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The Effectiveness of Cement in Primary Hip Replacements: A Rapid Review

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Evidence Development and Standards Branch at Health Quality Ontario

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Conflict of Interest Statement

All reports prepared by the Evidence Development and Standards branch 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 Evidence Development and Standards branch 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 and guidelines. Systematic reviews are evaluated using a rating scale developed for this purpose. If a 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 in the systematic review are retrieved and the GRADE criteria are applied to a maximum of 2 outcomes. Because rapid reviews are completed in very short time frames, other publication types are not included. All rapid reviews are developed and finalized in consultation with experts.

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. The Evidence Development and Standards branch works with expert advisory panels, clinical experts, scientific collaborators, and field evaluation partners to conduct evidence-based reviews that evaluate the effectiveness and cost-effectiveness of health interventions in Ontario.

Based on the evidence provided by Evidence Development and Standards and its partners, the Ontario Health Technology Advisory Committee—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.

Health Quality Ontario's research is published as part of the *Ontario Health Technology Assessment Series*, which is indexed in MEDLINE/PubMed, Excerpta Medica/Embase, and the Centre for Reviews and Dissemination database. Corresponding Ontario Health Technology Advisory Committee recommendations and other associated reports are also 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, Evidence Development and Standards and its research partners review the available scientific literature, making every effort to consider all relevant national and international research; collaborate with partners across relevant government branches; consult with expert advisory panels, clinical and other external experts, and developers of health technologies; and solicit any necessary supplemental information.

In addition, Evidence Development and Standards 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 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.

Disclaimer

This report was prepared by Health Quality Ontario or one of its research partners for the Ontario Health Technology Advisory Committee and was developed from analysis, interpretation, and comparison of scientific research. It also incorporates, when available, Ontario data and information provided by experts and applicants to Health Quality Ontario. It is possible that relevant scientific findings may have been reported since the completion of the review. This report is current to the date of the literature review specified in the methods section, if available. This analysis 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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List of Abbreviations

AMSTAR	Assessment of Multiple Systematic Reviews
CI	Confidence interval
GRADE	Grading of Recommendations Assessment, Development, and Evaluation
RCT	Randomized controlled trial

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 rapid review was to examine the effectiveness of cemented versus uncemented fixation components in primary hip arthroplasty.

Clinical Need and Target Population

Primary hip replacements may be conducted using cemented, uncemented or hybrid (a combination of cemented and uncemented) fixation components. (1) Cemented fixation was once more broadly used in primary hip replacements, but according to recent surveys, uncemented fixation has been adopted to varying degrees around the world. (2)

In Canada, the use of uncemented fixation had risen to 82% of all primary total hip arthroplasties by 2010, (2) in contrast to other countries such as Sweden, where only 15% of primary total hip arthroplasties used uncemented fixation techniques. (2) It remains uncertain whether there are significant differences in revision rates between the 2 fixation techniques.

Rapid Review

Research Question

What is the effectiveness of cemented versus uncemented fixation components in primary hip arthroplasty?

Research Methods

Literature Search

A literature search was performed on July 9, 2013, using Ovid MEDLINE, Ovid MEDLINE In-Process and Other Non-Indexed Citations, Ovid Embase, and EBM Reviews for studies published from January 1, 2008, to July 9, 2013. (Appendix 1 provides details of the search strategies.) 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 publications
- published between January 1, 2008, and July 9, 2013
- systematic reviews, meta-analyses, and health technology assessments
- primary hip arthroplasty
- comparing cemented versus uncemented fixation

Exclusion Criteria

- studies from which results on outcomes of interest could not be abstracted

Outcome of Interest

- revisions

Expert Panel

In April 2013, an Expert Advisory Panel on Episodes of Care for Hip and Knee Arthroplasty was struck. Members of the panel included physicians, personnel from the Ministry of Health and Long-Term Care, and representatives from the community.

The role of the Expert Advisory Panel on Episodes of Care for Hip and Knee Arthroplasty was to contextualize the evidence produced by Health Quality Ontario and provide advice on the appropriate clinical pathway for hip and knee arthroplasty in the Ontario health care setting. However, the statements, conclusions, and views expressed in this report do not necessarily represent the views of Expert Advisory Panel members.

