



Journal Club: 29 July 2013

Chairman: Mr Harvey Sandhu

Organiser: Mr Karadi H Sunil Kumar

Royal United Hospital, Bath

Papers presented

- 1. Does circumpatellar electrocautery improve the outcome after total knee replacement? : A prospective, randomised, blinded controlled trial.**
Baliga S, McNair CJ, Barnett KJ, MacLeod J, Humphry RW, Finlayson D.
J Bone Joint Surg Br. 2012 Sep;94(9):1228-33.
- 2. The Treatment of severe slipped capital femoral epiphysis via the Ganz surgical dislocation and anatomical reduction.**
Madan SS, Cooper AP, Davies AG, Fernandes JA.
Bone Joint J. 2013 Mar;95-B(3):424-9.
- 3. Primary total hip replacement with a Furlong fully hydroxyapatite-coated titanium alloy femoral component. Results at a minimum follow-up of 20 years**
N. Sandiford; C. Doctor; S. S. Rajaratnam; S. Ahmed; D. J. East; K. Miles; A. Butler-Manuel; and J. A. N. Shepperd.
Bone Joint J April 2013 vol. 95-B no. 4 467-471
- 4. Inadequate 'three point' proximal fixation predicts failure of the Gamma nail**
Abrams SGF, Pollard TCB, Andrade AJMD.
Bone Joint J 2013;95-B: 825-830.

Reviews

Baliga S, McNair CJ, Barnett KJ, MacLeod J, Humphry RW, Finlayson D. Does circumpatellar electrocautery improve the outcome after total knee replacement? : A prospective, randomised, blinded controlled trial. *J Bone Joint Surg [Br]* 2012;94:1228-33.

Reviewers: Mr Richard Barksfield & Miss Sabina Barbur

Introduction

Total knee replacement (TKR) is one of the most commonly performed orthopaedic procedures. 79,516 primary knee replacements were registered with the National Joint Registry in 2011. A

number of studies have demonstrated significant improvements in patient reported outcome measures following TKR however, it is well recognised that whilst overall pain scores improve, anterior knee pain can persist in up to 49% of patients. The patellofemoral joint is obviously implicated in any patient reporting anterior knee pain and much of the debate has focused on primary patella resurfacing. A number of systematic reviews and meta-analyses have shown that whilst patella resurfacing for TKR does reduce re-operation procedures, patella resurfacing does not seem to affect patient reported anterior knee pain post-operatively.

We were interested in reviewing this paper as it addresses an alternative surgical strategy intended to reduce anterior knee pain following TKR by denervating the patella using electrocautery. Patella denervation has been well described in the literature but has contrasting results thus this study sought to evaluate the effect of patella electrocautery on the pain and function of patients undergoing TKR.

Methods

Originality

This was not an original study. The authors did recognise this by citing techniques of thermal treatment to peripatellar soft tissues to reduce patellofemoral joint pain a retrospective cohort study (Vega, Golano and Perez-Carro et al 2006). In addition, two randomized controlled studies of circumpatellar electrocautery in non-resurfacing knee replacement had been published previously (van Jonbergen et al. 2011 and Altay et al. 2012) with varying results.

Ethics

The authors state that the study had ethical approval although no further details are provided.

Aims

The study had a clear aim to investigate the effect of intra-operative electrocautery on pain and function following primary TKR without patella resurfacing.

Study Type / Level of Evidence

Randomised controlled trial (Double blinded): Level of Evidence 1b

Study Design

The study was conducted at a single centre between 2007 and 2009 with all patients undergoing primary TKR considered for enrollment. 394 patients were considered eligible, although 194 were excluded either due to lead author being unavailable for consent or due to the patient declining to participate. 200 patients were therefore randomized to two groups, the intervention group receiving intra-operative circumpatellar electrocautery and the control group undergoing routine TKR without circumpatellar electrocautery. 15 patients did not attend for follow-up leaving 94 patients in the control group and 91 in the electrocautery group for analysis.

