# Pre-op cardio-respiratory and electrolytes status to predict post-op ICU stay in patients with proximal femoral fractures using POSSUM score

Shuaib Ahmed[1], K. Raghuveer Adiga[2],Vivian Roshan d'Almeida[3],Ashwin Kamath[4],Thomas Devasia[5]

[1]*Department of Orthopaedics, Fr.Muller Medical College Hospital, India*
[2]*Department of Orthopaedics, Fr.Muller Medical College Hospital, India*
[3] *Department of Orthopaedics, Fr.Muller Medical College Hospital, India*
[4] *Department of Orthopaedics, Fr.Muller Medical College Hospital, India*
[5] *Department of Orthopaedics, Fr.Muller Medical College Hospital, India*

***Abstract:*** *Fractures of the proximal femur in the elderly are common and occur mainly due to falls, osteoporotic bone, lack of care and due to pathological fractures. The timing of the surgery is a much debated topic and a scoring system is needed which can predict poor outcomes following surgery. The physiological and operative severity score for the enumeration of mortality and morbidity (POSSUM) is a scoring system that predicts postoperative morbidity and mortality.*
*Methods: A total of 30 patients with proximal femoral fractures were admitted in the Department of Orthopaedics in Father Muller Medical College hospital, Mangalore from December 2014 to May 2015 were included as part of the study after approval from the institutional ethical committee. The patients were followed up to assess their ICU stay.*
*Results: The patients with deranged pre-op cardiorespiratory and electrolyte status were compared with the post-op ICU stay and a positive correlation was observed.*
*Conclusion: The POSSUM scoring system can help assess the morbidity risk using the pre-op cardiorespiratory and electrolytes status.*
***Keywords:*** *femur,morbidity,cardiorespiratory,electrolytes,surgery*

## I. Introduction

Fractures of the proximal femur in the elderly are common and occur mainly due to falls, osteoporotic bone, lack of care and due to pathological fractures. These fractures pose a devastating injury with significant long-term consequences for the quality of life of both patients and care takers. Most of these patients have a number of concurrent medical comorbidities and are susceptible to postoperative complications and poorer outcome[1].

Following a femoral fracture in the elderly, timing of the surgery is a much debated topic and the controversial dilemma being whether surgical delay contributes to a poorer outcome[2]. Thus, a scoring system is needed which can predict poor outcomes following surgery[1]. The physiological and operative severity score for the enumeration of mortality and morbidity (POSSUM) is a scoring system that predicts postoperative morbidity and mortality, taking into account the patient's physiological as well as surgical factors[1].

The POSSUM scoring was originally devised to predict the outcome in general surgery, vascular surgery, surgical gastroenterology and urology. The POSSUM scoring system has been modified for orthopaedic surgery and validated by Mohamed et al[3].The orthopaedic POSSUM system (O-POSSUM) also has been validated as a method to assess 30-day morbidity and mortality rates in patients who undergo orthopaedic surgery[3].

The aim of our study was to predict the post-operative ICU stay with the help of pre-operative physiological score and morbidity score mainly using the cardiorespiratory and electrolytes status.

## II. Materials and Methods

A total of 30 patients with proximal femoral fractures were admitted in the Department of Orthopaedics in Father Muller Medical College Hospital, Mangalore from December 2014 to May 2015 were included as part of the study after approval from the institutional ethical committee. Proximal femoral fractures included fracture neck of femur, intertrochanteric fracture and sub-trochanteric fracture. Each patient was diagnosed to have fracture after x-ray and underwent other routine pre-operative investigations. Patients with concurrent co-morbidities were treated accordingly and fitness for surgery obtained from the physicians, cardiologists and

neurologists. Local ethical committee clearance was obtained and consent from the patients included in the study were obtained.

Each patient had their orthopaedic POSSUM score calculated as described by Mohamed et al[3]. The physiological score is divided into 12 categories and the operative severity score into 6 categories. Each category was graded (Table 1). The physiological POSSUM score was calculated at admission and immediately prior to surgery. The operative severity score was calculated from the operative notes.

## III. Results

Al the data was entered into an excel sheet and statistical analysis was done using the SPSS v17 software. The physiological and operative score was calculated by the following equation[3]:

$$\text{Log}_e\ R1/(1-R1) = -7.04 + (0.13 \times \text{physiological score}) + (0.16 \times \text{operative severity score})$$
$$\text{Log}_e\ R2/(1-R2) = -5.91 + (0.16 \times \text{physiological score}) + (0.19 \times \text{operative severity score})$$

The mean age among the 30 patients was 68.7 years with the minimum age of patient with fracture being 49 years and maximum being 93 years. The age group is as shown in table 4. Among the gender distribution of the patients 43.3% were females and 56.7% were males.

