.8</td>
<td>3.7</td>
<td>3.5</td>
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<td></td>
<td>Slides</td>
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<td>3.8</td>
<td>3.8</td>
<td>3.7</td>
<td>3.5</td>
</tr>
<tr>
<td>Content</td>
<td>Appropriate depth and difficulty</td>
<td>3.6</td>
<td>3.7</td>
<td>3.7</td>
<td>3.8</td>
<td>3.7</td>
<td>3.5</td>
</tr>
<tr>
<td></td>
<td>Appropriate breadth</td>
<td>3.6</td>
<td>3.7</td>
<td>3.7</td>
<td>3.8</td>
<td>3.8</td>
<td>3.4</td>
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<td></td>
<td>Provided useful approach to clinical problem</td>
<td>3.7</td>
<td>3.7</td>
<td>3.8</td>
<td>3.8</td>
<td>3.8</td>
<td>3.4</td>
</tr>
<tr>
<td>Surgeon overall</td>
<td>Insight</td>
<td>3.8</td>
<td>3.3</td>
<td>3.9</td>
<td>3.8</td>
<td>3.9</td>
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<tr>
<td></td>
<td>Knowledgeable</td>
<td>3.8</td>
<td>3.3</td>
<td>3.8</td>
<td>3.9</td>
<td>3.9</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Personable and approachable</td>
<td>3.7</td>
<td>3.9</td>
<td>3.8</td>
<td>3.9</td>
<td>4</td>
<td>3.9</td>
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</table>
address these unique learning needs, for example, by offering separate lectures or making it more exclusive to a particular group. Lengthening the series would allow for coverage of a greater breadth of topics including those relevant to other surgical subspecialties.

Another goal of this series was to provide positive surgeon role-models and to foster mentorship opportunities between students and staff surgeons—a process that can be intimidating for junior students to initiate independently. This series provided a glimpse into the professional and personal lives of staff surgeons who were eager to share their passion for general surgery. One of the participants had set up horizontal electives with three of the six staff surgeons who were involved in this series, suggesting that this experience had facilitated some positive interactions that may otherwise not have occurred. In contrast, one surgeon’s perceived distant demeanor actually made surgery less appealing for one participant, which affirms the need to provide students with positive role models. By fostering such familiarity and collegiality, we hope to equip medical students with the resources and confidence to enter core surgery rotations in clerkship and to pursue electives, research, and ultimately residency in this field. Additionally, incorporating more general surgeons into the heart of the curriculum as clinical skills preceptors and facilitators of large group sessions or tutorials would ensure that students are exposed to surgical role models.

The pilot initiative has received a positive response from students who have self-declared interest in pursuing both surgical and non-surgical specialties. Multiple staff participants have noted an influx of elective requests this past fall/winter semester (Dath D, Bailey K, Marcaccio M, Personal communication, December 15-16, 2010),28-30 and ongoing feedback from participants has affirmed the utility of the material covered with respect to clinical rotations (Knapp G, Chesney T, Li J, Personal communication, December 20-21, 2010).31-33 A cohort of students has expressed interest in continuing and expanding on this project in the following year (Li J, Personal communication, December 21, 2010).33 The multi-factorial nature of generating interest in a specialty prohibits us from delineating cause and effect based on this lecture series. Yet this project has highlighted the importance of providing early exposure to surgical topics and surgeon role models, not only to fill a perceived knowledge gap, but also to generate enthusiasm and interest in a field that is otherwise afforded little attention in the pre-clerkship curriculum.

The collection of data during the final session of the series is a major limitation of this study. The data pool is biased in favour of students who may have attended more lectures due to greater initial interest in general surgery, which persisted for the whole series. Ideally, for a more accurate evaluation of student feedback, surveys should be administered following each individual session. This would have captured initial impressions, tracked feedback from respondents subsequent-ly lost to follow-up, and perhaps provided further insight into the learning needs of undifferentiated students. Students not present at the final session were followed up with via email and were asked to fill out the survey, but the response rate was extremely low. Since many of the students not present in the final session attended relatively few lectures, it would have been valuable to gain insight into reasons for their absences—for example, lack of interest, conflicting commitments, or finding that the concepts were inappropriate for their level of training. Additionally, it would have been ideal to obtain more follow-up data at the two-month mark regarding students’ pursuits since the completion of the series. This information would allow us to more accurately gauge whether didactic teaching and surgeon interaction translated into knowledge application and seeking out of mentorship or elective opportunities.

While the positive feedback is encouraging, it suggests the need for an integrative assessment of the current surgical education opportunities offered at McMaster University, specifically as they relate to students’ interest in general surgery. Future research should incorporate other existing educational events, such as the pre-clerkship ‘Surgical Skills Half-Day’, with centralized leadership in order to provide a more holistic evaluation. In order to promote continuity and permanence in the undergraduate curriculum, efforts should be made to establish this lecture series as an official horizontal elective, recognized by the undergraduate curriculum committee. An integrative approach with support from the McMaster medical program will help facilitate informed career choices, debunk misconceptions about surgery and surgeons, and increase excitement for learning about surgery regardless of career aspiration. As the evidence suggests early exposure is the first step in generating interest in general surgery, perhaps these pre-clerkship experiences will be the igniting spark for a budding surgeon.

Acknowledgements

The students of Michael G. DeGroote School of Medicine, for being an enthusiastic audience each week and for their excitement for this pilot project; the endless support of Dr. Susan Reid and Dr. Deepak Dath; our staff presenters from the McMaster Department of Surgery, Dr. Michael Marcaccio, Dr. Wes Stephen, Dr. Karen Bailey and Dr. Ted Rapanos; and fellow student presenter Diana Khalil.

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INTRODUCTION

As healthcare delivery progresses towards a team-based approach, there is a growing need for adequate training and development of interprofessional collaboration skills. One of the main requirements for the creation of a collaborative team environment is a mutual understanding of the roles of other health professionals, which in turn helps to promote effective interprofessional communication.

The goal of interprofessional education (IPE) is to educate different healthcare professions about their respective roles and the roles of other professions through interaction, integration, and communication. However, the evidence for the effectiveness of IPE is inconclusive. Four of the six studies of a 2009 Cochrane review found that IPE improved patient satisfaction, the working environment, and clinical error rates in the emergency department. In the field of mental health, IPE was found to augment skills and knowledge of the care providers. However, the review found that inferences could not be made due to the heterogeneity of interventions and methodological limitations between the studies included, and

ORIGINAL RESEARCH

Dissecting Through Barriers: Findings from a Pilot Study on the Effect of Interprofessional Education in a Gross Anatomy Course

Stephanie Chan, BEng
Karen Tsui, BSc, GDipRM
Lauren De Meester, BHSc, MSc
Vincent Lacharite
Glen Oomen, BSc, MSc
Bruce Wainman, PhD
Patty Solomon, PhD

ABSTRACT

The implementation of interprofessional education within healthcare programs has been tentatively found to improve patient care and satisfaction, reduce clinical error rates, improve collaborative team behavior, and diminish negative professional stereotypes.

In 2009, an interdisciplinary, problem-based learning (PBL) gross anatomy course was implemented at McMaster University in Hamilton, Ontario. In 2010, a pilot study was initiated to determine if this course, offered in an interprofessional environment, influenced attitudes and perceptions towards students in other health professions. Twenty-four randomly selected students from the medicine, midwifery, nursing, physician assistant and physiotherapy programs at McMaster University participated in the eight-week dissection course. Pre-experience and post-experience surveys of the Interdisciplinary Education Perception Scale (IEPS) and Readiness for Interprofessional Learning Scale (RIPLS) were used to measure differences in attitudes and perceptions towards interprofessional education and collaboration. As well, weekly mandatory evaluations and focus group results were used to qualitatively evaluate these changes.

No significant differences were found between pre- and post-course surveys, which may be attributable to the small sample size, the inexperience of first-year students who may not yet fully comprehend their respective professional roles, and limitations of the IEPS and RIPLS. Overall, however, qualitative feedback was positive regarding the experience and students appreciated the opportunity to learn about other professions and interprofessional roles.

INTRODUCTION
more rigorous studies were required. Given the limitations of quantitative outcome measures in measuring the qualitative aspects of IPE, mixed method studies, which use both quantitative and qualitative analysis, are needed to adequately assess the efficacy of IPE in training healthcare professionals to work together effectively.

Recognizing the need for interprofessional learning as well as the value of a gross anatomy course for student learning, an interprofessional PBL gross anatomy course was founded at McMaster University in 2009. This course allowed students to develop teamwork skills, collaborate in learning anatomy and physiology, share their professional perspectives on the management of case studies, and discuss their experiences and respective roles as healthcare professionals. In 2010, a pilot study was initiated to determine if learning in an interprofessional environment influenced perceptions of other health professions among students.

METHODS
An eight-week problem-based learning (PBL) gross anatomy course, involving cadaver dissection by interprofessional teams, was developed in February 2010. Enrolment was offered to all students in the medicine (MD), physician assistant (PA), nursing (RN), physiotherapy (PT), and midwifery (MW) programs at McMaster University. Twenty-four students were selected via random number generator and systematically allocated into four interprofessional groups, each with members from three to four different programs (Figure 1).

A 70-year-old gentlemen presents to the ER with severe abdominal pain, abdominal distention and constitutional symptoms (fever, nausea) over the past 24 hours. His last bowel movement was two days ago and he has not passed flatus in the past 12 hours. He was previous healthy, although he has had increased constipation over the past month and has noticed blood in his stool. Abdominal x-ray shows grossly distended loops of large bowel and a CT scan shows fecalization of small bowel, distended loops of large bowel to the descending colon, an acute obstruction and collapsed large bowel distal to this point. The CT scan also showed a 3 x 4cm mass at this point. There was no indication of perforation (i.e. no free air). An NG tube was used to decompress the stomach and small bowel, and intravenous fluids were initiated. A sigmoidoscopy was performed and a diagnosis of obstructive colorectal cancer was made. The patient was counselled and consented to a left hemicolectomy surgery.

1. What are some of the underlying causes for this pathology?
2. What anatomical structures are affected?
3. How would you differentiate between a large bowel obstruction and a small bowel obstruction on x-ray? (Think of the general location and distinctive anatomical features of each).
4. Why do we remove half of the colon if only a small part is affected (consider lymphatic supply)?
5. How would you manage this patient?
6. How do you think each health profession (PT, PA, Midwifery, MD, Nursing) would contribute to the treatment of this patient? Who would you refer to and why?

Figure 2. Sample Case Study (gastrointestinal system)

During the course, the first 15 minutes were allocated to the student coordinators to present the general anatomical principles surrounding the case. Students were then separated into their respective groups, and given 15 minutes to discuss the questions given and to clarify the roles of each profession in the given scenario. Students were then allotted two hours to complete the dissection, enabling collaborative learning and team-building within each interprofessional group.

Pre-IPE and post-IPE surveys consisting of the revised Interdisciplinary Education Perception Scale (IEPS) and Readiness for Interprofessional Learning Scale (RIPLS) were completed by participants who committed to all eight weeks of the course. These scales enabled quantitative measurement of changes in attitudes towards interprofessional education following the course.
The IEPS was designed by Luecht et al. and is a content-validated pre-test and post-test tool used to measure changes in students’ attitudes resulting from an interprofessional experience. It is comprised of four subscales: Competence and Autonomy, Perceived Need for Cooperation, Perception of Actual Cooperation, and Understanding of Other’s Value. It was revised in 2007 by Mcfadyen et al. to improve psychometric stability and has shown good test-retest reliability and excellent internal consistency for three of the four subscales. This version of the IEPS has been validated in undergraduate students.

The RIPLS is a rating scale that assesses perceptions and attitudes of health care students towards interprofessional learning. The original measure has face, construct, and content validity. A revised version published in 2005 by Mcfadyen et al. was used for this study, which divided the original three subscales into four subscales with increased stability and improved psychometrics. The subscales include “team working and collaboration”, “professional identity (positive and negative)”, and “professional roles”. The revised RIPLS has high internal consistency and has been validated in both undergraduate and postgraduate healthcare students.

The pre- and post-course surveys of students completing the entire eight-week course (n=22) were analyzed using Mann-Whitney U tests in SPSS 16.0 for Windows to compare pre- and post-subscale and total score means. Nonparametric statistics were used due to the increased variability in small sample sizes and non-pairing of surveys.

In addition to the quantitative surveys, mandatory weekly written evaluations comprising of both Likert scale questions and open-ended questions were completed anonymously by each participant (Figure 3). As well, upon completion of the course, a focus group led by the course professors was held to qualitatively evaluate differences in attitudes and perceptions. Open-ended questions were used to lead the discussion, and topics including course format, group facilitation, relevance of the cases and professional roles were addressed.

The weekly evaluations and focus group data were analyzed by compiling comments and assessing themes and trends. The qualitative data was also used to determine potential areas of improvement and future directions for the course.

RESULTS

Comparisons of pre- and post-course subscale and total scores for both the IEPS and RIPLS showed little change and were statistically insignificant (p≥0.05). However, overall qualitative feedback was positive regarding learning about other professions and interprofessional roles. An analysis of weekly feedback indicated that 30.6% of the comments about what students enjoyed the most related to interprofessional collaboration (Table 1). Specifically, 22.6% of comments were about pre-dissection activities such as case discussions, and 8.0% of the comments discussed their interaction with peers from other professions.

1. Please complete:
   Week: ______________
   Topic: ______________

2. Please rate the following statements:

<table>
<thead>
<tr>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Neither Agree or Disagree</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>This week’s case studies were relevant to my own program of study/profession</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>This week’s dissection was relevant to my own program of study/profession</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>This week’s case studies fostered my understanding of other professions and interprofessional interaction</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>This week’s dissection fostered my understanding of other professions and interprofessional interaction</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>After this week’s session, I have a stronger understanding of the anatomy that was covered</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3. What I enjoyed most about this week’s session was:
   ____________________________________________________________________

4. Do you have any suggestions for the improvement of this session?
   ____________________________________________________________________

Figure 3. Weekly Evaluation Form
For example, students commented on their experience of “working with other healthcare professional students and learning the anatomy together” and “the atmosphere with all of the different professions”. In addition, focus group comments indicated that learning anatomy in an interprofessional environment allowed students to not only improve and enrich their knowledge of anatomy and physiology, but also increase their understanding of their respective roles and the roles of other healthcare professionals in patient care. Students appreciated the opportunity to learn about the breadth and depth of each profession, as well as how each profession contributed to disease management in the context of an interprofessional team.

**Table 1. Qualitative Results from Weekly Survey**

<table>
<thead>
<tr>
<th>Aspect of the course found to be most enjoyable</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>The hand-on experience with cadaveric material</td>
<td>58.7%</td>
</tr>
<tr>
<td>The pre-dissection activities (opening talks, case discussions)</td>
<td>22.6%</td>
</tr>
<tr>
<td>Interaction with peers from other professions</td>
<td>8.0%</td>
</tr>
<tr>
<td>Other</td>
<td>10.7%</td>
</tr>
</tbody>
</table>

**DISCUSSION**

While quantitative data failed to show any statistically significant results, qualitative data suggest that students found the course to be highly valuable. Students enjoyed the opportunity to work with students from other health professions and to learn clinically relevant anatomy and physiology. A similar initiative by Hamilton et al. showed similar qualitative results for an interprofessional gross anatomy course started at Mayo Medical School in Rochester, Minnesota for 70 first-year students in medicine and physiotherapy. However, these students were assessed over a two day span, which was comparatively shorter, and did not look at the integration of a variety of healthcare professions, as it incorporated only students in medicine and physiotherapy.

For this study, the lack of significant quantitative effect is likely attributable to a number of factors. The small sample size, which may diminish course effect, was due to resource and space limitations in the anatomy laboratory. In addition, students who did not complete the course were replaced by another student from their respective profession, which may have disrupted team dynamics. There was also uneven representation of professions in each group, which may have increased the variability of each group’s interprofessional experience. The IEPS and RIPLS have not been assessed for sensitivity to change, and it is possible that these instruments are not sensitive enough to measure changes in interprofessional perceptions and attitudes over an eight-week time period. In addition, these measures may not be suitable for students who are in the initial year of their program as these students may not fully comprehend their respective professional roles and are concurrently undergoing significant changes in their learning.6

Despite the lack of significant quantitative effect, the qualitative aspects of the study showed markedly positive results for learning in an interprofessional environment. The focus group results showed that students found that the course greatly improved their understanding of human anatomy and each profession was able to share their respective clinical knowledge in their exploration of the physiology.

The results and findings from this pilot study were instrumental in developing an improved framework and curriculum for subsequent interprofessional dissection courses. For example, revised case studies will include more questions relating to different healthcare professions such as midwifery and nursing. Students also requested more time for interprofessional interaction and case discussions preceding the dissections, which will be addressed in next year’s course. As well, by improving the methodology and design of this study, further research can be performed to assess the effectiveness of an interprofessional anatomy course as an interprofessional teaching tool.

**ACKNOWLEDGEMENTS**

Acknowledgements to Emily Aaronson, Katy Li, and Paul Stratford for their contributions to this project. Funding for this project was generously provided by McMaster University’s Program for Interprofessional Practice, Education and Research (PIPER).

**REFERENCES**

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Pharyngitis in the Emergency Department: An Evaluation of the McIsaac Clinical Decision Rule in Practice

Emily Aaronson, BA
Nathan Ludwig, BSc
Ira Price, MD, FRCPC

ABSTRACT
The McIsaac Clinical Decision rule was developed to help physicians identify and manage group A Streptococcus infection in patients presenting with sore throat. However, the application of this clinical decision rule is not uniform among all practice settings. A retrospective chart review was conducted to evaluate 271 patient encounters presenting with pharyngitis in a large tertiary care emergency department between January 1, 2006 and December 31, 2008. Patients with low McIsaac scores of -1, 0, and 1 were treated according to the clinical decision rule 21%, 20%, and 8% of the time, respectively. Patients with intermediate scores of 2 and 3 were treated according to the clinical decision rule 17% and 4% of the time, respectively. Patients with a high McIsaac score of 4 were treated according to the clinical decision rule 100% of the time. A total of 97% of the prescribed antibiotic treatments in this chart review were not indicated according the McIsaac clinical decision rule, resulting in overuse of antibiotics. A combination of physician education, resource availability and practice pattern likely contribute to this finding. The creation of a clinical decision rule guiding the treatment of pharyngitis specifically in the emergency department, taking into account unique constraints of the practice setting, could help improve compliance and move towards a more uniform management of this common presentation.

BACKGROUND
Pharyngitis is a common presentation in the emergency department. The differential diagnosis of pharyngitis is extensive and includes: respiratory viruses, streptococcal organisms such as group A β-hemolytic Streptococcus (GAS), Mycoplasma pneumoniae, and Chlamydia pneumoniae. It is estimated that 50% to 80% of pharyngitis symptoms are caused by viral infections while streptococcal infections have been estimated to be the cause in 5% to 36% of cases. The use of antibiotics in pharyngitis is justified in treating GAS because it decreases the likelihood of suppurrative complications, such as peritonsillar and retropharyngeal abscesses, and acute rheumatic fever. It is generally accepted that the treatment of GAS with antibiotics does not prevent associated glomerulonephritis.

The risks associated with antibiotic misuse and overuse, especially the contribution to the development of antibiotic resistant organisms, must be balanced with the potential for negative outcomes in untreated GAS. As a result, various clinical decisions rules have been developed in an attempt to risk-stratify patients with pharyngitis.

The Centor Strep Score is a scoring criteria that has been validated in adult populations in both emergency departments and office settings. This score was later modified using data from both children and adults to create the McIsaac Modification (Table 1). The McIsaac criteria improve upon the Centor Score criteria by assigning points based on the patient’s age, given that GAS is more common in children than other patient populations. The score is used to estimate the percent likelihood of a GAS infection (Table 2) and treatment is guided accordingly (Table 3). The McIsaac score was validated in 2000 by a study involving 621 patients in 97 family practices which concluded that appropriate use of the score would have reduced prescriptions to culture-negative patients by 63.7% and overall antibiotic prescriptions by 52.3%. It is of note that this scoring system was specifically validated in a multi-centre community based practice, but has not been validated in an emergency department setting.
Table 1. McIsaac Modification of the Centor Strep Score

<table>
<thead>
<tr>
<th>Patient Characteristic</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>History of fever or temperature &gt;38°C</td>
<td>+1</td>
</tr>
<tr>
<td>Absence of Cough</td>
<td>+1</td>
</tr>
<tr>
<td>Tender Anterior Cervical Adenopathy</td>
<td>+1</td>
</tr>
<tr>
<td>Tonsillar Swelling or exudates</td>
<td>+1</td>
</tr>
<tr>
<td>Age &lt;15 years</td>
<td>+1</td>
</tr>
<tr>
<td>Age &gt;45 years</td>
<td>-1</td>
</tr>
</tbody>
</table>

Table 2. Percent Likelihood of GAS Based on McIsaac Scoring System

<table>
<thead>
<tr>
<th>Score</th>
<th>% Likelihood of GAS</th>
</tr>
</thead>
<tbody>
<tr>
<td>-1 or 0</td>
<td>2-3</td>
</tr>
<tr>
<td>1</td>
<td>4-6</td>
</tr>
<tr>
<td>2</td>
<td>10-12</td>
</tr>
<tr>
<td>3</td>
<td>27-28</td>
</tr>
<tr>
<td>4 or 5</td>
<td>38-63</td>
</tr>
</tbody>
</table>

Table 3. Suggested Management of Suspected GAS Based on the McIsaac Scoring System

<table>
<thead>
<tr>
<th>Score</th>
<th>Suggested Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>-1 or 0</td>
<td>No antibiotics or culture required</td>
</tr>
<tr>
<td>1</td>
<td>No antibiotics or culture required</td>
</tr>
<tr>
<td>2</td>
<td>Culture all; treat patients with positive results</td>
</tr>
<tr>
<td>3</td>
<td>Culture all; treat patients with positive results</td>
</tr>
<tr>
<td>4 or 5</td>
<td>Treat with antibiotics without culture</td>
</tr>
</tbody>
</table>

METHODS

Study Design and Setting

A retrospective chart review was conducted using patients presenting to an urban tertiary-care emergency department with the discharge diagnosis of pharyngitis. The study included patients that presented to the emergency department at St. Joseph’s Healthcare in Hamilton, Ontario, Canada between January 1, 2006 and December 31, 2008. Inclusion criteria were a discharge diagnosis of pharyngitis or sore throat and that the chart was written by a staff physician. Illegible charts were excluded.

A total of 271 patient encounters from the charts of 19 physicians met the inclusion criteria (age demographics in Table 4). The average number of patient encounters per physician was 14.2, with a range of 8-15. The chart review was approved by the research ethics board of St. Joseph’s Healthcare in Hamilton.

Extraction Methods

Data extraction protocols for a retrospective chart review, as outlined by Worster et al., were followed. A data extraction form utilizing criteria from the McIsaac clinical rule was created and the total score was summed for each patient encounter. It was noted whether or not a throat swab was taken for culture, the swab result, and whether or not an antibiotic was prescribed.

To assess the use of the McIsaac score, two researchers performed duplicate extractions on 100% of the charts (k=0.95). Disagreement between the two data extractors in a binary data point was resolved by a third researcher who evaluated the chart to make a final decision. The data extractors were not blinded to the study objectives or to the name of the most responsible physician on the chart. The only patient characteristic extracted from the chart was age.

Primary Data Analysis

The number of patients receiving a score of -1, 0, 1, 2, 3, 4, and 5 as well as the number of patients receiving throat swabs and antibiotics was summed (Table 5). The primary outcome was whether or not the action taken by the physician was consistent with the recommended action according to the McIsaac clinical rule. The compliance percentage of individual physicians was not a calculated endpoint in this study, although marked variation between physicians was noted.

Table 4. Age Demographics of Patients Included in Study

<table>
<thead>
<tr>
<th>Age</th>
<th>Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-14</td>
<td>66</td>
</tr>
<tr>
<td>15-44</td>
<td>178</td>
</tr>
<tr>
<td>&gt;45</td>
<td>27</td>
</tr>
</tbody>
</table>

Table 5. Number of Participants with Each McIsaac Score

<table>
<thead>
<tr>
<th>Score</th>
<th>Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>-1</td>
<td>14</td>
</tr>
<tr>
<td>0</td>
<td>64</td>
</tr>
<tr>
<td>1</td>
<td>96</td>
</tr>
<tr>
<td>2</td>
<td>68</td>
</tr>
<tr>
<td>3</td>
<td>27</td>
</tr>
<tr>
<td>4</td>
<td>2</td>
</tr>
</tbody>
</table>

RESULTS

Antibiotic Use

Of the 271 patients included in the study, 236 (87%) were prescribed antibiotics. Of these patients, seven (3%) required antibiotics according to the McIsaac score. Patients with a score of 2 or 3 and a positive throat culture, or a score 4 or higher, were correctly prescribed antibiotics 100% of the time. Many patients presenting with lower risk clinical symptoms, however, were also given antibiotics. Specifically, 100% of the 27 patients that scored 3, 89% of patients that scored 2, and 85% of patients that scored 1 were started on antibiotic treatment. Additionally, of the 64 patients that scored a 0, and the 14 patients with no clinical symptoms and over 45 years of age (scoring a -1), 51 (71%) and 13 (92%)
were sent home with antibiotic treatment, respectively. No patients were incorrectly discharged without antibiotics who qualified to receive this treatment.

