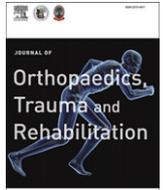




Contents lists available at ScienceDirect

# Journal of Orthopaedics, Trauma and Rehabilitation

Journal homepages: [www.e-jotr.com](http://www.e-jotr.com) & [www.ejotr.org](http://www.ejotr.org)



## Original Article

### A Comparative Study of the Postoperative Morbidity and Mortality in Femoral Neck Fractures in Elderly Patients Treated With Cemented and Uncemented Thompson Hemiarthroplasty

在年老病人患有股頸骨折，於應用骨水泥和沒有應用骨水泥鞏固的湯普森(Thompson)半髖關節置換術的療治中，其手術後的發病率和死亡率之一個比較研究。

Kankanala Gowtham, Shivarathre Deepak Gubbi\*, Pidikiti Prasad

Department of Trauma and Orthopaedics, St Helens & Knowsley Teaching Hospitals NHS Trust, Warrington Road, Prescot, Merseyside, United Kingdom

#### ARTICLE INFO

Article history:  
Accepted July 2010

Keywords:  
cemented  
hemiarthroplasty  
mortality  
Thompson

#### ABSTRACT

**Background:** Thompson hip hemiarthroplasty is a well-established procedure for the treatment of displaced intracapsular fracture neck of femur in the elderly. However, considerable debate exists regarding the use of cemented prosthesis in this elderly group of patients. The main purpose of our study was to analyse the outcomes following cemented and uncemented Thompson hemiarthroplasty of the hip with particular reference to cement-related morbidity and 30-day mortality.

**Methods:** Of the 110 patients who underwent Thompson hemiarthroplasty for intracapsular hip fracture, 30 (27.3%) had cemented and 80 (72.7%) had uncemented prosthesis. The mean age was 83.2 years with 87 female patients. The thigh pain and mobility at discharge, the inpatient complications and the 30-day mortality rates were compared between the cemented and uncemented groups.

**Results:** The study revealed no statistically significant differences in any of the postoperative outcome measures between the two groups.

**Conclusion:** Cemented and uncemented Thompson hip hemiarthroplasty have similar outcomes at discharge. Patients who underwent cementation without pressurisation did not show any higher incidence of bone cement implantation syndrome compared to their uncemented counterparts. Uncemented Thompson hemiarthroplasty can be an option in patients with very poor cardiopulmonary reserve without any significant complications in the short term.

#### 中文摘要

**背景:** 湯普森半髖關節置換術在老年病人的移位性囊內股頸骨折是一個已為大家接受治療方案。可是在應用骨水泥鞏固植入物上仍然有很大爭論，我們的研究之主要目的是分析應用骨水泥和不應用骨水泥的湯普森半髖關節的骨水泥關聯之發病率和30天死亡率。

**方法:** 在110位病人患有囊內股頸骨折以湯普森半髖關節置換術治療中，30(27.3%)人有應用骨水泥和80(72.7%)人沒有應用骨水泥鞏固植入物的兩個組別。總平均的年齡是83.2歲，其中87位是女病人。隨訪並比較兩組手術後住院時的大腿痛，活動能力和併發症包括30天的死亡率。

**結果:** 研究顯示兩組手術後的結果，沒有顯著的統計學上差別。

**結論:** 基於我們的研究結果，使用骨水泥鞏固湯普森半髖關節植入物和不使用骨水泥的結果相約。應用沒有加壓的骨水泥鞏固湯普森半髖關節植入物時，其骨水泥關聯的併發症發生率沒有增加。所以沒有加壓的骨水泥鞏固湯普森半髖關節植入物在一些病人術前的活動能力及心肺功能儲備不良時是一個選擇，其短期的發病率和死亡率很低。

\* Corresponding author. E-mail: [drdee\\_80@yahoo.co.uk](mailto:drdee_80@yahoo.co.uk).

