Journal club: 2 February 2011
Organiser: Mr Harvey Sandhu
United Hospital, Bath

Total hip replacement in morbidly obese patients with osteoarthritis – results of a prospectively matched study.
YH Chee, KH Teoh, BM Sabnis, JA Ballantyne, IJ Brenkel
J Bone Joint Surg [Br] 2010;92-B:1066-71.

Reviewers: J Cox, V Budnar

Introduction

Obesity has long been identified as a risk factor for the development of osteoarthritis of the hip. As the incidence of obesity increases, so an increasing population of patients with higher BMIs are coming forward for consideration for total hip arthroplasty. Historically, obese patients have been refused surgery, and there remains a trend to encourage weight loss and lifestyle alterations in this group of patients before proceeding to surgical intervention. This study aimed to assess the outcomes of surgery in this group compared with a group of patients with lower BMI, when matched for other comorbidities.

Methods

The study assessed total hip replacements carried out in a single unit over a 5 year period. The obese group were identified by calculation of BMI, and matched to non-obese patients by Harris hip score preoperatively, laterality and whether unilateral or bilateral arthroplasty was undertaken. Follow up over a period of 5 years was undertaken, with repeated Harris hip score and SF36 score as quality of life indicators measured at 6, 18, 36 and 60 months post op, and survival of the implant and complications recorded if and when they had occurred.

Aims & Hypotheses

This study aimed to ascertain if there is a poorer outcome following total hip arthroplasty in patients who have a BMI in the “morbidly obese” range (defined as >40 or >35 with co-morbidities) at the time of surgery.

Ethics

No ethical considerations or bodies from whom ethical approval was sought are mentioned in this paper.

Study Type

Matched case-control study.

Statistics

Power calculation for the study size are included. Survival analysis calculated by Kaplan Meier method, and student's T test and Mann-Whitney U test used to compare different types of data. The paper is clear and well explained as regards which analyses used for which interventions.

Subject Recruitment and criteria

Consecutive patients were recruited into the morbidly obese group. Controls were then found to match each case as closely as possible by Harris Hip Score. The authors admit that this was not always possible within their overall cohort of patients, and explain their reasoning behind any discrepancies in HHS. However, they do not fully describe in how many case-control pairs this alteration was needed, or indeed by how much the HHS varied between the two patients when the next worst HHS patient was chosen.

This study compared only primary cemented total hip arthroplasty, and used two hip systems – the charnley (DePuy) and Lubinus SPII (Waldemar Link gmbH) femoral components both used with cemented polyethelene acetabular components. Different femoral head sizes were used in the two systems. Patients from a single unit were studied, treated by eight different surgeons, using comparable methodology. Routine rehabilitation was used for all patients.

Follow up for the study was conducted by audit nurses at intervals. This was distinct from clinical follow up and rehabilitation.

Results

This study showed that both the non-morbidly obese and morbidly obese patients saw a significant benefit from their total hip joint replacement surgery. However it is highlighted that the morbidly obese group showed a statistically significantly lesser improvement in Harris Hip Score and SP36 compared with the slimmer patients.

The study also shows that there is no significant improvement in these outcome measures from 6 months post operatively. Between the pre-operative and 6 months post-operative assessments a significant improvement was seen in both groups, and this was maintained at 60 months. However at the 18 month point, a significant discrepancy was noted between the two groups; maintained to completion of this study, with the non morbidly obese group having better HHS and SF36 outcomes than the morbidly obese group, and the morbidly obese patients showed more

periacetabular radiolucency on radiographs taken at 5 years. Complications were reported at higher rates in the morbidly obese group across all types of complication.