**Following the Score**

Of the 271 study patients, only 39 (14%) were treated according to their score. Compliance was lowest with low-risk patients who should have been sent home without antibiotic treatment, whereas it was 100% with high-scoring patients (Figure 1).

Based on the criteria, patients presenting with a score of -1, 0 and 1 should have been sent home without antibiotic treatment. Of the 14 patients that presented with a score of -1, only three (21%) were appropriately treated. Similarly, of the 64 patients that presented with a score of zero, 13 (20%) were appropriately treated, and of the 96 patients that presented with a score of one, eight (8%) were correctly treated according to the McIsaac score.

Sixty-eight patients received a score of 2 and 27 patients received a score of 3, indicating a throat swab should be performed to guide treatment. In this case, 12 (17%) and one (4%) respectively were correctly treated properly.

Among the highest-scoring patients, 100% of the two patients that scored a 4 were discharged with the appropriate treatment.

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**DISCUSSION**

This retrospective chart review of the treatment of pharyngitis in an emergency department revealed poor overall compliance to the McIsaac Clinical Decision rule (15%). Overuse of empiric antibiotic treatment was apparent, with 97% of patients presenting with low or moderate risk symptoms receiving antibiotics. These findings suggest that physicians are not utilizing this clinical decision rule, and continue prescribing more antibiotics than clinically indicated.

Multiple factors likely account for the observations, including resource limitation such as lack of access to rapid antigen testing, patient expectations, physician education and long-standing practice patterns.

The McIsaac score was validated in a primary care setting, with adequate infrastructure to support patient follow-up. Its applicability in the emergency department is limited by physician time constraints and the lack of an organized system for the follow-up of culture results. Emergency department physicians in the study hospital are not routinely tasked with contacting patients to report abnormal test results, and do not routinely employ tests which require this kind of contact. Consequently, the use of a clinical decision rule, which indicates the use of throat culture, is cumbersome and requires the development of an infrastructure to support this cultural shift.

Rapid antigen testing is an effective alternative to the use of throat cultures for the diagnosis of GAS. If used exclusively, rapid antigen testing would eliminate the need for telephone follow-up, giving it an obvious advantage. However, the sensitivity of rapid antigen testing ranges from 70% to 92%, with only slightly higher specificity. The lack of sensitivity implies that negative results still require culture confirmation and subsequently a telephone follow-up. In addition, rapid antigen testing is expensive and may not be available in all emergency departments.

It is perhaps easy to understand that strict adherence to the McIsaac clinical decision rule necessitates difficult patient conversations, especially with patients presenting with low risk symptoms who should be sent home without empiric antibiotic treatment. The overuse of antibiotics and development of resistant organisms in the community is a well-known phenomenon that is gaining acceptance by both the medical community and general public. It is important for emergency physicians to explain to patients the rationale for sending them home without what they perceive to be adequate treatment.

With that in mind, physician education around the evidence supporting clinical decision rules as well as language that can be used to effectively deliver this information to patients can be powerful tools to increase compliance. This education could take place at a residency level as well as through continuing medical education modules for emergency department physicians.

**LIMITATIONS**

The limitations of this study include the method of case selection, which can allow for cases to be missed, the retrospective nature and dependency on deciphering medical records. The use of one hospital and a limited number of physicians can be confounding as the unique practice patterns and available resources may affect the diagnosis and treatment
of disease. Additionally, patient co-morbidities, which may contribute to antibiotic use, were not assessed.

CONCLUSION

The McIsaac clinical decision rule is not being implemented in this emergency department to guide the treatment of patients with pharyngitis. A combination of physician education, resource availability and practice patterns likely contribute to this finding. The creation of a clinical decision rule guiding the treatment of pharyngitis in the emergency department setting, taking into account the unique constraints of the practice, could help improve compliance and move towards a more uniform management of this common presentation. Additionally, increasing physician education and monitoring compliance with emergency department-based clinical guidelines, could help promote uniform adherence.

ACKNOWLEDGEMENT

The authors would like to thank Rachel Gagnier for her help with the raw data collection.

REFERENCES


Author Biographies

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Dr. Ira M. Price completed his residency training in Emergency Medicine at McMaster University, and subsequently completed a fellowship in Sports Medicine. He is currently an attending physician at Hamilton Health Sciences.
DEPARTMENT OF ANESTHESIA  
Faculty of Health Sciences  
McMaster University

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For anyone who has encountered palliative care in their personal or professional lives, the term is inextricably tied to a face and a story. It is worth taking a closer look at the clinical interactions that leave such a deep imprint on the people involved.

The World Health Organization describes palliative care as an approach aiming to relieve suffering and to improve quality of life of patients and families facing life-threatening illness.1 It was Dame Cicely Saunders who shaped the current concept of palliation in the early twentieth century—she spoke of “total pain”, encompassing the interplay of physical, psychosocial and spiritual stresses.2 An interdisciplinary team works actively to understand and alleviate every aspect of suffering, considering its impact on the whole experience of terminal disease.

In this year’s section on “Literature, the Arts and Medicine,” the McMaster University Medical Journal (MUMJ) asked for submissions from patients, their loved ones and members of their healthcare team, to explore the thoughts and feelings of people experiencing palliative care. Many choose to reflect in writing, although sculpture, music and painting have also been used by patients as forms of creative expression. One powerful example is Robert Pope’s series of acrylics, depicting his journey undergoing chemotherapy for Hodgkin’s lymphoma.3 MUMJ also recognizes the untold stories—some find it difficult to find the words, the time or the right listener. As healthcare professionals we are called to tap into these silent reflections, to enable our patients, families and colleagues to share in an environment of support and mutual respect.

A thoughtful tribute to Jim Dillon is offered by his widow Pam and by Reverend John Lougheed. Here we see the important role of a spiritual care provider in developing meaningful connections with families. Pam writes, “Could I dare to write about the joy we found, and would it be believed if I said we laughed every day, and that we talked about his death often and openly and still carried on with hope?” Open communication between healthcare providers and patients can help everyone to find peace with the passing of a loved one.

It is commonly believed that the constant exposure to death and dying would be disheartening for healthcare providers working in this setting. Yet a qualitative study of professionals in palliative and hospice care found that, though their work was punctuated by painful and distressing experiences, it provided them with a positive opportunity to normalize dying and to add meaning to their own lives.4 Tamara Hoppe shares a similar perspective as a medical student: she describes coming to terms with suffering seen on the wards, and finding a greater self-awareness through her interactions with patients.

A recent article in the New Yorker described a study of terminally-ill patients, where two-thirds of the group reported having had no discussion with their physicians about their goals for end-of-life care, though they carried an average prognosis of four months.5 Healthcare professionals may feel ill-equipped or uncomfortable eliciting a patient’s personal beliefs, yet broaching the subject is the keystone to effective palliative care. Patients from the study who proceeded to enter hospice care, where these discussions are paramount, were less likely to require intensive-care services, reported less suffering, and their family members were less likely to suffer from depression following their death.6 As healthcare providers, reflecting on our own values may enable us to overcome our reservations and to engage in an open dialogue about what approaching end-of-life means. Dr. Ahmed Jakda uses poetry as a medium for reflection, beautifully describing the human connection that he finds at the heart of every clinical encounter.

Where our treatment options fail, our ability to auscultate and investigate rendered futile, it exposes the patient-physician encounter as a simple human interaction. We are reminded that the relationships we form are in themselves therapeutic, and that our capacity to cure is only a subset of our capacity to heal.

Palliative care aims to alleviate suffering, and though this is often associated with the end-of-life, it is not reserved
for the terminally ill. Quality of life is threatened for many people experiencing chronic disease or pain. Palliation is often under-used in these settings, where it can be introduced concurrent with other medical treatments. Brigette Rieger, who suffers from severe neuropathic pain secondary to a meningioma, benefitted from a pain management plan developed by an interdisciplinary team. She writes, “I’m unable to work and I’m mostly confined to my home, so this so-called ‘benign’ brain tumour has taken a lot from me.” Her story reminds us to be mindful of the words we use to frame a disease, which is ultimately experienced uniquely by each patient.

Palliative care strives to uphold a patient-centered approach to relieve the patient’s personal experiences of suffering, in physical, psychosocial, and spiritual domains. At its most fundamental, isn’t this goal at the heart of all medicine? Isn’t this the model of what healthcare professionals should provide throughout the patient’s life course? We lament a lack of time, resources, training—but perhaps we need to prioritize this holistic approach in our use of the time and resources that we do have.

Principles of palliative care are broached in the health sciences curricula, yet the art of the interaction is learned at the bedside, and the important aspects of care are defined by those who receive it. For patients and families to impress this philosophy upon the world’s caregivers—what an incredible legacy.

REFERENCES
Jim was diagnosed with an inoperable brain tumour in August 2009. He underwent radiation and chemotherapy at Grand River Hospital and Regional Cancer Centre. A year later we were informed his treatment was no longer working, the tumour was growing again, and he was offered two drugs in a clinical trial. Jim decided to discontinue treatment and spent his last two months as he had spent the prior year, at home and at the lake with me and the ongoing love and attentions of three children, their partners and five grandchildren.

Prior to his diagnosis, we had just sold our business and happily retired. We had newfound delight – a growing family, individual interests wrapped in a great friendship, and love that started as a blind date, became an elopement and a grand adventure that lasted a lifetime – until it ended.

When Jim was first diagnosed, I spent most nights at his hospital bedside, sitting quietly in the dark – keeping watch. I was the sentinel, the witness and the wife. I thought I could ensure no further harm would come, if I could be present for Jim. I was filled with worry and wonder and fear, those thoughts coming in the middle of the night, often at three a.m.

I wrote a journal during the 14 months of Jim’s living and his dying. I wondered – could I tell the truth? Could I write and not edit away the painful parts, ones that brought me to my knees in grief? Could I dare to write about the joy we found, and would it be believed if I said we laughed every day, and that we talked about his death often and openly and still carried on with hope? Could I dare to believe the time we had been given was a miracle and not one great and disastrous sorrow?

Yes! Jim made this possible, our love and family made this possible. His palliative care made this possible. I remain so grateful for Jim and his great openness about his experience of dying.

On a Monday morning Jim became agitated, he wanted to get out of bed and talked about leaving. In the early hours he said – clearly and with a steady gaze – “Someone is coming through those doors to announce my death, are you ready?” He held his arms out to embrace me and through a descending fog of medication, managed to say, “I love you so much.” These were his last comprehensible words.

Our children came home and helped care for him in the last 24 hours of his life. His palliative nurse Agnes prepared his medications, gave quiet direction, offered her support. Her expression as she left made it clear that she would not see Jim again; she said a gentle and warm goodbye.

Many dark hours passed. We bore witness to Jim’s final struggle, sure in the knowledge that his dying was as much an important a part of his life as that which had preceded it.

“Mom, he is breathing slower”
I looked… and said, “Ah, he is dying.”

Jim died on November 2, 2010, two days after our 36th wedding anniversary. He was 56 years old. He died as he had hoped for, at home, surrounded by family – beloved.

In the weeks that followed a friend asked me to write a sentence about the journey and this is my late night thought: I believe that Cancer cannot steal the vast beauty of the human heart.

Author Biography
Pam Dillon (age 52) is a writer and a former co-facilitator at HopeSpring, a cancer support centre. She is the surviving spouse of Jim Dillon: successful entrepreneur, brilliant builder, master gardener, intrepid traveler, life-long partner, forever friend, charismatic father, joyous and devoted grandfather.
“CHASING DAYLIGHT”:
EXCERPTS FROM A HOMILY
First United Church, Waterloo
Rev. John Lougheed

“Chasing Daylight” is the title of a memoir by Eugene O’Kelly and his wife Corinne. Subtitled “How My Forthcoming Death Transformed My Life,” it is the story of their journey with his diagnosis of a brain tumour; how they savoured the time they had, and their hope to take the stigma from death.

Amidst circumstances they didn’t choose or deserve, the Dillons’ recent journey, like that of the O’Kellys, is a story of seeking, finding and sharing the answers to two questions: “Must the end of life be the worst part?” and, “Can it be made into a constructive experience – even the best part of life?”

With Jim’s diagnosis of a brain tumour, Pam has been writing along the way, drawing on her experience as a facilitator of patient and family groups at the local HopeSpring Cancer Support Centre, and most of all from her deep love and intuition. Pam describes the accompaniment and other personal care provided to Jim as “doing what love does.”

Last October, just before their 35th wedding anniversary, Pam wrote about a Buddhist saying she has cherished: “Before enlightenment … chop wood, haul water. After enlightenment … chop wood, haul water.”

As Pam went on to wonder:

“How does someone conquer the effects of a brain tumour? How do they make you believe they will move mountains, walk, survive? Because, before Jim had a brain tumour, he awoke at six a.m. to chop wood and haul water. And every day since being diagnosed… he wakes to do the same. The tasks may change but the determination and success is the same. I cope by his example. I am enlightened by his will and courage and hope. And when… I am tempted to rest for longer than I can or give in to despair or fear, I see [Jim] ahead of me… chopping wood and hauling water.”

Not for a moment do we minimize the lament for a husband, father, papa, son, brother and mentor… but we also can’t minimize the difference that the example of Jim’s life – and the way he lived before he died – will continue to make, as we continue chasing daylight. Until, as Jim has done, we “return home at eventide with gratitude.”

REFERENCES

Author Biography
Rev. John Lougheed is a chaplain in the Spiritual Care Department at the Grand River Hospital and Regional Cancer Centre in Kitchener, Ontario. He feels privileged to accompany many patients, families and staff members, and periodically conducts memorial services—such as this one—as part of this interfaith work.
LESSONS FROM A PALLIATIVE PATIENT
Tamara Hoppe

In the past year, I have learned how life can end, sometimes the consequence of a long illness, and at other times cruelly without warning. I have been exposed not only to theoretical ethical discussions concerning end-of-life care focusing on the emotional and spiritual aspects of dying, but also to real experiences on the medical wards. Recently, I was on a team treating a palliative patient whose needs called for hospice care. After speaking with him, I was surprised to learn that he was not afraid of death—he had accepted it as inevitable. Rather, he was sad because he would be unable to die in his own home, instead, in a strange place. He did not “rage against the dying of the light” as the poet Dylan Thomas wrote of his own father’s death, but wanted to be with his family, surrounded by his loved ones, at the moment when his life’s flame was extinguished. This conversation is one I will never forget.

Sometimes, palliative medicine can be unforgivingly depressing, yet each time I enter the hospital and see patients who are gravely ill, I remember the importance of providing caring and understanding to patients and their families. I still find it hard to deal with pain and death; the extent of suffering is something for which my education has not fully prepared me. Perhaps I will never be able to accept the reason for its existence in the world. Yet being so cognizant of the reality and inevitability of death has given me a more mature perspective on my own life. I hope that self-awareness, together with my experiences, will help me develop greater compassion and empathy for the needs of those who are nearing the end of life.

REFERENCE

Author Biography
Tamara Hoppe is a second-year student at the Michael G. DeGroote School of Medicine, McMaster University. Prior to medical school, she studied in the medical sciences program at the University of Western Ontario.
THE MOMENT
Ahmed Jakda

This patient, I do know.
I have seen her eyes before me,
fiery with hope,
a thousand times before me,
and more.

Those eyes have gazed, averted,
cast down and flooded.
They have widened, squinted,
been shuttered with one word.

The sea rises quick, dear friends,
in the torrent of calamity.
And that pupil, retina, iris and all,
panics suddenly.

The blue darkens,
the brown blackens,
and the sea green seems to lighten up.

Reflected is the white moon,
the piercing truth of the soul,
peeking out with immense beauty.
It is beautiful. Can you see it?

Sometimes, just sometimes,
that beauty travels across the room,
fast like a flash of light,
or floating like a white feather,
into another.

Sweet control,
Where have you gone?
This is not in the training.
These eyes are now dense, wet.

This is a moment, that moment.
I have seen it before.
These eyes,
a thousand times and more,
I have met before mine.

It is measurable, almost,
and I feel it trembling,
like the bird’s wings quickly flapping and flapping,
like the sudden shiver down a child’s small back,
like the quickened breeze with the dark pushy clouds,
like this hardened heart, suddenly thawed.

It is beautiful. Watch for it. Wait for it. And embrace it.

Author Biography
Dr. Ahmed Jakda is a palliative physician at the Grand River Regional Cancer Centre in Kitchener, Ontario. He enjoys the privilege of caring for his patients, who continue to remind him that life is precious and is to be celebrated daily.
STRUGGLES WITH A "BENIGN" BRAIN TUMOUR
Brigitte Rieger

When I was diagnosed with a brain tumour, I entered a world that I knew nothing about—suddenly I felt like I was having conversations in a foreign language. No one is prepared to receive the diagnosis I was given. Meningioma—I had difficulty pronouncing or spelling it. It was called a “benign” growth, one in which the tumour cells do not infiltrate the surrounding tissues, but the torture I experienced because of it was far from “benign”. It was explained to me that the tumour constantly compressed or distorted the trigeminal nerve, which caused the facial numbness and the constant aching pain and the severe attacks with exposure to triggers.

I had my share of experiences with overusing painkillers, including narcotics (all they ever did was dull the pain), antidepressants and several frustrating trials with anti-convulsants, which were either ineffective or had intolerable side effects. It challenged my sense of purpose and hope knowing that the cause of the problem could not be treated. The pain immobilizes me until it subsides; I’m unable to work and I’m mostly confined to my home, so this so-called benign brain tumour has taken a lot from me. Living year after year with the label “benign” has had an impact that goes far deeper than my physical pain. Adapting to this misleading label has meant dealing with feelings that were, at times, beyond anger.

It felt like the tumour was terrorizing my life. I lost my independence, my dignity and my health. It seemed it would never stop, like being on a runaway train. On one occasion, I had the most severe pain attack I have ever experienced—it felt like I was being stabbed in the face with an ice pick. My thoughts grew desperate and I just wanted to check out of this world—not because I wanted to die, but because it was the only way I would be able to control the pain.

I reached out to my role models, who challenged my way of thinking and empowered me step-by-step to believe in myself and to believe, once again, in life. I quickly began to recognize what a negative impact the wrong attitude and fear had on my condition. At a time when my world was shattered, my husband, my friends and my medical team immediately responded to my need to heal, treating me with dignity and respect. The team implemented a chronic pain management plan including one-on-one counseling with emergency care access, a number of medication trials, alternative medicine such as homeopathy and acupuncture, as well as education sessions. We created a unique approach considering my goals and treatment wishes, taking into account all aspects of my psychological, social and physical needs. Maintaining a healthy balance of realism and cautious optimism, I am now able to live with my tumour and the pain.

The author would like to acknowledge the memory of Thomas Hafenecker, Michael Newrzella and Tobias Retterath.

Author Biography
Brigitte Rieger (age 48) was diagnosed with trigeminal neuralgia resulting from a meningioma in the left cerebellopontine angle. She was treated in 2006 with gamma-knife radiosurgery. Her pain has been under control with multi-modal therapies. "I have found purpose and value in writing. I know that by sharing my experiences and my change in attitude towards my circumstances, I can give other people hope that change is possible in times when the world seems as though it is falling apart."

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Alcohol and Community-Based Violence: A Review of Evidence and Control Policies

Carly Heung, BSc (Hons), MPH(c)
Jason LeMar, BA
Benjamin Rempel, BPHE (Hons), MPH(c)

ABSTRACT
Alcohol is one of the most widely available psychoactive drugs. Both alcohol use and community-based violence share some common physiological, social, and economic variables. While the link between alcohol consumption and violent behaviour has been recognized in the literature, environmental and social influences have not been fully explored. Although alcohol consumption does not always lead to violent behaviour, epidemiological studies have shown that 62% of violent offenders were intoxicated at the time of their offence. A review of recent literature published from 1999 to 2009 in the English language identified 28 articles that explored the relationship between alcohol consumption and community-based violence. Electronic databases, grey literature, reference lists of relevant studies and previously published reviews on similar topics were searched using 17 keywords. Six parameters were found to connect alcohol consumption and community-based violence: alcohol outlet density, alcohol retail sale hours, price of alcohol, alcohol sales, characteristics of violent bars, and alcohol-related violent injuries in the hospital emergency department. It was found that alcohol-related violence is perpetuated by increased availability and harmful use of alcohol. Systematic evaluation of the included studies pointed to a strong environmental and social connection between alcohol consumption and subsequent violent behaviours. Incidents of violent behaviour thus may be prevented through public health policies. Eight strategies and 21 recommendations are made to inform public health policies intended to reduce alcohol’s contribution to community-based violence.

INTRODUCTION
Of the many psychoactive substances, alcohol is one of the most well-known, most commonly purchased, and most consumed.1 According to the 2004 Canadian Addiction Survey, about 80% of Canadians aged 15 years and older report having consumed alcohol at least once in the previous year.2 While alcohol consumption does not always follow a maladaptive pattern, the impairment resulting from its abuse can often lead to social or legal problems. In an epidemiological review of 26 studies involving 9,304 violent cases, Murdoch et al. found that 62% of violent offenders were intoxicated at the time of their offence.3

Community-based violence has been defined by Krug et al. as a type of interpersonal violence that typically occurs between acquaintances or strangers outside of the home (Figure 1).3 When this type of violence is linked to alcohol consumption, it is found to be disproportionately committed by young people in the late-night economy. While the link between alcohol consumption and violent behaviour has been well-established, the mechanisms—particularly the social and environmental influences—by which alcohol consumption leads to the escalation of community-based violence are not clear. The purpose of this paper is to provide a summary of the current research that examines the effects of alcohol consumption on community-based violence. Information sought will be used to identify patterns in which alcohol use contributes to community-based violence, identify predisposing physical and social factors, and provide policy recommendations to reduce its occurrence.
Methods

A review of the literature was performed in June 2009 by one researcher, to ensure consistency. The search for relevant literature included print, electronic, published and unpublished materials found through library databases, the Internet and reference lists of selected articles.

The library search strategy (Figure 2) used the following electronic databases: PubMed, Web of Science, and Scholars Portal (which included Social Sciences Citation Index, Sociological Abstracts, and Violence and Abuse Abstracts). These databases were chosen to encompass a wide range of disciplines particular to this topic, including biomedical, social and behavioural sciences. Specific inclusion and exclusion criteria used in the screening of relevant studies are listed in Table 1. Thirteen keywords representing ‘alcohol use’ were combined with five keywords related to ‘community-based violence’ using the ‘AND’ Boolean operator (Table 2).

Table 1. List of Inclusion and Exclusion Criteria

<table>
<thead>
<tr>
<th>Inclusion Criteria</th>
<th>Exclusion Criteria</th>
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<tbody>
<tr>
<td>• The study assessed alcohol intake and/or availability;</td>
<td>• Studies that focused on victims of alcohol-related violence or the views of the abused;</td>
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<tr>
<td>• The study assessed community-based violence documented through measured cases of injury, assault, violent crime and the like.</td>
<td>• Studies whose measure of violence was in the form of war, terrorism, or violent political conflict;</td>
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<td>• Studies on the treatment of alcoholism;</td>
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<td>• Studies that described the effects of alcoholism or alcohol-induced disorders;</td>
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<td></td>
<td>• Studies whose focus was on a specific type of injury such as human bite injury, head trauma, traumatic brain injury; and</td>
</tr>
<tr>
<td></td>
<td>• Studies that only focused on a specific population such as young adults or Aboriginals.</td>
</tr>
</tbody>
</table>

Table 2: Search Terms

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<thead>
<tr>
<th>Keywords for ‘Alcohol Use’</th>
<th>Keywords for ‘Community-based Violence’</th>
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<tbody>
<tr>
<td>• Alcohol drinking</td>
<td>• Assault*</td>
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<tr>
<td>• Alcohol abuse</td>
<td>• Brawl*</td>
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<tr>
<td>• Alcohol consumption</td>
<td>• Community violence</td>
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<tr>
<td>• Alcohol misuse</td>
<td>• Violence</td>
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<tr>
<td>• Alcohol use*</td>
<td>• Violent behaviour*</td>
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<td>• Alcohol-related drinking</td>
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<td>• Alcohol-related violence</td>
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<td>• Alcoholic beverages</td>
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<td>• Binge drinking</td>
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<td>• Drunkenness</td>
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<td>• Hazardous drinking</td>
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<td>• Harmful drinking</td>
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<td>• Social drinking</td>
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RESULTS

In total, 28 studies were identified through the described methodology (see Appendix published online at http://mumj.org). Included studies used a variety of study designs, including cross-sectional, retrospective, case-crossover, longitudinal, general population survey, case-control, and time-series analysis. Six major categories of alcohol and community-based violence studies were identified: alcohol outlet density; alcohol pricing; alcohol sales; alcohol retail sale hours; characteristics of violent bars; and alcohol-related violent injuries in the emergency department (ED).