The patients with deranged cardiorespiratory status were 56.7 % (Table 5). Patients with affected pre-operative electrolytes were 66.7% (Table 6).

All the patients underwent elective surgery and there were no deaths. Based on the scoring system, the predicted morbidity and mortality scores for each of the patients were calculated. The expected morbidity rate calculated was a maximum of 99.8% and minimum was 13.8 %. Among the mortality rates maximum was 42.6% and minimum was 2.3%

Post-op ICU stay was noted down in hours with the mean being 10.5 hours, maximum was 36 hours and minimum was 4 hours. This post op ICU stay was compared with pre-operative cardio-respiratory and electrolyte values. It was found that those patients with deranged pre-op cardiorespiratory and electrolytes status had a longer post-op ICU stay compared to the normal patients. The statistical analysis on these parameters showed a statistical significance (p< 0.005).

## IV. Discussion

Worldwide increase in medical awareness has led to the need for improving health care and surgical outcome. An important note regarding surgical specialties is that death after surgery is an obvious adverse outcome. Hence many non-surgical clinicians have suggested that the rates of mortality are a suitable indicator of surgical prowess[3]. Death is a rare complication following orthopaedic surgery and it usually follows a number of antecedent complications.

The overall mortality for those over 60 with an acute hip fracture ranges from 9.6 % at 30 days to 33 % at 1 year, or up to 19 % at 19 days[4,5]. A high physiological score showed an increase in morbidity score and hence a prolong post op ICU stay. Some of the patients who had a long pre-op wait due to fitness related delays also had a long ICU stay. Increased catabolism, aggravated by the prolonged fasting, delay before surgery and pain may be the cause for these results. Little inhibitory effect was seen when treated with analgesics[5]. The ensuing insulin resistance will accelerate the process of muscle loss and may propagate weakness[6,7], leading to an increase in time to discharge and recovery of mobility. Most of these patients are on bed rest and are prone to increased risk of bed rest-related complications such as thromboembolism, urinary tract infections, atelectasis, and pressure ulcers[8]. Another significant reason for delay in surgery is because of delirium which is common with hip fracture in the elderly[9].

Patients with longer pre-op wait due to fitness related reasons and with added morbidities invariable end up with post-op complications and a longer ICU stay. Simunovic et al[10] have shown in their study that early surgery significantly reduces the risk of 1-year mortality by 45 %. Patients with lower physiologic POSSUM scores tolerate surgical delay better, therefore this may help in prioritizing patients for surgery and avoid surgical delay. This way of targeting patients could yield health cost benefits, and correlates with prior studies suggesting that age is an important contributing factor affecting mortality in patients whose surgery is delayed[1]. Thus, sicker patients on admission could undergo surgery immediately[11,12].

As already discussed POSSUM scoring which was modified for orthopaedic surgeries was used in our study. According to the scoring system (Table 1, 2, 3) a proforma was made and the score was calculated. Statistical analysis was then done for the data.

We have used the pre-op cardio-respiratory and electrolytes values of patients to predict the post-op ICU stay. Those patients with abnormal values were labeled as affected and the rest were categorized as normal.

In our study we found that higher the pre-operative score more are the chances of intra-operative complications which in-turn reflects the mortality and morbidity scores. This also affected the post-op ICU stay (Table 7). The higher the pre-op score, longer was the post-op ICU stay. The 10 normal patients had a mean pre-

op score of 23.1 hours and their mean post-op ICU stay was 7.2 hours. The affected patients had a higher mean pre-op score of 32.8 hours which reflected in the form of longer mean post-op ICU stay upto 12.1 hours. This data was statistically significant. Hence, the POSSUM scoring can predict the morbidity risk. In addition to this, in our study we made an attempt to help predict the post-op ICU stay using the POSSUM score.

## V.    Figures and Tables

Table 1 Physiological and operative severity assessment in the orthopaedic POSSUM system

