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Clinical Utility of Echocardiography for Patients with Hip Fracture: A Rapid Review

M Nikitovic

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Conflict of Interest Statement

All reports prepared by the Division of Evidence Development and Standards at Health Quality Ontario are impartial. There are no competing interests or conflicts of interest to declare.

Rapid Review Methodology

Clinical questions are developed by the Division of Evidence Development and Standards at Health Quality Ontario in consultation with experts, end-users, and/or applicants in the topic area. A systematic literature search is then conducted to identify relevant systematic reviews, health technology assessments, and meta-analyses; if none are located, the search is expanded to include randomized controlled trials (RCTs), and guidelines. Systematic reviews are evaluated using a rating scale developed for this purpose. If the systematic review has evaluated the included primary studies using the GRADE Working Group criteria (http://www.gradeworkinggroup.org/index.htm), the results are reported and the rapid review process is complete. If the systematic review has not evaluated the primary studies using GRADE, the primary studies included in the systematic review are retrieved and a maximum of two outcomes are graded. If no well-conducted systematic reviews are available, RCTs and/or guidelines are evaluated. Because rapid reviews are completed in very short timeframes, other publication types are not included. All rapid reviews are developed and finalized in consultation with experts.

Disclaimer

This rapid review is the work of the Division of Evidence Development and Standards at Health Quality Ontario, and is developed from analysis, interpretation, and comparison of published scientific research. It also incorporates, when available, Ontario data and information provided by experts. As this is a rapid review, it may not reflect all the available scientific research and is not intended as an exhaustive analysis. Health Quality Ontario assumes no responsibility for omissions or incomplete analysis resulting from its rapid reviews. In addition, it is possible that other relevant scientific findings may have been reported since completion of the review. This report is current to the date of the literature search specified in the Research Methods section, as appropriate. This rapid review may be superseded by an updated publication on the same topic. Please check the Health Quality Ontario website for a list of all publications: http://www.hqontario.ca/evidence/publications-and-ohtac-recommendations.

About Health Quality Ontario

Health Quality Ontario is an arms-length agency of the Ontario government. It is a partner and leader in transforming Ontario's health care system so that it can deliver a better experience of care, better outcomes for Ontarians, and better value for money.

Health Quality Ontario strives to promote health care that is supported by the best available scientific evidence. Health Quality Ontario works with clinical experts, scientific collaborators, and field evaluation partners to develop and publish research that evaluates the effectiveness and cost-effectiveness of health technologies and services in Ontario.

Based on the research conducted by Health Quality Ontario and its partners, the Ontario Health Technology Advisory Committee (OHTAC)—a standing advisory subcommittee of the Health Quality Ontario Board—makes recommendations about the uptake, diffusion, distribution, or removal of health interventions to Ontario's Ministry of Health and Long-Term Care, clinicians, health system leaders, and policy makers.

Rapid reviews, evidence-based analyses and their corresponding OHTAC recommendations, and other associated reports are published on the Health Quality Ontario website. Visit http://www.hqontario.ca for more information.

About Health Quality Ontario Publications

To conduct its rapid reviews, Health Quality Ontario and/or its research partners reviews the available scientific literature, making every effort to consider all relevant national and international research; collaborates with partners across relevant government branches; consults with clinical and other external experts and developers of new health technologies; and solicits any necessary supplemental information.

In addition, Health Quality Ontario collects and analyzes information about how a health intervention fits within current practice and existing treatment alternatives. Details about the diffusion of the intervention into current health care practices in Ontario can add an important dimension to the review. Information concerning the health benefits, economic and human resources, and ethical, regulatory, social, and legal issues relating to the intervention may be included to assist in making timely and relevant decisions to optimize patient outcomes.

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http://www.hqontario.ca/evidence/publications-and-ohtac-recommendations/rapid-reviews.

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List of Abbreviations

AAGBI	Association of Anaesthetists of Great Britain and Ireland
ACC	American College of Cardiology
AHA	American Heart Association
ESA	European Society of Anaesthesiology
ESC	European Society of Cardiology
SIGN	Scottish Intercollegiate Guidelines Network

Background

As legislated in Ontario's *Excellent Care for All Act*, Health Quality Ontario's mandate includes the provision of objective, evidence-informed advice about health care funding mechanisms, incentives, and opportunities to improve quality and efficiency in the health care system. As part of its Quality-Based Funding (QBF) initiative, Health Quality Ontario works with multidisciplinary expert panels (composed of leading clinicians, scientists, and administrators) to develop evidence-based practice recommendations and define episodes of care for selected disease areas or procedures. Health Quality Ontario's recommendations are intended to inform the Ministry of Health and Long-Term Care's Health System Funding Strategy.

