Increased Rate Of Dislocation Of Total Hip Arthroplasty With Cementless Implants: Accuracy Of Acetabular Inclination.

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Citation

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Abstract

Accurate positioning of acetabular component in total hip arthroplasty is essential for stability. There is some evidence that cementless components are more difficult to position than cemented and have a higher dislocation rate. Our aim was to obtain information about rates of dislocation from the National Joint Registry (NJR) of England and Wales and to compare accuracy of acetabular component position of cemented and cementless implants. Methods: We made an enquiry of the NJR regarding number of dislocations during 2004-9 and compared rates of dislocation for cemented and cementless implants. We examined 126 post operative radiographs at our institution, assessing the angle of acetabular inclination to determine if there was a difference in the number of implants positioned within <±5° of the target angle. Results: There was a significant difference in rate of revision for dislocation with cementless implants (262/69,822) compared with cemented (266/92,928; c^2=12.1, p<.001; odds ratio 1.35, 95% confidence interval 1.14 to 1.60). Discussion: The greater accuracy of acetabular component positioning of cemented implants with, perhaps consequent, higher rates of revision due to dislocation should be considered when selecting mode of fixation for THA.

INTRODUCTION

Dislocation of the hip following total hip arthroplasty (THA) is a major short term complication not infrequently resulting in revision arthroplasty. Malposition of the acetabular component in total hip arthroplasty (THA) results in a higher rate of dislocation as well as increased wear and osteolysis.

There is evidence that acetabular position is more accurate with cemented implants[13,11,12].

A difference in the rate of dislocation between cemented and cementless implants has been reported elsewhere using joint registries. Dislocation is a relatively infrequent event so it is difficult to detect a significant difference in dislocation rates between cemented and cementless implants with the number of THA performed within a single institution. A compilation of data from multiple centres is therefore more likely to detect any difference.

We aimed to gain further information about whether there is a difference in dislocation rate of THA between cemented and cementless implants using the National Joint Registry of England and Wales. We assessed accuracy of acetabular component positioning at our institution, comparing cemented with cementless components and examined a possible reason for the findings.

PATIENTS, MATERIALS AND METHODS

An enquiry was made to the NJR about the number of revision THA procedures performed for which dislocation was stated as the indication over the five year period 2004-9. To estimate dislocation rate we compared the number of revisions for dislocation with the total number of primary THA, cemented and cementless over this period. We used the χ^2 test and calculated an odds ratio to assess whether there was a significant difference between the number of cemented and cementless implants undergoing revision due to dislocation.

For all THAs performed in our hospital in 2008, we assessed angle of acetabular inclination. Our measurement technique was based on that described by Lewinnek et al but for our assessment the angle measuring feature of the picture archiving and communication system (PACS) software was used (Sectra Imtec AB, Linköping, Sweden). Assessment of angle was performed using the anteroposteror pelvic radiograph taken at the first the first post-operative outpatient follow-up appointment. Acetabular inclination was taken as the angle between a line drawn level with the inferior margins of the pubes and another in alignment with the extremes of the acetabular component. For cemented implants a line was drawn intersecting the extremes of the radio-opaque metal ellipse of the acetabular component (figure 1)

Figure 1

Figure 1: measurement of acetabular angle using PACS programme.

No literature was identified reporting the validation and use of the angle measuring feature of PACS software. We performed validation of our measurement technique, involving assessment of reliability on repeated measurement by the same observer (intraobserver) and by different observers (interobserver).

To assess interobserver reliability all angle measurements were performed independently by two observers (NG, DR). To ensure intraobserver reliability, 20 angles were re-measured after an interval of three weeks by each observer. Statistical analysis described by Bland and Altman was used to assess reproducibility. This technique involves calculating the difference in measurements for each subject. The mean and standard deviation of the differences is then calculated. Reproducibility is good if a high proportion of the differences are within two standard deviations of the mean difference.

Varying opinions exist about optimal acetabular position[2,]. All operating surgeons were asked the intended angle of acetabular inclination in their practice. The aim of this work was to compare intended inclination angle with that assessed on post-operative radiograph. Component position was considered incorrect if angle of inclination was >±5° the surgical target. We determined whether the number of acetabular components outside this range was significantly different between cemented and cementless THA with χ^2 test.