Alcohol Outlet Density

There are two dominant theories about why alcohol outlet density and violence appear to be linked. The ‘selection effect theory’ suggests that simply the presence of outlets, as an independent factor, predisposes to violence. The ‘social disorganization theory’ presents a view that outlets provide a context for violence. From this perspective, alcohol outlets may represent a negative influence that promotes and encourages violence. Gorman et al. described the influence of this environment as follows: “Broken bottles and bars send essentially the same message as do broken windows, which is that mechanisms of informal social control have ceased to function.” It is debated whether the number of bars also correlates to the rate of violence. One study suggests that: “there may be a [threshold] point after which each additional outlet contributes increasing numbers of additional assaults.” Therefore, high alcohol outlet densities may reduce social prohibitions against violence, and subsequently, enable violence in community areas.

Geospatial studies linking alcohol outlet density and rates of violence have uniformly illustrated a positive relationship. However, the degree of association is dependent on the type of outlet—with pubs and clubs increasing the strength of the association—as well as the distribution in which they are located. In relation to place characteristics, Gruenewald et al. found that bars had a marked effect on violence in poor, unstable areas (violence rates increased with increased alcohol outlets), but were actually protective in stable, wealthy ones (violence rates decreased with increased alcohol outlets). This seems to illustrate an interaction between outlet density and socioeconomic status on alcohol-related violence.

Alcohol Pricing

Wagenaar, Salois & Komro’s meta-analysis of 112 studies found that alcoholic beverage taxes and increased prices reduce alcohol use. This relationship applies to all types of alcoholic beverages, and not only to overall consumption, but also to heavy drinking. Sivarajasingam, Matthews & Shepherd analyzed 353,433 alcohol-related violence ED cases along with the regional price of alcohol in England and Wales from 1995 to 2000. Their results indicated that “high regional violence-related injury rates correlated with low real price of alcohol as measured by price of beer,” and support an estimate that a “one-percent sustained increase in the price of alcohol above inflation will decrease violent injuries by nearly 2,200 a month in England and Wales.” Furthermore, a survey study conducted in New York found that “the cost of drinks was reported to be lower in violent bars than in nonviolent bars.” These findings suggest that increases in the price of alcoholic beverages may be an effective means of reducing violent injuries.

Alcohol Sales

Several international studies have demonstrated that increased sales through alcohol outlets are correlated with higher rates of violence. Factors shown to be important in this link include the volume of alcohol consumed and its frequency of consumption, cultural characteristics, social context, and income. Differences in drinking culture are especially important, since greater acceptance of alcohol misuse is likely to spur alcohol sales and levels of violence. Ray et al. assessed the association between retail alcohol sales across Ontario, Canada, and risk of hospitalization for intentional injuries captured by the Canadian Institute for Health Information Discharge Abstract Database from April 1, 2002 to December 1, 2004. Ray and his colleagues found that the risk of being hospitalized because of a violent assault was higher among those who live in the immediate vicinity of alcohol outlets with rising sales, measured through total volume of alcohol sold at each outlet. The study noted “a 13% higher risk of being hospitalized for assault with each additional 1,000 litres of alcohol sold per day, equivalent to about a doubling of the usual daily sales.” The risk of being violently assaulted was 41% higher during periods of peak alcohol sales than when sales were at their lowest.

Alcohol Retail Sale Hours

Several studies have evaluated whether changes in temporal access to alcohol affect local rates of violence. Restricting hours of alcohol sales may be a potential method of limiting alcohol availability and related violence. A policy to restrict alcohol sales was introduced in July 2002, prohibiting on-premise alcohol sales after 11 p.m. in Diadema, a city of predominantly low socio-economic status in Brazil. Before the law, most bars remained open 24 hours. One study analyzed assault data from 2000 to 2005 and found that “the average monthly number of assaults fell from 48 during the two years before the new law to 25 assaults in the three years after it.” Underlying trends were not accounted for in their analysis, however, and it is unclear if these effects were the result of the new law or another factor.

Changes in alcohol retail sale hours in Sweden enabled Norstrom and Skog to evaluate associated changes in assault rates. In 2000, alcohol retail monopoly shops extended sales hours to allow Saturday openings in certain parts of the country, for a trial period. Seventeen months later, Saturday opening was extended to the rest of Sweden. The authors found that the extension in retail sales to the whole of Sweden was followed by a slight increase in total alcohol sales of about 4%, with no significant change found in the indicators of alcohol-related
assaults. They examined the impact of extended drinking hours in Windsor and London, two cities in southwestern Ontario. No overall increase in assaults was observed in either locale. These two study findings suggest that extending drinking hours does not correlate to increased rates of violence.

**Characteristics of Violent Bars**

Briscoe and Donnelly examined the distribution of violent crime across licensed premises in three inner-urban areas of New South Wales and found that a large proportion of violent incidents occurred within a small proportion of licensed premises. Graham et al. analyzed incidents of aggression recorded by trained observers who attended large-capacity bars and clubs in Toronto, Canada. Incidents of aggression were based on narrative descriptions of behaviour related to both harm and intent to harm. Not only is the absolute level of intoxication a predictor of violence, but the level of intoxication relative to others was also a moderating factor in the relation between intoxication and violence. Homel et al. showed that reducing levels of intoxication of bar patrons at nightclubs in city-centre entertainment areas in Australia reduced violence. Key environmental variables associated with declining violence rates were identified: improved comfort, availability of public transport, less overt sexual activity, and fewer intoxicated males. These findings highlight the potential for violence-prone bars to modify their drinking environment by addressing certain physical and social characteristics (Table 3), thereby curtailing potential violence within their establishment.

**Table 3. Summary of Physical and Social Characteristics Associated with Violent Bars**

<table>
<thead>
<tr>
<th>Physical Characteristics</th>
<th>Social Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall comfort</td>
<td>Certain behaviours</td>
</tr>
<tr>
<td>High temperature</td>
<td>Rowdiness</td>
</tr>
<tr>
<td>High levels of noise and music</td>
<td>Overt expressions of sexual activity</td>
</tr>
<tr>
<td>Poor lighting</td>
<td>High levels of swearing</td>
</tr>
<tr>
<td>Poor ventilation</td>
<td>Sexual or general competition</td>
</tr>
<tr>
<td>Smoke-filled air</td>
<td>Heavy drinking or intoxication</td>
</tr>
<tr>
<td>Dirtiness</td>
<td>Underage drinking</td>
</tr>
<tr>
<td>Uncomfortable seating</td>
<td>Illegal drug use</td>
</tr>
<tr>
<td></td>
<td>Dancing</td>
</tr>
<tr>
<td></td>
<td>Bar location</td>
</tr>
<tr>
<td>Crowd density</td>
<td>Proximity to other bars</td>
</tr>
<tr>
<td>Capacity of venue</td>
<td>Neighborhood area where bar is located</td>
</tr>
<tr>
<td>Ethnic mix of patrons</td>
<td>(residential district versus entertainment district)</td>
</tr>
<tr>
<td>Others</td>
<td>Management practices</td>
</tr>
<tr>
<td>Presence of pool tables or billiards</td>
<td>Staff gender and attitude</td>
</tr>
<tr>
<td>Availability of public transport</td>
<td>Permissiveness of environment</td>
</tr>
<tr>
<td>Discounted drinks</td>
<td>Maintenance of bar environment</td>
</tr>
<tr>
<td>Employed bouncers</td>
<td>Serving to intoxication</td>
</tr>
</tbody>
</table>

**Alcohol-related Violent Injuries in the Emergency Department**

Violence is among the top causes of alcohol-related injuries presenting to the ED. In several studies across Latin America and New Zealand, 35-50% of all patients with a violence-related injury had recently consumed alcohol. Two Canadian studies, merged ED data from 16 countries to investigate alcohol impairment (based on blood alcohol concentration) for different types, causes, and contexts of injury. The authors found that patients with alcohol impairment were significantly more likely to sustain substance-related injuries than injuries from any other causes (such as vehicle crashes, falling, poisoning, or burns). In particular, approximately 22% of those with injuries were intoxicated, as opposed to 8% of those involved in motor vehicle crashes. The study noted: “Those consuming alcohol within six [hours] prior, compared to those not drinking during this time, were found to be 34 times more likely to have a violence-related injury among all cases [of emergency room patients] and controls, and 23 times more likely to have a violence-related injury among drinkers.” In addition, there is evidence that the risk and severity of a violence-related injury increases sharply with increasing amounts of alcohol consumed. Further, Macdonald et al. found that “a positive blood alcohol content (BAC) and a BAC of 0.08% were significantly related to violence.” A significant association was also found between a BAC level over 0.08% and the number of body regions injured. These results point to a causal role of alcohol in injuries related to violence, and suggest that the relation between alcohol consumption prior to the time of the injury is stronger than the relation between general alcohol consumption patterns (or dependence) and violence.

**DISCUSSION AND CONCLUSIONS**

A review of the evidence shows that excess alcohol consumption contributes to community-based violence. This finding emphasizes the increasing need for public health policy to address alcohol-related harm, as it relates to violence. Many incidents of violence can be prevented by reducing population alcohol consumption, particularly in areas of high alcohol outlet concentration. While regulations such as a minimum drinking age and a maximum BAC level for drivers currently exist in Ontario, even these policies are not easily enforceable. Future research in the area of alcohol-related violence prevention is needed to determine how discounted drinks, drink sizes, venue capacity, and venue style may be related to bar violence. Spatial analysis of bar locations would also provide more information about the alcohol-violence link. In addition to the list of physical and social factors that contribute to violence (Table 3), future policy development would benefit from identifying effective management practices as it relates to reducing violence. Further, reviewed studies that analyzed the relationship between alcohol retail sales hours and violence did not show a strong association; however, regulating alcohol retail sale hours is deemed an alcohol control best practice. This topic therefore requires further exploration in relation to violence.
In addition to limitations associated with the use of police record and emergency record data employed in many of the reviewed studies, the methodology of this review has some shortcomings. Abstraction forms were reviewed by a second researcher, however, selection bias may exist during the screening process in which only one researcher selected relevant studies and abstracted the data. Furthermore, ‘intentional injuries’ was not included as one of the search terms. Limitations on time and resources have also limited the scope of included studies.

The literature reviewed indicates that alcohol and community-based violence can be addressed by controlling the availability of and harmful use of alcohol. Effective alcohol control policies can help control alcohol-related violence. Table 4 illustrates eight strategies and 21 recommendations around regulation, taxation, service provision, and education, that can be acted on to help control alcohol-related violence. These recommendations are a culmination of data extracted from the literature reviewed, along with expertise of staff at Ontario Public Health Association’s (OPHA) Alcohol Policy Network, and are consistent with and supportive of those proposed by others.1,39-41

There is a clear niche for Public Health to work with relevant stakeholders and government agencies to effect the changes necessary to reduce alcohol-related harm. This may include the introduction of alcohol policy as well as the support and development of a provincial alcohol and violence prevention strategy. To this end, the development, implementation, and evaluation of evidence-informed interventions will play a positive role in mediating violence.↑

**ACKNOWLEDGEMENTS**

The authors would like to acknowledge the following individuals and groups for their valuable contributions to this paper:

**Dr. Joel G. Ray**, Clinical Scientist, St. Michael’s Hospital; Associate Professor, Departments of Medicine, and Health Policy Management and Evaluation, University of Toronto.

**Connie Uetrecht**, Executive Director (2005-2010), Ontario Public Health Association.

**Dorothy Birtalan**, Chief Information Officer, Ontario Public Health Association.

Ontario Public Health Association’s Violence Prevention Workgroup.

The Alcohol Policy Network is housed at the Ontario Public Health Association and is funded through the Ontario Agency for Health Protection and Promotion.
REFERENCES


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Efficacy of Preoperative MRI on Lumpectomy Re-Operation Rates in Breast Cancer

Andrew Bang, BSc
Shawn Dason

ABSTRACT
Breast cancer is the most frequently diagnosed cancer among Canadian women. Since early detection is associated with decreased morbidity and mortality, mammographic screening is standard protocol for women over the age of 50. Suspicious findings are evaluated using a triple assessment approach, consisting of a clinical assessment, imaging and pathology, to guide appropriate treatment. More recently, the use of preoperative MRI, which allows for superior tumour delineation, has become popular in efforts to reduce surgical re-excision rates and increase the efficacy of breast-conserving surgery. A variety of recently published studies, which have investigated the impact and efficacy of preoperative MRI on re-operation and recurrence rates, were reviewed. Notably, the COMICE trial concluded there was no statistical difference in re-operation rates (19%, 19%, $p=0.77$) between patients who received a preoperative MRI and those who received only standard triple assessment. A number of other studies showed variability in re-operation and recurrence rates for preoperative MRI. Based on this current evidence, preoperative breast MRI cannot be recommended solely to lower re-excision rates, however further research must be done in this area.

INTRODUCTION
Breast cancer is a cancer of the epithelial cells lining the lobules and ducts of the breast. In Canadian women, it is the most commonly diagnosed cancer and ranks second in mortality behind lung cancer.\(^1\) Triple assessment is the standard approach for diagnosis, and consists of clinical assessment, diagnostic imaging and needle biopsy (Figure 1). The diagnosis and management of breast cancer requires the participation and cooperation of a multidisciplinary team, ranging from surgical oncology for excision to medical oncology for a chemotherapy regimen.\(^2\)

Over the course of surgical treatment, the quantity of tissue to be excised becomes an important consideration. There is ample evidence to support breast conservation surgery in select cases over modified radical mastectomy, providing better cosmetic and psychosocial outcomes with no decrease in survival.\(^3,4\) However, inadequate tissue removal may leave positive margins and residual cancer, necessitating a second operation for re-excision. Current Canadian clinical practice guidelines suggest the use of preoperative mammography to determine whether to perform a lumpectomy or mastectomy; intraoperative margins are determined by inspection.\(^7\) Consequently, re-excision rates can be significant, ranging from 0% to 63%.\(^6\) While intraoperative frozen section or cytological techniques, such as imprint cytology, may be performed to guide margins and prevent re-excision, they are not always cost effective or available.\(^2,8\) The use of preoperative magnetic resonance imaging (MRI), a safe and widely available imaging modality, to reduce re-excision rates has been investigated in several recent trials.

The American College of Radiology and the European Society of Breast Imaging currently support the use of MRI for evaluation of the contralateral breast.\(^12,13\) Four percent of individuals may have a contralateral breast malignancy and early detection has been shown to increase relative survival from 27% to 47%.\(^14,15\) There is also evidence suggesting clinical outcomes may not be improved.\(^16\) Therefore, determining additional indications for preoperative MRI, such as reductions in re-operation rates, would be an important factor in encouraging its use.
**METHODS**

**Data Sources and Selection Criteria**

A literature search with relevant keywords was performed using MEDLINE and the Cochrane Library to find articles published before December 2010 relating to the effect of pre-operative breast MRI on re-excision rates following breast conserving surgery.

Keywords included combinations of: “breast cancer”, “MRI”, “re-operation” and “re-excision”. Studies classified as “case report”, “letter” or “editorial” were excluded. Language of publication was not a direct exclusion criterion.

The retrieved articles were reviewed if they were primary studies that addressed the question as to how preoperative MRI might affect re-excision rates.

**RESULTS**

Out of the 39 articles initially retrieved, four met the inclusion criteria.

**Comparative Effectiveness of MRI in Breast Cancer (COMICE), Turnbull et al.**

COMICE was a randomized controlled trial (open, parallel group) conducted in 45 UK centers. A total of 1,623 women scheduled for lumpectomy of a biopsy-proven breast cancer were randomly assigned to receive a preoperative MRI (n=816) or no further imaging (n=807). The primary endpoint of the study was the proportion of patients undergoing a repeat operation within six months of random assignment or a pathologically avoidable mastectomy at initial operation. This study concluded that there was no significant difference in re-operation rates between the two groups (19% in both groups, p=0.77).

**Mann et al.**

These investigators performed a retrospective cohort study on a consecutive series of patients with invasive lobular carcinoma presenting at one of two tertiary care centers between 1993 and 2005. A total of 267 patients met the inclusion criteria, with 99 having undergone a preoperative MRI and 168 having not. Patients who had received a MRI before operation had a re-excision rate of 9%, while those who did not had a re-excision rate of 27% (p=0.010). There was also a trend toward a lower final mastectomy rate when a preoperative MRI had been done (48%) than when it had not (59%, p=0.098). These investigators concluded that preoperative MRI reduces re-excision rates without increasing the rate of mastectomies.

**McGhan et al.**

These investigators conducted a retrospective study of patients diagnosed with invasive lobular carcinoma at a single institution from 2001 to 2008. Re-operation rates were compared between patients who underwent MRI and those who received conventional management. MRI was not found to significantly lower re-operation rates for close or positive margins (p>0.05). These investigators also noted that MRI had a better correlation (r=0.75) with tumor size at pathology than mammography (r=0.65), clinical breast exam (r=0.63) and ultrasound (r=0.45, all p<0.01). MRI-based tumor size was concordant with pathologic size in 56% of tumors and overestimated tumor size by >0.5 centimetres in 31% of tumors.

**Hwang et al.**

This prospective cohort study was conducted at Princess Margaret Hospital, Toronto, from 1999 to 2005. The study investigated ipsilateral breast tumor recurrence (IBTR) as well as re-operation rates in patients who received preoperative MRI versus those who did not. The study selected 463 patients diagnosed with invasive carcinoma, whose lumpectomies were performed by a single surgeon, to limit the inherent variability of lumpectomy techniques. The investigators found no significant improvements in IBTR for MRI compared to non-MRI groups (1.8% vs. 2.5%, p=0.4) and no significant differences in re-operation rates.
Table 1. Re-operation Rates for MRI vs. Standard Triple Assessment Only

<table>
<thead>
<tr>
<th>Study</th>
<th>Re-operation Rate, No MRI</th>
<th>Re-operation Rate with MRI</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>COMICE</td>
<td>19%</td>
<td>19%</td>
<td>0.77</td>
</tr>
<tr>
<td>Mann et al.</td>
<td>27%</td>
<td>9%</td>
<td>0.01</td>
</tr>
<tr>
<td>McGhan et al.</td>
<td>17%</td>
<td>7%</td>
<td>0.20</td>
</tr>
<tr>
<td>Hwang et al.</td>
<td>13.3%</td>
<td>11.8%</td>
<td>0.50</td>
</tr>
</tbody>
</table>

No other controlled studies were found that primarily investigated the effect of preoperative MRI on re-operation rates, although several made relevant observations. Grobmyer et al. found that the incidence of margin-positive partial mastectomy requiring re-excision was low (10%) in their uncontrolled retrospective series of 79 patients who received a preoperative MRI. In an uncontrolled prospective study, Bhattacharyya et al. similarly discuss low re-operation rates (9.5%) and superiority of correlation to histopathological size (r=0.71) in patients receiving a preoperative MRI rather than ultrasound or mammography. Conversely, Bleicher et al. and Pengel et al. both found that preoperative MRI did not significantly decrease the incidence of positive margins at lumpectomy. In a review of the COMICE trial, Morris raises some important points, which could impact its generalizability. She suggests that the trial may have been conducted in a setting where tissue margins of the initial surgical excision were quite wide. With a more radical approach to excision, the usefulness of MRI relative to standard triple assessment is difficult to elicit, as the surgeon would be more likely to successfully excise all malignant foci regardless of any extra information MRI may provide.

It is also noted that the trial spanned six years, over which advancements in MRI-guided biopsy and localization would have presumably decreased the number of unnecessary mastectomies. Pathologically avoidable mastectomies were counted towards re-operation rate, diminishing the effect of MRI. The COMICE trial also had a low incidence of detection of contralateral breast cancer (1.6%), either reflecting a real difference or the quality of imaging and interpretation. Finally, a large number of subjects (14%) who were enrolled in the trial were recruited by physicians who recruited only one to two patients per year, introducing a potential selection bias. Curiously, the trial also assessed re-operation rates as the primary endpoint rather than recurrence or mortality, which may be more clinically significant.

Table 2. Appraisal of the COMICE Study by Morris

- Low absolute re-excision rates (10%) are hard to improve upon
- Advancements in MRI biopsy and localization were not considered
- Low incidence of contralateral breast cancer questions imaging quality
- Low recruitment selection bias

Invasive Lobular Carcinoma

It may be that preoperative MRI reduces re-excision rates under specific conditions. When only invasive lobular carcinoma (ILC) was included in the study by Mann et al., re-excision rates were 27% and 9% in the no-MRI and MRI groups, respectively. The McGhan et al. study makes a similar conclusion when distal recurrence is considered with re-operation. Perhaps some intrinsic property of ILC, such as its increased propensity to be incompletely excised, causes a preoperative MRI to decrease re-excision rates. It was noted in the COMICE trial that ILC tended to have higher absolute re-excision rates. Further study of this phenomenon may identify a set of criteria for which preoperative MRI should be used in consideration for surgery.

Surgical Use

Although groups in the studies examined were divided based on whether they received an MRI or not, the actual extent to which the images were used in surgical planning was not evaluated. It would be important to determine the mechanisms by which MRI may guide margins and therefore affect re-excision rates. For example, margin width has been found to have an impact on ipsilateral recurrence rates and would be an important variable to consider in multicenter studies. Further, adoption of preoperative MRI on a large scale would require creation of guidelines outlining specific indications for its use, the nature of consultation with the interpreting radiologist, and effective surgical planning techniques.

Cost

The COMICE trial investigators conducted a concurrent economic analysis. They found that the group receiving a preoperative MRI had a larger mean resource cost per patient (GBP £5,508.40 vs. £5,213.50), but this was not statistically significant after controlling for other covariates. While the COMICE trial concluded that preoperative MRI did not
lower re-operation rates overall nor improve quality of life, it is important to note that there is evidence for its use in detecting contralateral breast cancer and in reducing re-operation rates in specific types of breast cancer.\textsuperscript{14,18,27} These additional benefits suggest that a preoperative MRI can be recommended without a significant cost increase. Since the COMICE trial was conducted in the United Kingdom, further study in a Canadian context is necessary to determine its applicability to the Canadian healthcare system.

CONCLUSION

With conflicting evidence, preoperative breast MRI cannot currently be recommended solely to lower re-excision rates. However, breast MRI does have other important uses, including contralateral breast cancer detection. Further research into preoperative breast MRI is needed to determine under what conditions it is indicated. Decreasing costs, improved technology and interpretation, and wider availability of MRI should be important factors in strengthening this recommendation in the future.

REFERENCES


Author Biographies

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Evaluation and Management of Ischemic Stroke

Lucy Lu

ABSTRACT
Stroke is the leading cause of disability and third leading cause of mortality in Canada. Ischemic strokes, which account for 80% of all strokes, result from embolism or thrombosis. Common etiologies of ischemic stroke include: atrial fibrillation, carotid artery stenosis, patent foramen ovale and hypercoagulable states. Timely recognition and management of ischemic stroke are crucial in reducing its associated morbidity and mortality. The purpose of this review is to discuss current guidelines pertaining to the evaluation, management and secondary prevention of ischemic stroke.

INTRODUCTION
Stroke is characterized by rapidly developing clinical signs of neurologic dysfunction caused by a sudden loss of perfusion to a cerebral vascular territory. The age-dependent incidence of stroke is 1-2 per 1,000 population, affecting 50,000 Canadians each year. It is the leading cause of adult disability in Canada, and the third leading cause of death, costing the Canadian economy $4 billion annually.

Stroke is classified as ischemic or hemorrhagic. Intracranial hemorrhage accounts for 10% to 15% of all strokes. The rest are ischemic, caused by a disruption of blood flow, glucose, or oxygen to the brain. The brain is the most metabolically active organ in the body, so it is extremely sensitive to decreased blood flow; an ischemic cascade begins seconds to minutes after onset of ischemia and is characterized by neuronal injury and death. Core brain tissue receiving less than 20% of blood flow suffers irreversible infarction within minutes. The ischemic penumbra, which surrounds the core tissue, may remain viable for a few hours due to collateral supply of blood. As a result, early recognition and management of stroke is crucial to preserving the penumbral neurons and reducing stroke severity. This paper will delve into common mechanisms of ischemic stroke and focus on current guidelines for its evaluation and management.

METHODS
A literature search was performed using the PubMed database with combinations of keywords: “ischemic stroke”, “etiologic”, “risk factor”, “acute management”, “secondary prevention”, “review” and “guidelines”. Reference lists of the articles identified were used to find additional manuscripts that were judged to be relevant.

ETIOLOGY
Ischemic strokes may be caused by embolism, thrombosis, or hypoperfusion. Twenty-five percent of ischemic strokes are embolic, occurring when a cerebral artery is blocked by a clot or other debris from a distant site in the body. Embolic strokes may simultaneously cause multiple infarcts in different cerebral vascular territories. Emboli can originate from the heart, arteries or veins and often occur in hypercoagulable states, such as in antiphospholipid syndrome, protein C and protein S deficiencies. Cardiogenic emboli may arise in conditions predisposing to blood stasis, such as atrial fibrillation, recent myocardial infarction (MI), dilated cardiomyopathy and severe congestive heart failure (CHF). Thrombi may also develop on valves that are diseased, damaged or prosthetic. Atherothrombotic or cholesterol emboli may originate in the aortic arch or extracranial arteries, including the carotid and vertebral arteries. Paradoxic emboli, arising in the venous circulation, can pass into the arterial system through a cardiac septal defect, such as a patent foramen ovale (PFO), and travel to the brain.