Two knee implants were used in the study and this was dependent on surgeon preference. TKR was performed through a standard medial parapatellar approach. The patellar was debrided as necessary in all cases but electrocautery performed only on those randomized to receiving the intervention using a standardised technique. It is of note that lateral patellar release was performed

where necessary although the incidence of this is not reported. Patients, assessors and data analysts were blinded to the intervention until the end of the study.

Primary outcome measures were changes in Oxford Knee Score (OKS) (questions 7&12- kneel & walk down stairs) and a visual analogue scale (VAS) (0- no pain , 10 severe pain) for anterior knee pain at 1 year post-operatively with secondary endpoints for the same measures at 3 and 6 months.

Statistical Analysis

The authors state that a power calculation was performed prior to commencement of the study, however this was lost. Several *post-hoc* power calculations were performed and suggested that the study was adequately powered to demonstrate a clinically relevant difference in both VAS and OKS between groups. Appropriate statistical tests were applied to parametric and non-parametric data and a logistic regression model built to factor in covariate effects on VAS and OKS.

Results

There was no statistical difference in either improvement of OKS or absolute OKS between either the electrocautery or control groups at any time period post-operatively. Repeated measures analysis of variance (ANOVA) scores had no significant statistical effect when incorporating time, age and gender. Interestingly there was a difference in OKS between those patients receiving Low Contact Stress (Depuy) and Kinemax (Zimmer) implants (LCS scoring 1.69 points lower than the Kinemax, $p=0.045$). Anterior knee pain VAS was consistently higher in the control group pre-operatively, three, six and twelve months post-operatively, however, when change in VAS was considered between groups, there was no significant difference at any time.

Further logistic regression modeling found the strongest predictor of post-operative anterior knee pain at 12 months to be the presence of anterior knee pain pre-operatively, while the use of electrocautery had poor predictive value. It is also important to note that the addition of implant manufacturer to this model did not alter these effects. It is also important to note that the addition of implant manufacturer to a logistic regression model had no effect on statistical significance.

Discussion

Strengths

- Prospective randomized controlled trial
- Patients, assessors and analysts blinded to treatment groups
- The paper has a clear aim and research question to which it provides an answer
- Ad-hoc power calculations demonstrate study was adequately powered to accept null hypothesis.
- The question is relevant to current clinical practice
- Multiple contributing surgeons and different knee implants used improve generalizability of results to other units
- Statistical analysis was supervised by statistician
- Clear flow diagram detailing patient enrolments

Weaknesses

- A large number of exclusions at the outset of the study due to lead clinician being unavailable for consent.
- This is a study investigating patellofemoral pain, but did not use a specific patellofemoral joint score such as the Kujalla score
- Seven patients underwent lateral release but further details are not presented – obviously this may affect perceived anterior knee pain post-operatively
- Loss of pre-study power calculation necessitating post-hoc calculations
- Not all VAS raw data was presented which would have been informative
- Patella resurfacing was mentioned only once in the introduction and not actually referred to in the surgical technique although we assume it was not undertaken in any patient

Summary

This study has prospectively evaluated the use of circumpatellar electrocautery in primary total knee replacement and demonstrated no benefit in improving either VAS for anterior knee pain or OKS up to 1 year post-operatively.

Madan SS, Cooper AP, Davies AG, Fernandes JA. The Treatment of severe slipped capital femoral epiphysis via the Ganz surgical dislocation and anatomical reduction. *Bone Joint J* 2013;95-B:424-9.

Reviewers: Mr Simon Bennet and Mr Gray Edwards

Study Background

This study from the Sheffield Children's Hospital presents the results of the modified Dunn procedure combined with a Ganz surgical dislocation in the treatment of severe SCFE performed between 2004 and 2010.

Aims

Clearly stated as assessing the rate of complications, degree of reduction, radiological changes, hip range of movement and functional outcome following this procedure.