Strengths

This is a clearly written paper which concisely outlines the methodology used by the authors to test their hypothesis. It addresses a growing concern within elective orthopaedic surgery, ie to quantify the excess risk of complications of this surgery in the morbidly obese; a growing proportion of the general population. By comparing pre and post operative hip scores, it also addresses the benefits of this surgery in the very overweight patient. The included tables and figures are clear and easy to interpret, and overall this paper gives a good insight into the experience of this unit in treating this group of patients. By matching their control cases carefully, the excess risks of surgery caused by diseases commonly seen in the obese such as coronary heart disease, diabetes etc were excuded from this study, as was the earlier onset of osteoarthritis in the obese. By including only those with morbid obesity, the likelihood of experiencing significant complications compared to the group with lower BMI was shown; an effect that was not seen in previous studies using the cutoff point of normal to overweight or obese patients (BMI over 25 or 30 as per NICE).

Limitations

The study had a relatively small sample size, which although giving power sufficient for the outcome measures given was not sufficient to allow the group to be further split to give for example the differential risks between men and women with morbid obesity undergoing this surgery. A five year follow up was long enough to have shown only five revisions, one following early dislocation and two for infection; it would be interesting to follow up these patients for a longer period to assess the longevity of these implants in the morbidly obese. As many patients claim preoperatively that their weight loss will be aided by joint replacement (by allowing them to return to exercise) it may be advantageous to assess the patient's BMI at post-operative assessments in addition to doing so preoperatively. Finally, the study used cemented implants of two designs only, and all hips were approached by the anterolateral method. It cannot be assumed therefore that these findings can be directly extrapolated to apply to patients undergoing an uncemented or hybrid arthroplasty, if a cemented implant is used of a different type, or if the posterior approach to the hip is used. This latter may be very important as 3 of the 5 described complications are of dislocation of the hip, the incidence of which is affected by the approach used. Therefore this could be a possible avenue for further study. The health economics of increased length of stay and of need for specialist equipment (such as hyperbaric ward beds, hoists and theatre tables) is also not addressed in this study, but remains an important consideration in the treatment of these patients, especially in the light of their lower improvement as reported here.

The association between clubfoot and developmental dysplasia of the hip.
DC. Perry, SM. Tawfiq. A Roche. R Shariff, NK Garg, LA James, J Sampath, CE Bruce
J Bone and Joint Surg [Br] 2010;92-B:1586-8.

Reviewers: Will Carlino and Matt Owen

Introduction
Clubfoot or congenital talipes equinovarus (CTEV) is a congenital deformity that can affect one or both feet. The affected foot has a fixed deformity of ankle equinus, heel varus, midfoot supination and forefoot adductus. Developmental dysplasia of the hip (DDH) addresses a range of pathology that encompasses mild acetabular dysplasia with a stable hip to more severe forms of dysplasia. This includes neonatal hip instability and established hip dysplasia with or without subluxation or dislocation. Both are of unknown aetiology.

Methods

Originality
This subject is contentious with large series studies difficult to perform. There are numerous published articles over the past decade either confirming or refuting a significant association between CTEV and DDH.

Aims and hypotheses
The aim of this study was to assess the incidence of DDH in infants with CTEV and whether or not any association is significant enough to justify a selective screening programme.

Ethics
There is no mention of ethical approval for the study.

Study type
This was an observational cohort study presenting level IV evidence data.

Preliminary statistics
The authors have used the chi-squared goodness of fit test and confidence intervals. A p-value of <0.05 was considered significant. However there is no hypothesis or null hypothesis stated. Moreover there is no power calculation included to verify the numbers required for statistical significance.

Subject recruitment
All cases of neonatal CTEV identified in a tertiary referral centre underwent routine clinical and ultrasound screening of the hip at six weeks of age. As in previous studies infants with neurological or muscular abnormalities or syndromic conditions were excluded.

Classification
The diagnosis of CTEV was made by a single observer and graded using the Pirani classification (0-10, 10 being worst). The Graf classification was used to assess the degree of hip dysplasia (Type I

being normal, type II normal or pathological dependent on age, III & IV always pathological). All infants with type II hips at 6 weeks were rescanned at 3 months.

