Acta Orthop. Belg., 2015, **81**, 565-571

REVIEW

Unicompartmental knee replacement in the elderly : a systematic review

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Unicompartmental knee replacement in the elderly may be associated with a better outcome than total knee replacement. The purpose of this review was to assess the clinical outcome in patients over the age of 70. A computerised search was performed using Pubmed and Embase. Quality assessment was performed using the Newcastle-Ottawa Scale. Eligible studies were identified according to defined criteria and reviewed in terms of peri-operative events, functional outcome and long-term results. 20 studies, representing a minimum of 2956 knees were included. There was a significant increase in the knee society score in the majority of studies to 89.5 (objective) and 80 (function) and the median range of motion (ROM) achieved was 115 degrees. There was no peri-operative mortality and the 10 year prosthesis survival rate was 87.5-98% Revision for periprosthetic infection was low at 0.13-0.30%

Keywords :

INTRODUCTION

Unicompartmental knee replacements (UKR) comprise 10% of the total number of knee replacements in the New Zealand Registry and 8% in the National Joint Registry for England and Wales (*2,28*). However in the very elderly the majority of patients undergo total knee replacement (TKR) – in the British NJR, the mean age of UKR patients in 2012 was only 64 years. Whilst TKR may be seen as the "gold standard" for arthroplasty, this should be weighed up against the increased morbidity from this procedure compared to UKR. Even if long-term prosthesis survival rates for UKR are not as good as TKR, the elderly may be optimal candidates due to the lower risk of general complications.

The age of 65 years is used by the World Health Organisation to describe the 'older' population (*33*). In a recent major orthopaedic journal, the elderly were described as over 70 years of age and the same age was therefore chosen for this article, which aims to systematically review the current literature on UKR in terms of peri-operative events, functional outcome and long-term results (*20*).

METHODS

The databases Pubmed and Embase were searched using the terms "unicompartmental knee replacement" or "unicompartmental knee arthroplasty" or "unicondylar knee replacement" or "unicondylar knee arthroplasty" or "partial knee replacement" or "partial knee arthroplasty". Inclusion criteria were papers assessing the clinical outcome of medial unicompartmental knee replacements

No benefits or funds were received in support of this study.
The authors report no conflict of interests.
The work was carried out at North Shore Hospital.

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with a mean patient age of 70 years and over, or age stratified outcome data for the over 70s. Exclusion criteria were non English language papers, lateral or patellofemoral UKR, and meta-analyses or registry papers. Although older implants were included, the porous coated anatomic unicompartmental knee arthroplasty was excluded as this design has a recognised poor outcome (*8,25*).

A total of 930 articles were identified. Abstracts of 266 articles were reviewed and a further 104 papers excluded. 162 full text papers were reviewed and 15 were identified as eligible for inclusion. A reference search of these papers identified a further 36 possible inclusions : these papers were reviewed and 5 were included. A total of 20 papers were finally identified as fulfilling the inclusion criteria (Fig. 1).

The quality of each study was assessed using the modified Newcastle-Ottawa Scale (NOS) (*31,35*). This is a validated outcome score to assess scientific papers where each study is scored out of five stars, with a maximum of two stars available for study design, one for patient selection, and two for outcome assessment.

Fig. 1. — Flow diagram

RESULTS

A total of 20 papers were identified that met the study criteria (Table I). Eleven studies were prospective and nine were retrospective. Eight papers focused on mobile bearing knees, eleven on fixed bearing and one compared the two. Four studies had a modified Newcastle-Ottawa Score of 5 out of 5 and the overall score for all papers combined was 67 out of a possible 100. Only two papers dealt with the very elderly over 80 years of age (*6,13*).

Study demographics are shown in table II.

Functional Results

Thirteen studies had post-operative Knee Society Scores and nine also had pre-operative data, as shown in table III. The median pre-operative KSS objective score was 49 (range 32.6-63.6) and this improved post-operatively to 89.5 (range 72-95). The median pre-operative KSS functional score was 50.5 (range 30-63.6), which improved to 80 (range 56-92).

Using the HSS score, Van Dalen *et al* reported only 75% of knees as satisfactory (excellent or good score) ; Bruni *et al* 4% of knees as excellent, 18% good and 8% fair (*29,4*), and Akizuki *et al* reported high post-operative scores (*2*).