Quality of Evidence

The Assessment of Multiple Systematic Reviews (AMSTAR) measurement tool was used to assess the methodological quality of systematic reviews. (3) Primary studies were abstracted from the selected reviews and referenced for quality assessment of the body of the evidence for the outcomes of interest.

The quality of the body of evidence for each outcome was examined according to the Grading of Recommendations Assessment, Development, and Evaluation (GRADE) Working Group criteria. (4) The overall quality was determined to be high, moderate, low, or very low using a step-wise, structural methodology.

Study design was the first consideration; the starting assumption was that randomized controlled trials (RCTs) are high quality, whereas observational studies are low quality. Five additional factors—risk of bias, inconsistency, indirectness, imprecision, and publication bias—were then taken into account. Limitations in these areas resulted in downgrading the quality of evidence. Finally, 3 main factors that may raise the quality of evidence were considered: large magnitude of effect, dose response gradient, and accounting for all residual confounding factors. (4) For more detailed information, please refer to the latest series of GRADE articles. (4)

As stated by the GRADE Working Group, the final quality score can be interpreted using the following definitions:

High	High confidence in the effect estimate—the true effect lies close to the estimate of the effect
Moderate	Moderate confidence in the effect estimate—the true effect is likely to be close to the estimate of the effect, but may be substantially different
Low	Low confidence in the effect estimate—the true effect may be substantially different from the estimate of the effect
Very Low	Very low confidence in the effect estimate—the true effect is likely to be substantially different from the estimate of effect

Results of Rapid Review

The database search yielded 41 citations published between January 1, 2008, and July 9, 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.

Four systematic reviews met the inclusion criteria. The reference lists of the included studies were hand-searched to identify other relevant studies, but no additional citations were identified.

Quality Assessment of Systematic Reviews

The included systematic reviews are summarized in Table 1. The AMSTAR scores of the identified reviews ranged from 7 to 9 out of a possible 11 (Appendix 2). (3)

Table 1: Summary of Included Systematic Reviews

Author, Year	Search Dates	Design of Included Studies	Inclusion Criteria	AMSTAR (out of 11)
Abdulkarim et al, 2013 (5)	Unclear	RCTs	Studies that examined primary total hip replacement in patients ≥ 18 years	8
Pakvis et al, 2011 (6)	1980–2009	RCTs and comparative cohort studies with ≥ 12 months' follow-up	Studies that examined fixation of acetabular components among patients with the indication of primary or secondary osteoarthritis for total hip arthroplasty	7
Toossi et al, 2013 (7)	Up to 2011[a]	Prospective or retrospective studies with ≥ 10 years' follow-up	Studies of primary total hip arthroplasty that examined acetabular components. Studies of revisions to total hip arthroplasty and studies that reported only revisions of stems were excluded	7
Voigt et al, 2012 (8)	Up to 2011[a]	RCTs	Studies of primary hip implant in patients with osteoarthritis or rheumatoid arthritis that examined fixation of cemented all-polyethylene versus uncemented metal-backed acetabular components while using the same femoral component	9

Abbreviations: AMSTAR, Assessment of Multiple Systematic Reviews; RCT, randomized controlled trial.
[a]No start date limit applied.

Upon further review, 3 of the reviews were excluded because they limited their search and findings to an examination of the use of cement in the fixation of the acetabular components only. (6-8) For the purposes of this rapid review, only the Abdulkarim et al review was included. (5)

Results for the Outcome of Interest

Revisions

The systematic review by Abdulkarim et al (5) included 9 RCTs published between 1991 and 2006; of those, 6 reported on revisions in primary total hip replacement. Based on information published in the systematic review, (5) the findings of the 6 RCTs (9-14) are summarized in Table 2.