Results

119 cases of idiopathic CTEV were screened for hip dysplasia, of these 81 were boys and 38 girls. The mean Pirani score was 5.02. There was an equal distribution in incidence of CTEV over the 6 year duration of the study. A chi-squared goodness of fit test supported this relationship (p=0.69). There were in total 7 infants requiring treatment with a pathological Graf II hip or greater, out of 119. The incidence of DDH requiring treatment in infants with CTEV was 5.9%. (95% CI 2.4-`12.1) There were more abnormal hips seen with bilateral CTEV but this failed to reach statistical significant

Discussion

The paper tries to address two separate issues, both as controversial as each other. Firstly is there a direct association between CTEV and DDH in individuals without neuromuscular syndromes, and secondly, if so should it be a risk factor included in a screening programme? This paper clearly comes down with a double positive in favour but no statistically significant results were obtained. Others have argued probably yes, but not enough to screen. Examination from a cost benefit viewpoint in todays climate would be interesting. This study averaged approximately 15 cases of CTEV per annum, with 1 child per year with DDH requiring treatment. It is recognised that the earlier DDH is diagnosed the less invasive the treatment modalities required. The paper clearly adds to the debate but does not define the answer.

Limitations

Single centre studies into conditions with a relatively low incidence often result in small cohorts making significant conclusions difficult to obtain. The observational nature of the study makes the level of evidence weaker with each diagnosis being made by a single observer. This can introduce systematic bias. The study would have benefited from multiple clinicians assessing the results of each patient before making a diagnosis to evaluate any intra-observer differences. The authors acknowledge the possibility that some of the patients with CTEV and DDH may have an as yet undiagnosed syndrome.

The current available literature contains no current consensus on the definition of pathological or ‘true’ DDH. It has therefore been suggested that some sonographic diagnoses of DDH may be unreliable. Indeed it has also been suggested that ultrasound may not be the optimal way in which to assess and diagnose DDH.

This is however a fascinating publication and lends valuable weight to the area of research into the association between CTEV and DDH. More work is undoubtedly required to carefully design a coherent definition of DDH and to exactly define the nature of the association between CTEV and DDH.

A comparison of hemiarthroplasty with total hip replacement for displaced intracapsular fracture of the femoral neck: a randomised controlled multicentre trial in patients aged 70 years and over.

MPJ. van den Bekerom, EF Hilverdink, IN. Sierevelt, EMBP Reuling, JM Schnater, H Bonke, JC Goslings, CN van Dijk, ELFB Raaymakers

J Bone Joint Surg [Br] 2010;92-B:1422-8.

Reviewers: Damian Clark & Marshall Sangster

Summary

Randomised control outcome study comparing THR vs Bipolar Hemi-arthroplasty in patients over 70yrs of age (please note exclusion criteria).

Originality and Design

There have been a number of papers comparing THR (total hip replacement) vs Hemi-arthroplasty/Bipolar including Blomfeldt et al JBJS 2007 who showed better function with THR without increasing complications in 120 elderly hip fracture patients. Keating JF et al also concluded that THR was a more effective treatment of hip fracture patients in their 2006 JBJS paper.

This paper has a greater number of patients than many of the other similar studies. Comparison in an over 70yrs cohort has also not previously been reported.

Study Design

Patients: Patients over the age of 70 with intra-capsular hip fractures. Patients must be free of metastatic disease and be able to consent, with an understanding of written Dutch. Exclusion criteria included dementia, hip arthritis and very poor mobility.

Intervention: Total hip replacement.
Comparator: Hemi-arthroplasty.
Primary Outcome: Harris hip score (HSS).
Secondary Outcome: Complication rate (ie Dislocation and suvivorship).

Introduction: The authors provide a succinct summary of the problem and the pertinent literature.

Method: The investigators randomised patients to receive either a THR or a hemiarthroplsty, the randomisation was performed by a unit detached from the operating surgeon using a computer randomisation program. This was an ‘open’ RCT, meaning that was no blinding of patients, surgeons or assessors. The sample size appears to have been well planned, when considering the power calculation for the five year follow up group the authors took into account the significant mortality rate. An interim analysis was performed to calculate the mortality rate and the power analysis adjusted. Surgery was performed by an undisclosed number of surgeons of varying grades. The femoral implants used were Weber Rotationsprosthese (SulzerAG, Winterthur, Switzerland) or a Müller Geradschaftprothese (Protek AG, Münsingen, Switzerland). The femoral implants then had either a bipolar hemiarthroplasty head or a 32mm head attached. The authors do not inform us what number of patients received which implant or if these were even spread between the study groups. The surgical approach used does varied between antero-lateral, posterior and

straight lateral. The posterior approach was used more often in THR than hemiarthroplasty (19% vs 4%).
Statistical analysis: Established statistical methods suitable to the problem at hand were used.

