Original Article

Does the ASA grading influence the outcomes of best practice tariff in fracture neck of femurs

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Abstract

Objectives: The aim of this study is to find the significance of different ASA grades in achieving the Best Practice Tariff (BPT) and their outcomes in patients with fracture neck of femur. **Methods**: A retrospective study over a five years period. Patient demographics, ASA grading, hospital admission timing, time to theatre and discharge date were recorded. The 30 day mortality rate and length of stay were calculated for each ASA grades for patients who met and failed BPT. **Results**: 1798 patients were included in the study. 54% was ASA grade 3, grade 4 represented 22% and grade 2, 19%. The mean AMT score was 6.4 who met BPT and 4.4 who failed BPT (p<0.001). 319 patients with ASA≤2 met BPT and 53 patients failed to meet BPT. In ASA ≥3, 1200 patients who met BPT and 225 patients failed BPT. The 30-day mortality in patients with ASA≤2 who met BPT was 2.57% and those who failed were 1.92%. In ASA ≥3 the 30-day mortality was 12.63% and who failed BPT was 25% which is statistically significant. **Conclusion**: In patients with ASA≥3 the 30-day mortality is significantly higher in those who failed BPT compared to ASA≤2 patients whether they achieved BPT or not.

Keywords: ASA grade, Best Practice Tariff, Failed, Neck of Femurs, Outcomes

Table 1. Requirements to achieve Best Practice Tariff (BPT).

The BPT price is payable only if all these characteristics are achieved:
a) time to surgery from arrival in an emergency department, or - if an admitted patient - time of diagnosis to the start of anaesthesia, is within 36 hours
b) assessment by a geriatrician 43 in the perioperative period (within 72 hours of admission)
c) fracture prevention assessments (falls and bone health)
d) an abbreviated mental test performed before surgery and the score recorded in National Hip Fracture Database (NHFD)
e) a nutritional assessment during the admission [introduced in 2017]
f) a delirium assessment using the 4AT screening tool during the admission [introduced in 2017]
g) assessed by a physiotherapist the day of or day following surgery [introduced in 2017].

Introduction

Fracture neck of femur in elderly is one of the frequent admissions to the hospitals in United Kingdom (UK). The numbers of admissions are estimated to be about 80,000 per year and the cost implications are predicted to an annual cost of two billion pounds[1]. It is one of the commonest cause of fracture related death in UK and the incidence is expected to rise to 100,000 by 2030[2]. The Best Practice Tariff was introduced in 2010 and later modified in 2011 to give an incentive of £1335 per case of fracture neck of femur treated according to the criteria set[3]. The criteria was

ASA Grade	Definition
ASA 1	Normal healthy patient, no underlying disease
ASA 2	Slight risk, systemic disease caused by surgical condition or by other pathological process and medically well controlled
ASA 3	Moderate risk, severe disease process that limits activity but not incapacitating
ASA 4	High risk, severe incapacitating disease process that is a constant threat to life
ASA 5	Extreme risk, moribund not expected to survive with or without an operation

Table 2. ASA Physical Status Grading.

further modified with addition of nutritional, delirium and physiotherapy assessment before or after surgery[4] Table 1.

There are previous studies in the literature which suggest that by reducing the time to theatre for fracture neck of femur surgery, the mortality rate and length of stay in the hospital is improved[5-7]. To qualify for the BPT one should make necessary arrangements to provide the level of service as depicted in the tariff. In order to get these patients to theatre early multidisciplinary approach should be facilitated. The decision to medically optimise the patients may lead to delay in the surgery which can cause an increased risk of mortality[8-10]. Hence early diagnosis of medical conditions and risk would be mandatory for the multidisciplinary team to make a decision regarding surgery and thus helping the hospital to meet the BPT.

The aim of this study is to find out the determining factors influencing the BPT in different ASA grades and determine the 30 day mortality in patients with fracture neck of femur undergoing surgery.

