Injury, Int. J. Care Injured 44 (2013) 730–734

Contents lists available at SciVerse ScienceDirect

Injury

journal homepage: www.elsevier.com/locate/injury

Cemented versus cementless hemiarthroplasty for intracapsular neck of femur fracture—A comparison of 60,848 matched patients using national data

Simon S. Jameson [a,b], Cyrus D. Jensen [b], David W. Elson [b,*], Andrew Johnson [c], Christopher Nachtsheim [c], Amar Rangan [a,d], Scott D. Muller [a,e], Mike R. Reed [a,e]

[a] National Orthopaedic Research and Surgical Outcomes, Newcastle, UK
[b] Northern Deanery Trauma & Orthopaedic Training Scheme, Waterfront 4, Goldcrest Way, Newcastle, NE15 8NY, UK
[c] University of Minnesota, 3 Morrill Hall, Minneapolis, MN 55455, United States
[d] Department of Orthopaedics, South Tees Hospitals NHS Foundation Trust, Marton Road, Middlesbrough, TS4 3BW, UK
[e] Department of Orthopaedics, Northumbria Healthcare NHS Foundation Trust, Woodhorn Lane, Ashington, Northumbria, NE63 9JJ, UK

ARTICLE INFO

Article history:
Accepted 22 October 2012

Keywords:
Neck of femur
Hip fractures
Hemiarthroplasty
Cementation

ABSTRACT

National guidelines recommend cemented hemiarthroplasty for intracapsular fractured neck of femur (NOF), based on evidence of less pain, better mobility and lower costs. We aimed to compare complications following cemented and cementless implants, using the national hospital episode statistics (HES) database in England.

Dislocation, revision, return to theatre and medical complications were extracted for all patients with NOF fracture who underwent hemiarthroplasty between January 2005 and December 2008. To make a ‘like for like’ comparison all 30,424 patients with a cementless implant were matched to 30,424 cemented implants (from a total of 42,838) in terms of age, sex and Charlson co-morbidity score. In the cementless group, 18-month revision (1.62% versus 0.57% (OR 2.90, $p < 0.001$)), 4-year revision (2.45% versus 1.11% (OR 2.28, $p < 0.001$)) and 30-day chest infection (8.14% versus 7.23% (OR 1.14, $p = 0.028$)) were significantly higher. Four-year dislocation rate was higher in cemented implants (0.60% versus 0.26% (OR 0.45, $p < 0.001$)). No significant differences were seen in return to theatre or other medical complications.

In this national analysis of matched patients mid-term revision and perioperative chest infection was significantly higher in the cementless group. This supports the published evidence and national guidelines recommending cement fixation of hemiarthroplasty.

Introduction

The majority of patients who sustain a displaced intracapsular neck of femur (NOF) ‘fragility’ fracture are treated with a hemiarthroplasty in the United Kingdom (UK), with the most popular implants[1] being the Austin-Moore[2] and the Thompson[3] prostheses. Both were designed over 50 years ago to be used without cement, although the Thompson prosthesis is usually cemented in modern trauma practice.

Reported benefits of cementation include reduced postoperative pain and improved function, perhaps as a consequence of immediate, secure implant fixation.[4,5] A recent Cochrane review in 2010 concluded that cemented hemiarthroplasty reduced post-operative pain and improved mobility.[6] A significant reduction in the revision rate following cemented versus uncemented hemi-arthroplasty was found using Australian National Joint Replacement Registry data.[7] Despite this, the National Hip Fracture Database reported in 2011 that 19% of hemiarthroplasties are still performed with cementless implants.[8] This database has also been analysed to show a small survival benefit associated with cementing.[9]

The National Institute for Health and Clinical Excellence (NICE) produce clinical guidelines for English health professionals. Based on the evidence, NICE recommend the use of cemented implants.[10] Our aim was to compare medical and surgical complications following cemented and cementless hemiarthroplasty in matched patient groups, using a national database.

Patients and methods

Data for English NHS patients who were admitted as an emergency with fractured NOF over a four-year period (January 2005 to December 2008), and underwent either cemented or cementless hemiarthroplasty (uni- and bi-polar), were extracted

* Corresponding author at: 91 Rothwell Road, Gosforth, Newcastle upon Tyne, NE3 1UA, UK. Tel.: +44 7900806146.
E-mail address: davidelson@yahoo.com (D.W. Elson).

0020–1383/$ – see front matter © 2012 Elsevier Ltd. All rights reserved.
http://dx.doi.org/10.1016/j.injury.2012.10.031

from the administrative hospital admissions database (Hospital episode statistics, HES). Records belonging to the same patient (defined using a combination of date of birth, sex and postcode) were linked so complications occurring within specific time intervals could be identified, even if the admissions occurred at different hospitals. Patients with missing dates of operation, age or sex were excluded. By employing the appropriate ICD-10 and OPCS-4 codes, complication rates could be established at specific time intervals following the index surgery (Appendix 1). Outcomes measured were: reoperation for infection within 30 days, medical complications at 30 days (LRTI, stroke, myocardial infarction [MI]) and pulmonary embolus (PE) at 90 days, dislocation and revision rates at 18 months and at four years. Age, sex and Charlson score[11] were available for each patient. The Charlson co-morbidity index predicts the one-year mortality for a patient who may have a range of co-morbid conditions. Each condition is assigned with a score of 1, 2, 3 or 6 (Appendix 2) depending on the risk of dying associated with this condition.