## Introduction

Thompson hip hemiarthroplasty is a very popular surgical procedure for the treatment of displaced intracapsular fracture neck of femur in the elderly.<sup>1</sup> Thompson designed and introduced this vitallium prosthesis in the pre-bone cement era.<sup>2</sup> However, following the advent of bone cement, the Thompson prosthesis is cemented at most centres in the United Kingdom.<sup>1</sup> There has been considerable debate over the use of cement in hemiarthroplasty of the hip for fracture neck of femur.<sup>1,3,4</sup>

The claimed advantages of cemented prosthesis are the decreased postoperative thigh pain<sup>3–7</sup> resulting in better mobility,<sup>5–8</sup> lower incidence of aseptic loosening,<sup>4,8–10</sup> and periprosthetic fractures.<sup>10</sup> However, the uncemented hemiarthroplasty is favoured by some surgeons as it eliminates the cement-related morbidity and mortality<sup>3,11–13</sup> and reduces operating time,<sup>4,14</sup> thereby reducing the postoperative complications.<sup>4,10,12,15</sup> Although there is good evidence for uncemented Austin-Moore hemiarthroplasty, the outcomes following uncemented Thompson hemiarthroplasty prosthesis has not been published extensively.<sup>16</sup> The main purpose of our study was to analyse the outcomes following cemented and uncemented Thompson hemiarthroplasty with particular reference to cement-related morbidity and 30-day mortality.

## Materials and Methods

One hundred fifteen elderly patients underwent Thompson hip hemiarthroplasty for the treatment of displaced intracapsular fractures of the hip at the authors' institution from January 2006 to December 2006. Five patients had life-threatening acute medical illness on admission and were unsafe for anaesthesia and surgery. The operations were deferred by more than 7 days and they were excluded from the study. The remaining 110 patients were included in the study. The data were collected retrospectively from the case notes and the radiographs. The minimum follow-up period was 2.5 years (range: 2.5–3.5 years, mean: 2.9 years). The medical comorbidities and the American Society of Anesthesiologists grading were recorded. The preinjury mobility and the postoperative mobility at discharge were carefully obtained from the physiotherapy records.

Cemented Thompson's hemiarthroplasty was reserved for the more active patients with relatively less comorbidity, as determined by the surgeon. The decision of choosing cemented or noncemented Thompson's hemiarthroplasty was made before the operation. Twenty-five patients were chosen to use the cemented implants because they were more active and had relatively less comorbidities preoperatively. The others were left uncemented. However, the preoperative decision to perform uncemented hemiarthroplasty had to be changed in 5 patients intraoperatively because the Thompson prosthesis failed to achieve stability with press-fit technique. All cementation was performed without pressurisation. While using an uncemented prosthesis, we did not formally ream the proximal femoral canal. Instead, we used a Trethowan bone lever (Figure 1) to create an entry path for the implant, thereby preserving the cancellous bone for impaction and achieving press-fit stability. Postoperative management was the same for both the groups of patients.



Figure 1. Trethowan bone lever.

In-patient postoperative complications, including wound infection, pulmonary events, cardiovascular accidents, and 30-day mortality were analysed in detail. Thigh pain was assessed at discharge in patients with no cognitive impairment. Because of patient-hospital linked program in United Kingdom, all the patients in this region would be managed in the same regional hospital throughout their lifetime. Routine follow-up of Thompson hemiarthroplasty is not done at our institution, but the patients are referred back if there are any symptoms and problems in the operated hip immediately. We then could pick up all early and late complications easily by calling the patients' files. The postoperative outcomes between the two groups were analysed using the  $\chi^2$  test.

## Results

The average age was 83.2 years (range: 70–98) with 87 female patients. Thirty (27.3%) patients were cemented and 80 (72.7%) patients had uncemented prosthesis (Table 1). The average delay in operation was 3 days (0–7). Ninety patients (81.8%) were operated within 4 days. Surgery had to be delayed in some patients to optimise the medical condition of the patient. One hundred one of 110 patients underwent general anaesthesia for surgery. The surgery was performed by consultants or experienced trainees.

