

Clinical Paper

Hip Hemi-Arthroplasty vs Total Hip Replacement for Displaced Intra-Capsular Hip Fractures: Retrospective Age and Sex Matched Cohort Study

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ABSTRACT

Introduction: The Royal Victoria Hospital in Belfast is the largest volume hospital in the UK Hip Fracture Database. Management of displaced intra-capsular hip fractures is evolving in light of NICE² and BOA guidelines³, with more patients receiving total hip replacement (THR) over hemi-arthroplasty. With current rationing within the NHS, it is vital that principles of the 'Getting It Right First time' (GIRFT) report⁴ are implemented and the correct treatment choice made. Our aim was to assess Barthel scores⁵, complication rate, blood transfusion rate and post op functional ability in two age and sex matched cohorts to see if our patient selection was appropriate.

Methods: Between January and December 2013, 2 age and sex matched cohorts each containing 46 hip fracture patients were retrospectively identified. The first group underwent Hip Hemi-Arthroplasty (HHA) and the second group underwent THR. We looked at complication rate, blood transfusion rate, pre- and post-operative locomotor ability as well as Barthel score⁵.

Results: Average age in the HHA group was 69.7 with an average ASA grade of 2.61, compared to 71.2 and 2.43 respectively in the THR group. Complication rate in the HHA group was 45.6% with 2/3 due to chest sepsis or urosepsis. The THR group had a complication rate of 8.7% with 3/4 due to venous thrombembolism, reflecting the better pre-morbid physiological function in this cohort. Blood transfusion rates were similar in both groups. Barthel scores⁵ showed average reductions of 2.67 in the HHA group and 0.30 in the THR group.

Conclusions: The application of the NICE guidelines² for arthroplasty choice in hip fracture management has led to judicious patient selection for THR. The THR group had a significantly lower complication rate ($p < 0.05$) and better Barthel scores⁵ ($p < 0.05$) compared to the HHA group. In addition, having a higher ASA score (III or IV) or lower Barthel score⁵ pre-operatively were independent predictors of complication occurrence.

INTRODUCTION

Neck of femur fracture is an increasingly common injury¹. Fifty percent of these fractures will be intra-capsular¹ and the treatment option in the elderly population is arthroplasty. This raises an important question in every trauma unit; 'is Patient X a THR candidate?' Previously the answer to this question was largely down to individual operator preference and subjective impressions of fitness, however in 2011 the National Institute of Clinical Excellence (NICE) published guidelines² on arthroplasty choice in this patient cohort.

The Royal Victoria Hospital in Belfast is the largest volume hospital in the UK Hip Fracture Database. The management of displaced intra-capsular hip fractures is evolving in light of NICE² and BOA guidelines³, with more patients receiving THR over HHA. In our unit, the NICE guidelines² on hip fracture management are used to direct our decision making

of HHA vs THR. These guidelines state that THR should be offered to patients with displaced intracapsular hip fractures provided they can; mobilise independently with the aid of no more than a stick, are not cognitively impaired and are medically fit for anaesthesia and the procedure².

With current rationing within the NHS it is vital that the principles outlined by Professor Tim Briggs in the 'Getting It Right First time' (GIRFT) report⁴ are implemented and the correct treatment choice made.

Our aim was to assess Barthel score⁵ changes, complication

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TABLE 1.

Baseline Demographics and Clinical Parameters

Variable	HHA Group (n=46)		THR Group (n=46)		P value
Gender (Count)					
Male	7		7		1
Female	39		39		
ASA class (Count / %)					
I/II	18	39.1%	26	56.5%	n/s
III/IV	28	60.9%	20	43.5%	
Barthel Index at admission (count/%)					
<19	10	21.7%	1	2.2%	0.004
>=19	36	78.3%	45	97.8%	
Mean Age					
	69.7		72.0		
Mean Hb levels (Mean g/dl)					
Pre-op	12.25		12.87		0.02
Post-op	10.44		10.57		n/s
Lowest	9.2		9.12		n/s

rate, blood transfusion rate and post op functional ability in two age and sex matched cohorts to see if our patient selection for THR was appropriate.

METHODS

A retrospective case-control study was performed on 92 patients; 46 undergoing HHA and 46 who underwent THR. HHA cases were matched with controls of corresponding age and gender who underwent THR. The patients undergoing HHA had their surgery performed via the anterolateral approach. An Exeter stem with either a mono-block or bipolar head was used. In our unit, HHA was generally performed by a senior core trainee or junior registrar with consultant supervision.