Other outcome measures were used in some of the remaining studies : Li *et al* reported a significant increase in Womac score for the Miller Galante prosthesis from 46 to 74 and for their Oxford prosthesis from 54 to 79 (*10*). Similarly there was an increase in patient SF-36 physical scores for the former from 27 to 37 and for the later from 29 to 40. Jahromi *et al* reported that out of 150 respondents, 65 felt their knee was normal (*7*).

Fourteen studies reported on ROM with all reporting an excellent mean ROM with a median arc of 115 degrees (range 103-132).

Results for the EIUS unicompartmental knee were poor and it has been withdrawn from sale due to design problems (*21*).

Table I. — Included studies and quality review

Study	Implant	Year published	Years implants inserted	Study type	Quality score (best possible 2,1,2)
Ingale (*6*)	Oxford phase 3 (Biomet UK Ltd, Bridgend, UK)	2013	2001-2009	Retrospective	1,1,0
Pandit (*17*)	Oxford phase 3	2011	1998-2009	Prospective	2,1,1
Bruni (*4*)	Preservation [fixed] (DePuy, Warsaw, Indiana)	2010	1996-2003	Retrospective	1,1,1
Saenz (*21*)	EIUS (Stryker, Warsaw, Indiana)	2010	2002-2005	Prospective	2,1,1
Fisher (*5*)	Preservation [fixed]	2010	2001- 2002	Retrospective	1,1,1
Takeuchi (*27*)	Compartment Uni-Kne (Nakashima Propeller Co)	2010	1994-2000	Prospective	2,1,1
Akizuki (*2*)	Zimmer unicompartmental high flex knee (Zimmer, Warsaw, Indiana)	2009	–	Prospective	2,0,1
Marya (*13*)	Allegretto (Zimmer)	2009	2002-2006	Retrospective	0,1,1
Seyler (*24*)	Miller Galante (Zimmer)	2009	–	Prospective	2,1,2
Lustig (*12*)	HLS Uni (Tornier, Saint Martin, France)	2009	1988-2004	Retrospective	1,1,1
Li (*10*)	Miller Galante/ Oxford	2006	2001-2003	Prospective	2,1,2
Price (*18*)	Oxford phase 1-3	2005	1982-2000	Prospective	2,1,1
Lisowski (*11*)	Oxford phase 3	2004	1999-2003	Prospective	2,1,2
Rajasekhar (*19*)	Oxford phase 2	2004	1989-2000	Retrospective	1,1,1
Jahromi (*7*)	Oxford	2004	2000-2002	Retrospective	1,1,0
Yang (*34*)	Marmor (Richards manufacturing, Tennessee)/mod 2	2003	1974-1989	Retrospective	0,1,0
Ackroyd (*1*)	St Georg Sled (Waldemar, Link, Hamburg)	2002	1977-1996	Prospective	2,1,2
Weale (*30*)	Oxford phase 1	1999	1982-1987	Prospective	2,1,1
Murray (*15*)	Oxford	1998	1982-1992	Prospective	2,1,1
Van Dalen (*29*)	Marmor	1991	1976-1983	Retrospective	0,1,0

Peri-operative results

Peri-operative events and complications were variably reported. Fisher *et al* found their UKR cohort had significantly less blood loss, significantly less transfusion requirements and significantly less narcotic use than their TKR cohort (*5*).

In one study by Ingale *et al*, specifically assessing the over 80s, medical complications were noted to be more frequent that implant related problems (*6*). 3.9% of patients had central nervous system problems, 5.9% urinary problems and 3.9% cardiac problems. There were three deaths within five years of surgery. There was a (predominantly medical) complication rate of 21.6% amongst the over 80s and of 19.4% amongst the 70-79 year olds.

Three studies addressed length of stay (*5,13,9*). Fisher reported a mean length of stay that was significantly decreased from 3.4 to 2.7 days compared against a similar total knee replacement group. Marya *et al* had a mean length of stay of 4 days and Ingale found that their patients over 80 years had a length of stay of 5 days versus 4 for their younger patients.