Results: The trial includes 252 patients in the final analysis, there were 29 exclusions, these are explained clearly. Of the 29 exclusions 11 were termed protocol violations, in these cases the patient received an operation different to that to which they were randomised, unfortunately we do not know which proportion of these patients were originally randomised to which group. These protocol violations should be considered as significant as they introduce a selection bias.
Of the 252 patients in the final analysis 115 received a THR and 137 received hemiarthroplasty. The one-year follow up included 99 patients in the THR group and 119 patients in the hemiarthroplsty group. The average HSS at one year was 76 in the THR group and 73 in the hemiarthroplasty group, there was no significant difference between these groups. At five year follow up there are 44 patients available in the THR group and 76 available in the hemiarthroplasty group, it is not clear if any patients were lost to follow up for any reason other than death. At five years there remained no significant difference between the HSS of each study group.
There were 81 general complications not pertaining directly to the hip joint, there was no significant difference between the two study groups. There were no dislocations in the hemiarthroplasty group but there were 8 in the THR group (p=0.002). The postero-lateral approach was performed more often in the THR group than the hemiarthroplasty group. When the patients with postero-lateral approach are removed from the figures there were only 3 dislocations, not statistically significant. In the hemiarthroplsty group 4% of patients required revision surgery whilst only 2% required this in the THR group.

Discussion and conclusions

The authors conclude that in the cohort patient group studied, management of displaced intra-capsular femoral neck fractures with a bipolar hemi-arthroplasty can provide long term results comparable to that of THR. The results produced by the group echoed that of a Cochrane review and contradict the findings of Baker.
Their results also showed no significant difference in postoperative complications as a group. However, there were a significantly higher number of dislocations in the THR group especially when inserted through a posterior approach.

Paper attributes

This was a well designed multicentre randomised control trial. A power analysis was performed to establish an adequate study size.
The research group also performed an intermediate review to ensure patient safety and compare results with other trials at that time.
A strict inclusion criteria, and five year follow up protocol with radiological and functional outcome.
The patient cohort was representative of the patient group which presents to UK trauma units.

Limitations

Bipolar hemi-arthroplasty compared to THR in this study is not commonly used in UK practice, and may represent different outcomes to uni-polar prosthesis.
The paper was presented as a randomised control study. The study was not blinded. There is some potential selection bias in the paper as the control group which we accept as the hemi-arthroplasty group is still subject to a number of variables including age, broad ASA grade and surgical approach.
A power analysis was performed by the group with an alpha level of 0.05 and a power of 90%, 83 patients would be required in each group. They increased the sample size to take into account the mortality rate. The secondary exclusions reduced the sample size by 29 from 281 to 252 before any results were reported on.
After an interim analysis which showed the mortality rate to be 41% they reduced the sample size to 140 patients per group. However, the mortality at 5yrs in the THR group was 62% with a final sample size of 44. The bipolar group had a 44% mortality rate at 5 years resulting in a sample size of 76, 7 patients short of their own power analysis.
The secondary exclusions and higher mortality rate therefore reduces the reliability of the statistics presented in the authors conclusions.
The authors commented on a raised dislocation rate in the THR group. We raise 2 concerns regarding this:
1) No power analysis was done to establish a sample size required to get reliable statistical analysis.
2) It is well reported that the posterior approach is associated with a greater risk of dislocation in THR for fracture management. We would suggest that if you remove the posterior approach group of THR dislocations then the dislocation risk may not be significantly different with the numbers the group report.