Thrombotic strokes, accounting for 50% of ischemic strokes, are caused by the formation of thrombi that occlude cerebral arteries (Figure 1). Large-vessel thrombosis involves the carotid and vertebral arteries and the Circle of
Obstruction of these vessels is usually due to rupture of atherosclerotic plaque, although, in younger patients, the differential diagnosis includes arterial dissection, fibromuscular dysplasia, vasculitis, sickle cell anemia, polycythemia, vasoconstriction from migraine or substance abuse and other hypercoagulable states. Small-vessel thrombotic strokes, also known as lacunar strokes, involve small, deep penetrating cerebral arteries. Occlusions of the smaller arteries are commonly the results of microatheroma (small atherosclerotic plaque) and lipohyalinosis (fatty hyaline buildup). Cerebral venous thrombosis is a rare cause of stroke, occurring when venous sinus drainage of cerebral blood flow is blocked; cerebral infarction is secondary to tissue congestion and inadequate arterial perfusion pressure.

The causes and mechanisms of ischemic stroke are summarized in Figure 2.

**Ischemic Stroke**

**Embolism**
- Cardiogenic: A. fib., MI, CHF, Dilated cardiomyopathy, Valvulopathies, Hypercoagulable states
- Arterial: Carotid stenosis, Vertebral stenosis

**Thrombosis**
- Venous: Via PFO
- Arterial: Carotid/vertebral stenosis, Arterial dissection, Fibromuscular dysplasia, Vasculitis, Sickle cell anemia, Migraine, Hypercoagulable states
- Venous (cerebral sinus): Nephritic syndrome, Trauma, Meningitis, Oral contraceptive, Hyperhomocysteinemia, Hypercoagulable states

**Hypoperfusion:**
- Carotid stenosis
- Cardiac arrest
- Hypovolemia

**Figure 2.** Mechanisms of Ischemic Stroke with their Associated Etiologies

**RISK FACTORS**

The most important risk factor for stroke is age, with risk of stroke doubling every decade. Other risk factors include: hypertension, atrial fibrillation, CHF, hyperlipidemia, diabetes, recent coronary artery bypass surgery, obesity, smoking and heavy alcohol consumption.

Cardiogenic strokes, caused by atrial fibrillation, are associated with higher mortality, more severe disability and more frequent recurrence. The CHADS2 score can be used to quantify stroke risk in a patient with atrial fibrillation. One point is scored for each of the following conditions: Congestive heart failure, Hypertension, Age ≥75 years, Diabetes, and two points are added if there is a history of Stroke or transient ischemic attacks. A CHADS2 score of zero or one signifies a low risk of stroke, whereas a CHADS2 score of two or more implies the annual risk of stroke is greater than 4% and anticoagulation therapy is warranted.

Transient ischemic attacks (TIA) can be warning signs for a future ischemic event. TIAs present with stroke-like symptoms that resolve in minutes to hours. They differ from ischemic strokes in that the neurologic dysfunction is temporary, resulting from focal cerebral ischemia without acute infarction. The ABCD2 score system is used to predict stroke risk after TIA (Table 1). Since the mechanism causing cerebral ischemia in a TIA may progress to an ischemic stroke, TIAs should be investigated within 48 hours, especially for high-risk patients (ABCD2 score ≥4).

Less commonly, systemic hypoperfusion, from decreased cardiac output or hypovolemia, may lead to decreased cerebral blood flow and cause watershed infarcts. Vascular border zones between two cerebral arteries, called watershed areas, have the lowest perfusion pressures and are therefore most prone to damage.
Table 1. ABCD2 Score

<table>
<thead>
<tr>
<th>Feature</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age ≥60 years</td>
<td>1</td>
</tr>
<tr>
<td>Blood pressure (BP) elevation:</td>
<td></td>
</tr>
<tr>
<td>Systolic BP ≥140 mmHg or Diastolic BP ≥90 mmHg</td>
<td>1</td>
</tr>
<tr>
<td>Clinical features:</td>
<td></td>
</tr>
<tr>
<td>Unilateral weakness</td>
<td>2</td>
</tr>
<tr>
<td>Speech impairment without focal weakness</td>
<td>1</td>
</tr>
<tr>
<td>Duration of TIA:</td>
<td></td>
</tr>
<tr>
<td>≥60 mins</td>
<td>2</td>
</tr>
<tr>
<td>10-59 mins</td>
<td>1</td>
</tr>
<tr>
<td>Diabetes</td>
<td>1</td>
</tr>
</tbody>
</table>

Risk of Stroke after a TIA

<table>
<thead>
<tr>
<th>ABCD2 Score</th>
<th>2-day risk</th>
<th>7-day risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-3</td>
<td>1%</td>
<td>1.2%</td>
</tr>
<tr>
<td>4-5</td>
<td>4.1%</td>
<td>5.9%</td>
</tr>
<tr>
<td>6-7</td>
<td>8.1%</td>
<td>12%</td>
</tr>
</tbody>
</table>

PRIMARY EVALUATION

Since stroke is a medical emergency, it is important to establish the patient’s airway, breathing and circulation and draw the relevant bloodwork prior to proceeding with a focused history and physical exam. On history it is important to note any risk factors for stroke and determine the time of onset of symptoms in order to assess the patient’s suitability for thrombolytic therapy. Rarer causes of stroke should be considered in younger patients, including recent trauma, coagulopathies, migraines, oral contraceptive use and illicit drug use. Witnesses and family members may provide helpful information and help establish the patient’s baseline condition.

Most stroke presentations include unilateral numbness or weakness of the face, arm or leg, difficulty speaking or understanding, visual disturbances, dizziness and loss of balance. Symptoms are typically maximal at onset and do not progress. Deficits that worsen or fluctuate over time, may suggest a propagating thrombus, recurrent emboli, edema expansion, vasculitis or hypoperfusion.

Stroke must be distinguished from other disorders that may present similarly, including seizure, hypoglycemia, tumor, infection, hyponatremia, migraine, multiple sclerosis and intracranial hematoma. The likelihood of stroke increases with presence of any of these three findings: acute facial paresis, arm drift or speech disturbance.

It is important to closely monitor vital signs, since a stroke patient’s condition may rapidly deteriorate. The National Institute of Health (NIH) Stroke Scale is a validated tool for quantifying stroke severity and assessing clinical progression of deficits. It measures neurological function including level of consciousness, vision, extraocular movements, facial palsy, speech, language, ataxia, neglect and motor and sensory deficits. The numerical score, calculated from the functional impairments elicited on physical exam, is a good predictor of outcomes: a score of 16 or greater predicts a high probability of death or severe disability, while a score of six or less forecasts a good recovery.

An emergent non-contrast head CT is required to differentiate ischemic stroke from hemorrhagic stroke and other neuropathologies, such as tumor and abscess. The earliest sign seen on CT is the loss of grey-white matter differentiation, caused by edema in the grey matter. While the CT scan may

Table 2. Common Symptoms and Signs of Specific Stroke Syndromes

<table>
<thead>
<tr>
<th>Anterior Cerebral Stroke</th>
<th>Middle Cerebral Stroke</th>
<th>Posterior Cerebral Stroke</th>
<th>Vertebrobasilar Stroke</th>
<th>Lacunar Stroke</th>
</tr>
</thead>
</table>
indicate the anatomic distribution and extent of the ischemia, clinical correlation is important in determining the specific stroke syndrome (Table 2).14 When a major cerebral artery is occluded by a thrombus, it may appear hyperdense on CT indicating that its arterial territory is at risk of infarction. The CT may appear normal initially, if there has not been sufficient edema buildup in the first six hours after the stroke.14 Diffusion-weighted magnetic resonance imaging (MRI) may be more sensitive at picking up acute ischemia, but the longer study duration and lack of availability make it unsuitable for the acute stroke setting.14

The rest of the primary assessment should be guided by the clinical scenario and may include auscultation for carotid bruits and heart murmurs, fundoscopy to look for signs of peripheral emboli, and bilateral blood pressures to rule out aortic dissection.

ACUTE MANAGEMENT

The primary goal of management in acute ischemic stroke is to minimize damage. If no hemorrhage is identified on the head CT, intravenous recombinant tissue plaminogen activator (IV rtPA) may be beneficial if administered within three hours of ischemic stroke onset.15 Its inclusion and exclusion criteria are outlined in Table 3.4 For certain patients meeting additional exclusion criteria (age >80, history of diabetes or stroke, patients on oral anticoagulation, or NIH stroke score >25), rtPA may be administered within 4.5 hours.15 Blood pressure must be maintained below 185/110 mmHg in tPA candidates, and no anticoagulants or antiplatelet agents may be administered within 24 hours of tPA administration.

Potential risks and benefits of rtPA should be discussed with patients and family members. The National Institute of Neurological Disorders and Stroke (NINDS) tPA trial showed that despite the 10-fold greater risk of intracerebral hemorrhage (6.4% with tPA vs. 0.6% in patients with traditional treatment), tPA produced a 12% absolute increase in excellent functional outcome and a 4% absolute risk reduction in mortality.16

For patients who are not candidates for IV rtPA, intra-arterial (IA) tPA may be considered if they are presenting within six hours of stroke onset and have a large vessel occlusion identified on a CT angiography (CTA).17 For patients who are not qualified for tPA, aspirin (325 mg/day) administered within 48 hours post ischemic stroke can reduce risks of early mortality, disability and stroke recurrence.18

High blood pressure is required to perfuse ischemic brain tissues, and should not be lowered unless it exceeds 220/120 mmHg, there is evidence of MI, CHF or aortic dissection, or thrombolytic therapy is planned.4 Hydration with isotonic maintenance fluids is important. Hyperglycemia, hypomagnesemia and fever worsen outcome and should be avoided.19,20 Nonambulatory patients should receive subcutaneous enoxaparin for deep venous thrombosis prophylaxis.21 In the days following the initial stroke, patients should be monitored closely for complications, including increased intracerebral pressure, seizures, depression, infection, pulmonary embolism and cardiac problems.

<table>
<thead>
<tr>
<th>Table 3. IV rtPA Inclusion and Exclusion Criteria4</th>
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<tbody>
<tr>
<td><strong>Inclusion criteria</strong></td>
</tr>
<tr>
<td>• Age ≥18</td>
</tr>
<tr>
<td>• Clinical diagnosis of ischemic stroke (NIH stroke score &gt;4)</td>
</tr>
<tr>
<td>• No hemorrhage on head CT</td>
</tr>
<tr>
<td>• Initiation of treatment within 3 hours of symptom onset</td>
</tr>
<tr>
<td>• Neurological defects not minor, isolated or clearing spontaneously</td>
</tr>
<tr>
<td><strong>Exclusion criteria</strong></td>
</tr>
<tr>
<td>• Symptoms suggestive of subarachnoid hemorrhage</td>
</tr>
<tr>
<td>• Past history of intracranial hemorrhage</td>
</tr>
<tr>
<td>• Hemorrhage on head CT</td>
</tr>
<tr>
<td>• Multilobar infarction on CT (hypodensity &gt;1/3 cerebral hemisphere)</td>
</tr>
<tr>
<td>• Patient on anticoagulants with INR &gt;1.7</td>
</tr>
<tr>
<td>• Heparin received within past 48 hours resulting in a prolonged aPTT</td>
</tr>
<tr>
<td>• Platelet &lt;100 x 10^9/L</td>
</tr>
<tr>
<td>• Unable to reduce systolic BP below 185 mmHg or diastolic BP below 110 mmHg</td>
</tr>
<tr>
<td>• Serious head trauma, stroke or myocardial infarction within last 3 months</td>
</tr>
<tr>
<td>• Major surgery within the last 21 days</td>
</tr>
<tr>
<td>• Gastrointestinal or urinary tract hemorrhage within last 14 days</td>
</tr>
<tr>
<td>• Seizure at the onset of stroke</td>
</tr>
<tr>
<td>• Arterial puncture at noncompressible site within last 7 days</td>
</tr>
<tr>
<td>• Glucose &lt;2.8 mmol/L or &gt;22 mmol/L</td>
</tr>
<tr>
<td>• Only minor stroke deficit which is rapidly improving</td>
</tr>
</tbody>
</table>

SECONDARY WORKUP

Once the patient is stable, a secondary workup can be performed to determine the underlying stroke etiology and appropriately target therapies. Curiously, in 18% to 40% of patients, especially younger patients, a specific cause of ischemic stroke cannot be identified even after intensive investigations.4 Diffusion-weighted MRI is useful because it can distinguish a new ischemic stroke from old ones and detect small areas of ischemia, particularly in the cerebellum and brain stem.14

Underlying carotid disease should be ruled out, as it can lead to ischemic strokes via multiple mechanisms. A carotid duplex Doppler ultrasound is the initial screening evaluation for carotid disease as stethoscope auscultation for carotid bruits is a poor predictor of underlying carotid stenosis.6,22 Carotid stenosis is considered symptomatic if it has caused
a TIA or stroke in the ipsilateral side. If symptomatic carotid stenosis is found, the diagnosis and degree of stenosis need to be confirmed by CTA, especially in the preoperative evaluation for carotid endarterectomy.

In addition, CTA can help depict detailed cerebrovascular anatomy and demonstrate subtle vascular occlusions from fibromuscular dysplasia, vasculitis and arterial dissection.

If cardiac causes of ischemic stroke are suspected, patients should be put on a Holter monitor to detect paroxysmal atrial fibrillation. An echocardiogram with bubble study can be obtained to identify presence of a patent foramen ovale, cardiac thrombi and valvular vegetations.

In patients less than 40 years of age, a workup for hypercoagulability disorders and autoimmune diseases should be conducted. These patients should be investigated for antiphospholipid syndrome, protein C and S deficiencies, Factor V Leiden thrombophilia, lupus, sickle cell anemia, hyperhomocysteinemia and heparin-induced thrombocytopenia. Rheumatologic markers, including erythrocyte sedimentation rate, rheumatoid factor, antinuclear antibody and antineutrophilic cytoplasmic antibody, should be tested.

SECONDARY PREVENTION

After an initial stroke, the risk of recurrence is at least 5% per year. Secondary prevention should begin immediately and should be tailored toward the underlying etiology. Warfarin reduces recurrent stroke risk by 64% in patients with atrial fibrillation, though it is associated with increased risk of bleeding. A combination therapy of clopidogrel plus aspirin may be considered for patients who cannot take warfarin.

Patients with symptomatic high-grade carotid stenosis (>70% stenosis) should undergo carotid endarterectomy within two weeks of the stroke, while patients with symptomatic carotid stenosis (50-60% stenosis) should have endarterectomy within one month. Stenting may be considered if endarterectomy is contraindicated or if there is bilateral symptomatic high-grade stenosis. Surgical intervention is not indicated in asymptomatic carotid stenosis as the operative risk exceeds the benefit. With or without surgery, all patients with carotid stenosis should be managed medically with a statin, antihypertensives and antiplatelet agents.

Strokes from other etiologies are generally managed with antiplatelet therapy. Aspirin (50 mg or 325 mg per day) is the initial choice because of its low cost, low risk and a 22% risk reduction in recurrent stroke. Studies have shown that Aggrenox (aspirin plus extended-release dipyridamole) may be superior to aspirin alone, with a 37% risk reduction, and can be considered as an alternative first-line therapy. Clopidogrel is recommended if there is an aspirin allergy or if aspirin therapy fails. The combination of clopidogrel and aspirin is not indicated due to increased bleeding risk without added benefit. Ticlopidine is a third-line therapy because of cost and the serious side effect of neutropenia.

Long-term blood pressure control is important in secondary prevention of stroke. Blood pressure should be maintained below 140/90 mmHg in patients who suffered a stroke, and below 130/80 mmHg in stroke patients with diabetes and chronic renal disease. Additionally, an angiotensin-converting enzyme (ACE) inhibitor combined with a diuretic have been shown to reduce recurrent stroke risk by 43% in both hypertensive and nonhypertensive individuals. Thus this combination therapy should be initiated in all ischemic stroke patients prior to discharge from hospital or within the first week after the stroke regardless of their baseline blood pressure. Benefits start to appear with a reduction of 10/5 mmHg in blood pressure.

Atorvastatin 80 mg has been shown in a large randomized controlled trial to reduce the risk of stroke by 16%. All patients with prior ischemic strokes should be treated with statins irrespective of their cholesterol level because of reduction of both fatal and non-fatal stroke.

CONCLUSION

As a leading cause of morbidity and mortality in Canada, timely recognition and management of stroke is imperative. Ischemic strokes, which account for 80% of all strokes, typically result from one of three mechanisms: embolism, thrombosis and hypoperfusion. There are a variety of etiologies, the determination of which is essential in targeting therapy and guiding secondary prevention. In acute stroke management, a focused history and physical exam should be completed within 10 to 15 minutes of the patient’s arrival in the emergency department to obtain information about the time of onset, symptoms, course, stroke risk factors, past medical history, neurologic deficits and cardiac function. An emergent CT head should be performed to distinguish ischemic stroke from hemorrhagic stroke and treatment with IV rtPA, IA rtPA or aspirin may be considered depending on the timing and patient suitability.

Research in ischemic stroke management is ongoing, new therapies are emerging, and clinical guidelines are constantly optimized for better patient care. For instance, dabigatran, a direct thrombin inhibitor, has recently been approved as an alternative to warfarin for stroke prevention in atrial fibrillation patients. Studies have shown that dabigatran is similar to warfarin in rates of stroke prevention and major hemorrhages, but may be advantageous in that there is no need to monitor INR. While significant advancements in stroke management are taking place, it should be noted that rehabilitation and lifestyle modifications remain crucial elements to stroke prevention and functional recovery.
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INTRODUCTION
Students, clinicians and anatomists all agree that the study of anatomy is integral to medical education and the practice of medicine. However, incoming residents’ knowledge of anatomy has been rated as inadequate for future practice by both clinicians and students themselves. This might be explained by large-scale changes made to medical curricula over the past 20 years. Namely, medical students may find their anatomy curriculum is fast-paced with little time to reflect on concepts. They may also find difficulty in accessing faculty members for guidance, and resources, such as a dissection laboratory, may not be readily available. Thus, students must take an active role in guiding their own learning to ensure their understanding facilitates transition into their future practice. This review discusses effective strategies for learning anatomy and creating a strong foundation of knowledge that can be built upon throughout medical training.

LEARNING STRATEGIES
The primary purpose of learning anatomy is to recognize the body’s normal structure and function so that when structures are altered by defect, trauma, or disease, knowledge of these deviations can be utilized in making clinical decisions. Anatomy also serves as the language of medicine through which we describe and assess human structure. Naturally, anatomy is an area of lifelong development where understanding is shaped by clerkship rotations, residencies, and destined specialties.

The strategies presented here offer useful considerations for a student’s self-directed approach to learning anatomy in conjunction with a formal curriculum. A student’s anatomy course and medical program provide a roadmap for learning, outlining the material to be learned, the order in which it should be covered, the depth of coverage and measures for evaluating performance. Active learners must follow this curriculum while supplementing it with information learned using self-directed study strategies. The three strategies highlighted are: deep learning, visualization, and application of knowledge.

Deep Learning
The learning process may be traditionally described through Marton & Saljo’s concepts of surface and deep level learning. Surface learning involves a reproduction of factual knowledge. Conversely, a deep approach is motivated by the vocational relevance of the material, with a focus on the meaning of content rather than just the content itself. For example, the aorta is described as the largest artery in the body with thick, elastic walls, which allow for expansion as blood is forcefully expelled from the heart. In this example, surface learning is the knowledge that there is a blood vessel called “the aorta”, whereas deep learners use a broader knowledge of the aortic wall structure to appreciate what the
walls of other arteries might be like. Making generalizations about structures, and then establishing a rationale for how and why they are similar or different, allows for the understanding of one concept to aid the understanding of another.

Following the steps presented in Figure 1 puts deep learning to practice. Rather than using memorization for learning, it is important to focus on the meaning of learned content and to make connections between concepts. This may involve brainstorming explanations for the design of a particular structure. Further, understanding the function of a particular structure may help explain other parts of the body. Finally, previously consolidated knowledge is useful for extrapolation and problem solving. Overall, adopting strategies that help form a deeper understanding of anatomical material will facilitate long-term retention and understanding.19

Visualization

Visualization, in the context of anatomy, can be defined as creating a mental picture of anatomical structures that is easily recalled. It is a powerful tool in learning anatomy since the complex spatial organization of the body across three dimensions is best represented visually.20

Two strategies that aid in visualizing anatomical concepts are highlighted (Table 1). First, studying from various sources offers different perspectives on a particular topic leading to a more complete mental picture of the area. Sources of information range from textbooks and electronic resources to cadaveric specimens that demonstrate different orientations and anatomical variances. Second, complex imagery is easier to understand if the visual stimulus is reduced to simple patterns.21 For example, the details of the internal thoracic artery—forming off of the subclavian artery and branching into the anterior intercostal, musculophrenic and superior epigastric arteries—can be represented as a line diagram (Figure 2). This simplified example can then be built upon by putting it in context of surrounding structures such as the ribs, intercostals muscles, and mediastinum.

Table 1. Strategies for Visualizing Anatomy

<table>
<thead>
<tr>
<th>Study from a Range of Sources</th>
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<tbody>
<tr>
<td>• Course lectures/notes</td>
</tr>
<tr>
<td>• Textbook text</td>
</tr>
<tr>
<td>• Textbook diagrams</td>
</tr>
<tr>
<td>• Atlases</td>
</tr>
<tr>
<td>• Cadaveric specimens</td>
</tr>
<tr>
<td>• Artificial models</td>
</tr>
<tr>
<td>• Online modules</td>
</tr>
<tr>
<td>• Online public health information, i.e. Heart and Stroke Foundation</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Work from the Basic to the Complicated</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Reduce complex anatomical design to simple drawings/depictions</td>
</tr>
<tr>
<td>• Master one concept then build upon it, i.e. understand arterial pathways first then place arteries in relation to other structures</td>
</tr>
<tr>
<td>• Take individual organs, become familiar with their design, then place them in context of the body cavity in which they reside, observing their relationship to other structures</td>
</tr>
</tbody>
</table>

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Figure 1. Deep Learning
Application of Knowledge

The application of anatomical knowledge to a variety of situations and problems is an effective method for establishing a deeper understanding of anatomy. Woods et al. argue that students who learn basic science in a clinically relevant manner are better able to remember clinical conditions after a delay period.

Since its introduction in the 1960s, problem-based learning (PBL) methods developed at McMaster University have been adopted by many institutions worldwide to encourage the application of biomedical knowledge to real-world problems and situations. Drawing on the theoretical foundations of Schmidt’s seven-step process for working through problem-based cases, Table 2 demonstrates how problem-based activities can be approached with a focus on related anatomy. With each case, specific questions can help identify clear learning goals, clarify clinical significance of related anatomy, and establish how material might be communicated and solidified through group-based discussion.

Beyond problem-based activities, there are many other ways students can apply their knowledge of anatomy (Table 3). For example, relating new concepts to personal or family experiences and designing individual clinical cases are two ways in which anatomy knowledge can be actively applied.

Table 2. Relevant Problem-based Case Questions that Focus on Developing Anatomical Knowledge

<table>
<thead>
<tr>
<th>Schmidt’s 7 Step Process</th>
<th>Relevant Questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Clarify terms and concepts not readily comprehensible</td>
<td>What anatomical terms and concepts must our group clarify? Does my understanding of related anatomical concepts differ from that of my peers?</td>
</tr>
<tr>
<td>2. Define the problem</td>
<td>What anatomical concepts and other interrelated phenomena should be explained/explored in relation to this case?</td>
</tr>
<tr>
<td>3. Analyze the problem and develop a hypothesis</td>
<td>Utilizing the knowledge developed in steps 1 and 2, what hypotheses can we brainstorm about the case?</td>
</tr>
<tr>
<td>4. Organize a systematic inventory of the explanations inferred from step 3 - discussing, evaluating and arranging possible explanations</td>
<td>How can we summarize and structure our case-analysis?</td>
</tr>
<tr>
<td>5. Formulate learning objectives</td>
<td>What are our learning objectives?</td>
</tr>
<tr>
<td>6. Collect additional information outside the group</td>
<td>Where do I find the appropriate resources to answer these questions?</td>
</tr>
<tr>
<td>7. Report back to the next tutorial, synthesizing and testing the newly acquired information</td>
<td>How can I explain my newly-formed anatomy knowledge to my peers in a way that will aid the group in understanding the case further?</td>
</tr>
</tbody>
</table>

Table 3. Creative Ways of Applying Anatomy Knowledge

- Approach problem-based cases with anatomy-specific questions (Table 2)
- Learn from personal, friend and family experiences
- Relate knowledge to observations through clinical rotations
- Relate knowledge to pop-culture, world events, and interesting clinical cases
- Try writing your own clinical cases
CONCLUSIONS

Overall, these three strategies aim to encourage an exploration of anatomy for today’s medical student. While there are no definitive guidelines for optimal learning, it is evident that active learning is essential in building a strong foundation of knowledge for transition into future practice. Being an active learner involves going beyond surface approaches, visualizing anatomy as a three-dimensional mental picture, and applying knowledge in a broad context. Anatomy is more than memorization and encounters with cadavers. It is a living tool that can bolster and improve clinical reasoning practices. It is up to students to decide for themselves if they will learn with the fervor necessary to achieve such goals.