Long-term results

Of the larger studies, Murray *et al*, reporting the ten-year survival of the Oxford (Biomet, UK) prosthesis, found a 98% ten-year implant survival rate, with five knees revised : two for lateral compartment progression and one each for infection,

Table II. — Demographics

Study	Implant	Number of knees	Number of patients	M :F ratio	Mean age	Age range	Mean Follow Up
Ingale	Oxford phase 3 (Biomet UK Ltd, Bridgend, UK)	51 ≥ 80 years, 145 : 70-79 years	46 ≥ 80 years, unknown : 70-79 years	25m : 26f ≥ 80 years, 75m : 70f 70-79 years	82.86 ≥ 80 years, 74.48 : 70-79 years	Maximum age 90	4.2 years
Pandit	Oxford phase 3	755	–	–	71	60-88	5.6 years for over 60s
Bruni	Preservation [fixed] (DePuy, Warsaw, Indiana)	83	83	60m : 23f	73.6	61-82	5 years
Saenz	EIUS (Stryker, Warsaw, Indiana)	144	113	52m : 61f	72	45-90	3 years
Fisher	Preservation [fixed]	44 UKR, 54 TKR	41 UKR, 50 TKR	68m : 23f	76 (entire cohort)	70-93	–
Takeuchi	Compartment Uni-Kne (Nakashima Propeller Co)	30	18	4m :14f	77	69-86	7 years
Akizuki	Zimmer unicompartmental high flex knee (Zimmer, Warsaw, Indiana)	30	18	17m :13f	76.8	68-83	9.7 months
Marya	Allegretto (Zimmer)	29	19	16m : 3 f	83	79-94	4 years
Seyler	Miller Galante (Zimmer)	80	68	29m : 39f	72	44-91	5 years
Lustig	HLS Uni (Tornier, Saint Martin, France)	144 (84 medial)	134	23m : 111f	72.2	25-90	5.2 years
Li	Miller Galante/ Oxford	28 Miller/Galante, 28 Oxford	48 patients	19m : 9f MG, 20m : 8f Ox	70 MG, 74 Ox	-	2 years
Price	Oxford phase 1-3	512	403	174m : 229f	71.4	60.1-94.5	-
Lisowski	Oxford phase 3	30	28	-	71.4	Standard deviation 8.8 years	2.54 years
Rajasekhar	Oxford phase 2	135	124	71m : 53f	70.2m, 73.1f	53-88	5.82 years
Jahromi	Oxford	183	150	76m : 74f	71.5	36-92	Minimum 12 months
Yang	Marmor (Richards manufacturing, Tennessee)/ mod 2	113	89	42m : 47f	71	42-87	16 years
Ackroyd	St Georg Sled (Waldemar, Link, Hamburg)	408	322	Not given	70 (median)	48-93	6.4 years
Weale	Oxford phase 1	56	45	17m :28f	71	55-87	11.4 years
Murray	Oxford	144	114	1m :1.2f	70.7	34.6-90.6	7.6 years
Van Dalen	Marmor	44	35	9m :26f	70	57-83	7.6 years

Table III. — Functional scores

Study	KSS objective pre-op	KSS objective post-op	KSS function pre-op	KSS function post-op
Weale	41	88 (10 years)	37	63 (10 years)
Yang	–	72	–	56
Lisowski	58.7	95	54.5	88.8
Rajasekhar	–	92.2	–	76.3
Li	–	91 MG; 89 Ox	–	84 MG; 85 Ox
Marya	49	84 at latest follow up	30	80
Seyler	49	95	48	92
Lustig (combined medial and lateral results, no sig difference between the med and lat KSS scores)	63.6	89.5	63.6	81.8
Saenz	55	92 (excludes revised)	49	89 (excludes revised)
Fisher	Mean 48	95 one year	52	80 one year
Takeuchi	58	88	57	79
Pandit	–	85	–	82
Ingale	32.55	One year ≥ 80 years 85.21, 70–79 years 87.33	–	One year ≥ 80 years 59.78, 70-79 years 79.54

unexplained pain and asceptic loosening (*15*). Price *et al* reported a 96% 10 year survival rate but this was in over 60s and Pandit found a similar rate of 95.1% (*18,17*). The most common reason for revision was progression of lateral compartment osteoarthritis.

