



The management of intracapsular hip fractures in the 'young elderly' internal fixation or total hip replacement ?

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There is a lack of consensus about how to treat intracapsular hip fractures in the 'young elderly' (50-75 years). Evidence for older more mobile patients seems to point towards Internal Fixation (IF) for undisplaced fractures and Total Hip Replacement (THR) for displaced fractures.

Radiographs of 263 patients from the Norfolk and Norwich University Hospital, who have suffered an intracapsular hip fracture between 2000-2009 were reviewed. The complication and mortality rates were noted. A Hip function questionnaire (Oxford hip score (OHS)) and Numeric pain score (NPS) were sent out to patients, then methods of treatment (IF and THR) were compared.

In displaced fractures THR compared favourably to IF, OHS (16.0 vs. 20.0 p 0.029), NPS (2.0 vs. 4.0 p 0.007), complications (Odds Ratio (OR) 2.90 ; p 0.006) and death rate (OR 3.61 ; p 0.007). Although not statistically significant when stratified for age, the youngest age group (50-60) still achieved better function with a THR (13.0 vs. 18.0 ; p 0.129). There was little difference in the results for undisplaced fractures.

This retrospective cross-sectional study showed IF is associated with a much higher complication rate than THR for patients who sustained a displaced hip fracture. THR also showed a better functional outcome and reduced pain. IF should be used in undisplaced fractures as there was no difference in functional outcome or complication rate. A large randomised controlled trial is needed to confirm these results.

Keywords : femoral neck fracture ; total hip replacement ; fracture fixation.

INTRODUCTION

An estimated 1.6 million people sustain hip fractures worldwide every year (14). Currently 5 million people in the world experience disability due to a hip fracture and the incidence is set to rise to more than 6 million by 2050 (14).

It has generally been accepted that undisplaced fractures (Garden classification type 1 and 2) are better treated with Internal Fixation (IF) (14,17). However identifying the correct management of displaced fractures has proved more problematic.

Currently there is strong evidence suggesting displaced intracapsular fractures should be treated with Total Hip Replacement (THR). A meta analysis by Rogmark *et al* (2006) advocated the use of replacement over fixation in active patients aged

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70-80 due to better functional outcome, lower re-operation rate and less post operative pain (14). This analysis also indicated that hemiarthroplasty is only suitable for older or impaired patients. The meta analysis followed a large amount of randomised controlled trials comparing fixation and replacement which found similar results (21,24,27).

Despite this evidence some surgeons feel that there is a place for IF in the management of displaced Intracapsular hip fractures. It is claimed that retaining the patient's femoral head will give better function than primary THR, and when IF fails there is an option of salvage THR (3). The risk of long-term complications, has also discouraged clinicians from performing replacement surgery (2). However a recent ten year follow-up trial indicated THR following fracture had a low rate of complications and is comparable to that of elective THR (11).

Given this debate there is a paucity of data concerning the 'young' hip fracture (50-70 years) where primary pathology is still assumed to be osteoporosis, but involving higher energy trauma. Currently only Greenough and Jones (1988) have examined the use of THRs for fractures in the 'young elderly' (< 70) (9). The study found an unexpectedly high rate of revision of THR after treatment for displaced intracapsular hip fracture (49% vs. 9% for other joint disease). As a result the authors suggested that in the more vigorous patient THRs were liable to fail early, so they recommended that replacement should not be used (9).

Study Aims

The aim of this retrospective cross-sectional study was to investigate hip function, pain perception and failure rate of patients who had undergone IF or THR for Intracapsular hip fractures at the Norfolk and Norwich University hospital (NNUH), a large teaching hospital in the United Kingdom.

Ethics

The protocol was reviewed by Essex Research and Ethics committee and ethical approval was granted (09/H0301/70). Relevant Research and development permission was also obtained.

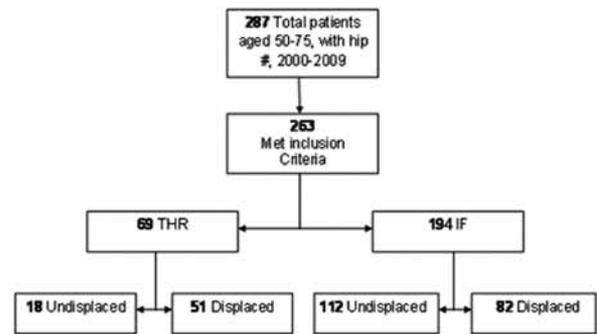


Fig 1. — Flow diagram of patients and treatments in the study

PATIENTS AND METHODS

Using the Operating Room Scheduling Office System (ORSOS) database at the NNUH, 287 patients aged between 50-75 years who had sustained an intracapsular hip fracture in the previous 10 years (1st January 2000-31st December 2009) were identified. A total of 263 (Fig. 1) patients met the inclusion criteria, 194 patients were treated with IF and 69 received THR. The median study age was 66 (IQR 60.5-71.7) (Table I).

