CAGS AND ACS EVIDENCE-BASED REVIEWS IN SURGERY. 29

Computed tomographic angiography for the diagnosis of blunt cervical vascular injury

Andrew Kirkpatrick, MD
David Evans, MD
Wayne Meredith, MD
for the members of the
Evidence-Based Reviews
in Surgery Group*

*The CAGS Evidence-Based Reviews in Surgery Group comprises Drs. N.N. Baxter, K.J. Brasel, C.J. Brown, P. Chaudhury, T.H. Cogbill, C.S. Cutter, E. Dixon, G.W.N. Fitzgerald, H.J.A. Henteleff, A.W. Kirkpatrick, S. Latosinsky, A. MacLean, T.M. Mastracci, R.S. McLeod, A. Morris, L.A. Neumayer, S. Smith, L.R. Temple and Ms. M.E. McKenzie.

Correspondence to:
Ms. M.E. McKenzie, RN
Administrative Coordinator, EBRS
Mount Sinai Hospital, L3-010
60 Murray St., PO Box 23
Toronto ON M5T 3L9
fax 416 586-5932
mmckenzie@mtsinai.on.ca

The term "evidence-based medicine" was first coined by Sackett and colleagues as "the conscientious, explicit and judicious use of current best evidence in making decisions about the care of individual patients."[1] The key to practising evidence-based medicine is applying the best current knowledge to decisions in individual patients. Medical knowledge is continually and rapidly expanding. For clinicians to practise evidence-based medicine, they must have the skills to read and interpret the medical literature so that they can determine the validity, reliability, credibility and utility of individual articles. These skills are known as critical appraisal skills, and they require some knowledge of biostatistics, clinical epidemiology, decision analysis and economics, and clinical knowledge.

Evidence-Based Reviews in Surgery (EBRS) is a program jointly sponsored by the Canadian Association of General Surgeons (CAGS) and the American College of Surgeons (ACS) and is supported by an educational grant from ETHICON and ETHICON ENDO-SURGERY, both units of Johnson & Johnson Medical Products, a division of Johnson & Johnson and ETHICON Inc. and ETHICON ENDO-SURGERY Inc., divisions of Johnson & Johnson Inc. The primary objective of EBRS is to help practising surgeons improve their critical appraisal skills. During the academic year, 8 clinical articles are chosen for review and discussion. They are selected for their clinical relevance to general surgeons and because they cover a spectrum of issues important to surgeons, including causation or risk factors for disease, natural history or prognosis of disease, how to quantify disease, diagnostic tests, early diagnosis and the effectiveness of treatment. A methodological article guides the reader in critical appraisal of the clinical article. Methodological and clinical reviews of the article are performed by experts in the relevant areas and posted on the EBRS website, where they are archived indefinitely. In addition, a listserv allows participants to discuss the monthly article. Surgeons who participate in the monthly packages can obtain Royal College of Physicians and Surgeons of Canada Maintenance of Certification credits and/or continuing medical education credits for the current article only by reading the monthly articles, participating in the listserv discussion, reading the methodological and clinical reviews and completing the monthly online evaluation and multiple choice questions.

We hope readers will find EBRS useful in improving their critical appraisal skills and in keeping abreast of new developments in general surgery. Four reviews are published in condensed versions in the *Canadian Journal of Surgery* and 4 are published in the *Journal of the American College of Surgeons*. For further information about EBRS, please refer to the CAGS or ACS websites. Questions and comments can be directed to the program administrator, Marg McKenzie, at mmckenzie@mtsinai.on.ca.

Reference

1. Evidence-Based Medicine Working Group. Evidence-based medicine. *JAMA* 1992;268: 2420-5.

SELECTED ARTICLE

Eastman AL, Chason DP, Perez CL, et al. Computed tomographic angiography for the diagnosis of blunt cervical vascular injury: Is it ready for primetime? *J Trauma* 2006;60:925–9.

