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Electrocardiograms for Diagnosing Ischemia as a Precipitant to Acute Heart Failure: A Rapid Review

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January 2013

Electrocardiograms for Diagnosing Ischemia as a Precipitant to Acute Heart Failure: A Rapid Review. January 2013; pp. 1–16.

Suggested Citation

This report should be cited as follows:

Brener S. Electrocardiograms for diagnosing ischemia as a precipitant to acute heart failure: a rapid review. Toronto, ON: Health Quality Ontario; 2013 Jan. 16 p. Available from: http://www.hqontario.ca/evidence/publications-and-ohtac-recommendations/rapid-reviews.

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.

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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.

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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.

Permission Requests

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List of Abbreviations

CHF	Congestive heart failure
ECG	Electrocardiogram
HF	Heart failure
STEMI	ST-elevation myocardial infarction

Background

As legislated in Ontario's *Excellent Care for All Act*, Health Quality Ontario's mandate includes the

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

Objective of Analysis

The objective of this rapid review was to examine the accuracy of electrocardiograms (ECGs) for identifying ischemia as the precipitant for an acute heart failure (HF) event.

Clinical Need and Target Population

An acute HF event may occur as a result of a number of known aggravating factors. (1;2) Ischemia is one of the most common precipitants, and there are important differences in patient outcomes among those with ischemic (versus nonischemic) causes of HF, including higher mortality rates. (2) Many hospital admissions for the decomposition of HF may in fact be preventable if precipitants such as ischemia are appropriately managed. (3) Furthermore, if the precipitant to the acute event is known, then the course of treatment can be tailored to consider the aggravating source. (4-7)

Technology

Electrocardiography records the contractions of the heart muscle. (8) Given its ease of use and non invasive application, ECGs are widely recommended and applied in HF. (8) As many as 99.9% of admitted HF patients have an ECG performed as part of initial diagnostic investigations. (9) As imaging technologies have improved, so has the sensitivity and specificity of ECG in diagnosing coronary artery disease and ischemia. In 1 systematic review, the sensitivity of ECGs to diagnose heart disease ranged from 42% with a specificity of 87%, to a sensitivity of 96% and specificity of 50%. (10) According to expert opinion, it is common practice to apply an ECG when trying to identify precipitants in a patient presenting with an acute HF exacerbation; however, the degree to which this practice is supported by evidence is uncertain.

Rapid Review

Research Questions

What is the diagnostic accuracy of an ECG for identifying ischemia as a precipitant for an acute HF episode?

Research Methods

Literature Search

A literature search was performed on October 17, 2012, using OVID MEDLINE, OVID MEDLINE In-Process and Other Non-Indexed Citations, OVID EMBASE, the Wiley Cochrane Library, and the Centre for Reviews and Dissemination database, for studies published from January 1, 2002, to October 17, 2012. Abstracts were reviewed by a single reviewer and, for those studies meeting the eligibility criteria, full-text articles were obtained. Reference lists and were also examined for any additional relevant studies not identified through the search.

Inclusion Criteria

- English language full-text reports
- published between January 1, 2002, and October 17, 2012
- health technology assessments, systematic reviews, meta-analyses, randomized controlled trials, and clinical practice guidelines
- HF population
- in-hospital setting

Exclusion Criteria

- studies evaluating the accuracy of ECGs to diagnose ischemia in contexts other than as the precipitant for an acute HF event
- studies where the outcomes of interest could not be abstracted
- case reports, editorials, letters, and commentaries

Outcomes of Interest

- sensitivity and specificity of ECGs to diagnose ischemia as the precipitant for an acute HF event

Expert Panel

In August 2012, an Expert Advisory Panel on Episode of Care for Congestive Heart Failure was struck. Members of the panel included physicians, personnel from the Ministry of Health and Long-Term Care, and representation from the community laboratories.

The role of the Expert Advisory Panel on Episode of Care for Congestive Heart Failure was to contextualize the evidence produced by Health Quality Ontario and provide advice on the components of a high-quality episode of care for HF patients presenting to an acute care hospital. However, the

statements, conclusions, and views expressed in this report do not necessarily represent the views of Expert Advisory Panel members.

Results of Literature Search

The database search yielded 1,393 citations published between January 1, 2002, and October 17, 2012 (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 studies were identified that examined the accuracy of ECGs for identifying ischemia as the precipitant for an acute HF event.

Hand searches of the literature identified a number of clinical practice guidelines discussing the use of ECGs. (4-6;11;12) For the most part, these guidelines recommended the use of ECGs to assist with the diagnosis of precipitating sources to an acute HF episode (Table 1). However, although the guidelines provided evidence to support their recommendations, the evidence was largely based on expert opinion. (4;5)

Table 1: Summary of Guidelines Recommending ECGs as Diagnostic Tools

Guideline, Year	Population	Guideline Recommendation		
		Guideline States to Diagnose Precipitants	Ischemia Listed as a Potential Precipitant	ECG Listed as a Diagnostic Tool for the Precipitant
Canadian Cardiovascular Society, 2007 (4)	Acute HF presentation in hospital	✓ [Class I, level C][a]	✓ [1 observational study][b]	✓ [Class I, level C][a]
American College of Cardiology/American Heart Association, 2011/12 (11;13)	Patients with unstable angina/ non-STEMI	✓ [Class 1, level C][c]	✓	Use for initial diagnosis of HF [Class 1, level C][c]
European Society of Cardiologists, 2012 (6)	Patients with suspected or confirmed HF	✓	✓	Use for initial diagnosis of HF
Heart Failure Society of America, 2010 (5)	Patients with chronic HF	✓ [Evidence = C][d]	✓ [Evidence = C][d]	✓
National Institute for Health and Clinical Excellence, 2010 (12)	CHF/ diagnosing CHF	✓	—	Use for initial diagnosis of HF

Abbreviations: CHF, congestive heart failure; HF, heart failure; ECG, electrocardiogram; STEMI, ST-elevation myocardial infarction.
[a]Evidence or general agreement that a given procedure is beneficial, useful and effective; consensus of opinion of experts and/or small studies.
[b]Ghali et al., 1988. (1)
[c]Recommendation is useful/effective, based on expert opinion, observational studies or standard of care.
[d]Evidence is based on extensive use of expert opinion, observational studies—epidemiologic findings or safety reporting from large-scale use in practice.