Materials and Methods

A retrospective study of all fracture neck of femurs admitted to our hospital for a period from April 2011 to December 2016 was carried out. The data was collected from the hospital fracture neck of femurs and cross checked with National Hip Fracture database. The patient demographics, ASA grading, hospital admission timing, time to theatre and discharge date were recorded.

The inclusion criteria was all the patients who had operative treatment following fracture neck of femurs and the exclusion criteria was those patients who were treated conservatively and who died before surgery. The 30 day mortality rate and length of stay were calculated for each ASA grades for patients who met and failed BPT. The patients were assessed by a senior consultant trauma anesthetist regarding the fitness for surgery by taking in to consideration the co-morbidities, medications, functional activity, AMT score, place of residence and their ASA grades were assessed using the American Society for Anesthesiologist Physical Status classification, Table 2.

The sample size has been calculated based on the number of patients with ASA≤2 and ASA≥3.Considering α error of 0.05 and a β error of 0.20.the sample size has been
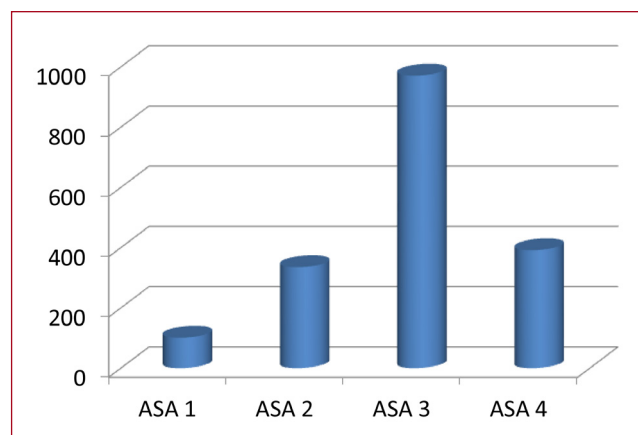

Figure 1. Chart showing ASA grades included in the study.

estimated at 300 patients in each group (a total of 600 patients) to recognize a p value of ≤0.001 as statistically significant.

Statistical analysis

The statistical analysis was done by using SPSS version 22.0. Comparison between the two groups of patients was performed using chi-squared, Student's t-test and Mann-Whitney U test for categorical, parametric and non-parametric data, respectively. A P value of ≤0.001 is considered as significant.

Results

There were a total of 1798 patients admitted with fracture neck of femurs during the study period and met the inclusion and exclusion criteria. There were 1318 females and 480 males. The average age was 83.03 (Range 61-101years).The time taken for the patient to be tracked from Accident and Emergency department to the Acute Trauma ward ranged from 40 minutes to 14 hours. The majority of patients was ASA grade 3, 971(54%), followed by ASA grade 4 ,391 (22%), and 335(19%) patients were

ASA Grading	Survived	Died	%
1	28	1	3.57
2	283	7	2.47
Combined 1 & 2	311	8	2.57
3	786	73	9.28
4	226	53	23.45
5	9	3	33.33
Combined 3, 4 & 5	1021	129	12.63
Grand total	1332	137	10.28

Table 3. The detailed breakdown number of patients in each ASA grades who survived and died.

Patient details	Met BPT	Did not meet BPT	P value
Patient numbers (%)	1519(84.4)	279(15.5)	<0.001
Age (mean years)	84.1	86.3	<0.05
Sex Males	404	74	<0.05
Females	1115	205	<0.05
Residence Own home	340	19	<0.001
Sheltered home	976	86	<0.001
Nursing home	58	96	<0.001
Residential home	49	45	<0.05
In patient	33	29	<0.05
Others	63	4	<0.001
AMT score (mean)	6.4	4.4	<0.001
ASA grade ≤2	319	53	<0.001
≥3	1200	226	<0.001
Length of stay (Days)	16.4	17.3	<0.001
Mortality (%)	9.4	16.5	<0.001

Table 4. Patient demographics and Best Practice Tariff (BPT).