Methods

A prospective cohort study which enrolled consecutive patients who had slips of >50°. There was a mixture of stable and unstable slips, closed and open physes and some patients already had slips pinned in situ at other hospitals. Patients were not excluded if they had pre-existing AVN. Ethical approval was obtained and informed consent given by parents. Effort was made pre-operatively to evaluate for the presence of AVN in unstable hips using MRI +/- bone scanning.

This was a single surgeon series. Each patient underwent a surgical dislocation as described by Ganz (trochanteric flip osteotomy) followed by capital realignment by means of a modified Dunn procedure and fixation with two 6.5mm cannulated screws.

Patients were reviewed at 6 and 12 weeks then at 6 monthly intervals until 2 years post-operatively. Modified Harris Hip Scores, Non-arthritic hip scores and hip osteoarthritis outcome scores were

collected. X-rays were assessed for the presence of AVN, non-union, chondrolysis and the quality of reduction. Range of movement was also documented.

Results

28 patients were included with a mean follow up of 38.6 months (minimum 24 months). Only 1 patient was lost to follow up, but data at 36 months post-op was available. Statistically significant improvements in all hip scores were found, with scores continuing to rise with each subsequent review.

Complications and additional procedures were discussed in detail. 4 patients developed AVN- 2 had this confirmed pre-operatively on bone scan and 2 developed AVN post-operatively, all of these were unstable slips. The quoted AVN rate was therefore 2/28 (7.1%). No patients developed an infection, DVT or nerve palsy, implant failure or non-union. Data is clearly presented and easy to correlate with the results shown in the tables.

Conclusions

In severe SCFE the slip can be safely reduced and fixed restoring the normal head neck relationship leading to good or excellent functional outcomes with low rates of complications.

Critique

Relevance

The optimum management of severe slipped capital femoral epiphysis (SCFE) remains unclear. The authors present evidence from the literature suggesting that impingement may occur following pinning in situ as a result of a persisting abnormal head-neck offset leading to cartilage damage and early osteoarthritis. Furthermore, traditional osteotomies around the femoral neck have reported high rates of AVN.

Strengths

- A prospective, protocol driven study with clearly stated aims, a well-defined study population and excellent follow up.
- Patients were assessed for the presence of AVN pre-operatively so as not to attribute the development of AVN to the procedure under investigation.
- A range of functional patient reported outcome scores were used that were relevant to the study population.
- Complications and additional procedures were openly stated.

Limitations

- A technically demanding procedure that many surgeons may not be trained to perform
- No good quality evidence that this procedure leads to superior long term outcome when compared to pinning in situ (followed by remodeling)
- Overall relatively small numbers and a relatively heterogenous group of patients- some stable slips, some unstable, some patients already surgically stabilized and some patients had closed physes.

Review Summary

The authors of this study should be congratulated for carrying out a very well designed study. The number of patients is comparable with other series (27 from a 5 surgeon series from the USA, JBJS Am, 2013 and 40 from 2 institutions in Switzerland, Clin orthop relat research, 2009).

They have shown that this can be a safe procedure with low rate of complications, including AVN. What remains to be seen is if this treatment approach will provide prevent degenerative changes secondary to femoroacetabular impingement in the future.

Orthopaedic surgeons who look after children with severe SCFE should consider discussing the case with their regional paediatric centre in light of these results.

Sandiford N, Doctor C, Rajaratnam SS, et al. Primary total hip replacement with a Furlong fully hydroxyapatite-coated titanium alloy femoral component. Results at a minimum follow-up of 20 years. *Bone Joint J* 2013;95-B:467-471.