Table 2: Revisions in Primary Total Hip Replacement

Author, Year	Location	Follow-up	Sample Size	Intervention Versus Control	Risk Ratio (95% CI)
Kärrholm et al, 1994 (9)	Sweden	2 years	64	Cemented stem versus uncemented stem (both groups used uncemented acetabular components)	1.10 (0.22–5.52)
Laupacis et al, 2002 (10)	Canada	6.3 years	250	Cemented total hip prosthesis versus uncemented total hip prosthesis	2.20 (0.86–5.61)
Önsten et al, 1994 (11)	Sweden	2 years	60	Cemented socket versus uncemented socket (both groups used cemented stem components)	0.33 (0.01–7.87)
Reigstad et al, 1993 (12)	Norway	5 years	120	Cemented total hip prosthesis versus uncemented total hip prosthesis	0.14 (0.01–2.71)
Ström et al, 2006 (13)	Sweden	8 years	45	Cemented stem versus uncemented stem (both groups used uncemented acetabular components)	0.32 (0.01–7.45)
Wykman et al, 1991 (14)	Sweden	5 years	180	Cemented total hip prosthesis versus uncemented total hip prosthesis	1.57 (0.86–2.87)

Abbreviations: CI, confidence interval.

When results were pooled (all studies and a subgroup of studies with more than 5 years' follow-up), the review found no statistically significant difference in revisions between cemented and uncemented fixation in total hip replacement (Table 3). (5)

Table 3: Pooled Effect Estimates, Revisions

Number of Studies	Number of Studies per Intervention Pairing	Total Sample Size	Pooled Effect Estimate, Risk Ratio (95% CI)
All Included Studies			
6 RCTs	3 RCTs examining cement in stem and cup 2 RCTs examining cement in stem (both arms used uncemented acetabular components) 1 RCT examining cement in acetabular components (both arms used cemented stems)	719	1.44 (0.88–2.87)
Studies With ≥ 5 Years' Follow-up			
4 RCTs	3 RCTs examining cement in stem and cup 1 RCT examining cement in stem (both arms used uncemented acetabular components)	595	1.43 (0.70–2.93)

Abbreviations: CI, confidence interval; RCT, randomized controlled trial.

The quality of this body of evidence was low (Appendix 2).

Conclusions

Based on low quality of evidence, there was no statistically significant difference in revisions between cemented and uncemented fixation for primary hip arthroplasty.

Acknowledgements

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Expert Panel for Health Quality Ontario: Episode of Care for Primary Hip/Knee Replacement

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Appendices

Appendix 1: Literature Search Strategies

Search date: July 9, 2013
Databases searched: OVID MEDLINE, MEDLINE In-Process and Other Non-Indexed Citations, EMBASE; All EBM Databases
Limits: 2008-current; English
Filters: Meta-analyses, systematic review and heath technology assessments

Database: EBM Reviews - Cochrane Database of Systematic Reviews 2005 to May 2013, EBM Reviews - ACP Journal Club 1991 to June 2013, EBM Reviews - Database of Abstracts of Reviews of Effects 2nd Quarter 2013, EBM Reviews - Cochrane Central Register of Controlled Trials June 2013, BM Reviews - Cochrane Methodology Register 3rd Quarter 2012, EBM Reviews - Health Technology Assessment 2nd Quarter 2013, EBM Reviews - NHS Economic Evaluation Database 2nd Quarter 2013, Embase 1980 to 2013 Week 27, Ovid MEDLINE(R) 1946 to June Week 4 2013, Ovid MEDLINE(R) In-Process & Other Non-Indexed Citations July 08, 2013
Search Strategy:

#	Searches	Results
1	exp Arthroplasty, Replacement, Hip/ use mesz,acp,cctr,coch,clcmr,dare,clhta,cleed or Arthroplasty, Replacement/ use mesz,acp,cctr,coch,clcmr,dare,clhta,cleed	22099
2	exp hip arthroplasty/ use emez or exp Hip Prosthesis/	56810
3	((hip* adj2 (replacement* or arthroplast* or resurfac*)) or ((femoral head* or hip*) adj2 prosthes?s) or THR).mp.	118853
4	or/1-3	123459
5	exp Bone Cements/ use mesz,acp,cctr,coch,clcmr,dare,clhta,cleed	18340
6	exp Bone Cement/ use emez	10270
7	exp Cementation/	8260
8	(((bone* or orthop?edic* or fixation or arthroplast*) adj2 (paste* or glue* or cement*)) or cementation).ti,ab.	18028
9	or/5-8	43418
10	4 and 9	10744
11	Meta Analysis.pt.	45649
12	Meta-Analysis/ use mesz,acp,cctr,coch,clcmr,dare,clhta,cleed or exp Technology Assessment, Biomedical/ use mesz,acp,cctr,coch,clcmr,dare,clhta,cleed	54613
13	Meta Analysis/ use emez or Biomedical Technology Assessment/ use emez	83518
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.	369062
15	((health technolog* or biomedical technolog*) adj2 assess*).ti,ab.	4888
16	or/11-15	422354
17	10 and 16	143
18	limit 17 to english language [Limit not valid in CDSR,ACP Journal Club,DARE,CCTR,CLCMR; records were retained]	127
19	limit 18 to yr="2008 -Current" [Limit not valid in DARE; records were retained]	74
20	remove duplicates from 19	45