For more information on Health Quality Ontario's Quality-Based Funding initiative, visit www.hqontario.ca.

Objective of Analysis

The objective of this analysis was to evaluate the clinical utility of preoperative echocardiography for the diagnosis and evaluation of aortic stenosis in patients with hip fractures.

Clinical Need and Target Population

Valvular heart disease, particularly aortic stenosis, has been independently associated with an increased risk of perioperative cardiovascular complications. (1;2) The prevalence of aortic stenosis increases with age, and approximately 3% of adults aged 75 to 86 years are estimated to have critical aortic stenosis (defined as a valve area ≤ 0.8 cm^2). (3;4) One study found that 8% of patients presenting with hip fracture had moderate to severe aortic stenosis (peak gradient > 36 mmHg) (5)

Technology/Technique

Echocardiography is considered the primary technique for the diagnosis of valvular heart disease and for assessing the severity and prognosis of aortic diseases. (1;6) An assessment of the severity of aortic stenosis should combine measurement of the valve area with flow-dependent indices to improve prognostic value. (1;6) Echocardiographic criteria for severe aortic stenosis is defined by a valve area less than 1.0 cm^2 and a mean pressure gradient greater than 40 mmHg. (1;6)

The specific role of echocardiography in identifying valvular heart disease prior to hip fracture surgery remains unclear. In particular, its impact on perioperative management, clinical outcomes, and potential delay of surgery is uncertain.

Rapid Review

Research Question

What is the clinical utility of echocardiography for the diagnosis of aortic stenosis among patients with hip fractures?

Research Methods

Literature Search

A literature search was performed on January 31, 2013, using OVID MEDLINE, OVID MEDLINE In-Process and Other Non-Indexed Citations, OVID EMBASE, EBSCO Cumulative Index to Nursing & Allied Health Literature (CINAHL), the Wiley Cochrane Library, and the Centre for Reviews and Dissemination database, for studies published from January 1, 2008, until January 30, 2013. Abstracts were reviewed by a single reviewer and, for those studies meeting the eligibility criteria, full-text articles were obtained. Reference lists were also examined for any additional relevant studies not identified through the search.

Inclusion Criteria

- English language full-text reports
- published between January 1, 2008, and January 30, 2013
- health technology assessments, systematic reviews, meta-analyses, randomized controlled trials, and guidelines
- adult hip fracture population or noncardiac, presurgical population
- studies evaluating the use of echocardiography for identification of valvular heart disease prior to surgery

Exclusion Criteria

- observational studies, case reports, editorials
- studies where outcomes of interest could not be abstracted

Outcomes of Interest

- mortality
- change in clinical management

Expert Panel

In December 2012, an Expert Advisory Panel on Episodes of Care for Hip Fractures was struck. Members of the panel included physicians, personnel from the Ministry of Health and Long-Term Care, and representation from the community.

The role of the Expert Advisory Panel on Episodes of Care for Hip Fractures was to contextualize the evidence produced by Health Quality Ontario and provide advice on the appropriate clinical pathway for

a hip fracture in the Ontario health care setting. However, the statements, conclusions and views expressed in this report do not necessarily represent the views of Advisory Panel members.

Results of Literature Search

The database search yielded 464 citations published between January 1, 2008, and January 30, 2013 (with duplicates removed). Articles were excluded based on information in the title and abstract. The full texts of potentially relevant articles were obtained for further assessment.

No systematic reviews, meta-analyses, health technology assessments or randomized controlled trails evaluating the clinical utility of preoperative echocardiography for the identification of aortic stenosis in the hip fracture population or in a general noncardiac surgical population were identified.

Clinical Guidelines

Four clinical guidelines on the use of preoperative echocardiography in a hip fracture population (7;8) or in a general noncardiac surgical population (2;9) were identified.