ASA grade 2, Figure 1. But for practical purposes we have divided the ASA grading in to two groups, Group 1 (ASA≤2), and Group 2(ASA≥3), Table 3 .

BPT results

1519 (84.5%) patients met the BPT criteria and 279(15.5%) missed the criteria. The mean age of the patients who met BPT was 84.1years compared to those who did not meet BPT, 86.3years (p<0.05). The male: female ratio was 2.75 and 2.77 between the patients who met and failed BPT respectively. The mean AMT score was 6.4 who met BPT and 4.4 who failed BPT (p<0.001).The majority of fracture neck of femurs admission 976 (64.3%) who met BPT came from sheltered accommodation. This is followed by those from their own homes, 340(22.4%) patients. In the group who failed BPT the majority of patients came from nursing homes, 96(34.4%, p<0.001) and 86 (30.8%, p<0.001) came from sheltered accommodation. There were 319 patients in Group 1 and 1200 patients in Group 2 ASA grading respectively who met BPT. There were 226 (81%, p<0.001) patients who failed BPT in Group 2 ASA grading. The overall length of stay in the hospital was 16.4 days for patients who met BPT compared to 17.3 days who failed BPT. The 30 day mortality in patients who met BPT was 9.4% and 16.5% who failed BPT which is statistically significant, Table 4.

ASA grading results

The mean age of Group 1 who met BPT was 80.9 years and 82.3 years in Group 2.The mean age of patients who failed BPT was 85.2 years in Group 1 and 86.9 years in Group 2 which is not statistically significant compared to the patients who met BPT. The two groups of ASA grades did not show any significant change in the ratio of males and females who met and failed BPT. The mean AMT score of patients who failed BPT was 4.5 and 3.9 (p<0.05) respectively for two groups of ASA grades which is not statistically significant. The average length of stay in the hospital was 17.5 and
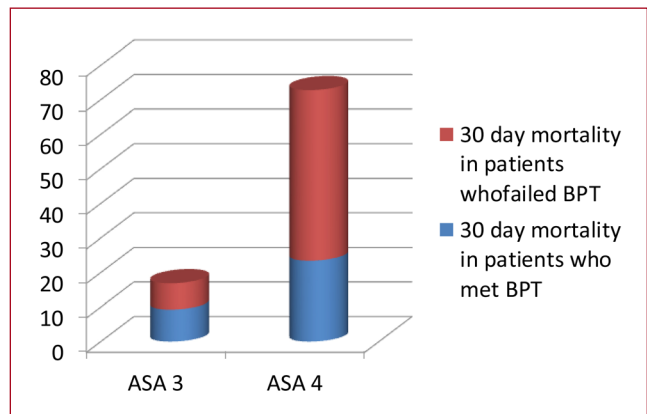

Figure 2. Chart showing significantly higher 30 day mortality in ASA grade3 & 4 who failed to meet Best Practice Tariff (BPT).

17.6 days in both groups respectively who failed BPT. The mortality rate in patients who failed BPT was 25% in Group 2 and 1.92% in Group 1 (P<0.001), Table 5. A detailed breakdown of mortality in various ASA grades that met and failed BPT is given in Table 6. The table shows that in ASA 3 patients the mortality rate was 7.61% in patients who failed compared to 9.28% those who met BPT. In ASA 4 patients who missed BPT the mortality was 49.33% compared to

Patient variables	Met BPT		Failed BPT		P value
	Group 1	Group 2	Group 1	Group 2	
Age (mean years)	80.9	82.3	85.2	86.9	<0.001
Sex M:F	1:2.74	1:2.75	1:2.71	1:2.76	<0.05
AMT score (mean)	6.8	6.5	4.5	3.9	<0.05
Length of stay (days)	15.2	16.8	17.5	17.7	<0.001
30 day Mortality (%)	2.57	12.63	1.92	25	<0.001

Table 5. Results of patient variables between two groups of ASA grades who met and failed Best Practice Tariff (BPT).