RESULTS

In the period 2004-9 92,928 cemented and 69,822 cementless THA were registered with according to the NJR of England and Wales. During the same period there were 266 revisions of cemented and 262 cementless THA with dislocation as an indication. Comparing number of primary THAs and revisions for dislocation provides an indication of dislocation rate for this period. A χ^2 test indicates there is a significantly higher dislocation rate with cementless implants (χ^2=12.1, p<0.001) and odds ratio of 1.35 (95% confidence interval 1.14 to 1.60) indicates a 35% increase in odds of dislocation with cementless implants compared to cemented.

One hundred and twenty-six THA were performed at our institution during the study period. Of the acetabular components 80 were cemented and 46 cementless. Analysis to determine interobserver reliability found 94% of differences in measurement to be within two standard deviations of the mean difference (figure 2). Comparison of measurements performed by the same observer found 90% of differences to be within two standard deviations of the mean difference (figure 3). This represents good reliability.

Figure 2

Figure 2: Bland and Altman plot: Interobsever reproducibility

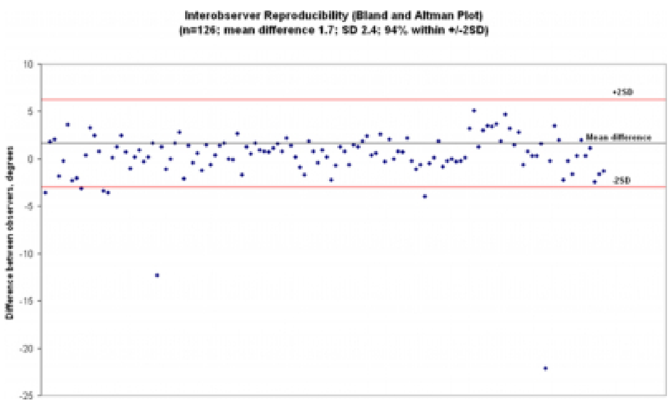
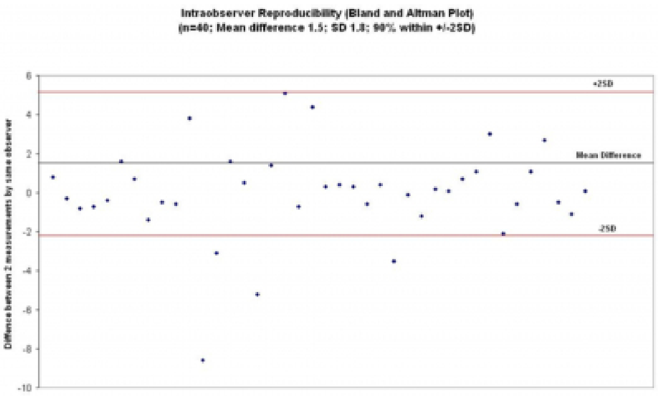


Figure 3

Figure 3: Bland and Altman plot: Intraobsever reproducibility.



Of the 126 THA examined 80 were cemented and 46 cementless. Of the 80 cemented acetabula 48 were ≤±5° the target angle, ie, acceptable position by our criteria. Thirty-two were positioned >±5° from target angle, ie, incorrectly positioned. For cemented implants overall the difference from the target angle ranged from -14.3 to 5.5°. Of the cementless implants 17 were acceptably positioned (ie, ≤±5° target angle) and 29 were incorrectly positioned (ie, >±5° from target angle). Overall for cementless implants the difference from the target angle ranged from -17.9 to 13.1°. Significantly fewer cemented compared with cementless components had angles of inclination outside the target angle range (48/80 vs 29/46; $\chi^2 = 6.39$, $p<0.05$).

DISCUSSION

The information we have gained from the National Joint Registry of England and Wales adds further evidence to small but significant difference in dislocation rate for cementless compared to cemented THA. We have observed at our institution that cemented implants are positioned more accurately than cementless. Component position is an important factor in stability of THA and we feel this may explain the greater rate of dislocation with cementless implants.