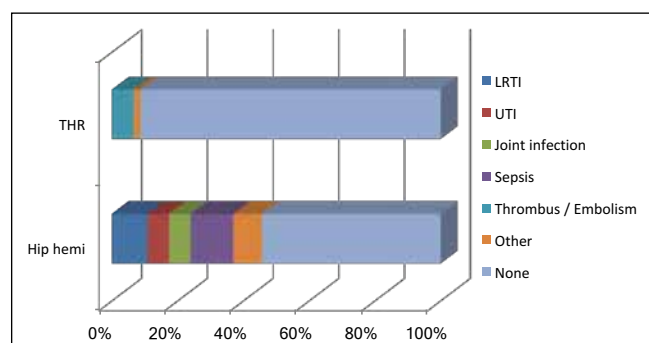


Fig 1. Demonstrates the complication rate in both groups. The majority of patients (90%) in the THR group did not suffer any complications. The range of complications in the HHA group was greater. Common complications in this group were respiratory tract infection, urinary tract infection and joint infection.

The total hip arthroplasties had their procedure performed via the posterior approach to the hip with capsular and piriformis repair on closure. The implants used were a cemented Exeter stem with either a cemented or cementless acetabular component. In our unit these surgeries are performed by a consultant or a senior registrar under consultant supervision.

ASA scores were recorded in both groups pre-operatively. Barthel Index⁵ was measured pre-operatively and after 3 & 12 months in both groups to assess post-operative functional recovery. The number and nature of comorbidities and complications were also recorded. The rate for blood transfusion was also recorded in both groups.

The primary outcome measure for this study was the Barthel score⁵ at 3 and 12 months post-operatively. Secondary outcome measures included requirement for blood transfusions and complication rate in both groups.

Statistical analyses

Data were entered into Excel and analyzed using SPSS 22 for Windows. Continuous variables were expressed as mean/standard deviation while categorical variables were expressed as count/percentage. Univariate analyses were performed using Pearson's Chi-Square or Fisher-Exact test for categorical variables. Shapiro Wilkov test was used to assess the normality of continuous variables. Normally distributed variables were compared using student t-test and ordinal/non-normal variables were compared using Mann-Whitney test. Unadjusted p-values were then calculated and a p-value less than 0.05 was considered statistically significant.

Multivariate logistic regression with a conditional forward approach was performed to account for the effect of the confounders and the multiple explanatory variables on the occurrence of surgical complications and the requirement for blood transfusion. Adjusted odds ratio and P values were calculated for the explanatory variables that were associated with each of the previous outcomes using univariate analysis. Continuous variables were recoded as categorical variables so that they could be integrated into a model to determine the independent predictors of surgical complications requirement for blood transfusion.



RESULTS

Baseline data

Baseline demographics, clinical and biochemical parameters for the all patients are shown in Table 1. The majority of study participants were females (84.4%). The mean age for patients in the HHA group was 69.7 ± 8.23 years, while patients in the THR group had a mean age of 72.02 ± 8.49 years. Both groups were matched for age and gender (P>0.05). Although the proportion of patients with ASA scores III/IV was higher in the HHA group, it did not reach statistical significance (P= 0.095). The majority of the participants were non/ex-smokers (80.4% in the HHA groups and 84.8% in the THR group, p=0.582). There was no significant difference in the drinking habits between both groups. The number of comorbidities was not significantly different between the groups; however pre-op haemoglobin levels were lower in the HHA group (12.25 ± 1.4 vs. 12.87 ± 1.1 in the THR group, p = 0.02) although this difference was very small and unlikely to be clinically relevant. Postoperative haemoglobin levels did not show such a difference. Another parameter that showed a significant difference between both groups was the Barthel score at admission. The proportion of patients with a Barthel score⁵ above 19 was significantly higher in the THR group

with only one patient having a score less than 19 (97.8% of THR group had Barthel scores 19 or higher). By contrast, only 36 patients (78.3%) of the HHA group had Barthel scores⁵ of 19 or higher (p= 0.004).

Complication rate, Blood transfusion rate and Reduction in Barthel Score; Hip Hemi-arthroplasty vs Total Hip Replacement

There was no significant difference between both groups with regards requirement for blood transfusion (Table 2), as 11 patients in each group needed one or more units of packed red cells during or after surgery (23.9% in each group). Although mortality was higher in the HHA group (4 patients after 12 months vs. none in the THR group), this difference was not statistically significant (p= 0.117). However, complications were more common in the HHA group; 21 patients (45.7%) versus four patients in the THR group (p=0.000068). Complications in the HHA group included hospital and community acquired pneumonia, urosepsis and joint infection, while most of the complications in the THR group were due to venous thromboembolism (Table 2). There was one dislocation in the THR group. The THR group had a smaller reduction in their Barthel score at 3 and 12 months post-op. After 3 months, the mean reduction in the Barthel

TABLE 2.