In the papers discussion the authors state their finding relate to patients who are in relatively good physical and mental condition. However, in table one, 15 patients were classified as ASA IV, which indicates a patient with severe systemic disease that is a constant threat to life.

The authors are not clear with their interpretation of the HHS results. They state that they have similar results to the Cochrane review in 2006 which showed better function with THR. This is in contradiction to their results which showed no statistical difference in HHS between the two groups.

Summary

This paper was chosen due to its relevance to hip fracture management in the 70 year old plus group. It is often a difficult decision whether to opt for a THR or simple hemi-arthroplasty especially with regard to costing.
Unfortunately despite this being a well designed study, the numbers and attention to detail have reduced the reliability of the statistics and is therefore unlikely to change practice.

Photographic measurement of the inclination of the acetabular component in total hip replacement using the posterior approach

JC Hill, D Gibson, R Pagoti and DE Beverland
J Bone Joint Surg [Br] 2010;92-B:1209-14.

Reviewers: Oliver Bradford, Deepu Bhaskar

Summary

Prospective single-surgeon case-series to compare intra-operative acetabular component inclination using photography to post-operative radiological inclination, in patients undergoing total hip replacement (THR) using the posterior approach

Originality and Design

The authors recognise other published work on the discrepancy between methods of describing and measuring acetabular orientation, but maintain originality in attempting to quantify the operative inclination through photographic measurement and its discrepancy with post-operative radiological inclination. Limitations of other methods of intra-operative assessment are discussed, including CT-based and computer-aided navigation. The influence of acetabular component inclination on dislocation and early wear is discussed, justifying the clinical relevance of the work.

Methods

Aims and Hypotheses

The primary aim of the study was clearly stated as use of photography to record and then measure the inclination angle achieved intra-operatively and compare to post-operative radiological inclination, in 60 patients undergoing THR using the posterior approach.

Although a formal hypothesis was not stated, the authors mention previous studies, and their own audit, which have shown discrepancy between intra-operative inclination, assessed by eye, and radiological inclination.

Though not stated as secondary aims the study also looked at difference between simulated intra-operative radiological (using photographs) and post-operative radiological inclination, the effect of fat depth at the level of the greater trochanter and the effect of placement of an inferior teardrop retractor to expose the transverse acetabular ligament on inclination values

Ethics

All patients included gave written consent for intra-operative photographs to be taken, but formal ethical approval was waived as the study was classed as an audit by the local research governance committee.

Study type/level of evidence

This was a single-surgeon prospective case-series study presenting level IV evidence.

Preliminary Statistics

The authors describe inter-observer reliability for radiographic measurements, but no correlation analysis is presented. Repeated measures analysis of variance (ANOVA) was used to compare the differences between operative, simulated radiological and post-operative radiological

measurements. Mean values and ranges were presented for inclination values. Mean difference between photographs with and without inferior retractor in position were presented with standard deviation values. Fat depth at the level of the greater trochanter was presented as a mean value with ranges stated.

Subject recruitment and criteria

60 patients undergoing THR were included in the results, with 7 patients excluded due to inadequate quality of photographs. No reason is given as to the cause of inadequate photographs. Apart from gaining written consent for photographs to be taken, there was no information regarding subject recruitment, with no dates given as to when data was collected, whether patients were consecutive, the laterality of the surgery, and whether all operations were primary.

Interventions

All patients underwent a standardised peri-operative set-up and procedure, using the senior author's standard technique. Positioning of the patient was described, but no description of the type or position of supports was given. Description of referencing for acetabular version was given. Fat depth was the only variable measured for all patients and was measured from the lateral surface of the greater trochanter to the skin, but it was not specified if skin referencing was from the anterior or posterior wound edge. Nor was there an explanation as to why the authors thought that it was important to collect this. Presumably the authors may have felt that it could potentially explain any discrepancies in their findings, but did not state it as one of the study aims.

A detailed description of set-up and execution of intra-operative photographic sequencing was included, allowing reproduction of the method, and explaining calculation of photographic operative and simulated radiological inclination of the acetabular component, whether patient position had changed during surgery, and to document acetabular anteversion. The latter measurement was not formally measured, and no results are presented for this. 10 of the 60 patients were also photographed in the same manner, but with the inferior teardrop retractor removed, to assess any effect of the retractor on resultant acetabular component inclination.