Reviewers: Mr K H Sunil Kumar & Dr Katie Williams

Introduction

The total number of primary hip replacement procedures undertaken in the UK in 2011 was 71 672, according to the NJR 2012 report. Of these 36% were cemented THRs and 41% were cementless total hip arthroplasties. There has been a gradual increase in the use of cementless prosthesis from 22% in 2005 to 41% in 2011 and hybrid prosthesis from 12% in 2005 to 17% in 2011. The average age of the patient undergoing cementless total hip arthroplasty in 65.4 years (IQR 58.8 - 73.3) compared to 72.8 years (IQR 67.2 - 79.5) for cemented prosthesis. More than half of the patients below 70 years of age are getting cementless prosthesis. There were 33724 cementless femoral stems were inserted in 2011 compared to 4461 in 2003. The use of Furlong HAC stem has declined from just above 30% in 2003 to above 10% in 2011.

There are various cementless stem currently in use. We are interested in this article as it presents the long-term results of one of the common cementless stems in use in the UK.

Ethics

No mention of ethical approval of the study.

Aims

This study reports the long-term outcome of fully HA coated femoral component at a minimum of 20 years.

Study Type / Level of Evidence

Case series/ Level 4

Study Design

This is was a prospective study performed at a single centre. It included 72 primary total hip arthroplasty performed, performed by the senior author or directly under his supervision, using

Furlong femoral component between 1986 and 1991. These 72 procedures were performed on 60 patients, 45 female and 15 male. The mean age at final follow up was 82.9 years (70 to 100).

All procedures were performed via Watson-Jones approach, three doses of prophylactic antibiotics were given and allowed to fully weight bear on first post-operative day. The Furlong femoral component (titanium alloy) with a collar and 12/14 morse taper with a modular 32mm ceramic head was used in all patients. 59 hips had cemented ultra-high molecular weight polyethylene (UHMWPE) acetabular component and 13 hips had HA coated acetabular shell with UHMWPE liner.

Clinical and radiological follow up was performed at regular intervals in the first year and annually thereafter. Clinical outcome was assessed with Merle d'Aubigne and Postal (MDP) score and visual analogue scale (VAS). Anteroposterior and lateral radiographs of the pelvis and operated hip were obtained at follow up and assessed for changes in the position of the components and evidence of osseointegration or loosening of the prosthesis.

Statistical analysis was performed using student t-test with a significance level of $p < 0.05$. survival analysis was performed using Kaplan-Meier method.

Results

The mean duration of follow up was 22.5 years (20 to 25 years). All patients reported excellent pain relief at the last follow-up. There was no statistically significant difference between MDP scores at 10 and 17 years, and 17 and 22.5 years. 17 patients had died at final review beyond 20 years. Seven patients underwent revision surgery – 6 for acetabular component loosening and one both-component revision associated with deep infection. There were no cases of aseptic loosening of femoral stem.

Overall survival of femoral component at 22.5 years was 98%. Survival with aseptic loosening as endpoint was 100%.

Strengths

- Long-term study
- Previously published results of the same cohort of patients
- Single surgeon and single center
- Regular follow-up – clinical and radiological
- Validated scoring system
- Reviewed clinical records, contacted GPs for information

Weakness

- Case series – no comparable cohort of cemented femoral stems
- The unit performs a high volume of uncemented hip replacements and including only 72 patients in the study raises the question of whether there has been any exclusions leading to selection bias
- 17 patients had died at last follow-up

Abrams SGF, Pollard TCB, Andrade AJMD. Inadequate 'three point' proximal fixation predicts failure of the Gamma nail. *Bone Joint J* 2013;95-B: 825-830.

Reviewers: Mr Peter W Robinson and Mr Greg Pickering

Introduction

The large burden of hip fractures in terms of numbers (70,000 patients) and finance (£2 billion) per year is mentioned. The authors highlight the further increased mortality, morbidity and financial burden associated with surgical failure (£10,000). 39% of hip fractures are peri-trochanteric and treated with sliding hip screws or cephalo-medullary implants. Although cephalo-medullary implants have a biomechanical advantage in unstable fractures there is a higher complication rate. Previous studies have shown the importance of adequate tip-apex distance (TAD) for both devices enabling adequate '2 point' fixation between head and shaft. The concept of '3 point' proximal fixation is discussed. The 3 points are the cortical contact point of the lag screw in the lateral femoral cortex, the cortical contact point of the nail (or end-cap) at the greater trochanteric cortex and the TAD of the lag screw. This concept is a design feature of the Gamma nail (Stryker) as detailed in the product literature, but not proven clinically.