Inclusion Criteria

Each patient required good quality pre and post operative radiographs which could be viewed using the hospital's Picture Archiving and Communications System (PACS). Any participants with signs of other pathology such as osteoarthritis, rheumatoid arthritis or pathological fracture to either the affected or unaffected hip were excluded. Patients were only included in the hip function analysis if they fulfilled five screening questions identifying them as mobile prior to their fracture. These are questions commonly used by surgeons to assess mobility such as "could you manage a flight of stairs without assistance before your accident". Patients were assumed to have reasonable cognitive function if they returned the questionnaire.

Radiological assessment

Two researchers (RT, LP) independently reviewed the radiographs and recorded the method of treatment (IF or THR), date of operation, age and gender of the patient as well as any subsequent operations or complications that occurred during or after treatment. The fracture was classified as undisplaced (Garden classification type 1 & 2)

Table I. — Characteristics of study participants

	Undisplaced	Displaced	Overall
THR			
Patients	18	51	69
Age, med (IQR)	64 (62-71)	66 (61-72)	65 (60-71)
Male, (%)	5 (28)	12 (24)	17 (25)
Months since Op, mean (SD)	46 (27)	50 (28)	40 (20-39)
Response Rate (%)	10 (55)	29 (63)	39 (57)
IF			
Patients	112	82	194
Age, med (IQR)	67 (67-72)	65 (61-72)	67 (61-72)
Male, (%)	27 (24)	19 (23.2)	46 (23.7)
Months since Op, mean (SD)	53 (28)	61 (30)	59 (29)
Response Rate (%)	45 (50)	31 (54)	76 (51)

Response rates calculated in % of patients still alive at follow-up.

or displaced (Garden classification type 3 & 4); this is an accepted classification which reduces observer bias in classification of fracture type (23).

Complications

Complications were defined for IF as nonunion, avascular necrosis (AVN), removal of metal work, conversion to arthroplasty and infection. The fracture was regarded as healed if trabeculations were visible across the fracture line, nonunion was regarded as absence of trabeculations and/or displacement. AVN was defined as stages II-VI of necrosis defined by the work of Steinberg *et al* (26). Complications for THR were signs of loosening (1,10), dislocation, periprosthetic fracture and infection. Complications for each treatment were assessed and recorded dichotomously. Radiographs for both groups were cross matched against BlueSpier[®], a patient administration system which highlighted any deceased patients. Postal questionnaires were sent to the surviving patients.

Only cannulated hip screws were recorded for IF. In 87% of operations 3 screws were used, however 13% used only 2. Several prostheses were used throughout the period for THR.

Primary Outcome ; The Oxford Hip Score

The primary outcome measure was the patient reported Oxford hip score (OHS). The OHS is a validated questionnaire (5,6) rating hip function from 12-60, 12

being considered very good hip function (7). Patients were contacted a minimum of 1 year post surgery as the majority of complications occur within this period (24).

Numeric Pain Scale

The secondary outcome measure, the Numeric Pain Scale (NPS), is a numbered scale with 1 representing no pain and 10 severe pain. It has been shown to provide good evidence for the presence of chronic pain (22) and is comparable with the Visual Analogue Scale in terms of reliability and validity (12). It has a good patient response rate, is easy to understand and interpret (4).

Statistics

In the initial analysis, all patients remained in their primary treatment groups (OHS_t). A second analysis was then undertaken excluding patients who had suffered complications (OHS_c). Sub group analyses were performed for age stratification and fracture pattern. Median OHS and NPS were compared utilizing a Mann-Whitney U test to ascertain statistical significance. Odds ratios (OR) were calculated for nominal variables and tested by Pearson's chi-squared method. The results were considered to be significant at $p < 0.05$. SPSS (SPSS Inc, Chicago, Illinois) 16.0 for Windows was utilised for all analysis.