Initial validation of the photographic sequencing, to attempt to quantify error produced by mal-positioning of the camera was described.

Results

The initial validation of the photographic sequencing of the model showed small changes in measured angles of inclination occurred with camera mal-positioning. **However we feel that it should be taken into account that, for each of the five positions of camera 3 it would result in a different position for camera 4 and thus for validation would require not five but 25 different positions of camera 4.**

Differences were demonstrated between mean values for operative (33.9°, range 27.0°-41.4°), simulated radiological (40.0°, range 30.9°-48.1°) and post-operative radiological (46.9°, range 29.0°-59.0°) inclination, which showed statistical significance ($p<0.001$).
Mean difference for simulated radiological inclination with the inferior teardrop retractor either in place or removed was 1.05° (SD 0.51), and for operative inclination was 1.18° (SD 0.49). No further statistical analysis was provided. The mean fat depth was 2.84cm (range 0.5cm-6.1cm).
In 6 patients, simulated intra-operative radiological inclination was similar to, or greater than the post-operative radiological inclination. Sub-analysis of these patients demonstrated a greater mean fat depth of 4.17cm (range 2.5cm-6.2cm), but no statistical analysis was performed to quantify significance of this difference.

Discussion

The authors identified six cases which went against the general trend that the radiological inclination was greater than the simulated radiological inclination, which in turn was greater than the operative inclination. In these cases the intra-operative radiological inclination was almost the same as or greater than the post-operative radiological inclination, by up to 4.0 degrees. It is postulated that the fat depth is the reason as the acetabular inserter impinges against the wound edge to increase the inclination in the intra operative measures. However, fat depth as explanation of discrepancy in finding is not convincing, as it would caused an increase, not just in the intra-operative measurements, but a corresponding increase in the radiological inclination as well, which does not seem to be the case. In conflict with this statement, the average operative inclination in these six patients was only 32.9 degrees (which in fact is less than the overall average of 33.9 degrees).
The authors try to explain why the simulated radiological and the radiological inclination should be different. They hypothesise that this may be caused by the inferior teardrop retractor moved the pelvis within the soft tissue envelop. However measurements in patients with this retractor removed disproved the point. This leads the authors to theorise that the lateral position leads to adduction of the uppermost pelvis which leads to a more open position of the cup when the patient is back in supine position.
While this is a plausible explanation we also feel that an important contributing factor could be that the photographs were centred on the trochanter while the x rays (to be able to measure inclination by the tear drop method) would have been centred on the pelvis.

The authors state that their findings are consistent with those of previous papers and with mathematical prediction that the operative inclination would be less than the radiological inclination. However there is concern that in 34% (17 patients) the radiological inclination was greater than 50 degrees, with it being greater than 55 degrees in 10% (5 Patients), even though the average operative inclination in these patients was only 37.3 degrees.

While these remain legitimate concerns, we feel that in the absence of information regarding angle of anteversion which is the major contributing factor to discrepancy between operative and radiological measurements in these patients and standardisation of x rays, this finding would warrant further investigation into the contribution of anteversion to this finding.

Finally the operative inclination achieved by the senior author when aiming for 40° was on average 33.9° and even this resulted in 34% of patients with radiological inclination above 50° and therefore there has been change of the senior author's practice in that he now aims for an operative inclination of 35°.

Strengths

(1) The paper comes from a well recognised senior author who produced the publication on use of transverse acetabular ligament to control acetabular depth, height and version and as a result reduce dislocation rates following THR.

Operative determination of the Inclination of the cup would be the logical next step in the process and this paper would be eagerly followed by practitioners.

(2) Excellent discussion of previous papers relevant to the present study.

(3) Innovative technique in which a visual representation of acetabular cup insertion angle using photographs, as happens intra operatively, is correlated to the post operative radiograph

(4) Raises awareness of the importance of patient positioning in THR from the inclination point of view rather than version.