Statistical analysis of the preoperative data ( $\chi^2$  test—SPSS version 15.0; SPSS, Inc., Chicago, IL, USA) revealed that a significantly higher number of patients in the uncemented group belonged to “mobile with frame” category than the cemented group ( $p < 0.05$ ). Although the mean age and American Society of Anesthesiologists grading of the uncemented group was higher, there was no statistically significant difference between the two groups ( $p > 0.05$ ).

There were no significant intraoperative complications in either group. The postoperative complications are detailed in Table 2. The overall superficial wound infection rate was 9% and the deep infection rate was 0.9%. Ten patients had clinically and/or radiologically diagnosed chest infection before operation. Only 4 patients developed postoperative hospital-acquired chest infection. Pulmonary embolism was diagnosed by ventilation-perfusion scan in two patients. Cardiovascular complications included acute coronary events (1 in cemented and 2 in uncemented group), pulmonary oedema, and right ventricular failure (1 in cemented and 7 in uncemented group). One patient had ischaemic stroke confirmed by CT scan. Only one patient had a cemented hemiarthroplasty dislocated at 3 months. Postoperative thigh pain was noted in one patient who had uncemented prosthesis.

Table 1  
Summary of the data

| Characteristics                      | Cemented      | Uncemented    |
|--------------------------------------|---------------|---------------|
| Total number of patients (%)         | 30            | 80            |
| Male:female                          | 8:22          | 15:65         |
| Mean age (range) (y)                 | 79.63 (64–98) | 83.06 (59–98) |
| Mean ASA grade                       | 3.1           | 3.7           |
| Preinjury mobility                   |               |               |
| Fully independent                    | 6             | 13            |
| Mobile with sticks                   | 24            | 30            |
| Mobile with frame                    | 5             | 34            |
| Wheel chair/bed bound                | 0             | 3             |
| Postop mobility (at discharge/death) |               |               |
| Fully independent                    | 0             | 0             |
| Mobile with sticks                   | 4             | 8             |
| Mobile with frame                    | 26            | 64            |
| Wheel chair/bed bound                | 0             | 8             |

**Table 2**  
Complications in cemented and uncemented hip hemiarthroplasty

| Complications (overall %) | Cemented | Uncemented | $\chi^2$ test | <i>p</i> |
|---------------------------|----------|------------|---------------|----------|
| Infection (10)            | 2        | 9          | 0.509         | 0.475    |
| RS complications (5.4)    |          |            |               |          |
| PE (1.8)                  | 1        | 1          | 0.53          | 0.466    |
| Chest infection (3.6)     | 1        | 3          | 0.012         | 0.91     |
| CVS complications (10.9)  | 3        | 9          | 0.033         | 0.855    |
| CVA (0.9)                 | 1        | 0          | 2.694         | 0.100    |
| GI complications (3.6)    | 2        | 2          | 1.082         | 0.298    |
| Renal complications (0.9) | 1        | 0          | 2.694         | 0.100    |
| Dislocation (0.9)         | 1        | 0          | 2.694         | 0.100    |
| 30-day mortality (4.5)    | 2 (6.7%) | 3 (3.6%)   | 0.426         | 0.514    |
| Overall complication rate | 12       | 31         | 0.013         | 0.909    |

CVA = cerebrovascular accidents; CVS = cardiovascular system; GI = gastrointestinal; PE = pulmonary embolism; RS = respiratory system.

The categorical data of postoperative complications were analysed using the  $\chi^2$  test (SPSS version 15.0). A *p* value less than 0.05 was considered to be significant. There was no statistically significant difference in any of the postoperative complications, including 30-day mortality between the cemented and uncemented groups. The overall complication rate was not significant either (*p* = 0.91).