ACKNOWLEDGEMENTS

The author wishes to acknowledge the faculty and staff of the Education Program in Anatomy at McMaster University who provided the inspiration and support for writing this article. In particular, the author wishes to thank Dr. Darren Bridgewater, Dr. Sahar Hafeez and Ms. Caitlin O’Connell for their review and support.

REFERENCES


Author Biography

Lauren De Meester completed a Masters in Anatomical Sciences from Queen's University in 2009. She now works as a prosector for the Education Program in Anatomy at McMaster University, where she enjoys mentoring students in their discovery of anatomy.
ABSTRACT
Sleep apnea is a potentially life-threatening condition with numerous negative metabolic, psychologic and cognitive effects. Although suspicion of sleep apnea can be obtained from the history and physical exam, the gold standard for diagnosis is polysomnography (PSG). In most cases, the cause of sleep apnea is secondary to upper airway obstruction. The treatment of sleep apnea varies depending on its severity, which can be quantified using PSG. Treatment options include lifestyle modification, oral appliances, positive airway pressure and upper airway surgeries. This paper reviews the current literature on epidemiology, genetics, diagnosis and management of sleep apnea.

INTRODUCTION
Sleep is essential for normal physiologic and metabolic homeostasis, with individuals spending an average of one third of their lifespan sleeping. Naturally, its disruption can be detrimental to a person’s health and well-being. Over the last century, sleep research has provided interesting insight into the normal functions of sleep and associated disorders. The following article will review the current understanding of sleep apnea, the most studied disorder in sleep medicine.

NORMAL SLEEP CYCLE
Sleep consists of two general stages: non rapid eye movement (NREM) and rapid eye movement (REM) sleep. NREM is divided into three stages: N1, N2 and N3, based on electroencephalogram (EEG), electrooculargram (EOG) and electromyogram (EMG) characteristics.1 The majority of sleep is spent in NREM sleep, which is associated with decreased brain and EEG activity. In contrast, REM sleep is characterized by a fast-frequency and low-voltage EEG tracing similar to an awake pattern. The hallmark feature of REM sleep is the presence of rapid eye movements with paralysis of all other voluntary muscles, defined by an atonic EMG.
A typical night of sleep consists of four to five cycles of REM and NREM sleep, which last 90-100 minutes each. An awake individual will drift into N1 briefly before proceeding into N2 and subsequently N3 and REM sleep. Deep sleep (N3) predominates in the first half of the night, while individuals alternate between N2 and REM sleep in the second half.2 Many physiological changes occur during both NREM and REM sleep involving the autonomic nervous system, respiratory, cardiovascular, gastrointestinal, endocrine and genitourinary systems.3

PATHOGENESIS
To accommodate for the complex functions of speech, swallowing and breathing, the oropharynx and hypopharynx are dependent on dilator muscles, notably the genioglossus and tensor palatine, and soft tissues to maintain patency. Obstructive sleep apnea (OSA) is a consequence of pharyngeal collapse that occurs during sleep, resulting in recurrent upper airway obstruction. Anatomical factors play an important role in OSA pathogenesis; the combination of enlarged soft tissue with anomalies in the craniofacial structures may result in narrowing of the upper airway lumen, consequently predisposing individuals to pharyngeal collapse.4 While awake, airway patency is maintained by increased pharyngeal dilator muscle activity, which counteracts the collapsing force of the negative pressure generated during inspiration.5 Sleep results in the loss of this neuromuscular compensation, leading to
collapse of the airway.\textsuperscript{4} The loss of pharyngeal muscle activity and tone is greatest during REM sleep.\textsuperscript{4}

The reduction or cessation of airflow causes hypopnea or apnea events, which lead to hypoxia and hypercapnia and stimulate increasing respiratory effort until sleep arousal occurs. Arousal allows for restoration of pharyngeal dilator muscle activity, establishing airway patency. After hyperventilation to correct the blood gas abnormalities, the patient returns to sleep, allowing the cycle to restart and causing recurrent sleep arousal and fragmentation. Ventilatory control instability, measured by loop gain, may contribute to the development of OSA by causing fluctuating upper airway mechanics.\textsuperscript{5} Additional contributory factors include differences in sleep arousal thresholds and lung volume.\textsuperscript{7,8}

**EPIDEMIOLOGY AND RISK FACTORS**

Apnea is defined as a cessation of airflow for more than ten seconds. Obstructive apnea involves a loss of airflow with maintained respiratory effort. It is secondary to collapse of the upper airway and is commonly accompanied by oxygen desaturation. Central apnea occurs with the loss of both airflow and respiratory effort, and is usually caused by neurologic disorders, stroke and other metabolic disorders. Mixed apnea episodes are characterized by signs of both obstructive and central apnea. Finally, hypopnea events are defined as a decrease in airflow of at least 30\% for ten seconds, with a 4\% reduction in oxygen saturation.\textsuperscript{7}

Using the above criteria, the apnea-hypopnea index (AHI) and the respiratory disturbance index (RDI) are calculated. AHI is determined by the number of apnea and hypopnea episodes per hour, while RDI is the relationship between the number of apnea, hypopnea and respiratory effort-related arousals per hour.\textsuperscript{8} According to the American Academy of Sleep Medicine (AASM), severity of sleep apnea is based on the RDI, with less than 15 classified as mild, 15-30 as moderate and greater than 30 as severe.\textsuperscript{9}

A variety of studies have investigated the prevalence of OSA in countries around the world such as the United States, Australia, Spain, Hong Kong, Korea and India.\textsuperscript{12-20} The prevalence of OSA ranges from 3\% to 7\% for adult men and 2\% to 5\% for adult women in the general population, with OSA defined as an AHI greater than five events per hour accompanied with excessive daytime sleepiness.\textsuperscript{10} It is of interest that the prevalence of OSA is about 24\% for men and 9\% for women if the only requirement for diagnosis is an AHI greater than five.\textsuperscript{12}

An important issue in the epidemiology of OSA arises from the lack of standardization in regards to the definition of hypopnea, which affects the AHI calculation.\textsuperscript{11} Further research has been recommended to investigate other evidence-based metrics for a more accurate and objective evaluation of the true prevalence of OSA.\textsuperscript{12}

Hormonal differences may play a role in the effect of gender on OSA prevalence since post-menopausal women have higher rates of OSA compared to pre-menopausal women.\textsuperscript{14} Also, post-menopausal women on hormonal therapy have a similar prevalence of OSA compared to pre-menopausal women, indicating a protective role for estrogen.\textsuperscript{14} Anatomical factors may also account for some prevalence differences between males and females.\textsuperscript{13}

Many studies have shown that, while the prevalence of OSA increases with age, the trend plateaus after 65 years.\textsuperscript{14} Possible mechanisms include the effect of age on pharyngeal anatomy that predisposes to collapse of the pharynx.\textsuperscript{15} It has been suggested that sleep apnea in the elderly is clinically different from OSA with more characteristics of central sleep apnea.\textsuperscript{12}

Obesity and its associated measures such as body mass index (BMI), neck circumference and waist-to-hip ratio are known to be major risk factors for OSA.\textsuperscript{16} Weight gain increases the risk of developing OSA while weight loss decreases the AHI and severity of OSA.\textsuperscript{17} Smoking has been shown to increase the risk of OSA by three-fold, though the effect is suspected to be reversible through smoking cessation.\textsuperscript{18} Alcohol consumption has also been shown to increase apnea and hypopnea acutely but its chronic effects remain controversial.\textsuperscript{19} Additional risk factors include craniofacial and upper airway soft tissue and skeletal abnormalities.\textsuperscript{20} Nasal obstruction also contributes to OSA by predisposing to airway collapse due to open-mouth breathing.\textsuperscript{21} Finally, OSA may have a genetic basis, as its pathophysiology is affected by heritable factors such as craniofacial morphology, fat distribution and variations in neural control of airway muscle tone and breathing.\textsuperscript{22}

**CLINICAL EVALUATION**

**History**

Excessive daytime sleepiness, described as fatigue, tiredness or a lack of energy, is a common presenting complaint of OSA.\textsuperscript{23} OSA results in daytime somnolence because apneic and hypopneic events cause recurrent arousal, diminishing the restorative effects of sleep. Unfortunately, daytime sleepiness due to nocturnal arousal may be underestimated by both the patient and physician because of its insidious onset and chronic nature. Patients are often unaware of any problems until they begin to affect their daytime performance and quality of life. It is also interesting to note that women are more likely to present initially with insomnia.\textsuperscript{24}

Complaints about loud snoring may also prompt patients to seek medical attention. As a result, input from partners and family members is valuable because they may report witnessed apnea events and provide additional information about daytime sleepiness. Other manifestations of OSA include morning headaches, irritability, personality or mood changes, depression and sexual dysfunction.\textsuperscript{25}
Physical Examination

The goal of the physical examination is to identify anatomic abnormalities that may predispose to OSA and to attempt to characterize the level of pharyngeal collapse and obstruction. However, the best method to assess the obstruction level remains controversial.26

General findings that are associated with or predispose to OSA include obesity, hypertension and other endocrine disorders. The physical examination consists of the use of flexible nasopharyngoscopy to evaluate the craniofacial morphology, nasal passages, oral cavity and pharynx. Throughout the examination, it is important to note craniofacial abnormalities in the maxilla and mandible as well as other skeletal, dental and soft tissue anomalies.27 The nasal examination should include assessment by anterior rhinoscopy for signs of obstruction such as nasal valve collapse, septal deviation, turbinar hypertrophy, mucosal swelling, rhinorrhea, or presence of polyps or masses.27 Adenoid hypertrophy or the presence of other masses in the nasopharynx should be noted. The oropharynx is evaluated for tongue, tonsillar or uvular enlargement, which can be quantified with the Mallampati score.27 Lateral pharyngeal hypertrophy or banding of the posterior pharyngeal wall is also evaluated.27 The hypopharynx and larynx are also assessed for any masses, lesions or other pathologies such as that may predispose to airway collapse.28

The Muller maneuver is a useful technique to evaluate the level of obstruction in OSA.28 It is performed by introducing the scope into the pharynx, asking the patient to inhale forcefully against closed mouth and nostrils to create negative pressure, thereby endoscopically visualizing where the collapse occurs in the airway. Drug-induced sleep videofiberoscopy may be even more effective in identifying the level of obstruction because sleep is induced, resulting in a more accurate reflection of the upper airway in OSA.28

DIAGNOSIS

A complete history and physical examination help identify patients suspicious of sleep apnea. A patient’s severity of snoring, neck circumference, BMI, observed apnea and hypertension are correlated with more severe OSA.29 A diagnosis of sleep apnea is confirmed by a formal overnight polysomnography (PSG). PSG determines the presence, severity and the form of the dyssomnia (obstructive, central or mixed).30 Variables measured during a PSG include type and duration of sleep stage (via electroencephalography), eye movements (via electrooculography), limb movement (via electromyography), body position, heart rate (via electrocardiography), oxygen saturation, nasal or oral airflow, respiratory effort and severity of snoring. A more specific test to identify excessive daytime sleepiness is the multiple sleep latency testing (MSLT) where sleep latency following multiple naps during the day is assessed.

Other causes of excessive daytime sleepiness need to be considered, and include narcolepsy, periodic limb movements of sleep as part of restless legs syndrome, or rotating shift work. Respiratory diseases or severe gastroesophageal reflux disease may also mimic OSA. These differential causes of daytime sleepiness make PSG essential to the diagnosis of OSA.

CONSEQUENCES OF SLEEP APNEA

Untreated sleep apnea has multiple negative medical, social and economical consequences. Prolonged hypoxemia has detrimental neurological and cognitive effects including memory loss, decreased verbal and visual learning, and impairment in attention and concentration.31 Sleep apnea also increases an individual’s risk for motor vehicle accidents. A study of Canadian drivers found sleep apnea patients had a 3.0-4.8 fold increase in rate of accidents compared to control subjects.32 In 1999, untreated sleep apnea patients used physician services two times more than controls and incurred $3.4 billion in additional medical services in the U.S.33

Obstructive sleep apnea is associated with hypertension, coronary artery disease, arrhythmias, stroke and diabetes. The prolonged hypoxemia and CO₂ retention in OSA lead to autonomic dysfunction and inflammatory overstimulation, which cause increased cardiac sympathetic drive.34 OSA patients have higher levels of serum cytokines, C-reactive protein, serum amyloid-A, adhesion molecules, which lead to atherosclerosis and endothelial lining dysfunction.35 Increased workload on the cardiac system in OSA leads to higher rates of myocardial infarction (MI), heart failure and pulmonary hypertension.36 Interestingly, OSA patients are more likely to develop an acute MI between 10 p.m. and 6 a.m. as compared to control subjects, whose risk is higher during daytime.37

TREATMENT OF SLEEP APNEA

The management of sleep apnea varies with severity of the apnea, the patient’s complaints and their quality of life. Primarily, it is important to identify factors associated with sleep apnea that need to be addressed, as well as to determine which patients would benefit from medical or surgical management. In most sleep centres, an AHI over 30 is used as an indication for treatment. Overall, the goal of treatment is to improve the sleep cycle, reduce apneic episodes and improve quality of life.

Initial management includes lifestyle modification such as weight loss, exercise and improved nutrition. One prospective study showed that 10% reduction in weight loss improved severity of sleep apnea in 26% of individuals.38 Specialized pillows and belts are used to prevent sleep in a prone position, which can help prevent upper airway obstruction in those with snoring and mild sleep apnea.39 Oral dental appliances used during sleep can advance the mandible and improve AHI and snoring, however they are expensive and require continuous readjustments.40 The most commonly used, non-invasive and effective management of sleep apnea is continuous positive airway pressure therapy (CPAP). A nasal or oral mask is attached to a machine that
provides continuous or intermittent positive pressure therapy, preventing airway collapse. CPAP has been proven in multiple studies to improve subjective sleepiness and cognitive function, and decrease AHI, the risk of MI and the risk of stroke. However, CPAP treatment is a lifelong commitment and the average adherence rate is low, ranging from 60% to 70%. In severe cases or non-compliant CPAP patients, surgical interventions may be a reasonable option. Surgical intervention is successful if it targets the actual site of upper airway obstruction. Nasal obstruction causing snoring or negative inspiratory pressure can be relieved by simple septoplasty and turbinate reduction surgery. The most common site of oropharyngeal obstruction is at the soft palate and is relieved by uvulopalatopharyngoplasty (UPPP), which involves resection of the uvula, tonsils and part of the soft palate to remove redundant tissue and open up the airway. UPPP can also be done in the office under local anesthetic using a laser or radioablation. UPPP is dependent on proper patient selection, based on site of pharyngeal collapse, and success rates as high as 80% have been reported. However, the long-term success of UPPP in the treatment of OSA has been questioned, as one study determined that only 30% of patients showed sustained improvement after three years. Hypopharyngeal obstruction from tongue can be alleviated with radioablation of the posterior tongue or repositioning the insertion of genioglossus musculature by advancement genioplasty. Another surgical option is maxillomandibular advancement (MMA). While MMA success rate have been reported as high as 90%, it remains a last resort due to its invasive nature.

CONCLUSION

Sleep apnea is a very prevalent and underdiagnosed disease. It has the potential of significant negative consequences in different aspects of an individual's life including health, wellness, work and safety. Individuals presenting with symptoms consistent with sleep apnea should be offered PSG. Multiple interventions including lifestyle modification, medical and surgical interventions exist, most requiring lifelong commitment.  

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Author Biographies

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Reflections on ‘Relief’ing: Lessons from Pakistan and Haiti

Mohammad Zubairi, BHSc, MD

This commentary incorporates the author’s personal reflections to explore the nature of international relief work, and to provide suggestions for addressing problems that are commonly encountered.

In September 2010, six weeks into the floods that affected one-fifth of Pakistan’s landmass, I had the opportunity to travel and witness the disaster firsthand. I was part of a team of four physicians with the goal of initiating mobile health clinics. In our group was an emergency physician, an anaesthesia trainee, a urology trainee and myself, a pediatric trainee, all connected to Hamilton, Ontario through place of training or residence. Part of the mandate was to liaise with local physicians in order to establish a sustainable medical relief effort.

My personal motivation to be involved came from knowing the possibility of a disaster impacting my own community in Canada, and reflecting on the way I would want to be helped. Haiti’s earthquake had happened earlier in 2010, and I was involved in fundraising for the victims. Having travelled to Sri Lanka for relief work following the tsunami in 2004 made my decision to participate much easier. The umbrella organization for this trip was Islamic Relief Canada, based out of Hamilton, with its centre for operations in the United Kingdom. Our destination was Muzaffargarh, an area in the province of Punjab, six hours from Lahore. Situated between the Indus and Chenab Rivers, the area was used for displaced people in large numbers.

The trip was planned on short notice: I heard about it on a Friday while leading a fundraising campaign called ‘Hope for Pakistan’ and we were in the air the following Thursday. Our visas were arranged two days prior on an urgent basis, and that same day I picked up and filled prescriptions for Malarone, an anti-malarial drug, and ciprofloxacin, an antibiotic for traveler’s diarrhea. I had visited family members in Pakistan in June 2009, and had already received my Hepatitis A and typhoid vaccinations. My ticket confirmation was handed to me at the airport several hours before we were scheduled to fly out, highlighting the logistical uncertainty that comes with relief work!

Disaster in Pakistan and Haiti and the International Response

The Pakistan floods were not the only natural disaster brought to the attention of the global community in 2010. Amidst many smaller events covered in the media, the widely-covered January 12 earthquake in Haiti killed an estimated 222,000 individuals1 and destroyed much of the country’s infrastructure—including healthcare outlets, schools and small businesses—within the span of a few minutes.2

KEY POINTS

• The shortage of clean water, food and shelter following natural disasters leads to a rise in health problems, including skin infections and diarrheal illness.
• Efficient mobilization of an adequate supply of resources, including personnel, is paramount in the immediate aftermath of natural disasters.
• Long-term sustainability of relief efforts is dependent upon collaboration and coordination between governments, non-governmental organizations and the local population of an affected area.

Through media and conversation, I had become aware that those living in the Muzaffargarh area had received warning of the floods, and had moved out to Internally Displaced Persons (IDP) camps set up by relief organizations, or onto the streets of nearby unaffected cities. There were a couple of issues on my mind as we flew to our destination: one was security, considering the political and religious instability of the country. My family lives in Karachi, the biggest city in the province of Sindh, and our team was far from this area of familiarity. I was also concerned that the team might not have enough resources to make a worthwhile contribution to its cause. I sent an email to my family, friends and colleagues asking for their prayers and donations for supplies, as news reports were highlighting a shortage of medications.
In contrast to Haiti’s disaster, the flooding in Pakistan, where water makes up only 3.0% of the total area, happened gradually and much of it was unanticipated. One in 10 people, or roughly 20 million, were affected by the floods, in a country still recovering from the 2005 earthquake that killed 75,000 people and left 3.5 million homeless. As farmland was transformed into artificial lakes, an estimated USD $1 billion worth of crop was destroyed. Agriculture became the hardest-hit sector; one that contributes 22.0% to Pakistan’s GDP, and employed 43.6% of the population in 2007.

Access to clean water, food and shelter becomes a major priority immediately following natural disasters. In the absence of these necessities, a number of preventable health problems arise. For example, eight million people in Pakistan could not access clean drinking water following the flooding, and the prevalence of acute diarrheal illness was reported to increase from 5.0% at baseline to 14.0%. Similarly, cholera has claimed almost 3,500 lives in Haiti since the disaster. With an event such as an earthquake, physical injuries also need to be addressed in the early aftermath.

Haiti and Pakistan are both considered developing countries, and their pre-disaster socioeconomic baselines, in comparison to developed nations like Canada, create unique challenges in dealing with such events (Table 1). Because of these differences, dependence on international aid through individuals, governments and non-governmental organizations (NGO) becomes a necessity.

<table>
<thead>
<tr>
<th>Table 1. Socioeconomic Differences between Pakistan, Haiti and Canada</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pakistan</td>
</tr>
<tr>
<td>Population in Millions (2009)</td>
</tr>
<tr>
<td>% GDP on Healthcare (2006)</td>
</tr>
<tr>
<td>% Population Access to Improved Sanitation (2008)</td>
</tr>
<tr>
<td>% Public Spending on Education (2000-2007)</td>
</tr>
<tr>
<td>% Illiteracy (1999-2007)</td>
</tr>
</tbody>
</table>

The response from the international community is often directly related to the nature and extent of media coverage. There is an element of donor fatigue both within and between disasters over time, however, which hinders the long-term sustainability of reconstructive efforts. The sense of closeness between donor communities and affected nations, both in geographical location and in the political context, also plays a role. Pakistan, for example, is a U.S. ally in the War on Terror and is the second largest recipient of U.S. foreign aid—following the earthquake in 2005, the country received over USD $700 million for reconstruction efforts.

Unfortunately, in the case of both Pakistan and Haiti, the instability of their governments makes it difficult to efficiently direct aid from the international community. Coordinating relief efforts with NGOs is also difficult, considering each organization has its own policies, agendas and bureaucratic limitations. In 2008, the collective aid budget to 54 recipient countries was reported as USD $22 billion, funding 90 different initiatives. The multi-faceted global response to natural disasters creates a logistical challenge, making it difficult to ensure its intended impact.

Healthcare delivery is particularly difficult in light of the pre-existing poor health infrastructure in most developing countries. Each NGO recruits and trains its own health teams, and care is delivered in isolation, although with similar goals: sanitation, immunization, and provision of emergency healthcare, with a focus on women and children. For personnel working in these teams, various factors impact on the effectiveness of daily relief; including location of camps or villages, time of day, supply of resources, and security. A new phenomenon of ‘medical tourism’ has also emerged. This trend, wherein individuals incorporate travel for personal reasons, is criticized for hindering the relief process as it reduces time spent on actual fieldwork.

Ultimately, the lack of resources and personnel is a major limitation in sustaining long-term relief efforts following natural disasters. Resource supplies are eventually exhausted when there is a strong dependence on external sources of aid. In Pakistan’s floods, 80% of relief funds have been channelled through NGOs, some of which only work in the acute setting. Personnel from outside countries may be stationed anywhere from a few weeks to several years. This transience highlights the importance of engaging local populations from affected communities, to enable a smooth transition into independent post-disaster management. One year following Haiti’s earthquake, media reports continue to describe extensive amounts of debris, but there are neither resources nor personnel to assist in its clearance.

Effective disaster aid requires two Cs: Collaboration and Coordination between the local populations, local governments, NGOs and the international community. From a healthcare perspective, having a standard model of delivery under an umbrella organization, such as the World Health Organization, has been suggested to facilitate such collaboration and coordination. This system will help to ensure an ongoing supply of resources and education to meet the demands of an affected community. The same principle can be extended to redevelopment of infrastructure including transportation, education and economy. In the end, the flow of responsibility is neither bottom-up nor top-down, but rather organized in a way where all players have equal roles in ensuring sustained relief efforts. This is yet to happen in Haiti or Pakistan.

**REFLECTING ON THE NATURE AND IMPACT OF RELIEF WORK**

Relief work in any disaster setting is a learning process that depends on reflection and the use of trial and error, with the goal of maximizing the number of beneficiaries of one’s
work. It is tiring, but the satisfaction of making progress is a source of motivation for participants. By the time we arrived in Pakistan, it had been almost a month since the floods began. On our first day, we drove on roads traversing through farmland that had turned into lakes, with trees among them giving an appearance of an oasis. The scenery seemed completely natural to me, but I was reminded that, six weeks earlier, this was arid farmland.

We were told that some villagers had travelled back to their communities, while many were still living in the IDP camps. In an area that had previously been desert, these camps were set up to offer basic necessities, including tents for shade, straw beds and a water cooler. Food was delivered once a day. Given the population, anywhere between seven to ten people inhabited a tent.

We arrived at noon, and the mid-day heat scorched us. We waited in our air-conditioned cars, as the local villagers set up a tent where we would base our clinic. I felt guilty, but it was an environment I was not used to, and I wanted to preserve my energy to maximize the day.

Our team stayed in Multan, a relatively urban centre an hour away from the field sites in Muzaffargarh, where we commuted on a daily basis. The pick-up truck we travelled in was loaded with medications and IV fluids and another truck followed with stretchers and IV poles. I noted aid workers from around the world, travelling in logo-covered vehicles representing other relief agencies or governments, such as the Red Cross or the United Arab Emirates Disaster Relief Team, with their physicians in army outfits. On the field, however, all groups worked independently.