Conclusions

- No studies were identified that examined the accuracy of ECGs for diagnosing ischemia as the precipitant to an acute HF event in a HF population.
- All 5 of the guidelines reviewed commented on the importance of using ECG in diagnosing the precipitants for an acute HF event.

Acknowledgements

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Episode of Care for Congestive Heart Failure Expert Panel

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Louie Luo	Senior Methodologist	Ministry of Health and Long-Term Care

Appendices

Appendix 1: Literature Search Strategies

Search date: October 17, 2012
Databases searched: OVID MEDLINE, MEDLINE In-Process and Other Non-Indexed Citations, EMBASE; Cochrane Library; CRD

Limits: English, 2002-2012
Filters: health technology assessments, systematic reviews, meta-analyses, randomized controlled trials and guidelines

Database: Ovid MEDLINE(R) <1946 to October Week 1 2012>, Ovid MEDLINE(R) In-Process & Other Non-Indexed Citations <October 16, 2012>, Embase <1980 to 2012 Week 41>
Search Strategy:

#	Searches	Results
1	exp heart failure/	327674
2	(((cardia? or heart) adj (decompensation or failure or incompetence or insufficiency)) or cardiac stand still or ((coronary or myocardial) adj (failure or insufficiency))).ti,ab.	258486
3	or/1-2	417506
4	exp *electrocardiography/	107203
5	(electrocardiogram* or ecg* or ekg* or electrocardiograph*).ti,ab.	213410
6	(telemetry adj2 (unit* or cardiac)).ti,ab.	562
7	or/4-6	260511
8	3 and 7	21725
9	Meta Analysis.pt.	36967
10	Meta Analysis/ use emez	66488
11	Systematic Review/ use emez	53812
12	exp Technology Assessment, Biomedical/ use mesz	8872
13	Biomedical Technology Assessment/ use emez	11399
14	(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.	293134
15	((health technolog* or biomedical technolog*) adj2 assess*).ti,ab.	3681
16	exp Random Allocation/ use mesz	76138
17	exp Double-Blind Method/ use mesz	117653
18	exp Control Groups/ use mesz	1376
19	exp Placebos/ use mesz	31442
20	Randomized Controlled Trial/ use emez	330814
21	exp Randomization/ use emez	59725
22	exp Random Sample/ use emez	4238
23	Double Blind Procedure/ use emez	111398
24	exp Triple Blind Procedure/ use emez	35
25	exp Control Group/ use emez	38585
26	exp Placebo/ use emez	206599
27	(random* or RCT).ti,ab.	1385590
28	(placebo* or sham*).ti,ab.	448978

29	(control* adj2 clinical trial*).ti,ab.	38400
30	exp Practice Guideline/ use emez	278889
31	exp Professional Standard/ use emez	269259
32	exp Standard of Care/ use mesz	582
33	exp Guideline/ use mesz	23126
34	exp Guidelines as Topic/ use mesz	102415
35	(guideline* or guidance or consensus statement* or standard or standards).ti.	219538
36	(controlled clinical trial or meta analysis or randomized controlled trial).pt.	456548
37	or/9-36	2979438
38	8 and 37	2607
39	limit 38 to english language	2316
40	limit 39 to yr="2002 -Current"	1627
41	remove duplicates from 40	1275

Cochrane Library

ID	Search	Hits
#1	MeSH descriptor: [Heart Failure] explode all trees	4862
#2	((cardia? or heart) next (decompensation or failure or incompetence or insufficiency)) or cardiac stand still or ((coronary or myocardial) next (failure or insufficiency)):ti,ab,kw (Word variations have been searched)	9326
#3	#1 or #2	9331
#4	MeSH descriptor: [Electrocardiography] explode all trees	7189
#5	(electrocardiogram* or ecg* or ekg* or electrocardiograph*):ti (Word variations have been searched)	994
#6	(telemetry adj2 (unit* or cardiac)):ti,ab,kw (Word variations have been searched)	0
#7	#4 or #5	7480
#8	#3 and #7 from 2002 to 2012	294

CRD

Line	Search	Hits
1	MeSH DESCRIPTOR heart failure EXPLODE ALL TREES	510
2	(((cardia? or heart) next (decompensation or failure or incompetence or insufficiency)) or cardiac stand still or ((coronary or myocardial) next (failure or insufficiency))):TI	312
3	#1 OR #2	548
4	MeSH DESCRIPTOR electrocardiography EXPLODE ALL TREES	224
5	((electrocardiogram* or ecg* or ekg* or electrocardiograph*)):TI	50
6	(telemetry adj2 (unit* or cardiac)):TI	0
7	#4 OR #5	232
8	#3 AND #7	14
9	(#8):TI FROM 2002 TO 2012	14

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