Component version as well as inclination is important for stability. Methods for the measurement of acetabular version of cemented components, ie, those with a radio-opaque metal ring, have been described[2, ,]. No such technique is described for cementless implants. Assessment is possible with CT post operatively or intraoperatively using a computer-navigated system. Computer navigation is not used in our institution and post-operative CT is not routinely performed for THA. Version was, therefore, not assessed in our work.

It has been demonstrated that the use of computer navigated systems for THA results in more accurate acetabular component positioning . The use of computer navigation, however, still demonstrates that positioning of cemented acetabular components is more accurate than cementless implants

Analysis of the national joint registry of Australia found that revision due to dislocation was more likely with a primary cementless acetabular component than with cemented implants[5]. Our enquiry of the UK National Joint Registry (NJR) 2004-9 found that significantly more revisions were performed for dislocation of cementless THR acetabular components compared with cemented.

Positioning of the acetabular component is more difficult when using cementless systems as on insertion of the implant the position of the cup is determined by orientation of reaming whereas with a cemented system there is potential for adjustment of final position of the implant. Chawda et al report modifying cementless acetabular component insertion technique to ensure good position, involving stabilisation of introducer by an assistant during impaction of component[13].

Data from joint registries has limitations. The data analysed by this work was cross sectional, not longitudinal in nature. The cases of dislocation were not linked to the number of primary THA used for statistical analysis. The revision operations considered were included if dislocation was marked as an indication. There may have been additional indications for the dislocation not considered by this work. As more centres participate in NJR data collection and with results from longitudinal linkage of primary THA and revision for dislocation more accurate data will become available.

The apparent tendency for a small but significantly increased risk of dislocation with cementless compared with cemented implants should be considered when selecting a mode of fixation for THA. Regular audit by individual surgeons of acetabular inclination in the way we have described may be a useful guide to practice modifications to help prevent the need for revision due to dislocation.

References

1. Kennedy JG, Rogers WB, Soffe KE, Sullivan RJ, Griffen DG, Sheehan LJ. Effect of acetabular component orientation on recurrent dislocation, pelvic osteolysis, polyethylene

wear, and component migration. J Arthroplasty. 1998;13:530-4.
2. Lewinnek GE, Lewis JL, Tarr R, et al. Dislocations after total hip-replacement arthroplasties. J Bone Joint Surg 1978;60:217.
3. Schmalzried TP, Guttmann D, Grecula M, et al. The relationship between the design, position, and articular wear of acetabular components inserted without cement and the development of pelvic osteolysis. J Bone Joint Surg Am 1994;76:677.
4. Little LJ, Busch CA, Gallagher JA, Rorabeck CH, Bourne RB. Acetabular polyethylene wear and acetabular inclination and femoral offset. Clin Orthop 2009;467(11):2895-900
5. Conroy JL, Whitehouse SL, Graves SE, Pratt NL, Ryan P, Crawford RW. Risk factors for revision for early dislocation in total hip arthroplasty. J Arthorplasty. 2008;23(6):867-72.
6. Bland JM, Altman DG. Statistical method for assessing agreement between two methods of clinical measurement. The Lancet 1986;i:307-310.
7. McCollum DE, Gray WJ. Dislocation after total hip arthroplasty: Causes and prevention. Clin Orthop 1990;261:159-70.
8. Harris W. Advances in surgical technique for total hip replacement: with and without osteotomy of the greater trochanter. Clin Orthop 1980;146:188-204.
9. Murray DW. The definition and measurement of acetabular orientation. J Bone Joint Surg [Br] 1993;75-B:228-32.
10. Visser JD, Konings JG. A new method for measuring angles after total hip arthroplasty. J Bone Joint Surg [Br] 1981;63:556-9
11. Najarian BC, Kilgore JE, Markel DC. Evaluation of component positioning in primary totalhip arthroplasty using an imageless navigation device compared with traditional methods. J Arthroplasty 2009;24(1):15-21.
12. Haaker RGA, Tiedjen K, Ottersbach A, Rubenthaler F, Stockheim M, Stiehl JB. Comparison of conventional versus computer-navigated acetabular componenet insertion. J Arthroplasty 2007;22(2):151-9
13. Chawda M, Hucker P, Whitehouse S, Crawford RW, English H, Donnelly WJ. Comparison of cemented vs uncemented acetabular component positioning using an imageless navigation system. J Arthroplasty 2009;24:1170-3.

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