Preoperative Cardiac Assessment Guidelines

The American College of Cardiology (ACC) / American Heart Association (AHA) (2) and the European Society of Cardiology (ESC) / European Society of Anaesthesiology (ESA) (9) recommend clinical and echocardiographic evaluation and, if needed, treatment before nonurgent surgery in patients with confirmed or presumed severe valvular heart disease. Neither recommend additional cardiac assessment of patients with no active cardiac conditions or clinical risk factors. (2;9)

In cases of urgent noncardiac surgery, the ESC/ESA recommend hemodynamic monitoring of procedures in patients with severe aortic stenosis and the ACC/AHA recommend perioperative surveillance in the operating room. (2;9) The ACC/AHA state the need for the consultant to identify the type, significance, and origin of the murmur in order to determine which patients require further quantification of severity.

Recommendations in both guidelines were based primarily on expert consensus or small observational studies. Apart from the limited evidence supporting these recommendations, these guidelines focus either on urgent or elective surgery and do not consider nonemergent ("semiurgent") surgical patients with moderate cardiac risk that make up the hip fracture population.

Hip Fracture Guidelines

Two hip fracture guidelines that discuss the use of preoperative echocardiography were identified: the 2011 guidelines of the Association of Anaesthetists of Great Britain and Ireland (AAGBI) on management of proximal femoral fractures (7) and the 2009 Scottish Intercollegiate Guidelines Network (SIGN) national clinical guideline on management of hip fracture in older people. (8) Table 1 shows a summary of these recommendations**.**

Neither of the guidelines recommends the routine use of preoperative echocardiography. However, both suggest that echocardiography or cardiac assessment be considered in those with suspected significant aortic stenosis or perioperative risk after clinical examination. Both guidelines note that echocardiography should not delay time to surgery, with SIGN recommending rapid access to echocardiography when appropriate. Recommendations from both guidelines were primarily based upon expert consensus.

Table 1. Summary of Clinical Guidelines for Preoperative Echocardiography for Hip Fracture Patients

Guideline, Year	Recommendations or Suggestions for Preoperative Echocardiography Assessment	Level of Evidence
AAGBI, 2011 (7)	A majority of clinicians favour proceeding to surgery with modification of technique towards general anesthesia and invasive blood pressure monitoring, with echocardiography in the early postoperative period	Expert Opinion
	Echocardiography may be indicated: • to establish left ventricular function if the patient is breathless at rest or low level exertion; or • to investigate the severity of an ejection systolic murmur heard in the aortic area, particularly if significant AS is suggested[a]	
	Awaiting echocardiography is not an acceptable reason for delaying surgery for hip fracture	
SIGN, 2009 (8)	Do not require routine additional cardiac investigation such as echocardiography before surgery	Grade C[b]
	Additional cardiac investigation may be considered in patients with clinical suspicion of perioperative cardiac risk	Grade C[b]
	Recommended best practices: • Echocardiography should be performed if AS is suspected, to allow confirmation of diagnosis, risk stratification, and any future cardiac management • Need for echocardiography, based on clinical history, physical examination and ECG findings should not delay surgery unduly • Rapid access to an echocardiography is recommended for appropriate patients to avoid unnecessary delay to surgery • Systems should be established to ensure additional cardiac investigations, when required, do not delay surgery	Expert Opinion

Abbreviations: AAGBI, Association of Anaesthetists of Great Britain and Ireland; AS, aortic stenosis; ECG, electrocardiogram; SIGN, Scottish Intercollegiate Guidelines Network.

[a] Significant as suggested by the presence of 2 or more of the following: a history of angina on exertion; unexplained syncope or near syncope; a slow rising pulse; an absent second heart sound; or left ventricular hypertrophy on the ECG without hypertension (although clinical signs of AS can be difficult to elicit).

[b] Grade C represents a body of evidence including studies that are directly applicable to the target population, demonstrating overall consistency of results, and rated as 2+ (i.e., well-conducted case control or cohort studies with a low risk of confounding or bias and a high probability that the relationship is causal).

Conclusions

- No systematic reviews, meta-analyses, health technology assessments, or randomized controlled trails that evaluated the clinical utility of echocardiography in a hip fracture or noncardiac presurgical population were identified.
- Four guidelines that provided recommendations for the use of echocardiography or cardiac assessment prior to noncardiac surgery were identified. Of these, 2 applied to the hip fracture population.
- Based primarily on expert opinion, the Association of Anaesthetists of Great Britain and Ireland (AAGBI) and Scottish Intercollegiate Guidelines Network (SIGN) hip fracture guidelines do not recommend routine echocardiography in this population. Both guidelines recommend echocardiography be used to investigate the severity of a systolic murmur. However, they state that echocardiography for appropriate patients should not delay surgery.