In order to identify dislocations OPCS codes for closed reduction of dislocation in theatre were used. This assumes most first-time dislocations are reduced closed in theatre (not the emergency department) and rarely require open reduction. Laterality was examined in the coding string to ensure the dislocation occurred on the same side as the index procedure. If this was not possible patients were excluded. Further dislocations were not recorded to ensure patients with recurrent dislocations did not create erroneous results. We are unaware of any changes to coding practice that could affect the results, and have previously found that 18-month dislocation rates following hemiarthroplasty did not change between 2005 and 2008.[12] For revision, we identified OPCS codes that described either revision to a second implant or a 1st stage revision.

Statistical analysis

Proportions for both cemented and cementless data were calculated for age, sex and Charlson score, and then compared using a two-sided test of equal proportions using Yates continuity correction.[13] Cemented hemiarthroplasties are more commonly performed. We therefore attempted to match each of the cementless hemiarthroplasty patients to cemented patients. A simple logistic model was created using Charlson score, age, sex and the type of fixation (cement or cementless) as independent variables. Complication rates at different time intervals were dependent variables. This model was then used to predict the outcomes of each individual in the data set. The numbers of adverse events (complications) in the cementless group were established by summing over the exponentiated predicted values (the probabilities) of the adverse event occurring. This process was then repeated for the cemented group. p values, adjusted odds ratios (OR) and 95% confidence intervals (CI) report the comparison between the types of fixation (cement or cementless) in the model. Nearest neighbour matching was then used to match all cementless procedures to optimal matches from the cemented data sets using the MatchIt package in R.[14] This was repeated for procedures with 4-year follow-up data available.

Propensity score methods as employed in this study are increasingly being used to eliminate potential bias when observational studies are used to compare the effects of different treatments.[15] The rates of adverse events were then calculated and compared using McNemar's test. The p value, adjusted OR and 95% CI are reported from McNemar's test.[16] These matched groups were then compared using a two-sided test of equal proportions using Yates continuity correction to ensure adequate matching.[13] Odds ratios over 1 indicate that rates are higher with uncemented than with cemented. Significance threshold was $p < 0.05$.

Table 1
Characteristics by treatment group for all patients.

Characteristic	Cemented, $n = 42,838$ (58.5%)	Cementless, $n = 30,424$ (41.5%)	p-Value
Age (years)			
<70 (n, %)	2560 (6.0)	1014 (3.3)	$p < 0.001$
70 < 80	11497 (26.8)	6316 (20.8)	$p < 0.001$
80 < 90	21760 (50.8)	15950 (52.4)	$p < 0.001$
≥90	7021 (16.4)	7144 (23.5)	$p < 0.001$
Sex			
Male	9958 (23.2)	6678 (21.9)	$p < 0.001$
Female	32880 (76.8)	23746 (78.1)	$p < 0.001$
Charlson score			
0	21545 (50.3)	13609 (44.7)	$p < 0.001$
1	13197 (30.8)	10510 (34.5)	$p < 0.001$
2+	8096 (18.9)	6305 (20.7)	$p < 0.001$

Results

In total, there were 73,262 procedures performed with use of cement described; 42,838 (58.5%) were cemented and 30,424 (41.5%) cementless hemiarthroplasties. The majority of patients in the study were female (56,626, 77.3%), aged 70–90 years (55,523, 75.8%) and Charlson grade <2 (58,861, 80.3%). All demographic differences were significant between the two groups (Table 1). After propensity score matching, statistically significant differences remained in numbers of procedures performed in over 80 year olds, but these were clinically small differences (52.4% of cemented procedures were performed in 80 < 90 year group compared with 53.6% in the cementless group) (Table 2). There were 24,318 procedures with 4-year data available (13,265 cemented and 11,053 cementless procedures).

Revision

After adjusting for significant influences, the multivariable model showed that cementless implants had a significantly higher revision rate at 18-months (1.66% versus 0.67%, OR = 2.90, 95% CI 2.50–3.37, $p < 0.001$) and at four years (2.56% versus 1.39%, OR = 2.22, 95% CI 1.84–2.70, $p < 0.001$) compared with cemented implants (Tables 3 and 5). Similar results were found in the propensity score model (18 month: 1.62% versus 0.57%, OR = 2.90, 95% CI 2.44–3.46, $p < 0.001$, 4-year: 2.45% versus 1.11%, OR = 2.28, 95% CI 1.45–3.65, $p < 0.001$) (Tables 4 and 6).

Dislocation and return to reoperation for infection

The multivariable model showed that cementless implants had a significantly lower first-time dislocation rate at 18-months

Table 2
Patient characteristics by treatment group (propensity matched patients).

Characteristic	Cemented, $n = 30,424$	Cementless, $n = 30,424$	p-Value
Age (years)			
<70 (n, %)	1014 (3.3)	1014 (3.3)	$p = 1$
70 < 80	6316 (20.8)	6316 (20.8)	$p = 1$
80 < 90	16294 (53.6)	15950 (52.4)	$p = 0.005$
≥90	6800 (22.4)	7144 (23.5)	$p < 0.001$
Sex			
Male	6796 (22.3)	6678 (21.9)	$p = 0.253$
Female	23628 (77.7)	23746 (78.1)	$p = 0.253$
Charlson score			
0	13667 (44.9)	13609 (44.7)	$p = 0.642$
1	10289 (33.8)	10510 (34.5)	$p = 0.060$
2+	6468 (21.3)	6305 (20.7)	$p = 0.107$