Study Question

A null hypothesis is clearly stated: Given the known importance of the TAD, the other 2 points of fixation would have no importance in predicting mechanical failure (as seen with radiological analysis).

Methods

Patients: This was a retrospective cohort study of 299 patients with a Gamma nail between 2006-2010. Exclusion criteria included inadequate radiographs (20); prophylactic nails (19); death < 30 days (14); not a peritrochanteric fracture (9); pathological fractures (8); periprosthetic fractures (6). Therefore 223 patients were included (61 males and 162 females). 180 long nails and 43 short nails. Post-operative management involved partial weight bearing until 6 weeks.

Analysis: Pre- and intra-operative radiographs were reviewed. Fractures graded by single surgeon using modified system of Evans (1-5) and quality of reduction graded as poor, acceptable or good as described by Baumgaertner *et al.* A separate observer assessed the 3 points of fixation as binary outcomes: satisfactory or not. TAD was satisfactory if <25mm. Lateral femoral cortex position was satisfactory if the screw was in contact or protruding from the lateral femoral cortex. The position of the proximal end of the nail or end cap was satisfactory if it was in contact or protruding beyond the cortex of the greater trochanter (GT).

Mechanical failure was the end point assessed. This was identified either from the final clinical assessment of patients still being followed up (with on-going problems) or in those referred back to the unit with problems (pain or complications). They aim to follow up all patients at 6 weeks and discharge at that stage if mobile and pain free. Mechanical failure identified by loss of fracture reduction with migration of the lag screw leading to cut out; nail subsidence shown by distal locking bolt fracture; nail fracture representing fatigue failure due to non-union. Other complications such as deep infection were not included.

Statistics: An independent statistician was used. First univariate logistic regression analysis was performed to assess for confounding factors (age, gender, fracture classification, reduction quality and implant type). Any factor found to be associated with mechanical failure with $p < 0.2$ was included and adjusted for in the multivariate regression analysis (fracture classification and reduction quality). Each of the 3 points of fixation was put into the model individually and together and their association with mechanical failure reported as odds ratios (OR). $P < 0.05$ was used to identify statistical significance of effect on mechanical failure. Intra-observer repeatability and inter-observer reproducibility was assessed and kappa values calculated showing good association.

Results

The mean follow-up was 290 days (44-1834). 16 failures identified at a mean 15.6 weeks (2-70). These included 12 failures of fixation, 3 nail fractures and 1 nail subsidence. Of particular note out of 42 short gamma nails there were 7 late distal femoral fractures and their unit stopped using short gamma nails in 2008 due to increased complications. These fractures were not excluded or included as mechanical failures because they had all united proximally.

The main findings were as follows:

13.9% (31 nails) the lag screw was short of the lateral femoral cortex

25.8% (n=8) failed OR 7.53 ($p < 0.001$)

22.4% (50 nails) TAD > 25 mm

18.0% (n=9) failed OR 6.86 ($p = 0.001$)

13.0% (29 nails) the top of the nail (or end cap) was short of the GT cortex

6.9% (n=2) failed OR 1.09 ($p = 0.92$) – no significant association seen.

After adjustment for TAD and short lag screw at lateral cortex each in turn, both were found to be independently associated with fixation failure. TAD > 25 mm OR 9.44 ($p = 0.0001$) and short lag screw at lateral femoral cortex OR 10.84 ($p < 0.001$). The findings suggest that adequate TAD and lateral femoral cortex contact are more important than the number of points of fixation achieved.