Intra-observer variation was measured between the two researchers for fracture pattern and complication assessment. Cohen's Kappa score (k) was used. There

Table II. — Comparison of function and pain perception ; THR vs. IF

	Treatment	<i>n</i>	OHS _t (IQR)	OHS _c (IQR)	NPS (IQR)
Undisplaced					
	THR	10	15.0 (13.0-18.0)	13.0	1.5 (1.0-3.0)
	IF	46	15.5 (12.0-20.0)	12.0	2.0 (1.0-5.0)
			p 0.779	p 0.881	p 0.323
Displaced					
	THR	29	16.0 (16.0-24.0)	14.0	2.0 (1.0-3.0)
	IF	31	20.0 (13.5-21.0)	15.5	4.0 (2.7-6.0)
			p 0.029	p 0.156	p 0.007

n = Number of patients returning questionnaire. OHS_t = Oxford hip score all patients, OHS_c = Oxford hip score excluding patients with complications, NPS = Numeric Pain Score.

Table III. — Age stratification and comparison of function for displaced fractures ; THR vs. IF

	THR		IF		
Age	<i>n</i>	OHS _t (IQR)	<i>n</i>	OHS _t (IQR)	
50-60	9	13.0 (13-18)	10	18.0 (15.3-24.0)	p 0.129
60-70	13	16.0 (14-20)	14	20.0 (15.8-24.0)	p 0.242
70 >	7	21.0 (15-21)	8	26.0 (22.2-36.0)	p 0.023

n = number of patients returning questionnaire. OHS_t = Oxford hip score all patients.

was excellent intraobserver agreement for fracture pattern, k 0.82 ($p < 0.005$) and radiological complications k 0.76 ($p < 0.005$).

Ethics Approval

The protocol of the study was reviewed by Essex Research and Ethics committee and ethical approval was granted (09/H0301/70).

RESULTS

One hundred fifteen responses to the questionnaires (53.7%) were received. This was slightly higher in the THR group (56.5% vs. 51.0%), and compares to other similar postal questionnaires (8,16).

Function

The median OHS for displaced fractures treated with THR was 16.0, compared to IF 20.0 (p 0.029) (Table II). There was little difference in hip function

for undisplaced fractures (THR 15.0 vs. IF 15.5 ; $p = 0.779$).

When patients suffering with complications were excluded (OHS_c) there was little difference in function in both displaced (14.0 vs 15.5 ; $p = 0.156$) and undisplaced fractures (12.0 vs 13.0 ; $p = 0.881$).

When the outcome was stratified for age (Table III) the youngest age group (50-60 years) showed better hip function with THR in comparison to IF, 13.0 vs. 18.0 ($p = 0.129$). The older age group (70-75 years) showed a statistically significant difference (21.0 vs. 26.0 ; $p = 0.023$).

Complications and mortality

In displaced fractures, THR had a much lower complication rate (17.6% vs. 45.1%, OR 2.97 ; $p = 0.006$) (Table IV), whereas for undisplaced fractures there were more complications in the THR group compared to IF (16.7% vs. 11.6% ; OR 0.67 ; $p = 0.544$). The mortality rate in patients was

Table IV. — Complication and mortality rates for THR and IF

	Undisplaced			Displaced		
	THR <i>n</i> (%)	IF <i>n</i> (%)	OR (p)	THR <i>n</i> (%)	IF <i>n</i> (%)	OR (p)
Complications	3 (16.7)	13 (11.6)	0.67 (0.544)	9 (17.6)	37 (45.1%)	2.97 (0.006)
Mortality	0 (0.0)	21(18.8)	N/A	5 (9.8)	22 (26.6%)	3.61 (0.008)