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Editorial Staff
Joanna Odrowaz, BSc (Hons.)

Medical Information Services
Corinne Holubowich, Bed, MLIS
Kellee Kaulback, BA(H), MISt

Expert Panel for Health Quality Ontario: Episode of Care for Hip Fracture

Name	Role	Organization
Chair		
Dr. James Waddell	Orthopedic surgeon	St. Michael's Hospital, Toronto
Orthopedic Surgery		
Dr. John P. Harrington	Orthopedic surgeon	William Osler Health System, Toronto
Dr. Mark Harrison	Orthopedic surgeon	Queen's University, Kingston
Dr. Hans J. Kreder	Professor	Division of Orthopaedics, Department of Surgery, University of Toronto
Dr. Allan Liew	Orthopedic surgeon	Department of Surgery, University of Ottawa
Dr. Mark MacLeod	Orthopedic surgeon	London Health Sciences Centre
Dr. Aaron Nauth	Orthopedic surgeon	St. Michael's Hospital/University of Toronto
Dr. David Sanders	Orthopedic surgeon	London Health Sciences Centre
Dr. Andrew Van Houwelingen	Orthopedic surgeon	St. Thomas Elgin General Hospital
Anesthesiology		
Dr. Nick Lo	Staff anesthesiologist	St. Michael's Hospital, Toronto
Emergency Medicine		
Dr. Michael O'Connor	Emergency medicine	Kingston General Hospital
Dr. Lisa Shepherd	Emergency medicine	South West Local Health Integration Network (LHIN), London
Family Medicine		
Dr. Christopher Jyu	Physician lead, primary care	Central East LHIN, Ajax
Geriatrics		
Dr. Anna Byszewski	Geriatrician	The Ottawa Hospital
Dr. Maria Zorzitto	Chief of geriatric medicine	St. Michael's Hospital, Toronto
Physiotherapy		
Ruth Vallis	Physiotherapist	University Health Network, Toronto
Rehabilitation		
Charissa Levy	Executive director	GTA Rehab Network

Name	Role	Organization
Dr. Peter Nord	Vice president, chief medical officer and chief of staff	Providence Healthcare, Toronto
Research		
Dr. Susan Jaglal	Chair	Toronto Rehabilitation Institute, University of Toronto
Dr. Valerie Palda	Associate professor	Department of Medicine and Institute of Health Policy, Management and Evaluation, University of Toronto
Administration		
Jane de Lacy	Executive director, patient services	William Osler Health System, Toronto
Brenda Flaherty	Executive vice president and chief operating officer	Hamilton Health Sciences
Jo-anne Marr	Executive vice president and chief operating officer	Mackenzie Health, Richmond Hill
Malcolm Moffat	Executive vice president, programs	Sunnybrook Health Sciences Centre, Toronto
Kathy Sabo	Senior vice president, clinical programs/operations	University Health Network, Toronto
Community Care Access Centres		
Patricia (Tricia) Khan	Senior director, client services	Erie St. Clair Community Care Access Centre, Chatham
Janet McMullan	Project director, consultant	Bone and Joint Canada
Professional Organizations		
Ravi Jain	Director, Ontario osteoporosis strategy	Osteoporosis Canada
Rhona McGlasson	Executive director	Bone and Joint Canada

Appendices

Appendix 1: Literature Search Strategies

Database: Ovid MEDLINE(R) <1946 to January Week 4 2013>, Ovid MEDLINE(R) In-Process & Other Non-Indexed Citations <January 30, 2013>, Embase <1980 to 2013 Week 04>
Search Strategy:

#	Searches	Results
1	exp Hip Fractures/ use mesz	16212
2	exp Hip Fracture/ use emez	26440
3	((hip* or femur* or femoral* or trochant* or petrochant* or intertrochant* or subtrochant* or intracapsular* or extracapsular*) adj4 fracture*).ti,ab.	55691
4	((hip* or ((femur* or femoral*) adj3 (head or neck or proximal))) adj4 fracture*).ti,ab.	38480
5	or/1-4	69132
6	exp Echocardiography/	270782
7	(echocardiogram* or echocardiograph* or cardioechograph* or (cardia* adj echograph*) or (heart adj echo*) or ((ultrasound or echo*) adj cardiogra*)).ti,ab.	232971
8	or/6-7	330718
9	5 and 8	224
10	exp Preoperative Care/ or exp Preoperative Period/ or Perioperative Period/	258999
11	exp Perioperative Care/ use mesz	116676
12	(pre?surg* or pre?operat* or peri?operat*).ti,ab.	478656
13	or/10-12	674115
14	8 and 13	17218
15	9 or 14	17378
16	Meta Analysis.pt.	36886
17	Meta Analysis/ use emez	68653
18	Systematic Review/ use emez	56872
19	exp Technology Assessment, Biomedical/ use mesz	8789
20	Biomedical Technology Assessment/ use emez	11433
21	(meta analy* or metaanaly* or pooled analysis or (systematic* adj2 review*) or published studies or published literature or medline or embase or data synthesis or data extraction or cochrane).ti,ab.	300870
22	((health technolog* or biomedical technolog*) adj2 assess*).ti,ab.	3931
23	exp Random Allocation/ use mesz	76043
24	exp Double-Blind Method/ use mesz	117246
25	exp Control Groups/ use mesz	1361
26	exp Placebos/ use mesz	31188
27	Randomized Controlled Trial/ use emez	336292
28	exp Randomization/ use emez	60635
29	exp Random Sample/ use emez	4544
30	Double Blind Procedure/ use emez	112873
31	exp Triple Blind Procedure/ use emez	37
32	exp Control Group/ use emez	41603
33	exp Placebo/ use emez	212295
34	(random* or RCT).ti,ab.	1408059
35	(placebo* or sham*).ti,ab.	453656

36	(control* adj2 clinical trial*).ti,ab.	38941
37	exp Practice Guideline/ use emez	285040
38	exp Professional Standard/ use emez	274892
39	exp Standard of Care/ use mesz	616
40	exp Guideline/ use mesz	23107
41	exp Guidelines as Topic/ use mesz	102236
42	(guideline* or guidance or consensus statement* or standard or standards).ti.	221929
43	(controlled clinical trial or meta analysis or randomized controlled trial).pt.	455375
44	or/16-43	3025432
45	15 and 44	1486
46	limit 45 to english language	1362
47	limit 46 to yr="2008 -Current"	585
48	exp Case Reports/ use mesz or exp case report/ use emez	3474878
49	47 not 48	569
50	remove duplicates from 49	466

Cochrane Library

	Search	**Hits**
#1	MeSH descriptor: [Hip Fractures] explode all trees	968
#2	((hip* or femur* or femoral* or trochant* or petrochant* or intertrochant* or subtrochant* or intracapsular* or extracapsular*) near/4 fracture*):ti (Word variations have been searched)	1418
#3	((hip* or ((femur* or femoral*) adj3 (head or neck or proximal))) near/4 fracture*):ti (Word variations have been searched)	801
#4	#1 or #2 or #3	1712
#5	MeSH descriptor: [Echocardiography] explode all trees	3101
#6	echocardiogram* or echocardiograph* or cardioechograph* or (cardia* near echograph*) or (heart near echo*) or ((ultrasound or echo*) near cardiogra*):ti (Word variations have been searched)	1074
#7	#5 or #6	3360
#8	#4 and #7	5
#9	MeSH descriptor: [Preoperative Care] explode all trees	4732
#10	MeSH descriptor: [Preoperative Period] explode all trees	50
#11	MeSH descriptor: [Perioperative Period] explode all trees	4989
#12	MeSH descriptor: [Perioperative Care] explode all trees	9328
#13	pre?surg* or pre?operat* or peri?operat*:ti (Word variations have been searched)	4
#14	#9 or #10 or #11 or #12 or #13	13713
#15	#7 and #14	113
#16	#8 or #15 from 2008 to 2013	23