Over five days, our team assessed and treated approximately 1,500 patients. Demographics, working diagnosis, and treatment plan were recorded, and the majority of patients were between the ages of one and 35. The most common presentations were diarrheal illness, conjunctivitis and skin infections. There were also a large number of villagers with upper respiratory infections. As a pediatric trainee, I was delegated to assess children. I recall the case of a nine-year-old boy who was rushed in by his parents, unconscious, with an elevated temperature. We quickly moved him into another tent and treated him for heat stroke. Despite rapid initial IV hydration, he continued to be confused and required a prolonged course of fluids, continuing after we left the premises.

We faced a number of challenges common to relief work. My greatest personal limitation was the language barrier. Most villagers spoke Saraiki, a dialect unique to the province of Punjab, and outside my comfort of Urdu. There was little room to examine patients, and most diagnoses were based on history alone. Post-pubertal females preferred to be assessed by a female physician, who joined the team on our second day. I found that patient flow varied depending on location of the clinic and time of the day. Given security issues, everyone aimed to head back to home-base before sunset.

My pre-departure fear of a lack of resources was a reality. I blogged: “Medication distribution is never a pleasant process. One of our team members would sit in the ambulance which served as the makeshift pharmacy to fill the scripts given by the assessing physicians. As we packed up at the end of the day, it was hard not to quickly ask the patient about their symptoms and give them medications without scripts. But this highlights the problem: there will continue to be a huge demand, but there will also continue to be a limited supply of time and resources.”

Although we successfully liaised with local doctors and pharmacies in Muzaffargarh to ensure a steady flow of care over the next three months following our visit, the question that bothers me the most is: what will happen after these three months? Six months? A year?

REFERENCES

Author Biography
Mohammad Zubairi is a second-year resident in Pediatrics at McMaster University. He has helped organize McMaster Residents for Relief to mobilize resources for those affected by natural disasters.
THE EMERGENCE OF CLINICAL ANTIMICROBIAL RESISTANCE

The discovery of antimicrobial chemotherapeutics and their introduction into the clinical setting ranks among the most significant advances in the history of medicine.1 Infectious disease is no longer the leading cause of death in the industrialized world, due in large part to the effectiveness of antimicrobial drugs.2,3 The rapid and widespread emergence of clinical antibiotic resistance among bacterial pathogens, however, presents a formidable challenge to infectious disease management.4 Antibiotic-resistant bacterial strains are prevalent around the globe,4 including Canada.5 The development of these strains has been identified as a serious public health issue, particularly in hospital settings.6

Noteworthy antibiotic-resistant pathogens found in Canadian hospitals include methicillin-resistant *Staphylococcus aureus* (MRSA), vancomycin-resistant *Enterococcus* (VRE), β-lactam- and fluoroquinolone-resistant *Enterobacteriaceae* (e.g. *Escherichia coli* and *Klebsiella pneumoniae*), and multidrug-resistant gram-negative bacilli (e.g. *Pseudomonas aeruginosa*), among others (Table 1).6-8 Although lower than those observed in the United States, antibiotic resistance rates in Canada have increased dramatically in recent years. In 2008, MRSA accounted for 27.0% of all *Staphylococcus aureus* isolates in Canadian hospitals, rising from 6.0% in 1999.9 Similarly, 21.4% of *Escherichia coli* urinary tract isolates were resistant to the fluoroquinolone ciprofloxacin,9 up from 1.1% in 1997.10 Rates of multidrug resistance are also high, particularly in intensive care units.11 From 2005-2006, 12.6% of *Pseudomonas aeruginosa* isolates from Canadian intensive care units demonstrated resistance to three or more antibiotic classes.11

<table>
<thead>
<tr>
<th>Classification</th>
<th>Species</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gram-positive</td>
<td><em>Enterococcus faecalis</em></td>
</tr>
<tr>
<td></td>
<td><em>Enterococcus faecium</em></td>
</tr>
<tr>
<td></td>
<td><em>Staphylococcus aureus</em></td>
</tr>
<tr>
<td></td>
<td><em>Staphylococcus epidermidis</em></td>
</tr>
<tr>
<td></td>
<td><em>Streptococcus pneumoniae</em></td>
</tr>
<tr>
<td>Gram-negative</td>
<td><em>Acinetobacter baumannii</em></td>
</tr>
<tr>
<td></td>
<td><em>Enterobacter cloacae</em></td>
</tr>
<tr>
<td></td>
<td><em>Escherichia coli</em></td>
</tr>
<tr>
<td></td>
<td><em>Klebsiella pneumoniae</em></td>
</tr>
<tr>
<td></td>
<td><em>Pseudomonas aeruginosa</em></td>
</tr>
</tbody>
</table>

THE DIVERSITY OF MECHANISMS CONFERRING ANTIBIOTIC RESISTANCE

The mechanisms of bacterial antibiotic resistance are numerous and diverse, and the clinical resilience of many pathogens is attributable to their expression of several of these mechanisms.12 All species possess some degree of intrinsic antibiotic resistance, and exposure to a certain drug...
then provides selective pressures to promote the emergence of acquired resistance through mutation or horizontal gene transfer. No antibiotic is immune to bacterial resistance, as evidenced by the discovery of resistance to nearly every clinically-available antibiotic (Table 2).12,14

Table 2. Major Antibiotics, Targets, and Associated Resistance Mechanisms12,14

<table>
<thead>
<tr>
<th>Antibiotic Class</th>
<th>Example Agents</th>
<th>Bacterial Target</th>
<th>Resistance Mechanisms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aminoglycosides</td>
<td>Amikacin, Gentamicin</td>
<td>Protein synthesis</td>
<td>Enzymatic inactivation, Active Efflux</td>
</tr>
<tr>
<td>β-lactams</td>
<td>Penicillins (Amoxicillin, Cloxacillin), Cephalosporins (Cefazolin, Cefazidime), Carbapenems (Meropenem), Monobactams (Aztreonam)</td>
<td>Cell wall synthesis, DNA synthesis, Protein synthesis</td>
<td>Enzymatic inactivation, Target site modification, Decreased uptake, Active Efflux</td>
</tr>
<tr>
<td>Fluoroquinolones</td>
<td>Ciprofloxacin, Levofloxacin</td>
<td>DNA synthesis</td>
<td>Target site modification, Active Efflux</td>
</tr>
<tr>
<td>Glycopeptides</td>
<td>Vancomycin</td>
<td>Cell wall synthesis</td>
<td>Target site modification</td>
</tr>
<tr>
<td>Glycylcyclines</td>
<td>Tigecycline</td>
<td>Protein synthesis</td>
<td>Active Efflux</td>
</tr>
<tr>
<td>Lincosamides</td>
<td>Clindamycin</td>
<td>Protein synthesis</td>
<td>Target site modification</td>
</tr>
<tr>
<td>Lipopeptides</td>
<td>Daptomycin</td>
<td>Cell membrane</td>
<td>Target site modification</td>
</tr>
<tr>
<td>Macrolides</td>
<td>Azithromycin, Clarithromycin</td>
<td>Protein synthesis</td>
<td>Target site modification, Active Efflux</td>
</tr>
<tr>
<td>Nitroimidazoles</td>
<td>Metronidazole</td>
<td>DNA synthesis</td>
<td>Clear</td>
</tr>
<tr>
<td>Oxazolidinones</td>
<td>Linezolid</td>
<td>Protein synthesis</td>
<td>Target site modification</td>
</tr>
<tr>
<td>Phenics</td>
<td>Chloramphenicol</td>
<td>Protein synthesis</td>
<td>Enzymatic inactivation, Active Efflux</td>
</tr>
<tr>
<td>Polymyxins</td>
<td>Colistin</td>
<td>Cell membrane</td>
<td>Clear</td>
</tr>
<tr>
<td>Pyrimidines</td>
<td>Trimethoprim</td>
<td>Folate metabolism</td>
<td>Target site modification, Active Efflux</td>
</tr>
<tr>
<td>Rifamycins</td>
<td>Rifampin</td>
<td>RNA synthesis</td>
<td>Target site modification</td>
</tr>
<tr>
<td>Streptogramins</td>
<td>Quinupristin, Dallopristin</td>
<td>Protein synthesis</td>
<td>Enzymatic inactivation, Target site modification, Active efflux</td>
</tr>
<tr>
<td>Sulfonamides</td>
<td>Sulfamethoxazole</td>
<td>Folate metabolism</td>
<td>Target site modification</td>
</tr>
<tr>
<td>Tetracyclines</td>
<td>Doxycycline, Tetracycline</td>
<td>Protein synthesis</td>
<td>Target site modification, Active Efflux</td>
</tr>
</tbody>
</table>

The production of antibiotic-inactivating enzymes is one of the best known mechanisms of resistance,15 and is typified by the β-lactamases.16 A major group of β-lactamases is the extended-spectrum β-lactamases (ESBLs), which inactivate many penicillins, cephalosporins, and monobactams, but generally not carbapenems.17 Additionally, plasmids encoding ESBLs often contain genes encoding resistance to other antibiotic classes, namely aminoglycosides18 and fluoroquinolones,19 and thus are significant contributors to multidrug resistance.20 The rising prevalence of ESBLs among the Enterobacteriaceae has forced a greater reliance on the use of carbapenems.21 Yet this treatment option is also threatened by pathogen acquisition of carbapenem-inactivating enzymes.22 Among the notable carbapenemases is the recently discovered (and widely publicized) New Delhi metallo-β-lactamase-1 (NDM-1), which has been identified in Escherichia coli and Klebsiella pneumoniae.23 NDM-1-carrying strains have now been isolated in many countries,24 including Canada.25 In addition to β-lactam resistance, enzymatic inactivation also plays a major role in resistance to aminoglycosides.26

Other mechanisms of resistance include decreased uptake and increased active efflux, both of which prevent the accumulation of the antibiotic at the target site.27 In gram-negative bacteria, resistance to certain β-lactams is mediated through decreases in porin production,28,29 as β-lactams must cross the outer cell membrane through porins in order to reach their target: penicillin-binding proteins.30 Active efflux involves the energy-dependent removal of antibiotics from the cell by efflux pumps.27 Although first described as a mechanism of tetracycline resistance in Escherichia coli,31 class-specific and multidrug efflux systems conferring resistance to most antibiotic classes have now been characterized in many bacterial pathogens.32 Multidrug efflux pumps are major contributors to antibiotic resistance in gram-negative bacilli, including Acinetobacter baumannii33 and Pseudomonas aeruginosa.34

The alteration of target sites to prevent the binding of antibiotics is another mechanism of resistance.35 A clinically-significant example is MRSA, in which the production of an altered penicillin-binding protein with decreased affinity for methicillin confers resistance to nearly all β-lactams, including those resistant to inactivation by most staphylococcal β-lactamases (e.g. methicillin, oxacillin, cloxacinil).36,37 Modified penicillin-binding proteins also account for β-lactam resistance in other gram-positive bacteria.38,39 Other notable examples of target site alteration include fluoroquinolone resistance in various species,40-42 macrolide resistance in Strep-tococcus pneumoniae,43 and vancomycin resistance in VRE.44

THE CLINICAL AND ECONOMIC IMPACT OF ANTIBIOTIC RESISTANCE

Antibiotic resistance among bacterial pathogens has major clinical implications for infectious disease treatment. The spread of resistant organisms in the clinical setting presents a
considerable public health concern, as infections with such organisms are often associated with poor clinical outcomes.\textsuperscript{45,46} Patients infected with resistant organisms frequently require lengthier hospitalizations and suffer higher mortality rates, particularly in the case of bloodstream infections caused by MRSA,\textsuperscript{47} VRE,\textsuperscript{48} and ESBL-producing Enterobacteriaceae.\textsuperscript{49,50} The adverse clinical outcomes associated with resistant infections are due in large part to limitations in therapeutic options, as well as decreased efficacy of remaining antibiotic options (i.e. vancomycin). Resistance frequently compromises the effectiveness of empirically-determined treatments, resulting in increased rates of treatment failure.\textsuperscript{50-52} Failure of first-line therapies may necessitate further investigations, additional antibiotic treatments, surgical procedures, or may result in patient death.\textsuperscript{53} The management of resistant infections is further complicated by the fact that antibiotics used to treat resistant infections are often associated with more severe toxicities.\textsuperscript{53} One example is colistin, a treatment of last resort for infections caused by multidrug-resistant gram-negative bacilli, which has known nephrotoxicity.\textsuperscript{54} However, colistin use continues due to a desperate need for effective antibiotics against gram-negative bacilli.\textsuperscript{55,56} Research trends in antimicrobial development compound the issue of limited treatment options, as the development of new antimicrobial agents continues to decline.\textsuperscript{57} The dwindling number of chemotherapeutic options, particularly in the case of multidrug-resistant pathogens, highlights the unsettling possibility that infections refractory to all available treatments may soon arise in the clinic.\textsuperscript{58,59}

Table 3. The Cost of Antibiotics for the Treatment of \textit{Staphylococcus Aureus} in 2008\textsuperscript{61}

<table>
<thead>
<tr>
<th>Pathogen</th>
<th>Antibiotic</th>
<th>Daily Cost (CDN)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSSA  \textsuperscript{64}</td>
<td>Cloxacillin</td>
<td>$0.70-$14.40</td>
</tr>
<tr>
<td>MRSA  \textsuperscript{61}</td>
<td>Vancomycin</td>
<td>$92.54</td>
</tr>
<tr>
<td></td>
<td>Linezolid</td>
<td>$141.28</td>
</tr>
<tr>
<td></td>
<td>Daptomycin</td>
<td>$165.00</td>
</tr>
<tr>
<td></td>
<td>Tigecycline</td>
<td>$165.46</td>
</tr>
</tbody>
</table>

MSSA – methicillin-sensitive \textit{Staphylococcus aureus};
MRSA – methicillin-resistant \textit{Staphylococcus aureus}.

CONCLUDING REMARKS

The issue of antimicrobial resistance is an escalating challenge to public health. Antimicrobial drugs are among the most revolutionary pharmaceuticals in modern medicine, but the emergence of resistance among bacterial pathogens continues to compromise their clinical effectiveness. Antibiotic-resistant infections are associated with increased patient morbidity and mortality, as well as increased healthcare costs. The need for increased awareness of antimicrobial resistance and its consequences has led to its selection by the World Health Organization as the theme for World Health Day 2011.\textsuperscript{62} Although there are unique trends in antimicrobial resistance in Canada, it is truly a global health problem.\textsuperscript{63} While the focus of this article has been limited to bacterial antibiotic resistance, the worldwide existence and impact of antimicrobial resistance among viral,\textsuperscript{64} fungal,\textsuperscript{65} and parasitic (including protozoal\textsuperscript{66} and helminthic\textsuperscript{67}) pathogens should not be overlooked.

Controlling antimicrobial resistance requires a multifaceted approach. The selective pressures of antimicrobial exposure emphasize the need for caution and stewardship in antimicrobial prescription,\textsuperscript{68} while the increasing prevalence of resistant organisms in hospitals underscores the need for surveillance of resistance rates and implementation of strong infection control practices.\textsuperscript{69} The lack of viable treatment options for multidrug-resistant organisms also stresses the need for the continued development of novel antimicrobial compounds.\textsuperscript{70} Such initiatives will ensure antimicrobial chemotherapy will continue to fulfill its essential role in infectious disease treatment in the future.

Author Biography
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BACKGROUND
Media attention to the potential role of vitamin D as a powerful anti-cancer agent has resulted in conflicting opinions regarding sun exposure and sunscreen use among Canadians. The Institute of Medicine (IOM) currently recommends 400 IU/day for individuals over four years old, with the recommended dietary allowance at 600 IU/day and the upper level intake at 4000 IU/day. While vitamin D can be obtained from a number of dietary sources, it is also produced naturally in human skin exposed to ultraviolet (UV) light.

With recent emphasis on the importance of maximizing vitamin D intake through diet and sunlight exposure, there is a concern that the increase in UV irradiation could lead to increasing incidence of skin cancer. This commentary delves into the potential benefits of vitamin D as an anti-cancer agent and discusses whether they may outweigh the potential risk of UV-induced skin cancer.

ROLE OF VITAMIN D
Vitamin D acts as a hormone that is integral to calcium homeostasis in the body. The two main forms of vitamin D are vitamin D3 (cholecalciferol) and vitamin D2 (ergocalciferol). Once transported to the liver, vitamin D3 and vitamin D2 are converted to 25-hydroxyvitamin D3 and 25-hydroxyvitamin D2, which are the major circulating metabolites of vitamin D. The measurement of these metabolites in serum is an indicator of vitamin D status in humans. In response to falling blood calcium concentrations, 25-hydroxyvitamin D is further hydroxylated in the kidney, forming 1,25-dihydroxyvitamin D3 (calcitriol). This metabolically active hormone serves important roles including enhancing calcium and phosphate absorption, inhibiting parathyroid hormone synthesis, and mineralizing bone matrix.

VITAMIN D AND CANCER
Vitamin D is classically described as an essential agent in improving bone health, reducing fractures, and lowering the risk of falls. Recent research, however, has taken a new direction, probing the non-traditional roles of vitamin D. Epidemiological studies suggest a link between vitamin D deficiency and developing type 1 diabetes. The importance of vitamin D in the endocrine system is further supported by animal models which demonstrate impaired insulin synthesis and secretion in the setting of vitamin D deficiency. In the immune system, vitamin D plays a role in increasing the production of cathelicidin, an antimicrobial peptide that is produced by macrophages in response to bacteria, viruses and fungi. Consequently, individuals deficient in vitamin D are at increased risk for microbial infections.

One of the most intriguing areas of current vitamin D research is its impact on cancer risk. Several epidemiological studies have found an association between low circulating vitamin D levels and elevated risk for developing cancer. Others have demonstrated that a low serum level of 25-hydroxyvitamin D is associated with increased risk for colorectal cancer and adenoma only. Further, another study links seasons with increased cancer risk, noting that individuals are at greater risk during winter months due to lower amounts of sunlight exposure. Yet current research predominantly consists of observational studies, rather than randomized controlled trials, as revealed in a systematic review by the World Health Organization and the International Agency for Research on Cancer. Evidently, further research is needed to determine the exact relationship between vitamin D and cancer.

Researchers posit that vitamin D plays a role in the body’s fight against cancer through its action on the vitamin D receptor (VDR). Polymorphisms of the gene encoding VDR have been linked to an increased risk for developing certain cancers, including prostate, colorectal, breast, bladder and melanoma. CYP3A4 is another vitamin D-regulated gene whose protein product detoxifies a carcinogenic agent called lithocholic acid (LCA). Elevated LCA levels have been shown to play a role in promoting colon carcinogenesis by damaging intestinal cell DNA.

Cancer impacts the lives of Canadians nationwide, making it no surprise that news of anti-cancer agents quickly captures the public’s interest. Although some researchers are fascinated by the promise of vitamin D, others remain
cautious. Vitamin C was previously promoted for its anti-cancer properties but subsequent trials did not confirm any benefits; in fact very large doses of vitamin C were associated with increased risk of cancer in some populations. As vitamin D has yet to be subjected to large-scale clinical trials, it is difficult to draw accurate conclusions about its role in cancer.

MEDIA CONTROVERSY

There is controversy over the ideal amount of circulating vitamin D levels in the blood. Statistics Canada reports readings of at least 75 nmol/L of vitamin D as being ideal, while the IOM study recommends a target 60 nmol/L. Statistics Canada also showed that two-thirds of the population has vitamin D levels that are lower than the amount associated with reducing the risk of chronic disease. However, 90% of Canadians have levels that are adequate for good bone health, begging the question of whether deficiency really is a major health concern.

Canadians are at increased risk for vitamin D deficiency as a result of decreased sunlight exposure during long winter months and use of sunscreen in the summer. While the evidence has shown that sunscreen does lower the rate of vitamin D synthesis, its use has not been associated with vitamin D deficiency. As such, it is reasonable to conclude that Canadians should not be avoiding sun-protective agents out of fear of such a deficiency.

Statistics Canada also cited a significant disparity in vitamin D levels amongst Canadians of different racial origins. Caucasian individuals had an average of 40% more circulating vitamin D than non-Caucasian individuals. The average Caucasian had 71 nmol/L, modestly under the purported optimum threshold, while non-Caucasian individuals had lower levels, averaging 52 nmol/L. While racial differences in vitamin D levels are significant, it is important to note that these statistics may be based on inconclusive studies rather than evidence-based research.

RECOMMENDATIONS

The current evidence, which is based predominantly on observational studies, suggests that benefits of vitamin D in non-traditional roles are associated with levels above 75 nmol/L. Assuming this to be true, Canadians can maintain sufficient circulating levels of the vitamin by following IOM recommendations. To obtain a vitamin D level equivalent to a blood concentration of 75 nmol/L from exposure to sunlight, a Caucasian individual requires only four minutes of exposure to 25% of the body surface (arms and most of the legs). Older or dark-skinned individuals may need as long as 18 minutes. Evidently, it is unnecessary to avoid sunscreen in favour of achieving presumed therapeutic vitamin D concentrations. Further, UV radiation has cumulative effects, and dermatologists recommend avoiding strong sun exposure particularly in the summer months and instead relying on oral intake of vitamin D. Dietary sources of vitamin D include fatty fish like salmon and tuna, as well as vitamin D-fortified foods such as cow’s milk and margarine (in Canada), and some orange juices, yogurts and cereals. Following the above recommendations ensures good bone health while mediating cancer risk.

REFERENCES

D uring the summer of 2008, Canadians faced the worst listeriosis outbreak in the nation’s history. The consumption of contaminated deli meats produced at a Toronto Maple Leaf Foods plant sickened a total of 57 Canadians and claimed 23 lives.1,2 Illnesses were reported in seven provinces,1 and the number of deaths was more than triple that of the *Escherichia coli* outbreak that struck Walkerton, Ontario in May 2000.3 A panel of international food safety experts later concluded that the source of the contamination was most likely meat residue, which accumulated deep within the slicing machines of two production lines in the processing plant.1 This residue provided an ideal environment for the *Listeria* bacteria to multiply and subsequently contaminate the deli meats produced on the lines.

**WHAT IS LISTERIOSIS?**

Listeriosis is a relatively rare infection caused by *Listeria monocytogenes*—one of six known *Listeria* species.5 *L. monocytogenes* is a facultatively anaerobic, gram-positive bacterium that is pervasive in the environment: it can be found in soil, decomposing vegetation and water, and may also form part of the fecal flora of various mammals, including some healthy humans.6

Almost all listeriosis cases are believed to arise through the foodborne route.1 *L. monocytogenes* may be present in raw vegetables, fruits, and meats, as well as in unpasteurized dairy products.7 *Listeria* may also contaminate certain foods, such as deli meats and hot dogs, during processing.7 Unfortunately, refrigeration does not keep the bacterium at bay: *L. monocytogenes* is able to multiply at temperatures ranging from 3°C to 45°C.4 Moreover, there is no change to the appearance, smell or taste of foods harbouring *Listeria*,4 so it is impossible for a food handler or a consumer to identify contaminated products. These factors undoubtedly contributed to the 2008 outbreak.

The manifestations of listeriosis vary considerably.4 The majority of healthy adults and children who consume foods contaminated with *L. monocytogenes* experience only mild to moderate illness, such as gastroenteritis.4,6 The symptoms of gastroenteritis associated with listeriosis usually arise following an incubation period of six to 48 hours, and include fever, chills, headache, myalgias, abdominal pain, and diarrhea.9 Some people experience life-threatening effects from listeriosis, however, including meningitis,6 encephalitis,6 and sepsis.1

Those at highest risk of developing listeriosis and experiencing serious illness from the infection include: pregnant women and their unborn children, the elderly, and immunocompromised individuals including chemotherapy or transplant patients, and those with HIV/AIDS or diabetes.10 Pregnant women who develop listeriosis are at increased risk of chorioamnionitis, preterm labour and stillbirths, and neonatal infection may also occur.11,12 Up to 20 to 30% of listeriosis cases in high-risk individuals result in death10 despite treatment with antibiotics, such as penicillin, erythromycin, ampicillin ± gentamicin, trimethoprim-sulfamethoxazole, and chloramphenicol.9,11

**KEY POINTS**

- In 2008, the accumulation of *Listeria* bacteria within meat slicing equipment at a Toronto Maple Leaf Foods plant led to Canada’s worst-ever listeriosis outbreak.
- Almost all cases of illness and death involved elderly individuals in hospitals or long-term care homes.
- Deli meats, known to be at high risk of harbouring *Listeria*, were being served to individuals recognized as being more susceptible to severe illness from listeriosis. Years prior to 2008, prominent American and Canadian agencies had published documents referring to these risks.
- Heating deli meats prior to serving is a relatively simple and practical step that could have been employed to prevent or reduce the consequences of the outbreak.
GAMBLING WITH THE VULNERABLE

There were several factors that contributed to the 2008 outbreak, including unsatisfactory *Listeria* control measures at the Maple Leaf Foods facility, deficiencies in federal meat inspection regulations, and slow recognition of the developing outbreak.1 Perhaps most surprising is the gamble that was taken leading up to the event: individuals at a higher risk of developing listeriosis were served foods that are at a comparably high risk of causing the infection. Moreover, knowledge of these particular risks was well-established prior to the listeriosis outbreak.