Transfusion requirements, mortality, complications and Barthel scores; Hip Hemi vs THR

	HHA Group (n=46)		THR Group (n=46)		P value
Transfusion needed					
Yes	11		11		
No	35		35		
Mortality at 12 months (Count / %)					
Alive	42	91.3%	45	100%	0.117
Deceased	4	8.7%	0	0	
Complications (Count / %)					
Yes	21	45.7%	4	8.7%	6.8 x 10⁻⁵
No	25	54.3%	42	91.3%	
Complication according to class (Count/%)					
Respiratory tract infections	5	10.9%	0	0	
Urinary tract infection	3	6.5%	0	0	
Joint infection	3	6.5%	0	0	
Sepsis	6	13%	0	0	
Thrombus/Embolism	0	0	3	6.5%	
Other	4	8.7%	1	2.2%	
None	25	54.3%	42	91.3%	
Mean reduction in Barthel index at 3 months	1.95		0.196		0.000125
Mean reduction in Barthel index at 12 months	1.21		0.311		0.051



score was 1.95 in the HHA group compared to only 0.195 in the THR group ($p=0.000125$, Table 2). After 12 months, the reduction in score was still higher in the HHR group (Table 2) although the difference was marginally significant in this case ($p=0.051$).

Requirement for Blood Transfusion

High ASA score and low preoperative haemoglobin level were associated with requiring blood transfusion post-operatively. Patients with ASA III / IV were 4x more likely to require blood transfusion than those with ASA score of I/II (95% CI 1.38 – 13.68) (Figure 2). Patients with preoperative haemoglobin less than 12.5 also had a higher chance of requiring blood transfusion (OR 4.11, 95% CI 1.48 – 11.44) (Table 3). Multivariate logistic regression showed that both ASA scores and preoperative haemoglobin level were independent predictors for requiring blood transfusion.

TABLE 3.

Association between demographics, biochemical parameters, clinical parameters and requirement for transfusion

Variable		Required transfusion	
		No.	No. Percentage
ASA	I / II	44	5 11.4%
	III / IV	48	17 35.4% ($p = 0.07$)
Age	<70	34	6 17.6%
	>70	58	16 27.6% ($p = NS$)
Pre-op Haemoglobin (g/dl)	<12.5	39	15 38.5%
	>12.5	53	7 13.2% ($p = 0.005$)

Complications during/post-surgery

Univariate analysis showed that males were more likely to experience complications peri-operatively ($p=0.051$) although the association was marginally significant (Table 4.) Nearly half of patients who underwent hemi-arthroplasty experienced complications (45.7%) compared to only 8.7% of those who underwent THR ($p=6.8 \times 10^{-5}$). Moreover, the requirement for blood transfusion was associated with developing surgical complications (45.5% vs. 21.4%, $p=0.027$). This is further illustrated in Figure 3.

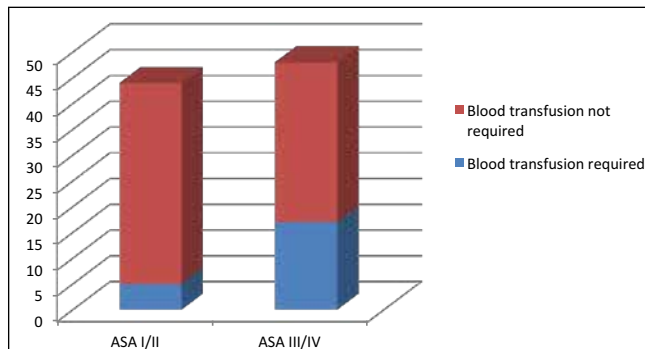


Fig 2. ASA score as predictive of requiring blood transfusion

TABLE 4.

