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Abstract

Background

The omega approach represents a modification of the lateral approach to the hip for joint replacement. It was developed to reduce the potential for gluteus muscle dysfunction and thereby improve functional outcome following hip replacement.

Methods

A cohort of 415 consecutive hip replacements receiving the same type of cemented femoral component were followed up at a mean of three years postoperatively and invited to complete functional outcome and satisfaction scores.

Results

There were no differences between the omega and the posterior approach in terms of post-operative Oxford Hip Score, Short Form-12 score, patient satisfaction and a range of radiographic parameters.

Conclusions

The omega approach appears to perform equally to the posterior approach in this cohort of patients.

1. Introduction

Total hip replacement is one of the most commonly performed orthopaedic procedures. Currently in the UK, the two most frequently performed approaches to the hip are the posterior and the lateral. The 2014 annual National Joint Registry of England, Wales and Northern Ireland reveals that 31% of the 80,194 hip replacement cases recorded in 2013 were performed via the lateral approach, whereas 65% were performed via the posterior approach.[1]

The lateral approach was popularised by Hardinge,[2] and has undergone numerous modifications.[3-5] These approaches all make use of the superficial interval between tensor fasciae latae and gluteus maximus. Deep to this, access to the hip joint is gained by releasing part of gluteus medius from the greater trochanter.

The omega approach is a further modification of the lateral approach. Rather than splitting and releasing a part of the gluteus medius muscle from the trochanter, the entirety of the gluteus medius, minimus and vastus lateralis are detached at their dense crescentic attachment to the greater trochanter.[6] The purported benefit of this modification is that it facilitates reattachment of the glutei and thereby helps to preserve abductor muscle function which is known to be important for normal gait.

The posterior approach has also been described and refined by numerous authors,[7-9] but employs a superficial plane splitting through gluteus maximus and requires a tenotomy of the short external rotators and a posterior capsulotomy. Repair of the short external rotators has been shown to reduce post-operative dislocation rates.[10]

There is a perception that the lateral approaches may result in abductor muscle dysfunction, either due to failure of repair onto the greater trochanter, or because of injury to the superior gluteal nerve, which innervates these muscles. A recent systematic review and meta-analysis could not attribute a functional advantage to either the lateral or posterior approach, but did conclude that the lateral approach was associated with a higher rate of post-operative Trendelenburg gait.[11] The omega approach was designed to reduce the deleterious effect of abductor dysfunction, however such claims have not been thoroughly investigated.

The aim of this retrospective study was to use functional outcome scores and radiographic analyses of a consecutive cohort of patients to determine whether the omega approach is associated with an inferior outcome compared with the standard posterior approach to primary total hip replacement.

2. Methods

Patients undergoing primary THR with a standardised cemented femoral component (C stem AMT, DePuy Int., Leeds, UK) were recruited to the study. The study was approved by the local ethics committee (ref: 08/H0107/97). The operations were performed by multiple surgeons at a tertiary referral orthopaedic centre. The patients were a case series of convenience of consecutive patients undergoing THR with the identified implant between March 2005 and April 2008, for whom radiographs and outcome scores were both available at follow up.

Patient functional outcome was determined by means of the Oxford Hip Score (OHS),[12] the SF-12 health survey[13] (SF-12 physical component score (PCS) and mental component score (MCS)) and the self-administered patient satisfaction scale (SAPS).[14] Radiographic follow up was performed annually with the postoperative and most recent radiograph being utilised for analysis. Anonymised radiographs were uploaded to a freely available image analysis programme (http://www.imatri.net/). Adjustment for magnification was made with reference to the known diameter of the implanted prosthetic head. Radiological parameters were assessed by means of recognised grading systems. The cement mantle was graded according to the method of Barrack et al.[15] Radiolucencies were measured in the zones of Gruen[16] according to the method of Johnston et al.[17] Radiolucencies were considered to be present when the measured line was greater than 1mm in width and greater than 5mm in length.[18] Proximal bone resorption was classified according to the method of Engh et al.,[19] and heterotopic ossification according to the method described by Brooker et al.[20] Stem alignment was measured relative to the axis of the femoral shaft, varus alignment is given as a negative angle and valgus as positive.