CRD

Line	Search	Hits
1	MeSH DESCRIPTOR hip fractures EXPLODE ALL TREES	161
2	((hip* or femur* or femoral* or trochant* or petrochant* or intertrochant* or subtrochant* or intracapsular* or extracapsular*) adj4 fracture*)):TI	125
3	((hip* or ((femur* or femoral*) adj3 (head or neck or proximal))) adj4 fracture*)):TI	103
4	#1 OR #2 OR #3	205
5	MeSH DESCRIPTOR echocardiography EXPLODE ALL TREES	155
6	(echocardiogram* or echocardiograph* or cardioechograph* or (cardia* adj echograph*) or (heart adj echo*) or ((ultrasound or echo*) adj cardiogra*)):TI	87
7	#5 OR #6	166
8	#4 AND #7	0
9	MeSH DESCRIPTOR preoperative care EXPLODE ALL TREES	252
10	MeSH DESCRIPTOR preoperative period EXPLODE ALL TREES	13
11	MeSH DESCRIPTOR perioperative period EXPLODE ALL TREES	215
12	MeSH DESCRIPTOR perioperative care EXPLODE ALL TREES	630
13	(pre?surg* or pre?operat* or peri?operat*):TI	385
14	#9 OR #10 OR #11 OR #12 OR #13	1016
15	#7 AND #14	9
16	(#15) FROM 2008 TO 2013	3

References

(1) Vahanian A, Alfieri O, Andreotti F, Antunes MJ, Baron-Esquivias G, Baumgartner H, et al. Guidelines on the management of valvular heart disease (version 2012). Eur Heart J. 2012;33(19):2451-96.

(2) Fleisher LA, Beckman JA, Brown KA, Calkins H, Chaikof EL, Fleischmann KE, et al. ACC/AHA 2007 guidelines on perioperative cardiovascular evaluation and care for noncardiac surgery: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (Writing Committee to Revise the 2002 Guidelines on Perioperative Cardiovascular Evaluation for Noncardiac Surgery) developed in collaboration with the American Society of Echocardiography, American Society of Nuclear Cardiology, Heart Rhythm Society, Society of Cardiovascular Anesthesiologists, Society for Cardiovascular Angiography and Interventions, Society for Vascular Medicine and Biology, and Society for Vascular Surgery. J Am Coll Cardiol. 2007 Oct 23;50(17):e159-241.

(3) Eveborn GW, Schirmer H, Heggelund G, Lunde P, Rasmussen K. The evolving epidemiology of valvular aortic stenosis. The Tromso study. Heart. 2012;99(6):396-400.

(4) Mittnacht AJ, Fanshawe M, Konstadt S. Anesthetic considerations in the patient with valvular heart disease undergoing noncardiac surgery. Semin Cardiothorac Vasc Anesth. 2008 Mar;12(1):33-59.

(5) Loxdale SJ, Sneyd JR, Donovan A, Werrett G, Viira DJ. The role of routine pre-operative bedside echocardiography in detecting aortic stenosis in patients with a hip fracture. Anaesthesia. 2012 Jan;67(1):51-4.

(6) Baumgartner H, Hung J, Bermejo J, Chambers JB, Evangelista A, Griffin BP, et al. Echocardiographic assessment of valve stenosis: EAE/ASE recommendations for clinical practice. J Am Soc Echocardiogr. 2009 Jan;22(1):1-23.

(7) Griffiths R, Alper J, Beckingsale A, Goldhill D, Heyburn G, Holloway J, et al. Management of proximal femoral fractures 2011: Association of Anaesthetists of Great Britain and Ireland. Anaesthesia. 2012 Jan;67(1):85-98.

(8) Scottish Intercollegiate Guidelines Network. Management of hip fracture in older people: A national clinical guideline. 2009. 49p. Available from: http://www.sign.ac.uk/pdf/sign111.pdf

(9) Poldermans D, Bax JJ, Boersma E, De Hert S., Eeckhout E, Fowkes G, et al. Guidelines for pre-operative cardiac risk assessment and perioperative cardiac management in non-cardiac surgery: The task force for preoperative cardiac risk assessment and perioperative cardiac management in non-cardiac surgery of the European society of Cardiology (ESC) and endorsed by the European society of anaesthesiology (ESA). Eur J Anaesthesiol. 2010;27(2):92-137.

Health Quality Ontario
130 Bloor Street West, 10th Floor
Toronto, Ontario
M5S 1N5
Tel: 416-323-6868
Toll Free: 1-866-623-6868
Fax: 416-323-9261
Email: EvidenceInfo@hqontario.ca
www.hqontario.ca