Association of demographics, biochemical and clinical parameters with occurrence of surgical complications

Explanatory Variable	Occurrence of Complication		
	N	N	Percent
Gender	Male	14	7 50%
	Female	78	18 23.1%
			Yes ($p = 0.028$)
Surgical procedure	Hip Hemi	46	21 45.7%
	THR	46	4 8.7%
			Yes ($p = 0.0002$)
Transfusion	Yes	22	10 45.5%
	No	70	15 21.4%
			Yes ($p = 0.018$)
ASA	I/II	44	7 15.9%
	III/ IV	48	18 37.5%
			Yes ($p = 0.02$)
Age	<70	34	10 29.4%
	>=70	58	15 25.9%
			No
Barthel score	<19	11	7 63.6%
	>=19	81	18 22.2%
			Yes (0.008)
Co-morbidities	<2	34	9 26.5%
	>=2	58	16 27.6%
			No

Having an ASA score of III/IV was also associated with an increased risk of complication ($p=0.02$, Table 4). The number of comorbidities alone was not associated with developing surgical complications (Table 4), however a lower Barthel score⁵ at admission (<19) did have a significant association with complication occurrence ($p=0.008$, Table 4).

In summary, multivariate logistic regression identified gender, nature of surgery and requirement for blood transfusion as independent predictors of developing surgical complications. Patients who underwent HHA were more likely to experience complications after surgery (OR 12.1, 95% CI 3.3 – 45.35), as were males (OR 0.17, 95% CI 0.035 – 0.822) and those requiring blood transfusion (OR 0.21, 95% CI 0.056 – 0.767).

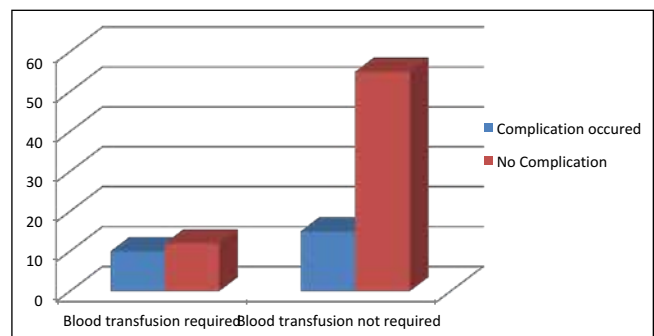


Figure 3. Complication rate according to requirement for blood transfusion

DISCUSSION AND CONCLUSION

The results demonstrated significant differences in the post-operative recovery in these two patient cohorts. Interestingly the mean age in the HHA group was younger than in the THR group which is perhaps the opposite of what would have been expected. There were a larger proportion of ASA III/ IV patients in the HHA group which reflects the frailer nature



of this cohort. The fact that this difference did not reach statistical significance may indicate that the sample sizes in this study were not large enough.

The complication rate in the HHA group (45.7%) was significantly higher in comparison to the THR group (8.7%). This may be explained by a poorer physiological condition in this cohort upon admission. There were also a greater proportion of patients in this cohort with a Barthel score⁵ <19. In our experience, patients with a poorer mobility baseline are slower to rehabilitate and mobilise post-operatively and are thus more vulnerable to chest and urinary infection. This may have contributed to the high rate of chest and urosepsis in this cohort. Another factor which may have contributed to the higher complication rate is the grade of operating surgeon. In our unit, HHA is generally performed by a senior core trainee or junior registrar under consultant supervision. Procedure time may have been longer than if a senior surgeon was operating.

Of note, there was only one dislocation in the THR group. This would be considered a low rate of dislocation given that the THRs were being performed in the setting of trauma. It is well documented that the rate of dislocation in THR performed following a fractured neck of femur is significantly higher⁶.

We found patients with ASA grade III or IV were nearly 4x more likely to require blood transfusion than those with ASA scores of I or II. This may be explained by a poorer haematopoietic potential in frailer patients with more comorbidities.

There are some weaknesses in this study. Firstly, the sample sizes may not have been large enough as certain expected differences between the cohorts such as mean ASA score and mortality rate did not reach statistical significance. There were also different grades of surgeons operating on each cohort which may influence operative time and thus complication rates.

In our experience, the application of the NICE guidelines² for arthroplasty choice in hip fracture management has led to judicious patient selection for THR. In this study, the THR group had a significantly lower complication rate ($p < 0.05$) and better Barthel scores⁵ ($p < 0.05$). With the trend toward performing greater numbers of THR surgeries in the hip fracture population, it is important to emphasise careful patient selection. It is important that we do not tip the balance and over-select patients for THR as this may lead to frailer patients undergoing a more invasive procedure which may bear out in higher complication rates and increased mortality.

Large, appropriately powered studies are required to further define pre-morbid criteria to enable appropriate patient selection for THR.

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FURTHER READING

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