Statistical calculations were performed using GraphPad InStat and Prism (GraphPad Software Inc, La Jolla, CA, USA). Statistical significance was determined when $p < 0.05$. Data was tested for normality with a Kolmogorov-Smirnov test, if this was failed non-parametric tests were utilised. Where data was not normally distributed, it is described as a median value and inter-quartile range (IQR) unless stated otherwise. Where data was normally distributed, it is described as a mean value with standard deviations (SD). Categorical data was compared with a Chi squared test. Continuous data was compared with unpaired t tests when the data was normally distributed and Mann-Whitney tests when it was not.

3. Results

Three hundred and eighty six patients received 415 hip replacements with the standardised cemented femoral component in the identified date range. Of these, 179 had the procedure performed via an omega approach and 236 via a posterior approach. Ninety three patients died in the follow up period, 17 patients were unable to complete the questionnaire due to medical comorbidities (e.g. dementia, cerebrovascular event) and 7 patients did not wish to participate in follow up. Questionnaires were returned by 89% of the remaining patients.

At the time of final follow up 116 cases in the omega group (63%) and 152 patients in the posterior group (64%) had functional and radiological data available for analysis. None of the patients underwent revision during the study period.

The mean patient age at the time of surgery was 73 years (SD 7.7). There was a difference in age between the groups (omega mean age 71.4 (SD 7.6); posterior mean age 74.5 (SD 7.5); p=0.0008). See table 1 for additional demographic data. Of the patients with data available for analysis, one patient in the omega group had died at 52 months following their operation. The median follow up period for the functional scores was 37 months (range 36-51, IQR 36-38). The median follow up period for the radiological assessment was 38 months (range 1-73, IQR 33-43).

3.1 Functional outcomes

The functional outcome data was not normally distributed. There was no significant difference between the approaches when the OHS (p=0.095), SF12 PCS (p=0.849), SF12 MCS (p=0.771) or SAPS (p=0.107) were considered, see table 2.

3.2 Radiological outcomes

When radiological outcomes were considered, all cases were Engh grade 0 or 1, 93% of cases were grade 1, there was no difference between approaches (P=0.961). 83% of cases were Brooker grade 0, 10% were grade 1, 5% were grade 2 and 2% were grade 3. There were no differences between the approaches (P=0.292). 93% of cases were Barrack grade A and 7% were grade B, there were no differences between approaches (P=0.308). 6% of cases had a radiolucency in one or more Gruen zones of the postoperative radiograph, there was no difference between approaches (P=0.690). 8% of cases had a radiolucency in one or more Gruen zones of the follow up radiograph, there was no difference between approaches (P=0.124). Stem alignment did vary significantly by approach ($p<0.001$). There was a tendency for stems inserted through the Omega approach to sit in valgus alignment (median 0.5^0 valgus, range 5^0 varus to 6^0 valgus, IQR 1.1^0 varus to 1.6^0 valgus) when compared to those inserted through a posterior approach (median 1.5^0 varus, range 8^0 varus to 4^0 valgus, IQR 2.6^0 varus to

0.1^0 valgus), see table 2. There was no difference between the approaches for stem subsidence in the study period (p=0.139).

3.3 Reoperations

There were three reoperations in the series, one in the omega group and two in the posterior group (P=0.735). In the omega group, there was a revision of the acetabular component for multidirectional instability to a capture device. In the posterior group there was one closed reduction for an episode of dislocation following a fall with no recurrence and one fracture of the greater trochanter that was openly reduced and fixed with no revision of the components. No nerve palsies occurred in either group.

4. Discussion

Our results do not show any difference in functional or radiographic outcomes between the omega and posterior approaches to primary total hip replacement in a cohort of 415 hip replacements.