(5) Sound and reproducible methodology applied in capturing the photographs to reproduce simulated radiographic and operative inclination.

(6) Attempt at validation of this new technique to measure angles intra-operatively.

(7) Aberrant readings were identified and attempts made to logically explain a cause, by measurement of fat thickness.

(8) Surprisingly high number of patients with high inclination in spite of low operative inclination and therefore identified the requirement of further investigation into pelvic position during surgery.

(9) Most importantly points out that patient positioning resulting in an adducted pelvis can result in significant increase in radiological inclination in up to a third of the patients undergoing THR.

(10) Clinically significant messages - Surgeon aiming for 40 degree inclination can end up with operative inclination anywhere between 27 to 41 degrees averaging 33.9 degrees, but post-operative radiological inclination in a third of these patients may be greater than 50 degrees despite this.

Limitations

(1) It is well recognised that acetabular anteversion is a cause of discrepancy between the operative, anatomical and radiological inclinations. The authors recognise this fact; however, they fail to measure the anteversion of these patients. This leaves them open to the criticism that all discrepancies in the study could potentially be explained by anteversion as the confounding factor and by 'outliers' with extremes of anteversion. The Authors mention that they have recorded acetabular version, 'for a visual record' – but unfortunately did not use it in this study.

(2) 'Fat Depth' was the only variable collected prospectively in this group of patients and is not convincing as a cause of discrepant findings in the six patients described. Fat depth range for the whole group is 0.5cm to 6.1cm. Included within the 'whole group' are the 6 abnormal data and the quoted upper range is 6.2cm.

(3) Demographic variables and potential influences of the cup positioning have not been provided, for example gender, age, BMI, incision length or laterality of operation. Thus we are unable to determine whether this cohort is similar to our patient group, and whether these variables influence inclination, from this study.

(4) Also, no mention of what dates the operations occurred between, and whether patients were consecutive, which would be more likely to yield consistent results through regular repetition of study protocol; how subjects were recruited; and whether all operations were primary (implied but not stated).

(5) Each radiograph was measured by two authors to ensure inter-observer reliability but no results to confirm adequate correlation was described. As photographic measurement is the new concept introduced in this paper, absence of reliability data for this, in particular, is sub-optimal. There is also no mention as to whether the radiographs were standardised. This may affect outcomes as the difference between photograph centred on trochanter and x ray centred on the pelvis may explain the difference between the simulated radiographic and the actual radiographic inclination.

(6) Regarding set-up for photographic protocols for both validation model and patients, there was a discrepancy between photographic sequences used, impairing the validation. Patient and model positions were deemed not to have changed, but no description of landmarks used was offered, and no 'positional' photographs were taken for the validation model. There was also no mention of type of supports used to stabilise the pelvis, which reduces comparison to reader's populations, and may influence the results obtained.

(7) No explanation is given as to why 7 patients excluded from the study had inadequate photographs. This would be helpful to further understand photographic methodology, and allow readers the knowledge of potential difficulties should they wish to reproduce the study themselves.

(8) The graph displaying the results could be clearer, with extrapolation of the x-axis making the overall trends for the three inclination measures more appreciable.

(9) Previous paper by Beverland as senior author describes orienting acetabular inclination with reference to the post labrum**.** Its needs clarification whether this method was used as a guide to inclination or whether it was purely eyeballing by the surgeon that was used in this study to achieve the targeted 40 degrees. Also needs clarification whether the use of alignment guides would help achieve the targeted inclination better.

(10) Further statistics to correlate fat depth to inclination, could have elucidated its influence.

Conclusion

A well-considered paper that introduces an innovative technique using photographs to record the surgeons' intra-operative judgement of acetabular inclination and measuring it against post operative radiographs. The paper postulates that surgeons tend to overestimate operative inclination.

Introduces the concept of pelvic adduction in the lateral position, secondary to adduction of the limb, as explanation of increase in post operative radiological inclination in excess of that mathematically predicted.

Falls short in not providing data on anteversion and standardisation of x rays which could potentially have conclusively proven the point.