ABSTRACT

Question: Is computed tomographic angiography (CTA) as effective as catheter angiography in diagnosing blunt cervical vascular injury (BCVI)? **Design:** Prospective cohort study. **Setting:** Trauma unit at an academic centre. **Patients:** Computed tomographic angiography was performed on 162 patients who sustained blunt trauma and met at least 1 criterion of a modification of the Denver screening criteria for blunt cerebrovascular injuries. Ninety percent of the patients (146) had these findings confirmed with standard catheter angiography. **Description of test and diagnostic standard:** Patients underwent CTA using a 16-channel CT scanner, and interpretation was performed using axial source images and 2- and 3-dimensional maximum-intensity pixel and volume reading display techniques. Catheter angiography of the head and neck, which is considered to be the gold standard, was performed using a Siemens Artis BA biplane neuroangiographic unit. An attending neuroradiologist performed both readings; CTA was primarily read without any knowledge of catheter angiography results. **Main outcome:** Sensitivity, specificity, positive and negative predictive values and accuracy of CTA. **Results:** Forty-six percent of BCVIs were identified among 43 patients. In 45 of 46 patients (98%), the results of CTA and catheter angiography were in agreement. There was a single false-negative CTA; the remaining 103 patients had normal CTAs confirmed by normal catheter angiography. The sensitivity, specificity, positive predictive value, negative predictive value and accuracy of CTA for the diagnosis of BCVI were 97.7%, 100%, 100%, 99.3% and 99.3%, respectively. **Conclusion:** Computed tomographic angiography is an effective and sensitive diagnostic test for the detection of BCVIs.

COMMENTARY

Although BCVIs were initially thought to be extremely rare, the emergence of high-risk screening criteria and improved imaging technology has led to a significant increase in the diagnosis of this type of injury. Several series have reported the presence of BCVI in about 1% of all blunt trauma patients. Despite the relatively low prevalence, this remains an important issue since the natural history of BCVIs can be devastating. These injuries are associated with a stroke risk of about 50% in patients with carotid artery injuries and about 20%–25% in those with vertebral artery injuries. With any potentially serious condition that does not have obvious signs at the time of presentation, the goal is to identify it early enough to allow early intervention and management in the hope of reducing mortality or disability. To successfully screen for BCVIs, preferably an ideal, or at least adequate, test is required to avoid misdiagnosis, overdiagnosis, false reassurance and procedural complications of the test. With advances in technology, the modern trauma literature is replete with clinical studies advocating CTA as a valid diagnostic alternative to traditional interventional angiography for vascular injury, the long held "gold standard." Indeed, CTA is now believed to be superior owing to fewer complications, cost and increasing practicability, and it is used ubiquitously for the definitive diagnosis of blunt aortic injury, solid organ vascular injury and extremity vascular trauma.

Methodologically, the study by Eastman and colleagues was well performed. Briefly, CTA was performed on all adult patients who sustained blunt trauma and met at least 1 criterion of a modification of the Denver screening criteria for blunt cerebrovascular injuries. Out of 4216 patients admitted to the medical centre, 162 patients were considered to be at risk for BCVI and underwent a CTA. Forty-six BCVIs were detected in this population, yielding a prevalence in the screened population of 28.4% and an overall prevalence of 1.25% in the presenting trauma population. This overall prevalence of BCVI was comparable to that reported in other studies that used comprehensive screening protocols in other cohorts of blunt trauma patients. The study population, primarily men and patients injured in motor vehicle collisions, was similar to those of many trauma practices. The study had an independent blinded comparison with a reference standard test, although there was a modest verification bias in that some patients either refused the angiogram or were discharged before its performance. The study results are appropriately described statistically and the results are compelling. Likelihood ratios are felt to be more accurate and give a better assessment of the value of a diagnostic test than the sensitivity, specificity, positive and negative predictive values. As a rough guide, the likelihood ratios of both the positive and negative likelihood ratios in this study suggest that CTA is an excellent test for diagnosing BCVIs.