These results are in concordance with a Cochrane review of the posterior and lateral approaches to the hip,[21] and a recent meta-analysis of outcomes and complications following these two approaches.[11]

However, there is a growing number of large cohort studies to suggest that functional outcome is worse following the lateral approach to the hip. Superior WOMAC functional outcomes have been observed following the posterior approach in a retrospective study of over 1000 patients.[22] A cohort of 3881 patients undergoing hip replacement with available Oxford Hip scores demonstrated a small but statistically significant benefit in Oxford Hip Score and EQ5D index following the posterior approach.[23] A large cohort study from the Swedish Arthroplasty Register identified improved pain, satisfaction and EQ5D scores favouring the posterior approach when compared to the lateral approach.[24]

In addition to functional outcomes, 90-day mortality has been shown to be lower following the posterior approach in a cohort of 409,096 patients, with a hazard ratio of 0.82.[25]

Although modifications exist for both approaches, the lateral approach group represents a diverse range of surgical techniques, and it is difficult if not impossible, to identify which specific type of lateral approach was used in these large cohort studies.

The advantage of the cohort we present is that the lateral approach used herein was performed or supervised by one surgeon using the omega variation of the technique which remained completely unchanged throughout. This study therefore represents a direct comparison of one specific type of lateral approach, rather than including a heterogeneous mixture of varying techniques.

Another limitation which exists within this and other studies comparing functional outcomes following different approaches to the hip is the ceiling effect. This is the statistical skew of functional outcome data arising due to the number of patients achieving the best possible score post-operatively. The lack of sensitivity these outcome measures have regarding the differentiation of high functioning patients hampers the positive identification of differences between groups.[26, 27]

5. Conclusion

The omega approach appears to confer similar functional and radiographic results to that achieved following the posterior approach. No superiority was demonstrated and as such we do not recommend surgeons change their practice from their preferred surgical approach.

Tables

	Omega	Posterior	Chi squared P value
Patient Gender - Male : Female	51 : 65	45 : 108	0.014
Grade of surgeon - Consultant : Trainee	16 : 100	48 : 105	0.0008
Acetabulum component - uncemented : Cemented	64 : 52	77 : 76	0.431

Table 1: Comparison of categorical variables

	Omega	Posterior	Mann-Whitney P value
OHS	40 (29-45)	42 (34-47)	0.095
SF12 PCS	46 (37-55)	45 (38-55)	0.849
SF12 MCS	26 (21-31)	25 (21-29)	0.771
SAPS	100 (75-100)	100 (100-100)	0.107
Stem alignment	0.5^0 (-1.1-1.6)	-1.5^0 (-2.6-0.1)	<0.0001
Stem subsidence	1.1mm (0.8-1.5)	1.3 (0.9-1.6)	0.139

Table 2: Comparison of continuous variables

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References

1. No authors listed. National Joint Registry for England and Wales 11th Annual Report 2014. Available at: http://www.njrreports.org.uk/Portals/0/PDFdownloads/NJR%2011th%20Annual%20Report%202014.pdf. (Date last accessed 1 December 2014).
2. Hardinge K. The Direct Lateral Approach to the Hip. *J Bone Joint Surg Br.* 1982;64:17-19.
3. Frndak PA, Mallory TH, Lombardi AV, Jr. Translateral surgical approach to the hip. The abductor muscle "split". *Clin Orthop Relat Res.* 1993:135-141.
4. Mulliken BD, Rorabeck CH, Bourne RB, Nayak N. A modified direct lateral approach in total hip arthroplasty: a comprehensive review. *J Arthroplasty.* 1998;13:737-747.
5. Schneider M, Kawahara I, Breusch SJ. [Modifizierter Hardinge-zugang mit kurzinzision] Modified Hardinge approach with limited incision. *Orthopade.* 2006;35:751-760.
6. Learmonth ID, Allen PE. The omega lateral approach to the hip. *J Bone Joint Surg Br.* 1996;78:559-561.
7. Moore AT. The Moore self-locking vitallium prosthesis in fresh femoral neck fractures: a new low posterior approach (the Southern Exposure). *AAOS Instr Course Lect.* 1959;16:309.
8. Gibson A. Posterior exposure of the hip joint. *J Bone Joint Surg Br.* 1950;32:183-186.
9. Marcy GH, Fletcher RS. Modification of the posterolateral approach to the hip for insertion of femoral-head prosthesis. *J Bone Joint Surg Am.* 1954;36:142-143.

10. Pellicci PM, Bostrom M, Poss R. Posterior approach to total hip replacement using enhanced posterior soft tissue repair. *Clin Orthop Relat Res.* 1998:224-228.