Other important findings

Evans fracture classification – tendency to increasing failure rate with increased Evans grade (0% in type 1, 10.5% in type 5. OR 1.53, $p = 0.06$). Therefore fracture classification corrected for in the multivariate analysis.

Grade 3 & 4: 7 failures – 6/7 had inadequate TAD

Evans 5: 8 failures – 7/8 inadequate lateral cortex

Quality of fracture reduction – tendency to increasing failure rate with poorer reduction (3.8% with good reduction, 9.5% poor reduction. OR 1.73, $p = 0.19$). Therefore quality of fracture reduction corrected for in the multivariate analysis.

Number of adequate points of fixation – tendency to increasing failure rate with fewer adequate points of reduction (3/3 – 0.8%, 0/3 – 100%)

When all 3 points of fixation were adequate the failure rate was $< 1\%$.

Discussion

The authors report that their TAD findings agree with previous studies. They discuss potential reasons for the lack of significance of the nail position relative to the GT, which may include

measurement bias due to the radiological projection. This might increase the number of false positives for inadequacy, thus lowering the failure rate at this point. Of note out of 16 failures only 2 had inadequate fixation at the GT, so the numbers here are very small.

The authors comment on the originality of their work by emphasising that there have been no biomechanical or clinical studies previously investigating the '3 point' proximal fixation principle, although previous work mostly with comparison to sliding hip screws has concentrated on the different lever arms on the fracture, cut out from the head, stress shielding at the calcar and dynamic sliding of the lag screw.

The authors suggest that Evans type 3 and 4 are most likely to have failure predicted by the TAD as seen by 6/7 failures with inadequate TAD (type 3 lateral cortex intact and type 4 lateral cortex not in continuity with the head fragment. However type 5 the lateral cortex is likely to be in continuity with the head and therefore lateral cortex lag screw contact is likely to predict failure (seen by 7/8 type 5 failures having an inadequate lateral cortex lag screw fixation).

Strengths

- Large cohort study (223 consecutive patients included) with good follow up period (mean 290 days)
- Clear and reasonable exclusion criteria, shown with good flow diagram
- Multivariate regression analysis correcting for significant confounding factors
- Measurement reliability and reproducibility checked and good.
- Appropriate statistical analysis with odds ratios
- Clear presentation of results with sensible discussion

Limitations

- This unit treats all extracapsular fractures with cephalo-medullary devices, including stable fracture patterns. This will likely explain the low failure rates seen. However they do show a good spread across the 5 different Evans grades. There is no subgroup analysis of unstable fractures because the numbers did not reach significance. This may make the results not as relevant to units using a sliding hip screw for stable fractures, who only use cephalo-medullary devices for unstable patterns.
- Small numbers of actual failures analysed (n=16, although significance still reached)
- Unable to account for grade of operating surgeon – acknowledged in paper.
- It is not clear why the modified Evans classification is used and this could have been usefully explained with a diagram
- Mechanism of injury not mentioned – although assumption that as >90% were over 60 yrs the majority were likely to be low energy fragility fractures – discussed in paper.
- Follow up was not to radiological union in all patients, however this pragmatic approach is taken by most units. It is not clear if all patients were assessed at 6 weeks and how many were followed up for longer.
- Assumption made that any patient with problem would be referred back – this may miss some failures. This is justified because the population is likely to be non-migratory, however the cohort covers a large age range and clearly some patients may have moved area and therefore be lost.

- Different implants (short and long nails) were used, however univariate logistic regression analysis found no significant association with failure rate.
- All patients were kept partial weight bearing until 6 weeks. This is different from our unit and the NICE guidelines for management of fragility hip fractures. This could underestimate the rate of failure.

Conclusion

This is a well-designed paper with a clear study question. It has provided new information showing the importance of both adequate TAD and lag screw lateral femoral cortex contact in predicting mechanical failure of proximal fixation with the Gamma nail. Although further work is needed to assess how applicable this is to other cephalo-medullary devices it provides some further intra-operative guidance to aim for.