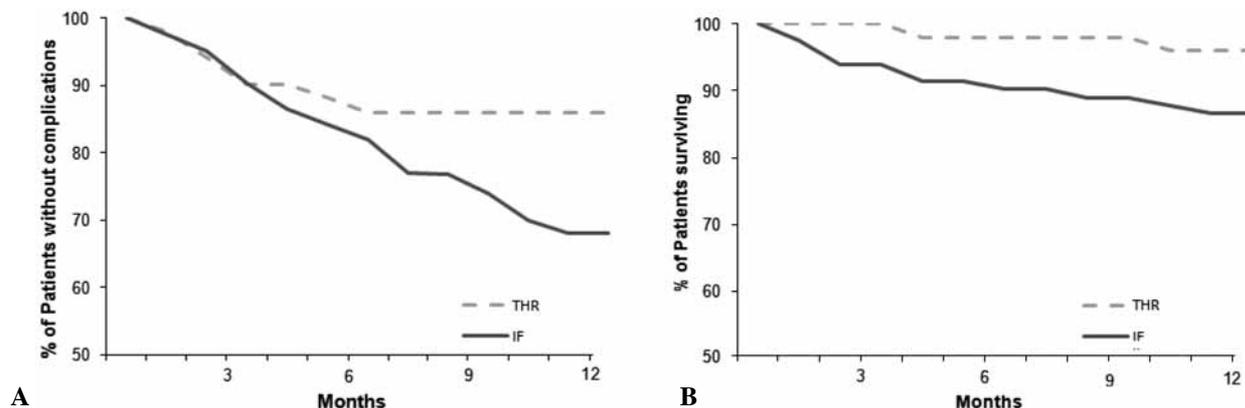


Fig 2. — A : Percentage of patients without complications over the first 12 months post-op for THR and IF ; B : Percentage of patients surviving for the first 12 months post-op.

higher in both displaced and undisplaced fractures for IF (Table IV).

Figure 2a shows the success of THR and IF for displaced fractures. At 12 months post operative 13.7% of THR patients had suffered complications, this is compared to 31.7% of patients that had been internally fixated. Figure 2B shows the first 12 months of mortality for displaced fractures which was 3.9% for THRs and 13.4% for IF.

DISCUSSION

There remains ongoing debate about the optimum treatment of intracapsular hip fractures in the ‘young elderly’ (50-70). Through comparison of the OHS, NPS and complications of treatment for intracapsular hip fractures over a 10 year period at a large teaching hospital this retrospective study aimed to identify such a treatment.

Oxford Hip score

Patients who suffered a displaced fracture showed increased hip function after THR compared with IF (16.0 vs. 20.0 ; $p = 0.029$). Even when discounting patients with complications there was no significant difference between the two groups (14.0 vs 15.5 ; $p = 0.156$). This finding contradicts the hypothesis that by retaining the femoral head better function can be achieved with IF. Sub group analysis examining age, showed that even in the youngest patient group (50-60 years) there was a trend towards better function with a THR, with an OHS of 13.0 vs. 18.0 ($p = 0.129$). However this difference was greatest in the older age group. In patients 70-75 years better function was observed in the THR group, 21.0 vs. 26.0 ($p = 0.023$), a finding which concurs with other studies which recommend THR for active older patients (11,20,27).

Table V. — Complications of THR and IF for undisplaced and displaced fractures

	Complication	Undisplaced <i>n</i> (%)	Displaced <i>n</i> (%)	Total <i>n</i> (%)
THR	Loosening	0 (0.0)	0 (0.0)	0 (0.0)
	Dislocation	2 (16.6)	7(13.7)	10 (13.4)
	Periprosthetic #	0 (0.0)	1 (1.7)	1 (1.4)
	Infection	1 (5.0)	1 (1.7)	2 (2.8)
IF	Avascular Necrosis	4 (3.5)	16 (19.5)	20 (10.3)
	Nonunion	6 (5.3)	14 (17.3)	22 (11.3)
	Infection	0 (0.0)	0 (0.0)	0 (0.0)
	Removal of Screws	3 (2.6)	7 (8.3)	10 (5.1)

Numeric Pain Score

Scores for chronic pain (NPS) were low in all groups, however generally lower in THR when compared with IF for displaced fractures (2.0 vs. 4.0 ; $p = 0.007$). Increased pain is usually associated with complications, further analysis excluding those with complications showed that both treatment groups had similar pain scores.

Undisplaced fractures showed little difference between THR and IF for either pain perception or function in both the main analysis and the subgroup stratification.

Complications

The majority of complications for both IF and THR occurred within the first 12 months post operatively. This pattern is similar to what is seen in older patients (11,24).

IF showed significantly more complications with a total of 50 (25.7%). This was much higher for displaced fractures (45.1% vs. 11.6%). The complication rate is equal to those found by other studies, some of which report two year follow-up complication rates for displaced fractures at nearly 50% (13). The rate of nonunion in displaced fractures in this study was lower (Table V) (17.3% vs 28.0%) than in other studies which had an older population, however the rate of AVN increased (19.5% v. 12.0%) (3). AVN as noted by Loizou *et al* (15) has a higher incidence in a younger population, which could account for the trend seen.

Screws were removed from healed fractures in 8.3% of displaced fractures. The removal of metal-work varies in the literature, from 7 to 20% (25,27).