11. Berstock JR, Blom AW, Beswick AD. A systematic review and meta-analysis of complications following the posterior and lateral surgical approaches to total hip arthroplasty. *Ann R Coll Surg Engl.* 2015;97:11-16.

12. Dawson J, Fitzpatrick R, Carr A, Murray D. Questionnaire on the perceptions of patients about total hip replacement. *J Bone Joint Surg Br.* 1996;78B:185-190.

13. Ware JE, Kosinski M, Keller SD. A 12-Item Short-Form Health Survey: Construction of scales and preliminary tests of reliability and validity. *Med Care.* 1996;34:220-223.

14. Mahomed N, Gandhi R, Daltroy L, Katz JN. The self-administered patient satisfaction scale for primary hip and knee arthroplasty. *Arthritis.* 2011;2011:591253.

15. Barrack RL, Mulroy RD, Jr., Harris WH. Improved cementing techniques and femoral component loosening in young patients with hip arthroplasty. A 12-year radiographic review. *J Bone Joint Surg Br.* 1992;74-B:385-389.

16. Gruen TA, McNeice GM, Amstutz HC. Modes of failure of cemented stem-type femoral components. A radiographic analysis of loosening. *Clin Orthop Relat Res.* 1979;141:17-27.

17. Johnston RC, Fitzgerald RH, Jr., Harris WH, Poss R, Muller ME, Sledge CB. Clinical and radiographic evaluation of total hip replacement. A standard system of terminology for reporting results. *J Bone Joint Surg Am.* 1990;72:161-168.

18. Yates PJ, Quraishi NA, Kop A, Howie DW, Marx C, Swarts E. Fractures of modern high nitrogen stainless steel cemented stems: cause, mechanism, and avoidance in 14 cases. *J Arthroplasty.* 2008;23:188-196.

19. Engh CA, Bobyn JD, Glassman AH. Porous-Coated Hip-Replacement - the Factors Governing Bone Ingrowth, Stress Shielding, and Clinical-Results. *J Bone Joint Surg Br.* 1987;69B:45-55.

20. Brooker AF, Bowerman JW, Robinson RA, Riley LH, Jr. Ectopic ossification following total hip replacement. Incidence and a method of classification. *J Bone Joint Surg Am.* 1973;55:1629-1632.

21. Jolles BM, Bogoch ER. Posterior versus lateral surgical approach for total hip arthroplasty in adults with osteoarthritis. *Cochrane Database Syst Rev.* 2006:CD003828.

22. Smith AJ, Wylde V, Berstock JR, Maclean AD, Blom AW. Surgical approach and patient-reported outcomes after total hip replacement. *Hip Int.* 2012;22:355-361.

23. Jameson SS, Mason J, Baker P, Gregg PJ, McMurtry IA, Deehan DJ, et al. A comparison of surgical approaches for primary hip arthroplasty: a cohort study of patient reported outcome measures (PROMs) and early revision using linked national databases. *J Arthroplasty.* 2014;29:1248-1255 e1241.

24. Lindgren JV, Wretenberg P, Karrholm J, Garellick G, Rolfson O. Patient-reported outcome is influenced by surgical approach in total hip replacement: a study of the Swedish Hip Arthroplasty Register including 42,233 patients. *Bone Joint J.* 2014;96-B:590-596.

25. Hunt LP, Ben-Shlomo Y, Clark EM, Dieppe P, Judge A, MacGregor AJ, et al. 90-day mortality after 409,096 total hip replacements for osteoarthritis, from the National Joint Registry for England and Wales: a retrospective analysis. *Lancet.* 2013;382:1097-1104.

26. Marx RG, Jones EC, Atwan NC, Closkey RF, Salvati EA, Sculco TP. Measuring improvement following total hip and knee arthroplasty using patient-based measures of outcome. *J Bone Joint Surg Am.* 2005;87:1999-2005.

27. Wamper KE, Sierevelt IN, Poolman RW, Bhandari M, Haverkamp D. The Harris hip score: Do ceiling effects limit its usefulness in orthopedics? *Acta Orthop.* 2010;81:703-707.