ASA Grading	Met BPT				Failed BPT			
	Survived	Died	30 day mortality	P value	Survived	Died	30 day mortality	P value
1	28	1	3.57	<0.05	8	0	0	<0.05
2	283	7	2.47	<0.05	44	1	2.27	<0.05
Combined 1 & 2	311	8	2.57	<0.05	52	1	1.92	<0.05
3	786	73	9.28	<0.001	105	8	7.61	<0.001
4	226	53	23.45	<0.001	75	37	49.33	<0.001
5	9	3	33.33	<0.001	0	0		
Combined 3, 4 & 5	1021	129	12.63	<0.001	180	45	25	<0.001
Grand total	1332	137	10.28	<0.001	232	46	19.82	<0.001

Table 6. Patients who survived and died in all ASA Grades with Best Practice Tariff (BPT) results.

Patient's residence	AMT score (mean)	Met BPT		Failed BPT		P values
		Group 1	Group 2	Group 1	Group 2	
Own Home	8.1	202	138	12	7	<0.05
Sheltered Home	7.7	316	660	34	52	<0.001
Nursing Home	2.9	16	42	15	81	<0.001
Residential home	4.2	15	34	15	30	<0.001
In-patients	5.8	9	24	8	21	<0.001
Others	7.4	30	33	1	3	<0.05

Table 7. Co-relation between ASA grades, patient's residential source, Abbreviated Mental Test (AMT) scores and Best Practice Tariff (BPT) results.

23.45% who met BPT (P<0.001), Figure 2.

The patients with ASA≥3 who failed BPT, 81(84%) from nursing home with a mean AMT score of 2.9, 30(67%) from residential homes, mean AMT score of 4.2, 52(60%) from sheltered home, mean AMT score of 7.7and 21(72%) were in-patients, mean AMT score of 5.8, Table 7. The analysis shows those patients admitted from a nursing home, residential home or as in-patients who sustained a hip fracture have a higher ASA grade and low AMT scores compared to those from own home or sheltered accommodation which is statistically significant.

Discussion

American Society of Anesthesiologists (ASA) physical status is been used widely to assess a patient preoperatively

regarding the fitness to have surgery and also determine the risk associated with it[11]. It is divided in to five grades. ASA 1 is a healthy patient, ASA 2 is a patient with mild disease, ASA 3 is a patient with severe systemic disease, ASA 4 is a patient with severe systemic disease with a constant threat to life and ASA 5 is a moribund patient[12]. In fracture neck of femurs delay in surgery is usually associated with increased mortality[13,14]. Although there are several studies looking at the mortality after neck of femur surgery[15,16] but no reports of the impact of ASA grading in the outcome of meeting or failing BPT.

The National Institute of Clinical Excellence (NICE)[17] guidelines recommend early surgery for patients admitted with fracture neck of femur and hence the modified BPT was introduced in 2011 to improve the outcomes such as time to theatre, length of stay and mortality after fracture neck of femur surgery. In our study group all the patients were assessed by anesthetists and orthogeriatricians and fitness for surgery is determined so that the BPT tariff should be met. In our study there were 1375 patients who were ASA≥3 (Group 2) which means they had more co-morbidity at the time of admission and need more input from the orthogeriatricians so that they achieve the BPT.

In our study patients the mean age of patients in both ASA groups were higher in patients who failed BPT and lower in patients who met BPT. The higher age the chance of not meeting BPT is more likely irrespective of ASA grade. There was no difference between males and females and ASA grade in achieving or failing the BPT. Sharrock et al in their study on the factors that affected the outcome of fracture neck of femurs concluded that there is no co-relation between age, sex, and ASA grades. They also found that the results are not influenced by the mental status of the patient[18]. In our study also we found that BPT results are not influenced by age, sex and ASA grades.