Patients were far more likely to suffer a complication in the IF group for displaced fractures than those who had a THR (OR 2.90 ; $p = 0.006$).

Most patients (79%) suffering a complication following IF in both the displaced and undisplaced groups, underwent a salvage arthroplasty. Although not statistically significant, patients who underwent salvage THR after IF for displaced fractures had worse hip function than those having a primary THR (16.0 vs. 22.5 ; $p = 0.135$). This result is reflected in other studies (3,18).

It has been noted that surgical approach has significant effect on dislocation rate in THR. In this study, where approach cannot be commented on due to lack of data, patients had a total dislocation rate of 13.4% which falls in the middle of the range reported in the literature 2-22% (27). The incidence of infection as defined by revision surgery in the study was 2.8%.

Mortality

Mortality was significantly higher in the IF groups (undisplaced 0.0 vs. 18.8%, displaced 9.8 vs. 26.6%). Although randomised trials have found similar mortality rates for IF (up to 33%) (25) meta analysis has failed to show a significant difference between treatments and death rates (1,2,20). Care must be taken when interpreting the results of this study due to the confounding effect of surgeons

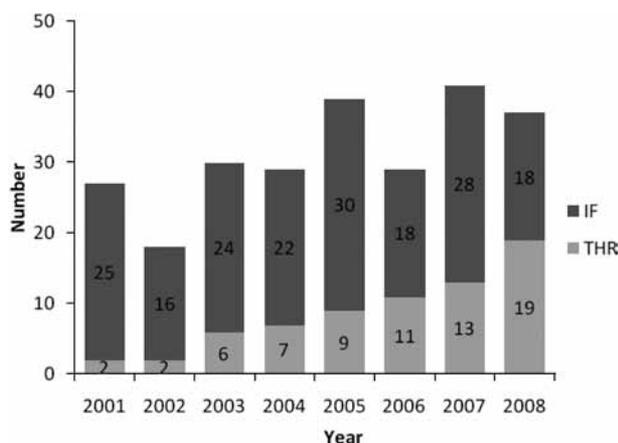


Fig 3. — Showing a trend towards THR for intracapsular hip fracture at the NNUH in 50-75 year old patients during the period 2001-2009.

selecting fitter patients for THR, which is associated with greater blood loss and operative time (1).

Patients who suffered complications in both treatment groups were more likely to die than those without complications (OR 3.53 ; $p = 0.012$).

Study limitations

The data reflects the practices of a large teaching hospital, but due to the retrospective nature of this study it has significant limitations.

The selection of patients for surgical procedure was non randomised, so frailer patients were more likely to undergo IF.

Figure 3 shows the changing trend in the management of hip fractures over the last ten years. There has been a move towards THR over IF for the treatment of displaced fractures. During 2001 there were only 2 (7.5%) THR operations that met the study's inclusion criteria compared to 25 IFs. In 2008, the last full year data was collected for, this rose to 19 (51.3%) THRs compared to 18 IFs. This trend has had an effect on the study results. The mean time since operation is slightly higher in the IF group (46.1 vs. 61.0 months) this may be responsible for the increased death rate/complication rate, although it was felt both treatment groups had a sufficient follow-up time.

CONCLUSION

Undisplaced Fractures

IF is favoured by most surgeons, and the evidence provided by this study supports this based on similar function, pain score and decreased complications. IF should be used as the treatment of choice for undisplaced intracapsular hip fractures in the 'young elderly'

Displaced fractures

Primary analysis indicated THR was associated with better function and less pain. A further finding was the high complication rate (45.1%) associated with IF in the young elderly. This is primarily due to the higher incidence of AVN in the younger patient.

The study's results refute the argument that by retaining the femoral head it is possible to achieve better hip function. This study indicates that even when IF works there is no beneficial gain in hip function. In addition salvage THR for a failed IF has been shown to have significantly decreased function and increased complication rates (3,18).

Clinicians have also had concerns regarding the long-term suitability for the use of THR for hip fractures, especially in the younger age group. However THRs used in the treatment of displaced hip fractures have recently been shown to have similar long-term complication rates to elective THRs for arthritis (11).

In conclusion the results suggest that THR should be considered over IF for the treatment of intracapsular hip fractures in a younger patient (50-75).

This study highlights the need for a large randomised controlled trial looking at the management of displaced hip fractures in the 'young elderly' which can overcome some of the limitations seen within this study.

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