WHO WAS MOST SEVERELY IMPACTED BY THE OUTBREAK?

Almost 95% of the 57 listeriosis cases involved elderly individuals in hospitals or long-term care homes.1 As of November 2008, when 56 cases were confirmed, the average age of affected patients was 74.1 Although it would be expected for elderly and/or chronically ill individuals to be impacted more heavily by a listeriosis outbreak, this situation was somewhat unique: during the spring and summer of 2008, Maple Leaf Foods was dramatically increasing its production at the Toronto plant in order to meet heightened demand for large packages of deli meats at institutions such as hospitals and long-term care homes.1 Therefore, some of the deli meats contaminated with *L. monocytogenes* were specifically manufactured for hospital patients and long-term care home residents—two of the most vulnerable populations. In fact, the final numbers indicated that approximately 80% of the total listeriosis cases involved hospital patients or long-term care residents who were served deli meats from the large packages specifically made for these institutions.1

KNOWLEDGE OF RISK WAS WELL-ESTABLISHED PRIOR TO 2008

The knowledge that deli meats are at a comparably high risk of causing listeriosis, and that the elderly and immunocompromised are at higher risk of developing the infection, was realized and published long before the 2008 outbreak occurred. The unsafe nature of deli meats was firmly established at least as early as 2003. A *Listeria monocytogenes* Risk Assessment published in that year by the Food and Drug Administration (FDA) and the US Department of Agriculture (USDA) examined the relative risk of foodborne listeriosis from 23 different categories of ready-to-eat (RTE) foods with a documented history of contamination with *Listeria*. The report listed the predicted number of listeriosis cases for each RTE food category for the total US population. On a per serving basis, six food categories, including deli meats, were described as high risk (>5 predicted cases of listeriosis per billion servings); three were described as moderate risk; and the 14 remaining categories were described as low risk. Ultimately, the FDA/USDA report indicated that deli meats were the highest risk food of the 23 categories examined, assigning an overall listeriosis risk designation of “very high” (>100 predicted cases). This increased risk was attributed to the following: the fact that deli meats have moderate contamination frequency but high contamination levels, readily support rapid *Listeria* growth at refrigeration temperatures, are stored for prolonged periods, are regularly consumed, and have been directly linked to listeriosis outbreaks. As a result, the report called for the establishment of improved control strategies and consumer education programs regarding these “very high risk” products, in an effort to reduce the national incidence of listeriosis.

The 2003 FDA/USDA report also emphasized that certain populations are particularly susceptible to listeriosis, including the elderly and the immunocompromised.15 The risk assessment placed these populations into the category of “high risk individuals.” This information was not new in 2003, however. A 1988 WHO Bulletin on foodborne listeriosis made reference to the vulnerability of these populations, as did a number of reputable reviews published between 1980 and 1990.15

Prior to the 2008 outbreak, Canadian agencies were also aware of the susceptibility of elderly and immunocompromised individuals to listeriosis, as well as the high risk of deli meats in causing the infection. In fact, Health Canada (HC) and the Canadian Food Inspection Agency (CFIA) jointly published a “Policy on *Listeria monocytogenes* in Ready-to-Eat Foods” in 2004 that emphasized these concepts.16 The Policy indicated that the presence of *L. monocytogenes* in Category 1 foods (the highest-risk category, including deli meats) should trigger a Health 1 concern: this describes an instance where there is reasonable probability that exposure to the food will cause serious health consequences, or where probability of a foodborne illness outbreak is high. Moreover, the HC/CFIA Policy indicated that any RTE food contaminated with *L. monocytogenes* that is specially produced for susceptible populations, including the elderly and immunocompromised, should be at least a Health 2 concern, indicating a reasonable probability that exposure to the food will cause some degree of health consequences (albeit those that are temporary or non-life threatening).16

PROTECTING THE VULNERABLE

Multiple factors were responsible for the extent and devastation of the 2008 listeriosis outbreak. Sadly, the fact that food products known to be at a comparably high risk of causing listeriosis were served to individuals known to be at higher risk of developing the infection (and serious cases, no less) also contributed to the morbidity and mortality that occurred. At first glance, it seems that a straightforward preventative measure would have been simply not serving deli meats to susceptible people, such as hospital patients and long-term care home residents. Yet one must consider some of the reasons for providing deli meats to these individuals: these products are easy to chew, relatively nutritious, require little
preparation, and are reasonably economical. If the recommendation of removing these products from hospitals and long-term care homes had been made, it likely would have been considered impractical, unachievable, and somewhat excessive. A simpler, more pragmatic solution could have been adopted to prevent—or at least reduce—the consequences of the outbreak: heating the products before serving. Indeed the 2003 FDA/USDA Listeria monocytogenes Risk Assessment includes the statement that sufficiently heating food will kill Listeria, thus eliminating the bacterium’s pathogenicity.

Fortunately, since 2008, considerable progress has been made with respect to protecting Canadians from future listeriosis outbreaks. For example, Health Canada has altered their health risk assessment process by decreasing the turn-around time from 24 hours to eight hours for Health 1 concerns. Moreover, a drafted copy of Health Canada’s upcoming Policy on Listeria monocytogenes in Ready-to-Eat Foods calls for the use of listericidal/listeriostatic agents in RTE products, and encourages all levels of government and various governmental organizations to educate consumers, especially the vulnerable and their caregivers, about the risks of foodborne listeriosis. From the industry perspective, Maple Leaf Foods has implemented numerous improvements, such as doubling the number of testing sites and the frequency of sampling on all production lines of their RTE food plants, and reconstructing some slicing equipment in order to help eliminate points of bacterial harbourage.

CLOSING REMARKS

The dire consequences of the 2008 listeriosis outbreak serve as a reminder of the importance of taking heed of infection risks and appropriate precautions, particularly in widely-distributed food products. The retrospective examination of this incident brings to light various approaches that can be used to prevent such an incident from recurring, allowing us to recognize that public health measures can make a large difference to vulnerable populations.

REFERENCES

Intellectual disability (ID) is a significantly reduced ability to understand new or complex information and to learn new skills (impaired intelligence), with a reduced ability to cope independently (impaired social functioning), beginning before adulthood with a lasting effect on development. Patients with ID are seen in all specialties, yet one finds little to no focused training regarding their care in most undergraduate medical programs. This leads not only to ignorance of medical students, but creates barriers for this population in accessing adequate healthcare. In surveying physicians, they felt they lacked adequate training to equip them to care for patients with ID.

WHY INTELLECTUAL DISABILITY (ID) TRAINING IS RELEVANT

In an average family physician practice of 7,500 patients, 25 individuals (0.33%) will have intellectual disabilities. The prevalence of severe and profound ID is 3-4 per 1,000 births (0.3-0.4%). Within this group of patients, there are clear negative health trends that can be attributed to their illness, but also to the quality of care received. While life expectancy overall is improving, people with ID continue to have a reduced life expectancy compared with the population as a whole. For example, life expectancy for the general population in developed countries is typically 81 years for women and 76 years for men. In the ID population, life expectancy negatively correlates with increased severity of the disability: individuals with mild to moderate level disability have a life expectancy of approximately 65 years, and with severe disability it is even further reduced. The top causes of mortality include respiratory disease (pneumonia, inhalation, choking), heart disease (congenital), cancer (esophageal, stomach, and gall bladder cancer and leukemia), accidents and injuries, and seizures.

People with ID suffer from a range of morbidities with differing trends compared to the general population. There is a higher prevalence of lifestyle-related health problems such as obesity, poorer levels of physical fitness and nutritional problems, issues with poly-pharmacy, multiple complex chronic disorders, twice the risk of hospitalization, incontinence, increased prevalence of dental disease, and greater risk of psychiatric illnesses. Conversely, health problems related to smoking, alcohol, and use of illegal drugs are less prevalent. Difficulties with communication are common, and can lead to under-recognition of common disorders. As well, ID patients tend to under-report problems due to the often limited ability to recognize and verbalize symptoms, and thus rely heavily on a third party to advocate their needs.

Some problem behaviours, such as self-injury and pica, are more specific to people with ID and may be associated with particular genetic syndromes. Thus people with ID suffer from morbidities in unique patterns, and unfortunately, the identification and treatment of disease is often more complex (Table 1). This contributes to ongoing health inequality, chronic ill health, and premature death.

For many people with intellectual disabilities, poor health may impair their ability to achieve the best possible quality of life. The attainment and maintenance of health, at a level comparable to the general population, should be the goal. To achieve this, it is important for future physicians to understand the challenges that this population faces in accessing health services, as well as the unique patterns of health needs. Resources such as a health checklist or informative interview guide can be useful tools for physicians.
intellectual disabilities can pose unique challenges to conducting a medical consult, and medical trainees can benefit from training on how to interview patients with ID. The following are some suggestions of interview strategies that could be taught, taking into consideration the unique needs of ID patients in accessing healthcare.

**Table 1.** Main Deficits in Provision of Health Services for Intellectually Disabled Patients

<table>
<thead>
<tr>
<th>A. Untreated, yet treatable, medical conditions.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Most individuals have a wide range of health needs, which would normally be raised with a general practitioner. These include simple conditions such as overproduction of ear cerumen to more serious problems such as major cardiac arrhythmias.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>B. Untreated specific health issues related to the individual’s disability.</th>
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</thead>
<tbody>
<tr>
<td>There is a need to systematically manage health needs associated with the patient’s disability or syndrome. For example, thyroid screening must increase for patients with Down syndrome who have a higher prevalence of hypothyroidism.</td>
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</table>

<table>
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<tr>
<th>C. Less generic health promotion.</th>
</tr>
</thead>
<tbody>
<tr>
<td>This population receives less benefit from health promotion measures compared to their non-disabled counterparts.</td>
</tr>
</tbody>
</table>

**PREPARING FOR THE FIRST ENCOUNTER**

**Offer the First Appointment**

It can be helpful to give your ID patient the first morning appointment at the clinic, as some people with ID have difficulty with crowds, lack of space or waiting for extended periods of time.

**Offer Double Consultation Time**

Take your time with the person with intellectual disabilities. People with intellectual disabilities need to be encouraged and empowered to speak for themselves. As with any patient, try and determine the level of understanding he/she has at your first meeting.

**Contact Caregiver Prior to Appointment**

It is useful to ask caregivers to bring any previous reports or results of assessments/tests to the appointment. Also, find out how the patient communicates: if the person uses a communication device, remind the caregiver to bring it to the consultation. Finally, if not already noted in their records, inquire about who is the patient’s guardian or substitute decision maker.

**STRATEGIES FOR INTERVIEWING**

**Make the Individual Comfortable**

Ensuring patient comfort can be accomplished by suggesting that someone familiar (i.e. the caregiver) remain present during the interview or by encouraging the use of “comforters” such as the patient’s favourite item. Introduce yourself as the doctor or medical student so the patient and caregiver know who is informing or questioning them. It may be helpful to briefly re-introduce yourself at the beginning of each contact, as many people have trouble remembering faces and names. Spending some time explaining the process of consultation before you start can help reduce anxiety caused by previous experiences. It is also important to clearly explain and show them what you are going to do before proceeding with any physical exam or test. Advance warning of potential pain, irritation or uncomfortable procedures is also essential.

**Speak to the Patient with ID First, then the Caregiver if Necessary**

A unique challenge faced when interacting with patients with ID is that they are often accompanied by a caregiver. It is important to speak to the person with ID first and then check with the caregiver if something is not clear. Sometimes the supporter can dominate the interview and answers all questions for the patient. However, the person with ID should be allowed to answer for themselves unless they ask their supporter for help.

**Tips for Gathering and Sharing Information**

Communication challenges can be one of the most difficult aspects of caring for patients with ID. When talking with the patient, use simple language that they can understand and that correlates to their level of ID, for example, wording that can be understood by a six-year-old may be appropriate for someone with moderate ID. Communication through diagrams and written words is often clearer to patients than spoken language, or can be a useful supplement. You can use prepared materials (e.g. photos or drawings) to help the patient describe what they are experiencing, or what has happened previously. Concepts of time can be very difficult for patients with ID. Some patients may have little idea of measures of time like weeks or months, and may struggle to distinguish questions about a single event from questions about duration of a condition. This may challenge you to think of unique ways to explain things, for example, “take this medicine with breakfast and supper” versus “twice a day”. Finally, it is important to keep explanations simple. In checking patients’ comprehension, it is often insufficient to simply ask, “Do you understand what I just told you?” Many patients will simply say “yes” in order to be agreeable, even though they have not understood everything. It may be helpful to invite patients to say in their own words what they have heard.

**Negotiating Consent**

Patients with ID who have lived in institutions may be unaccustomed to making personal choices, although they may be competent to do so. It can be useful to establish whether patients have experience making decisions in daily life.
When explaining treatments, be aware that patients may have a concrete interpretation of the procedures that you are proposing. For example, it might be hard to imagine how one sees inside one’s bowel in a colonoscopy. Also, a person with ID may think only about the temporary pain of a procedure, and not be able to understand future benefits including the health problems that it prevents. You might need to present these in visual form—either using pictures or showing patients the procedural instruments.

**DOCUMENTATION**

**Treatment Plans**

As with all patients, good documentation is very important when dealing with individuals with ID who often have complex medical scenarios. Adherence to treatment plans can be improved by providing written instructions for any health advice, especially since support workers can change frequently, and the person may receive care in several settings. It is also important to review a medication list to see if there are any drug interactions or poly-pharmacy that could be reduced.7,14

**Maintaining Personal Health Records**

Because an intellectual disability is life-long, many different healthcare professionals may be involved with the patient’s care over time. Contributing to an individualized personal health record held by the caregiver can have many benefits, such as avoiding using medications or treatments that have previously been tried and found to be ineffective.8,14

**CONCLUDING REMARKS**

There are many competing topics vying for medical trainees’ attention throughout medical school. Training on how to care for patients with intellectual disabilities is typically underrepresented in the curriculum. There is currently a need for clinical skills training regarding this special population starting at the medical undergraduate level. It is unfortunate since all physicians will come across such a patient in their practice at one point in time.4 Furthermore it can be an enriching experience to work with individuals who can be exceptionally affectionate, emotionally expressive, and appreciative of your efforts to achieve mutual understanding. It is rewarding to be involved in the care of intellectually disabled patients, and they can provide lessons on communication which can be transferrable to one’s general practice.

**ACKNOWLEDGEMENTS**

Dr. Nick Kates.

**REFERENCES**

The relationship between the circumstances in which people live and their state of health is well-studied. At McMaster, medical students learn about social determinants of health (SDOH) as a part of the professional competencies curriculum early in their first year of training, and principles of population health are identified as key concepts for the Medical Council of Canada’s qualifying examination for physicians (Table 1). Yet an acknowledgement that social and economic factors can explain health inequities is of little value without accompanying action, like praising democracy without placing a vote. The role of health advocate, identified as an essential physician competency in the CanMEDS framework, was shown to have the least incorporation into residency programs in a 2001 survey.1 In order to fulfil this role, physicians must be aware of the SDOH that affect their patients, as well as know how to intervene on their behalf. Providing avenues for advocacy as a part of physician training highlights our responsibility to influence health outcomes on a population level.

Table 1. Social Determinants of Health

| 1. Income and Social Status |
| 2. Social Support Networks |
| 3. Education and Literacy |
| 4. Employment/Working Conditions |
| 5. Social Environments |
| 6. Physical Environments |
| 7. Personal Health Practices and Coping Skills |
| 8. Healthy Child Development |
| 9. Biology and Genetic Endowment |
| 10. Health Services |
| 11. Gender |
| 12. Culture |


To gain more insight on how to equip physicians-in-training for this task, MUMJ editor-in-chief Kathleen Huth interviewed Dr. Dennis Raphael, a prominent Canadian advocate for policies that address the SDOH and a professor at the School of Health Policy and Management at York University.

Huth: What should medical trainees know about the social determinants of health as they prepare for their medical practices?

Raphael: Prospective physicians need to recognize that the social determinants of health—the living conditions their patients are exposed to that are created largely by public policy decisions—are the primary factors that shape whether individuals are healthy or ill. These living conditions are also the primary factors that shape their recovery from acute illness and their successful management of chronic diseases.

These may seem to be rather powerful statements, but the impact of living conditions upon health has been known since the mid-1850s, and the thousands of studies that have taken place since then have only served to confirm this relationship. Indeed, there appear to be only a handful of afflictions—usually genetic in origin—that appear to be unrelated to living conditions. And even these afflictions are impacted by living conditions as families must cope with the loss of income and the need to care for members of the household who are ill.

Factoring in living conditions is especially important considering there is such inequality in living conditions among the population. In Canada, about 15% of the population experiences the material and social deprivation associated with living in poverty, and this number surely
underestimates the prevalence of poverty since it comes from the period prior to the current recession. In addition to Canada’s high poverty rates, we also have one of the weakest social safety nets among wealthy developed nations. All of this leads to a rather bleak outlook concerning the health of Canadians. As just one example of our population health profile, in 1980 Canada was ranked 10th among 30 Organisation for Economic Cooperation and Development (OECD) nations in infant mortality rates. Though we showed some improvement in absolute rates, we now stand 24th of 30 OECD nations in this important population health indicator.²

Huth: Considering these statistics, what are some ways that students and health care professionals can get involved in advocacy work?

Raphael: One avenue is through medical association action. The Canadian Medical Association and the Canadian Pediatric Society have argued forcefully for action on the social determinants of health. The leadership of these organizations must be supported in their efforts to raise these kinds of issues. The Ontario Physicians Poverty Work Group and Health Providers against Poverty provide opportunities for physicians-in-training to become engaged in the social determinants of health. Finally, anyone can join and/or support organizations that work to strengthen the evidence for social determinants of health. Some of the links to these organizations, and suggestions for action are provided in the document “Social Determinants of Health: The Canadian Facts” at http://thecanadianfacts.org/. There are a number of additional resources available online (Table 2).

Huth: How should the SDOH be addressed in the medical school curriculum?

Raphael: In addition to providing information, the medical school curriculum must address the profound barriers preventing the medical profession from seriously considering the social determinants of health. These barriers include the conservative nature of much medical research and practice where focus—especially in epidemiological work—is usually on the concrete and observable as opposed to the abstract and conceptual. There are also class-related issues where wealthy and high-status physicians have little personal experience of the daily barriers to health that are experienced by so many Canadians.

Finally, like most health professionals, there is reluctance among physicians to address issues whose origins are to be found in the organization of society and the political and economic forces that shape how these societies distribute resources. In 1848, the famed German physician Rudolph Virchow stated: “If medicine is to fulfil her great task, then she must enter the political and social life. Do we not always find the diseases of the populace traceable to defects in society?”³

Table 2. Resources on the SDOH: From Global to Local

<table>
<thead>
<tr>
<th>Resource</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>Health Providers Against Poverty <a href="http://www.healthprovidersagainstpoverty.ca/">http://www.healthprovidersagainstpoverty.ca/</a></td>
<td>Information about campaigns in Ontario and access to their listserv. “Poverty: A clinical tool for primary care” can be downloaded from the website.</td>
</tr>
<tr>
<td>Community Health Initiative for Medical Education <a href="http://chimeonline.ca">http://chimeonline.ca</a></td>
<td>A needs assessment for Hamilton conducted by an interprofessional group of McMaster students and information on local volunteer opportunities.</td>
</tr>
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If there is one lesson that prospective physicians need to learn it is that promoting health is a profoundly political activity. While it may be helpful for some of your patients to be badgered to eat fruits and vegetables, engage in physical activity and quit their smoking and excessive alcohol use, it will be much more useful for them in the long term to have you urge governmental authorities to provide all citizens with the foundations necessary for health. These foundations include income, employment, housing, and food security. This lesson has been learned in most European nations where public policy is oriented towards the promotion of health and the prevention of disease. This has not been the case in Canada.

The medical profession has come to recognize that health care is political. It has to learn that the origins of health and the causes of disease are also political. To date, this latter dictum has generally been ignored. Critical analysis of these issues by the medical school curriculum offers the possibility of physicians contributing to the ongoing debate as to the origins of health and the causes of illness.

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**Author Biographies**

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INTRODUCTION

In the Canadian Medical Association’s Code of Ethics, 54 basic principles provide some insight into the responsibilities and societal role of the physician. The first principle reads, “Consider first the well-being of the patient.” It is the fundamental role of the physician to advocate for their patient, first and foremost. Not until the 43rd principle is the physician reminded of “the responsibility of physicians to promote equitable access to healthcare resources.”

These principles sometimes call for seemingly incompatible actions: patient advocacy seeks to draw preferentially from a limited pool of resources, often at the expense of resource allocation to individuals without access to an advocate. Arguably, one of the most important resources available to the general public is access to a primary care physician. Access to a primary care physician is particularly important given their role in facilitating access to specialized care in addition to their management of chronic conditions.

The Canadian and provincial governments are ultimately responsible for balancing the pressures of public access to healthcare with individual needs. Decisions regarding how resources are allocated are made based on a variety of factors but, as in any government program, are subject to influence by lobbying and political bias—which may or may not reflect the objective needs of a given population. For this reason, it is crucial to ensure that an evidence-based approach to healthcare resource allocation is utilized, for the purpose of identifying and rectifying underlying causative variables.

THE NEED TO IMPROVE ACCESS TO CARE

The current state of Canadian healthcare is akin to a legal system with a lawyer shortage. If there were not enough lawyers to represent everyone, those who were represented would be at a clear advantage over the unrepresented. In a situation such as this, one could not expect every member of a population to have equal access to justice. With governments ultimately responsible for the distribution of healthcare resources, people or populations without a physician must rely on public policy for advocacy. In 2008, there were 4.1 million Canadians without a primary care physician. Thus there is a large niche for special-interest lobbying, which has become an integral component of public health policy-making. Lobbyist groups like the Centre for Social Justice utilize an evidence-based approach to shed light on the multitude of socioeconomic factors that affect an individual’s need and ability to access healthcare.

The impact of socioeconomic and cultural factors on health outcomes can be appreciated through consideration of the Aboriginal (which includes Canada’s First Nations people, Inuit and Metis) and recent immigrant (those who have lived in Canada for less than five years) populations. For example, the Centre for Social Justice statement on improving access to healthcare for Aboriginals identifies factors such as exposure to education, socioeconomic status and language barriers. The correlation between health outcomes and access to a primary care physician is also demonstrated clearly in the Aboriginal population. Amongst Aboriginals, rates of access to a primary care physician are much lower than the Canadian average, while rates of health issues such as Human Immunodeficiency Virus (HIV) prevalence are much higher, and life expectancy is much shorter. Cultural factors intrinsic to a group may largely affect their

KEY POINTS

• A disproportionate number of Aboriginals and recent immigrants do not have a primary care physician, and poorer health outcomes in these populations are due to a combination of cultural and socioeconomic factors.
• Evidence-based allocation of healthcare resources calls for a multi-factorial approach to public policy-making, to gear medical training and clinics towards meeting specific population needs.
attitudes towards healthcare and thus could have a significant impact on their willingness to search for a primary care physician. For example, Aboriginal people living off-reserve are 5% more likely to report unmet healthcare needs due to personal circumstance (which includes not pursuing healthcare because they are too busy, deciding not to bother, believing that their care would be inadequate, not knowing where to go, or disliking/fearing doctors) than their non-Aboriginal counterparts. This holds true even when controlling for variables such as household income and health status. This evidence suggests that there are certain attitudes, values, or other cultural factors that are independent and significant determinants of access to healthcare.

Yet the 5% difference in reporting unmet healthcare needs accounts for less than half of the disparity between the Aboriginal population (24% without a primary care physician) and the Canadian national average (12% without a primary care physician). Attitude toward Canadian healthcare also cannot account for the even more dramatic lack of access for recent immigrants (35% without a primary care physician), as personal circumstance was not found to be a significant variable within this group. Other factors in addition to cultural values must be considered in order to rectify these disparities in population healthcare. The disparity between Aboriginal and recent immigrant access to a primary care physician serves as an example of how, when cultural factors are addressed without acknowledging other socioeconomic variables, groups that are less efficient at lobbying and making themselves visible in the public eye may not receive equal allocation of the resources they require.

**SUPPORT FOR AN EVIDENCE-BASED APPROACH TO POLICY-MAKING**

Improving the efficiency of government healthcare spending requires a better understanding of the problems that face specific populations. Addressing these underlying causes could help to meet the needs of many people who depend on public health policy for their advocacy. One example is low income, which is not only more common in both the Aboriginal and recent immigrant populations, but is also linked to diminished access to healthcare. Canadian universal health insurance reduces financial barriers at point-of-care, but low income correlates with unmet health needs due to a variety of other factors, such as lack of transport to primary care physicians or an inability to pay for prescription medications. These financial barriers can lead to delays in access to care, particularly cost-effective and life-saving preventative management, and accounts for much of the disparity in income-related health outcomes.