The majority of admissions in our study with neck of femur fractures came from sheltered accommodation. A recent study by Whittaker et al found that patients admitted from residential homes have got a high chance of meeting BPT but found no statistically significant co-relation between residential status and ASA grades[19]. But in our study the patients who failed BPT we found that the patients who came from sheltered accommodation, nursing home, in-patient or residential homes had ASA grade of 3 or more.

The length of stay is depended on several factors[20]. The most important factor is the prevalence of pre fracture co-morbidities of the patient. There are also other factors such as lack of adequate medical, nursing and social support needed pre and post discharge. In the study by Khan et al there length of stay was compounded by outbreak of norovirus in the wards and lack of rehabilitation beds due to winter pressures[21]. In our study the mean length of stay were similar between the groups who met and failed BPT. But in ASA ≤2 group who met BPT the average length of stay was 15.2 days which was shorter than both groups of

ASA grades who failed BPT. Yeoh et al in their study about ASA grade and fracture neck of femur in elderly had similar findings which concluded that higher the ASA grade longer is the length of stay[22].

The average 30 day mortality for fracture neck of femurs ranges from 6 to 9%[23]. In our study the 30 day mortality of patients who met BPT was 9.4% but those who failed BPT was 16.5%. The patients who failed BPT the mortality rate was higher in ASA ≥3. The reasons of not achieving BPT was the delay in getting these patients to theatre, mainly due to the time needed for resuscitation and medical optimization so that they are fit for anaesthesia and surgery. The study by Lefaivre et al showed that the delay in surgery is not a factor affecting the 30 day mortality[24]. In our series we found that the cause for increased mortality in ASA≥3 was linked to the number and type of medical conditions rather than delay in surgery.

In our study the 30 day mortality was higher in patients with ASA grade 3 or more. We believe that when a patient with fracture neck of femur being admitted is noted to be of ASA≥3, they should be prioritised. Any investigations that may delay their surgery should be ordered as urgent instigation on admission such as ECHO cardiogram or stabilising the coagulation status if they are on anticoagulants. They should be placed ideally at the beginning of the trauma list. The pre op optimisation should be more dynamic in patients with higher co-morbidities with involvement of orthogeriatrician, medical and anaesthetic consultants to avoid any delays in the surgery.

We collected our data from the departmental neck of femur database and cross checked with NHFD.There have been several studies in recent years looking directly at the NHFD which is closely aligned to BPT achievement and is almost certainly the tool by which most neck of femur data is collected. We believe that national data set could be used in future studies to get the larger sample size and confirm the findings of this study on a much larger scale.

Conclusion

The ASA grading significantly influence the outcomes of BPT. In our study we found that if a patient is ASA grade 3 or more with higher age, AMT score, those from nursing, residential, sheltered accommodation, inpatients are more likely to fail BPT. We also found that the length of stay is longer and 30 day mortality is higher in patients with ASA ≥3 compared to ASA≤2 who did not meet BPT.

References

1. Baker PN, Salar O, Ollivere BJ, Weerasuriya N, Moppett IK, Moran CG. Evolution of the hip fracture population: Time to consider the future? A retrospective observational analysis. BMJ Open 2014; 4:e004405.

2. White SM, Griffiths R. Projected incidence of proximal femoral fracture in England: a report from the NHS Hip Fracture Anaesthesia Network (HIPFAN). Injury 2011; 42:1230-1233.

3. Best Practice Tariff (BPT)-The National Hip fracture Database.http://www.nhfd.co.uk>hip fractureR.nsf>Best Practice tariff user guide. Accessed 25 October 2019.

4. Guidance in best practice tariff-NHA improvement.http://improvement. nhs.uk>document>Annex_DtD_Best_practice_tariff. Accessed on 25 October 2019.

5. Khan SK, Kalra S, Khanna A, Thiruvengada MM, Parker MJ. Timing of surgery for hip fractures: a systematic review of 52 published studies involving 291,413 patients. Injury 2009; 40:692-697.