Appendix 2: Evidence Quality Assessment

Table A1: AMSTAR Scores of Included Systematic Reviews

Author, Year	AMSTAR Score[a]	(1) Provided Study Design	(2) Duplicate Study Selection	(3) Broad Literature Search	(4) Considered Status of Publication	(5) Listed Excluded Studies	(6) Provided Characteristics of Studies	(7) Assessed Scientific Quality	(8) Considered Quality in Report	(9) Methods to Combine Appropriate	(10) Assessed Publication Bias	(11) Stated Conflict of Interest
Abdulkarim et al, 2013 (5)	8	✓	✓		✓		✓	✓		✓	✓	✓
Pakvis et al, 2011 (6)	7	✓		✓			✓	✓	✓	✓		✓
Toossi et al, 2013 (7)	7	✓	✓	✓	✓			✓		✓		✓
Voigt et al, 2012 (8)	9	✓	✓	✓	✓	✓		✓		✓	✓	✓

Abbreviations: AMSTAR, Assessment of Multiple Systematic Reviews.

[a]Maximum possible score is 11. Details of AMSTAR score are described in Shea et al. (3)

Table A2: GRADE Evidence Profile for Comparison of Cemented and Uncemented Fixation for Primary Hip Arthroplasty

Number of Studies (Design)	Risk of Bias	Inconsistency	Indirectness	Imprecision	Publication Bias	Upgrade Considerations	Quality
Revisions							
6 (RCTs)	Serious limitations (–1)[a]	No serious limitations	No serious limitations	Serious limitations (–1)[b]	Undetected	None	⊕⊕ Low

Abbreviations: RCT, randomized controlled trial.

[a]Studies had limits with respect to allocation concealment and blinding, but because the nature of the outcome was nonsubjective, there was less risk that these biases would influence the outcome of interest. Therefore, this risk of bias was deemed a serious limitation. Details on risk of bias are described in Table A3.

[b]The confidence interval around the pooled effect estimate was wide enough to cross the clinical decision threshold between recommending and not recommending treatment.

Table A3: Risk of Bias Among Randomized Controlled Trials for Comparison of Cemented and Uncemented Fixation for Primary Hip Arthroplasty

Author, Year	Allocation Concealment	Blinding	Complete Accounting of Patients and Outcome Events	Selective Reporting Bias	Other Limitations
Kärrholm et al, 1994 (9)	Limitations[a]	Limitations[b]	Limitations[c]	No limitations	No limitations
Laupacis et al, 2002 (10)	Limitations[d]	No limitations	Limitations[c]	No limitations	No limitations
Önsten et al, 1994 (11)	Limitations[a]	Limitations[b]	No limitations	No limitations	No limitations
Reigstad et al, 1993 (12)	Limitations[a]	Limitations[b]	No limitations	No limitations	No limitations
Ström et al, 2006 (13)	Limitations[a]	Limitations[b]	No limitations	No limitations	No limitations
Wykman et al, 1991 (14)	Limitations[a]	Limitations[b]	No limitations	No limitations	Limitations[e]

[a]Insufficient details were provided to ensure allocation concealment was present.
[b]Patients were not blinded to treatment arm.
[c]Analysis was per-protocol, as opposed to intention-to-treat; results may therefore contain bias, because the outcomes of patients lost to follow-up were uncertain.
[d]Assessors of outcomes were blinded, but surgeons were not.
[e]Randomization was not truly random; consecutive assignment to study groups was applied.

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