Ackryod *et al* described a 6.1% revision rate (*1*). Twenty five knees were revised : nine for lateral or patellofemoral disease progression, twelve for failure of the prosthesis, three for polyethylene wear and one for unexplained pain.

Collation of the remaining fifteen smaller studies in the review, and excluding the EIUS, showed the total number of revisions was 47 (3.7% of 1281 knees), and 45 if the two revisions for deep infection are excluded. Indication for revision were : 17 for asceptic loosening ; 7 for disease progression ; 3 for pain ; 2 for polyethylene wear ; 2 for technical error, 2 for late fracture ; 2 for deep infection ; 1 for implant failure ; 1 for dislocation of a mobile bearing, and 10 for unknown reasons. The revision rate for periprosthetic infection was low at 0.16% amongst these studies.

Overall, combining all 20 studies, the revision rate for infection was still low, at between 0.13% to 0.30%.

DISCUSSION

Kozinn and Scott published their indications for UKR in 1989 and included those over the age of 60, of body weight less than 82kg and who have low activity levels (*9*). Subsequent papers have disputed these thresholds and UKR is now routinely performed in the young and physically active (*17,18*), with the higher early failure risk seeming to lead to a preference for TKR in the elderly.

The results of this review suggest that the outcome of UKR in the elderly is generally good but there is surprisingly little data available. Another two studies were identified during the literature review that were interesting but did not meet the inclusion criteria : Sah *et al* found that the prosthesis would outlive the patient in a study of both medial and lateral UKR in octogenarians and Sebilo *et al* conducted a retrospective multicentre study and

reviewed the outcome of 944 UKRs that were performed over a twenty year period until 2008, 862 of which were medial compartment replacements (*22, 23*). A total of thirty different implants were used and they found a significantly increased 10 year survival rate for the prosthesis in those over the age of 70 (88.3%) versus those younger than 70 (76.7%). They also found the over 80s had a significantly better improvement in both the KSS objective and functional scores than those under 80.

When UKR and TKR are compared in general, UKR appears to have a lower risk profile. Morris *et al* assessed the 90-day morbidity and mortality rate in 1000 consecutive UKRs in 828 patients and found it to be a safe procedure with a low rate of serious complications (*14*). In their retrospective review they had no deaths, one episode of deep vein thrombosis and three patients had a non-fatal myocardial infarction. In another large multicentre study, Brown *et al* showed that TKR had higher postoperative morbidity than UKR (*3*). They found the risk of complications was 4.3% for UKR versus 11% for TKR. TKR had a significantly increased risk of admission to ICU, of requiring an MUA and of requiring a blood transfusion. There was also a strong trend towards an increase in deep joint infection, hospital readmission, venous thromboembolism and re-operation. There was no difference in mortality.

The perceived outcome of UKR versus TKR is controversial. Patient reported outcomes are now routinely recorded and Williams *et al* reviewed the effect of age on outcome reporting. In a study that predominantly focused on TKR (2242 knees), 214 UKRs were included (*32*). Patients were stratified into ten-year age cohorts and at two years there was no significant difference in Oxford or EQ-5D scores between any cohort. There was no significant difference in post-operative change in scores between the UKR and TKR patients. However, the adjusted two-year revision rate was significantly higher in patients aged less than 55 years, with two revisions for instability and one for asceptic loosening.

The cost-effectiveness of UKR in elderly, low demand patients in the United States has been analysed in a theoretical cohort of 78 year olds with medial compartment osteoarthritis (*26*). Outcome was assessed in quality adjusted life years (QALYs). They found UKR resulted in a higher number of QALYs and a lower accumulated cost for patients.

In conclusion, we found that the literature support the view that the functional outcome of UKR in the elderly is good, with low rates of peri-operative morbidity and mortality. The 10 year implant survival rate was 87.5-98% and revisions for periprosthetic infection were low at 0.13-0.30% It can therefore be seen, especially in the age of patient centred care and informed choice, that its risk-reward profile could potentially be a more appealing to the elderly than a TKR.

Overall, there is a need for further studies specifically assessing UKR in the very elderly.

Acknowledgements

We would like to acknowledge the help of Jennifer Paterson, visiting medical student, in preparing this paper.

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