6. Shiga T, Wajima Z, Ohe Y. Is operative delay associated with increased mortality of hip fracture patients? Systematic review, meta-analysis, and meta-regression. Can J Anaesth 2008; 55:146-154.

7. Simunovic N, Devereaux PJ, Sprague S, Guyatt GH,Schemitsch E,Debeer J,Bhandari M. Effect of early surgery after hip fracture on mortality and complications: systematic review and meta-analysis. CMAJ 2010; 182:1609-1616.

8. McGuire KJ, Bernstein J, Polsky D, Silber JH. The 2004 Marshall Urist award: delays until surgery after hip fracture increases mortality. Clin Orthop Relat Res 2004; 428:294-301.

9. Weller I, Wai EK, Jaglal S, Kreder HJ. The effect of hospital type and surgical delay on mortality after surgery for hip fracture. J Bone Jt Surg Br 2005; 87(3):361-366

10. Grimes JP, Gregory PM, Noveck H, Butler MS, Carson JL.The effects of time-to-surgery on mortality and morbidity in patients following hip fracture. Am J Med 2002; 112(9):702-709

11. Owens WD. American society of anaesthesiologists physical status classification system is not a risk classification system. Anesthesiology 2001; 94(2):378.

12. Dripps RD. American Society of Anesthesiologists. New classification of physical status. Anesthesiology 1963; 24(1):111.

13. Casaletto JA, Gatt R. Post-operative mortality related to waiting time for hip fracture surgery. Injury 2004; 35 (2):114-120.

14. Elliott J, Beringer T, Kee F, Marsh D, Willis C, Stevenson M. Predicting survival after treatment for fracture of the proximal femur and the effect of delays to surgery. J Clin Epidemiol 2003; 56(8):788-795.

15. Richmond J, Aharonoff GB, Zuckerman JD, Koval KJ. Mortality risk after hip fracture. J Orthop Trauma 2003; 17 (1):53-56.

16. Elliott J, Beringer T, Kee F, Marsh D, Willis C, Stevenson M. Predicting survival after treatment for fracture of the proximal femur and the effect of delays to surgery. J Clin Epidemiol 2003; 56(8):788-795.

17. NICE clinical guideline 124. Hip fracture: the management of hip fracture in adults. National Institute for health and Clinical Excellence NICE; 2011.

18. Sharrock MN, Davies RM, Smith P, Lovell ME. Factors that affect fractured neck of femur outcome: Clinical commissioning groups influence length of stay and discharge destination. Injury 2016; 47(2):444-7.

19. Whitaker SR, Nisar S, Scally AJ, Radcliffe GS. Does achieving the 'Best Practice Tariff' criteria for fractured neck of femur patients improve one year outcomes? Injury 2019; 50(7):1358-1363.

20. Brown CA, Olson S, Zura R. Predictors of length of hospital stay in elderly hip fracture patients. J Surg Orthopaed Adv 2013; 22(2):160-163.

21. Khan SK, Rushton SP, Dosani A, Gray AC, Deehan DJ. Factors influencing length of stay and mortality after first and second hip fractures: an event modelling analysis. J Orthop Trauma 2013; 27:82-86.

22. Yeoh CJC, Fazal MA. ASA Grade and Elderly Patients with Femoral Neck Fracture. Geriatric Orthopaedic Surgery & Rehabilitation 2014; 5(4):195-199.

23. Moran CG, Wenn RT, Sikand M, Taylor AM. Early mortality after hip fracture: is delay before surgery important? J Bone Joint Surg Am 2005; 87(3):483-489.

24. Lefaivre KA, Macadam SA, Davidson DJ, Gandhi R, Chan H, Broekhuyse HM. Length of stay, mortality, morbidity and delay to surgery in hip fractures. J Bone Joint Surg Br 2009; 91(7):922-927.