The study by Eastman and colleagues is relevant in that it contributes to a growing body of evidence supporting the reliability of CTA performed with latest generation imaging techniques for the definitive diagnosis of BCVIs. The initial work comparing CTA to catheter angiography was done on 4-slice CT scanners. The imaging technology has advanced rapidly, with most trauma centres now having 16-slice or better scanners resulting in substantial improvement in CT angiographic resolution and 3-dimensional reconstruction capabilities. Further, as CT technology continues to improve and 64-slice and better

scanners are introduced, it is likely that the performance of CTA will only continue to improve. However, the absence of skilled interpretation would seriously limit CTA, angiography or any other modality used.

It is important to appreciate that the study did not evaluate therapy or outcomes related to BCVI diagnosed as outlined; this makes it difficult to judge the value of the intervention based on such a diagnostic strategy. Nonetheless, making the diagnosis is the critical first step in management. As major trauma is now widely managed throughout North America and Europe within fairly evolved regionalized trauma systems that concentrate the highest-risk patients in well-established tertiary-level trauma centres capable of advanced vascular imaging comparable to that used in this analysis, the study techniques are highly feasible and the findings generalizable to similar centres.

Competing interests: None declared.

Canadian Surgery FORUM

The Canadian Surgery FORUM canadien de chirurgie will hold its annual meeting Sept. 10–13, 2009, in Victoria, British Columbia. This interdisciplinary meeting provides an opportunity for surgeons across Canada with shared interests in clinical practice, continuing professional development, research and medical education to meet in a collegial fashion. The scientific program offers material of interest to academic and community surgeons, residents in training and students.

The major sponsoring organizations include the following:

- The Canadian Association of General Surgeons
- The Canadian Society of Colon and Rectal Surgeons
- The Canadian Association of Thoracic Surgeons
- The Canadian Society of Surgical Oncology

Other participating societies include the American College of Surgeons, the British Columbia Surgical Society, the Canadian Association of Bariatric Physicians and Surgeons, the Canadian Association of Surgical Chairmen, the Canadian Association of University Surgeons, the Canadian Hepato-Pancreato-Biliary Society, the Canadian Undergraduate Surgical Education Committee, the James IV Association of Surgeons and the Trauma Association of Canada.

For registration and further information contact surgeryforum@rcpsc.edu; www.cags-accg.ca.

FORUM canadien de chirurgie

La réunion annuelle du Canadian Surgery FORUM canadien de chirurgie aura lieu du 11 au 14 septembre 2008 à Halifax en Nouvelle Écosse. Cette réunion interdisciplinaire permet aux chirurgiens de toutes les régions du Canada qui s'intéressent à la pratique clinique, au perfectionnement professionnel continu, à la recherche et à l'éducation médicale d'échanger dans un climat de collégialité. Un programme scientifique intéressera les chirurgiens universitaires et communautaires, les résidents en formation et les étudiants.

Les principales organisations qui parrainent cette réunion sont les suivantes :

- L'Association canadienne des chirurgiens généraux
- La Société canadienne des chirurgiens du côlon et du rectum
- La Société canadienne de chirurgie thoracique
- La Société canadienne d'oncologie chirurgicale

Le American College of Surgeons, le Canadian Association of Surgical Chairmen, l'Association canadienne des chirurgiens universitaires, le Canadian Hepato-Pancerato-Biliary Soceity, le Comité canadien de l'éducation chirurgicale de premier cycle, Doctors Nova Scotia, l'Association des chirurgiens James IV, le Ontario Association of General Surgeons, et l'Association canadienne de traumatologie sont au nombre des sociétés qui appuient cette activité.

Pour vous inscrire, veuillez communiquez à surgeryforum@rcpsc.edu; www.cags-accg.ca.