It is crucial that public policy continue to reflect the accumulating data on the causes of diminished access to healthcare. Increasing evidence suggests that programs geared toward specific cultural groups can serve a greater number of people if they seek to address other social determinants of health. Maintaining an evidence-based policy program depends on the availability of quality research to identify these determinants and evaluate pilot interventions. The relative and combined impact of cultural factors, immigration status and income, in addition to variables such as geographic distribution, language barriers, and access to education, requires further study.

The impact of the above variables on population health supports a multi-factorial approach to the provision of healthcare. This approach calls for the incorporation of more varied services in pre-existing programs, such as community health centres that seek to address a population’s unique needs. Prioritizing cultural-sensitivity training in clinics in optimal geographic locations to service low-income areas could help serve several populations in need simultaneously. Moreover, facilitating access to culturally-sensitive clinics for individuals from isolated communities or low-income households of all cultures could be both cost-effective and beneficial, as it uses existing infrastructure to serve multiple populations while still meeting specific cultural needs.

Identifying barriers to access and incorporating specific solutions into public health policy improves efficiency at all levels, from individual communities to nation-wide. An evidence-based approach to public health helps to identify and rectify causes of disparity without painting populations with broad brush-strokes of generalized interventions in programs or policy. This is not only cost-effective, but more importantly it enables access to care for those whose needs are not specifically targeted by current programs.

This article is intended to spark a much-needed and long-overdue discussion about healthcare allocation in Canada. The examples provided only begin to illustrate how small changes in public policy in light of new information can improve access to healthcare for underserviced populations. An evidence-based approach to policy-making accounts for socioeconomic and cultural factors, allowing us to effectively advocate for the populations that need it the most.

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Greg’s wealth management practice is a division within Investors Group which has a leading group of specialists that provide advanced financial planning strategies for physicians. Greg helps his physicians with many aspects of their financial situations but here are some specific topics:

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Intrusive Thoughts in a Boy: A Review of Intermittent Explosive Disorder

Wendy K. Ng, MD
Jose Mejia, MD

CASE PRESENTATION

A 17-year-old boy presented with concerns about frightening nightmares. He stated that he had difficulty falling asleep, and would awake with bad dreams 30 to 40 times per night. On further questioning, he revealed that he felt himself becoming progressively angrier over the past six months, particularly over the most recent five weeks. He described his feelings of anger as arising suddenly and without any clear provocation. This was accompanied by escalating impulsive, recurrent and constant thoughts about violently killing anyone that he saw, predominantly using weapons such as knives, swords or guns. The intrusive thoughts interfered with his concentration and made it difficult for him to go to school or to leave his home. He stated that he was not very well-organized, not a collector, and that he had no rituals. He had no compulsions. His medical, surgical, family and legal histories were unremarkable. He denied any substance use or abuse. On two occasions, when he was alone in his home, he expressed his anger by breaking and tearing apart furniture. He had never been in fistfights, nor had he ever hurt any people or animals. His suicide risk was low.

At time of admission, he looked his stated age and was dressed casually in jeans and a t-shirt. His mood was angry, congruent with his affect. His thoughts were focused on his preoccupation with killing people. Despite his distressing thoughts, he had remarkable insight into his condition. He was started on escitalopram 10 mg daily and olanzapine 2.5 mg daily. Subsequently, his sleep improved. However, the distressing thoughts persisted and anger management was arranged. While he noted no change in the frequency and intensity of his distressing thoughts, he stated that he felt some relief in the attempts to address his situation.

When this boy presented to our care, a range of differential diagnoses were considered including: obsessive-compulsive disorder, intermittent explosive disorder, depression or an adjustment reaction. His recurrent and impulsive violent thoughts were most suggestive of intermittent explosive disorder. An EEG was ordered, and revealed epileptic foci. He was started on carbamazepine, an anticonvulsant, and subsequently experienced a decrease in the frequency and intensity of violent thoughts.

INTERMITTENT EXPLOSIVE DISORDER
Definition, Epidemiology and Diagnosis

According to the DSM-IV-TR diagnostic criteria, Intermittent Explosive Disorder (IED) is characterized by discrete episodes of aggressive impulses that result in serious assault acts or destruction of property, in which the degree of aggression is greatly out of proportion to any precipitating psychosocial stressors. These episodes are not otherwise accounted for by another mental disorder or due to the direct physiological effects of a substance or a general medical condition.

Patients may describe the symptoms of IED as spells or attacks. These appear within minutes or hours and remit spontaneously and abruptly regardless of duration. Patients tend to demonstrate regret following each episode. Between episodes, signals of general impulsivity or aggressiveness are not seen.

It is estimated that one to two percent of the general population has IED, although the proportion may be greater in psychiatric wards and in individuals with other disorders such as alcohol dependence or personality disorder. The seizure-like quality of the outbursts has been described to be like an “epileptioid personality”, suggesting IED may be a consequence of an organic disease process. It has also been suggested that activity in the anterior cingulate gyrus may be different in patients with IED, based on a proton magnetic resonance spectroscopy study.

While intermittent explosive disorder is underreported, it appears to occur more frequently in males than in females. Male patients with IED are more often seen in correctional institutions, whereas female patients with IED are more often seen in psychiatric institutions. It tends to present between late adolescence and early adulthood. Usually, it decreases in
severity with middle age. This may be due to patients gaining better insight into their own symptoms with time and developing behavioural management strategies.

Classification

Traditional impulse control disorders in the DSM-IV-TR include pathological gambling, trichotillomania (hair loss from compulsive pulling), kleptomania (irresistible urge to steal items of trivial value), pyromania (compulsion to set fires) and IED. These disorders are characterized by repetitive behaviours and impaired inhibition of these behaviours. As described by Dell’Osso et al., such impulse control disorders include the following:

- “The failure to resist an impulse to perform some act that is harmful to the individual or others;
- An increasing sense of arousal or tension prior to committing or engaging in the act;
- An experience of either pleasure, gratification, or release of tension at the time of committing the act.”

It has been suggested that frequent verbal aggression could be included in future iterations of the IED criteria set. Some researchers have suggested that impulse control disorders should be thought of as a part of an obsessive-compulsive spectrum; a DSM-V task force has considered separating obsessive-compulsive disorder from the anxiety disorders and placing it in a separate category known as the obsessive-compulsive spectrum disorders.

Since diagnosis of IED may prove difficult, various aids have been investigated for this purpose. Notably, the Interview Module for Intermittent Explosive Disorder (M-IED) has been studied as a potential tool to aid in the diagnosis of IED in adolescents. It is based on the Structured Clinical Interview for DSM-III-R (SCID) and focuses on frequency of outbursts, level of aggression and social impairment.

Organic causes of IED have been investigated. Koelsch et al. have studied EEG correlates of moderate IED. In moderate IED, individuals act less intensely during an episode and in a socially acceptable manner, such as slamming doors or shouting loudly. Coccaro et al. have found that subjects diagnosed with IED perform poorly on facial emotion recognition tasks. Further, they have determined that patients with IED demonstrate exaggerated amygdala reactivity and diminished orbitofrontal cortex function on functional MRI studies. Finally, it has been proposed that endocrine factors play a role in the aggressiveness seen in many Axis I disorders, such as attention deficit/hyperactivity, alcohol abuse, post-traumatic stress disorder (PSTD), chronic fatigue and burnout. In these disorders, low basal glucocorticoid levels persist for years. A similar contributing factor cannot be excluded in IED.

Treatment

A pharmacological and psychotherapeutic approach may be considered as a treatment option for IED. Unfortunately, psychotherapy in these patients tends to be difficult due to their angry outbursts. Therapists may further be challenged with countertransference and limit-setting. A primary therapeutic goal may be to encourage the patient to identify thoughts or emotions that precede explosive episodes in order to avoid acting them out. Family and group therapy may also be beneficial for adolescent patients.

Anticonvulsants have been used in treating IED. Lithium may be helpful in lessening aggressive behaviour. Other anticonvulsants that have shown some benefit in IED patients include carbamazepine, valproate, divalproex, and phenytoin.

While antipsychotics have been used successfully in some cases, a positive response may raise the possibility that schizophrenia or a mood disorder is the underlying diagnosis rather than IED. Clozapine, in relatively modest doses (mean daily dose of 102 mg), may have clinical benefits for adolescents with bipolar disorder, IED, and PTSD, although it has no labelled indication for these disorders. Its beneficial effect is demonstrated by decreased requirements for concomitant mood stabilizers, antidepressants, and anxiolytic medication use.

Treatment with beta-adrenergic receptor antagonists and calcium channel blockers has been effective in some cases. Operative treatment for intractable violence and aggression is another possibility, but there is no evidence for the efficacy of this option.

CONCLUSION

Ultimately, organic causes of this boy’s symptoms were investigated. When an EEG revealed epileptic foci, it was evident that a seizure disorder may have been triggering his recurrent and intrusive violent thoughts. The boy’s subsequent improvement on carbamazepine further supported this hypothesis. However, escitalopram, a selective serotonin reuptake inhibitor, and olanzapine, an atypical antipsychotic, may have also played contributory roles.

It remains important to generate broad differential diagnoses, and to consider psychiatric as well as other organic disease. This case reminds us of the possibility that a seizure disorder may mimic the symptoms of IED. While an anticonvulsant provided a suitable treatment for an underlying seizure disorder in this patient, true cases of IED—those not caused by an underlying medical condition, such as a seizure disorder—are more difficult to manage. To date, there have been no studies examining patients with IED to universally rule out concomitant epileptic foci seen on EEG. Further investigation may shed light on the causes, classification and treatment of this challenging condition, allowing physicians to more effectively help patients with IED.
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Author Biographies
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Primary Squamous Cell Carcinoma of the Ovary

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INTRODUCTION

Malignant ovarian lesions encompass many clinicopathologic entities, some with bizarre histomorphologic features. Although many ovarian malignancies have comparable presenting clinical features, much of the intrigue they arouse stems from the subsequent pathologic work-up. Not only do the histopathologic features of an ovarian lesion better define its ontogeny and biology, they may also predict prognosis. Furthermore, their identification may assist in planning adjuvant therapy. What follows is a case report of an exceedingly rare primary ovarian lesion, squamous cell carcinoma (SCC). A relevant review of the literature, encompassing both the clinical and pathologic features of this lesion, is also presented.

CASE PRESENTATION

A 58-year-old female presented to her general practitioner complaining of buttock and abdominal pain. Approximately three months prior she had been admitted to hospital with chest pain, whereupon a thoracic angiogram revealed a pulmonary embolus. She was started on heparin, bridged to warfarin and was sent home for follow-up in the community upon resolution of her acute symptoms. Concerned about a potential second clotting event, her general practitioner ordered immediate lower limb and abdominal ultrasounds as well as basic bloodwork.

Although there was no evidence of a clot in her lower limbs, the abdominal ultrasound incidentally revealed a right adnexal mass. An abdominal CT was subsequently performed, confirming a cystic and solid lesion, adherent to the right fallopian tube as well as the appendix. There was no past history of malignancy and no history of abnormal Pap tests; her family history was also non-contributory. She was referred to the gynecology service for surgical work-up and planning.

Pre-op bloodwork revealed a slightly elevated CA-125 of 41 µg/mL (normal = 0-35 µg/mL). She was bridged to heparin, and taken to the operating room for excision of the mass. The specimen consisted of a solid and cystic mass, approximately 10 cm in maximal dimension, with a roughened and granular external surface and no grossly evident normal ovarian tissue. The cut surface demonstrated several yellow-white cystic structures containing pasty sebaceous material and necrotic debris, with a white and slightly fibrous intervening stroma (Figure 1). The fallopian tube and appendix were identified as adherent to the larger lesion. Frozen section revealed invasive squamous cells with zones of pseudogland formation. On analysis, there were no teratomatous or true gland formations, and no evidence of transitional cell or endometrioid components was observed. A frozen section diagnosis of SCC was rendered.

Figure 1. Gross photograph with cut surface demonstrating solid and cystic components, the latter showing sebaceous contents (arrow)
Further histological examination showed several areas with pronounced keratinization (Figure 2). The invasive component also showed prominent keratin pearl formation. Detailed sampling confirmed the absence of true glands, as well as teratomatous and transitional cell components. A small remnant of normal ovarian cortex was also identified in the original specimen (Figure 3). Finally, a small focus of endometriosis, involved by tumour, was identified (Figure 4). There was no evidence of endometrioid adenocarcinoma in the primary specimen nor in the completed hysterectomy specimen. Detailed histological examination of the cervix was also undertaken, revealing no abnormality. The immunohistochemical profiles of both the pseudogland formations and the typical squamous components were identical (Figure 5). The tumour was strongly positive for MA903, p63 and CK5/6. Since the tumour was also found to involve the pelvic peritoneum, omentum, one pelvic lymph node group and the uterine serosa, it was assigned a FIGO stage IIIc.

Figure 2. Photomicrograph of tumour demonstrating pronounced keratinization (arrow) (H&E, 200X)

Figure 3. Photomicrograph demonstrating pseudogland formations (arrow) as well as a small amount of residual ovarian cortex (arrowheads) (H&E, 100X)

Figure 4. Photomicrograph demonstrating tumour (open arrow) involving a focus of endometriosis (solid arrow) (H&E, 100X)

Figure 5. Immunohistochemistry photomicrographs demonstrating positive staining for MA903 (above, cytoplasmic staining, 200X) and p63 (below, nuclear staining, 200X) stains
The patient recovered from her primary surgery and was discharged within a week. Her case was reviewed at the gynecological oncology clinicopathological rounds and a course of carboplatin/paclitaxel chemotherapy was recommended. Unfortunately, she experienced a negative reaction to paclitaxel and was therefore switched to single agent carboplatin. She returned to hospital five weeks post-surgery with confusion and obtipation. She was diagnosed with a bowel obstruction secondary to massive recurrent peritoneal disease, confirmed by abdominal CT. A CT scan of the head ruled out brain metastases and investigations for a potential paraneoplastic syndrome were undertaken. Unfortunately, before the latter investigations were completed, she developed severe respiratory distress and died.

**SQUAMOUS CELL CARCINOMA OF THE OVARY**

SCC of the ovary presents an intriguing diagnostic challenge to clinical and pathology teams. SCC more commonly arises from non-ovarian sources, making the above diagnosis exceedingly rare. When this entity occurs, however, it presents an interesting insight into the histopathological variation that may be seen in epithelial malignancies of the ovary.

Primary ovarian lesions are classified into the epithelial, germ-cell or sex-cord-stromal categories. Mature teratomas (dermoids), included in the germ-cell category, are the single most common ovarian tumour and can occur at any age. Squamous elements are most commonly identified in ovaries as part of a mature teratoma. Although the squamous component in a teratoma is often benign, SCC can arise from mature teratomas; this entity, in fact, is the most common malignant component arising from a mature teratoma. Only one to two percent of mature teratomas harbour a malignant component, but up to 80% will be squamous. Squamous elements arising in the absence of a teratomatous component (i.e. arising as a purely epithelial lesion) are distinctly rare. Generally, these occur as metastases from extra-ovarian squamous lesions or as part of a metaplastic process in an endometrioid adenocarcinoma or Brenner tumour. Endometrioid adenocarcinoma of the ovary typically presents post-menopausally and is typified by areas of squamous differentation arising within neoplastic endometrioid glands. Brenner tumours are primary ovarian tumours that occur chiefly at age 40-50 and show predominantly transitional (urothelial) differentiation; these more infrequent tumours may also show areas of squamous differentation. Rarer still are SCCs showing none of the above features. Some primary pure SCCs will arise in concert with foci of endometriosis, and rarely, others are noted entirely de novo.

SCC of the ovary generally behaves aggressively. The lesion is typically identified as an enlarging pelvic mass, coinciding with symptoms of abdominal pain in the absence of significant ascites. Other symptoms are related to tumour invasion of neighboring structures, such as the urinary system and other gynecologic organs, and to distant metastases. The routine use of CA-125 may be helpful in differentiating cases of SCC from other types of ovarian malignancies. It appears to be normal or moderately elevated in SCC, but is present in high levels in other aggressive ovarian malignancies.

While there are no pathognomonic radiological features in SCC, pelvic imaging remains important in the workup of ovarian malignancies. The radiologic and gross pathologic findings generally show a heterogeneous solid and cystic mass, approximately 10-15 cm in maximal dimension. This latter fact may be helpful in sorting out the preliminary differential diagnosis given that many aggressive ovarian neoplasms are often much larger. Areas of necrosis are often visible and there are often adhesions to surrounding pelvic structures.

SCC of the ovary can only be confidently diagnosed histologically. It is identified by the presence of architectural and/or cytological features that resemble those found normally in squamous elements but that also show evidence of invasion. As in other SCCs throughout the body, the clinically aggressive character of SCC of the ovary is recapitulated histologically by its tendency to form invasive ribbons and tongues of tumour cells that may extend well beyond the original tumour focus. In its well-differentiated form, SCC will show squamous maturation, keratin formation and intracellular bridging. In its poorly differentiated form, few normal squamous features may be identifiable; such cases may require ancillary immunohistochemical or electron microscopic studies to confirm the diagnosis. Infrequently, SCC may show “pseudogland” formations; these structures may confuse the diagnosis, especially in tissue more likely to harbour an adenocarcinoma than an SCC. In the latter scenario, the use of immunohistochemical markers specific for squamous elements can be very helpful.

Intraoperative pathology consultation, comprising of tissue sampling and frozen section interpretation, is often requested at the time of surgery for intra-operative and post-operative planning. A diagnosis of SCC can be made, provided that the histological features are present. The underlying etiology should not be guessed at, however, given that extensive sampling of the surgical specimen is required to rule out the more common squamous lesions. Detailed examination of the cervix is required to rule out a cervical SCC, since ovarian metastases in such cases have been documented. With a diagnosis of ovarian SCC, full gynecological staging should be undertaken including completion of total abdominal hysterectomy and bilateral salpingo-oophorectomy as well as peritoneal, omental and lymph node biopsies as indicated. Invasion of nearby tissues may require resection and reconstruction.

In addition to surgery, adjuvant treatment may also be attempted. Some case reports have noted a response to early paclitaxel in combination with a platinum agent. However, outcomes remain poor in most cases. In particular, most cases (80% in one study) of SCC arising with or without endometriosis result in death within a few months of diagnosis.
Based on the few published reports available, radiotherapy is also of limited value.\textsuperscript{3,4}

**CONCLUSION**

Our case of SCC of the ovary occurring in association with endometriosis is an exceedingly rare example of an ovarian tumor demonstrating squamous elements and an even rarer example of SCC without an associated teratoma. As in our case, debate persists over the pathogenesis of SCC associated with endometriosis. Most authors suggest the SCC in this context arises from neoplastic transformation of pre-existing endometrial epithelium.\textsuperscript{5} This is in keeping with the varied neoplasia that may arise in concert with endometriosis. Cases of SCC of the ovary showing no other associated lesions are an even greater etiological conundrum; some authors suggest that these lesions may arise due to seeding from occult pre- or fully-malignant squamous lesions in other locations.\textsuperscript{3}

**ACKNOWLEDGEMENT**

The authors acknowledge Dr. Dean Daya for his expert opinion on this case.

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**Author Biographies**

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CASE 1
A 40-year-old woman presents with a unilateral red eye and complains of pain, a foreign body sensation and decreased vision. Fluorescein staining and cobalt blue lighting of the eye is shown.

CASE 2
A 30-year-old man previously diagnosed with inflammatory bowel disease presents with a two day history of a unilateral red eye and complains of pain, photophobia and decreased vision.
CASE 3
A 25-year-old man presents with bilateral red eyes and complains of pain, discharge and a foreign body sensation for the past three days. Preauricular lymph nodes are palpable. Fluorescein staining and cobalt blue lighting of the conjunctiva is shown.

CASE 4
A 30-year-old woman presents with a red eye after having it scratched by her baby daughter two hours ago. She complains of pain and tearing. Fluorescein staining and cobalt blue lighting of the cornea is shown.

CASE 5
A 75-year-old man presents with a red eye, severe pain, photophobia, tearing, and decreased vision. He thinks he may have scratched his eye with a used eyedrop bottle nine days ago, but did not seek medical treatment at the time.

CASE 6
A 55-year-old paper mill worker presents with a red eye and severe pain following a workplace incident where chlorine entered his eye.
CASE 1 DIAGNOSIS: HERPES SIMPLEX VIRUS KERATITIS

Herpes Simplex Virus (HSV) Keratitis classically presents as corneal ulcers with a dendritic pattern, easily seen with fluorescein staining and cobalt blue lighting. Patients often present with a red eye, pain, photophobia, tearing and decreased vision. Patients may also have vesicular skin lesions. HSV is treated with topical antivirals; it is important to remember that the use of corticosteroids is generally contraindicated. Patients should be referred to an ophthalmologist for possible dendritic debridement, topical antivirals, and to monitor for complications including increased intraocular pressure, uveitis and very rarely retinitis.

CASE 2 DIAGNOSIS: IRRITIS

The slit beam of light highlights a shower of white blood cells in the anterior chamber, indicative of inflammation. There are also keratic precipitates present inferiorly on the corneal endothelium and adhesions between the iris and lens (synechiae). While intraocular inflammation may be caused by infection, neoplasm, trauma and surgery, it is often autoimmune or idiopathic in nature.

Acute anterior uveitis, or iritis/iridocyclitis, is characterized by inflammation of the iris and ciliary body and is usually unilateral. Patients will often complain of pain, photophobia and blurry vision. Inspection typically reveals “ciliary flush”, or conjunctival redness most prominent around the limbus. While iritis is often idiopathic, it has been linked to HLA-B27.

Patients with this HLA type may also suffer from seronegative arthropathies, including ankylosing spondylitis, psoriatic arthritis, inflammatory bowel disease and reactive arthritis. It can be helpful at times to ask relevant questions surrounding these disorders.

CASE 3 DIAGNOSIS: FOLLICULAR CONJUNCTIVITIS

Conjunctival follicles, as seen in this picture, with preauricular lymphadenopathy are characteristic of a viral conjunctivitis.

Conjunctivitis has numerous etiologies, including atopy/allergy, bacteria, viruses and lice. It is characterized by generalized hyperaemia, which is often less marked around the limbus (contrast with iritis). Patients often complain of pain, a scratching or burning sensation, and discharge. Purulent or profuse exudate is usually indicative of a bacterial pathogen. Bacterial conjunctivitis is treated with topical or systemic antibiotics depending on the case. Allergic conjunctivitis is characterized by itching and is often treated with cold compresses, artificial tears and topical or oral antihistamines. Follicular conjunctivitis has its own differential diagnosis, which is almost exclusively viral in nature. An important type of viral conjunctivitis is Epidemic Keratoconjunctivitis (EKC), a highly contagious disease caused by specific serotypes of human adenoviruses. When dealing with EKC, precautions such as handwashing and cleaning of equipment should be taken by healthcare professionals and patients to avoid spread.

CASE 4 DIAGNOSIS: CORNEAL ABRASION

The fluorescein staining and cobalt blue lighting clearly show an area of de-epithelization indicating a corneal abrasion.

Corneal abrasions are painful and patients complain of foreign body sensation. They are generally treated with topical antibiotics to prevent infection and clear within a few days. Additionally, abrasions caused by organic materials, such as tree branches or fingernails, should be treated with a fluoroquinolone. Anti-pseudomonal coverage is important in contact lens wearers. Patching of the eye is not usually indicated and is contraindicated in contact lens wearers.

CASE 5 DIAGNOSIS: CORNEAL ULCER

This picture shows a severe corneal ulcer with corneal opacity and pus filling the anterior chamber (hypopyon) inferiorly.

Corneal ulcers may present similarly to abrasions. When examining the eye with a slit-lamp, the involved area in an abrasion remains relatively clear and the details of the iris remain visible. Conversely, the details of the iris are lost when looking at it through an opaque corneal ulcer.

Important causes of corneal ulcers include corneal abrasions, foreign bodies, and use of contact lenses. The ulcer is typically cultured and treated with topical antibiotics. Corneal ulcers require urgent referral to an ophthalmologist in order to prevent serious complications such as corneal perforation and endophthalmitis.
CASE 6 DIAGNOSIS: CHEMICAL KERATOCONJUNCTIVITIS

This picture shows generalized inflammation of the conjunctiva and cornea. When exposure to chemical agents occurs, the eye must be continuously irrigated for at least 30 minutes and the fornices must be swept to remove any remaining particulate material. Urgent referral to an ophthalmologist is warranted, and depending on the severity, it may be treated with artificial tears, antibiotic ointment, and control of the intraocular pressure and pain.

REFERENCES

Author Biographies
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The Connections Within

Greg McRoberts

Greg McRoberts is a second-year student at the Ontario College of Art and Design (OCAD) studying Industrial Design. He works with a multitude of media including painting, drawing, photography and digital photo manipulation. He has been blind in one eye since birth and loved to look at medical textbooks in the doctor’s office as a small child, which has inspired many of his works. He writes: “The Connections Within” is a painting in oil on canvas that was inspired by the internal structure of bone. It represents the paths we follow both forward and laterally to gain strength in our lives, mentally and physically.”