## Discussion

Thompson prosthesis was invented historically to treat nonunions of the femoral neck fractures and was designed to be implanted without the cement.<sup>2</sup> Following the discovery of bone cement, Charnley<sup>17</sup> showed that the cement increases the weight bearing capacity by 200-fold. The popular option of orthopaedic surgeons in the United Kingdom is to cement the Thompson implant.<sup>1</sup>

Our study represents one of the largest comparative studies between cemented and uncemented Thompson hemiarthroplasty.

Although the modern anaesthesia is more sophisticated to deal with the cement-related events, the increased risks of perioperative morbidity and mortality from bone cement implantation syndrome have discouraged some surgeons from pressurising cement into the femoral canal in the compromised elderly patients.<sup>3,4,10–13</sup> Bone cement implantation syndrome leads to serious clinical events because of haemodynamic effects of fat marrow embolism.<sup>18</sup> Previous studies have demonstrated high-risk factors, which include advanced age, severe osteoporosis, hip fractures, and preoperative cardiopulmonary comorbidities.<sup>18–21</sup> In our study, we did not find any significant difference in any of the postoperative cardiopulmonary events between the two groups. The 30-day mortality in the two groups showed no significant difference. We believe this is because of our practise of avoiding cementation of the implant in patients with significant cardiopulmonary compromise.

The most important disadvantages related to uncemented implants have been a higher incidence of postoperative thigh pain, aseptic loosening, and periprosthetic fractures.<sup>3,4,8–10</sup> In our study, we did not find any statistically significant difference in terms of thigh pain at discharge in patients without cognitive impairment. We do not routinely follow up the patients in our speciality clinic. The patients and their carer are informed to visit the fracture clinic if there are any untoward problems associated with the operated hip. Moreover, experienced general practitioners will also follow up the patients during their routine visit. Most of the complications, such as loosening of Thompson prosthesis, periprosthetic fracture, and infection can be picked up without delay.

The limitation of the study is not to review the patients by the specialists with follow-up radiographs regularly. The follow-up of hip fracture patients is not feasible under the National Health Service in United Kingdom because of financial constraints. In our region, the patients who develop postoperative problems are referred back to hospitals where the index procedure was performed. However, there may be extremely rare circumstances where the patients may have had treatment elsewhere because of relocation of their residence without noticing us. In that case, error may occur. However, we believe that symptomatic aseptic loosening or periprosthetic fractures in the first 2.5 years postoperatively that rarely occurred could not be missed. Another study should be carried out to study the radiological aseptic loosening rates in the uncemented and cemented implants in the long term especially in more active patients. However, none of the patients in the study underwent revision procedure probably because of their age.

Achieving press-fit in certain Dorr C type proximal femur (stovepipe, osteopenic) may be impossible as noted in the five patients in our study and we advocate cementation without pressurisation in such patients.<sup>22</sup>

Some studies have suggested increased operating time and higher incidence of wound infection with cemented prosthesis.<sup>4,14</sup> We did not find any statistically significant difference in wound infection rates between the two groups.

We also acknowledge the fact that there is some bias in the sample, which is not randomised. In fact, it is somewhat difficult in real clinical situation.

Based on our results, we conclude that both cemented and uncemented Thompson hip hemiarthroplasty have similar outcomes at discharge. Patients who underwent cementation without pressurisation did not show any higher incidence of bone cement implantation syndrome compared with their uncemented counterparts. Avoiding cementation in the poorly mobile elderly patients with severe cardiovascular compromise may theoretically decrease the perioperative complications and can be considered as an option without any significant short-term sequelae. The incidence of thigh pain is very low. Long-term randomised controlled studies are required to evaluate the survivorship of the implants.

## References

- Crossman PT, Khan RJ, MacDowell A, et al. A survey of the treatment of displaced intracapsular femoral neck fractures in the UK. *Injury* 2002;**33**:383–6.
- Thompson FR. Two and a half years experience with a vitallium intramedullary hip prosthesis. *J Bone Joint Surg* 1954;**36A**:489–502.
- Anderson GH, Harper WM, Gregg PJ. Management of the intracapsular fractures of the proximal femur in 1990: a cause for concern? *J Bone Joint Surg* 1991;**73B**(Suppl 1):70.
- Lo WH, Chen WM, Huang CK, et al. Bateman bipolar hemiarthroplasty for displaced intracapsular femoral neck fractures. Uncemented versus cemented. *Clin Orthop Relat Res*; 1994:75–82.
- Khan RJK, MacDowell A, Crossman P, et al. Cemented or Uncemented hemiarthroplasty for displaced intracapsular femoral neck fractures. *Int Orthop* 2002;**26**:229–32.
- Khan RJ, MacDowell A, Crossman P, et al. Cemented or uncemented hemiarthroplasty for displaced intracapsular fractures of the hip—a systematic review. *Injury* 2002;**33**:13–7.
- Sonne-Holm S, Walter S, Jensen JS. Moore hemi-arthroplasty with and without bone cement in femoral neck fractures. A clinical controlled trial. *Acta Orthop Scand* 1982;**53**:953–6.
- Lausten GS, Vedel P. Cementing v. not cementing the Monk endoprosthesis. *Injury* 1982;**13**:484–8.
- Dorr LD, Glousman R, Hoy AL, et al. Treatment of femoral neck fractures with total hip replacement versus cemented and noncemented hemiarthroplasty. *J Arthroplasty* 1986;**1**:21–8.
- Browett JP. The uncemented Thompson prosthesis. *J Bone Joint Surg* 1981;**63B**:634–5.
- Muirhead-Allwood W, Hutton P, Glasgow MMS. A comparative study of cemented and uncemented Thompson prosthesis. *J Bone Joint Surg* 1983;**65B**:218–9.

12. Lennox IA, McLauchlan J. Comparing the mortality and morbidity of cemented and uncemented hemiarthroplasties. *Injury* 1993;**24**:185–6.
13. Parvizi J, Ereth MH, Lewallen DG. Thirty-day mortality following hip arthroplasty for acute fracture. *J Bone Joint Surg Am* 2004;**86-A**:1983–8.
14. Emery RJ, Broughton NS, Desai K, et al. Bipolar hemiarthroplasty for subcapital fracture of the femoral neck. A prospective randomised trial of cemented Thompson and uncemented Moore stems. *J Bone Joint Surg* 1991;**73**:322–4.
15. Gebhard JS, Amstutz HC, Zinar DM, et al. A comparison of total hip arthroplasty and hemiarthroplasty for treatment of acute fracture of the femoral neck. *Clin Orthop Relat Res*; 1992:123–31.
16. Faraj AA, Branfoot T. Cemented versus uncemented Thompson's prostheses: a functional outcome study. *Injury* 1999;**30**:671–5.
17. Charnley J. *Acrylic Cement in Orthopaedic Surgery*. Edinburgh: E and S Livingstone; 1970.
18. Donaldson AJ, Thompson HE, Harper NJ, et al. Bone Cement Implantation syndrome. *Br J Anaesth* 2009;**102**:12–22.
19. Peebles DJ, Ellis RH, Stride SD, et al. Cardiovascular effects of methylmethacrylate cement. *Br Med J* 1972;**1**:349–51.
20. Parvizi J, Holliday AD, Ereth MH, et al. Sudden death during primary hip arthroplasty. *Clin Orthop Relat Res* 1999;**369**:39–48.
21. Patterson B, Healey J, Cornell C, et al. Cardiac arrest during hip arthroplasty with a cemented long stem component. A report of seven cases. *J Bone Joint Surg Am* 1991;**73**:271–7.
22. Dorr LD. Structural and cellular assessment of bone quality of proximal femur. *Bone* 1993;**14**:231–42.