Physiological score

|  | 1 | 2 | 4 | 8 |
|---|---|---|---|---|
| **Age (years)** | <60 | 61 to 70 | >70 |  |
| **Cardiac signs** | Normal | On cardiac drugs/ steroids | Edema/ warfarin | Raised JVP |
| **Chest radiograph** | Normal |  | Borderline cardiomegaly | Cardiomegaly |
| **Resp signs** | Normal | SOB exertion | SOB stairs | SOB rest |
| **Chest radiograph** | Normal | Mild COAD | Mod COAD | Any other change |
| **Systolic BP (mmHg)** | 110 to 130 | 131 to 170 | >171 | <89 |
| **Pulse (/min)** | 50 to 80 | 81 to 100 | 101 to 120 | >121 |
| **Coma score** | 15 | 12 to 14 | 9 to 11 | <8 |
| **Blood urea(mmol/l)** | <7.5 | 7.6 to 10 | 10.1 to 15 | >15.1 |
| **Blood Na(mmol/l)** | >136 | 131 to 135 | 126 to 130 | <125 |
| **Blood K(mmol/l)** | 3.5 to 5 | 3.2 to 3.4 | 2.9 to 3.1 | <2.8 |
| **Hb(g/100ml)** | 13 to 16 | 11.5 to 12.9 | 10 to 11.4 | <9.9 |
| **White cell count(x1012/l)** | 4 to 10 | 10.1 to 20 | >20.1 |  |
| **ECG** | Normal |  | AF | Any other change |

JVP-Jugular venous pressure
SOB-shortness of breath
COAD- chronic obstructive airway disease
AF- atrial fibrillation

Table 2 Operative severity score

|  | 1 | 2 | 4 | 8 |
|---|---|---|---|---|
|  |  |  |  |  |
| **Magnitude** | Minor | Intermediate | Major | Major |
| **Number of operative variables within 30 days** | 1 |  | 2 | >2 |
| **Blood loss per operation (ml)** | <100 | 101 to 500 | 501 to 999 | >1000 |
| **Contamination** | None | Incised wound, i.e. stab | Minor contamination or necrotic tissue | Gross contamination or necrotic tissue |
| **Presence of malignancy** | None | $I_0$ | Node metastasis | Distant metastasis |
| **Timing of operation** | Elective |  | Emergency. Resuscitation possible <48 hours | Emergency. Immediate < 6 hours |

Table 3 Operative complexity for the operative severity score

| **Minor** | Fasciotomy<br>Ganglion/bursa<br>Tenotomy/tendon repair<br>Arthroscopic surgery<br>Carpal tunnel/nerve release<br>Removal of metal<br>Closed reduction of fracture |
|---|---|
| **Intermediate** | Excision/osteotomy small bone<br>Minor joint replacement<br>Amputation digit/digits<br>Closed reduction with external fixation<br>Open reduction of fracture of small bone |
| **Major** | Osteotomy long bone<br>Ligamentous reconstruction + prosthesis Arthrodesis large joint<br>Major joint replacement<br>Amputation limb<br>Disc surgery<br>Open reduction of fracture of a long bone |
| **Major +** | Radical tumourectomy<br>Major spinal reconstruction<br>Revision prosthetic replacement, major joint Hindquarter/forequarter |

| amputation |
|---|

Table 4 Age(years)

| | Frequency | Percent |
|---|---|---|
| 60 and below | 5 | 16.7 |
| 61 - 70 | 16 | 53.3 |
| Above 70 | 9 | 30.0 |
| Total | 30 | 100.0 |

Table 5 Preop status-Cardiorespiratory

| | Frequency | Percent |
|---|---|---|
| Normal | 13 | 43.3 |
| Affected | 17 | 56.7 |
| Total | 30 | 100.0 |

Table 6 Pre-op electrolytes

| | Frequency | Percent |
|---|---|---|
| Normal | 10 | 33.3 |
| Affected | 20 | 66.7 |
| Total | 30 | 100.0 |

Table 7 Post-op ICU stay

| | No of patients | Mean pre-op score(Physiological score) | Mean (ICU stay in hours) | Standard deviation |
|---|---|---|---|---|
| **Normal** | 10 | 23.1 | 7.2 | 2.9 |
| **Affected** | 20 | 32.8 | 12.1 | 6.4 |

## VI.    Conclusion

Possum scoring can be used as a tool for a better orthopaedic care. There may be a few patients who have all the parameters in POSSUM score within the normal range yet have a longer post-op ICU stay. This can be explained by the fact that such patients may have other parameters deranged which are not a part of the POSSUM scoring system. Hence the scope of this study can be improved by including a larger sample size and adding more vital parameters to the scoring system.

## References

[1].    Hapuarachchi KS, Ahluwalia RS, Bowditch MG. Neck of femur fractures in the over 90s: a select group of patients who require prompt surgical intervention for optimal results. J Orthopaed Traumatol 2014;15:13–9.
[2].    Siegmeth AW, Gurusamy K, Parker MJ. Delay to surgery prolongs hospital stay in patients with fractures of the proximal femur. J Bone Jt Surg Br 2005;87:1123–6.
[3].    Mohamed K, Copeland GP, Boot DA, Casserley HC, Shackleford IM, Sherry PG et al. An assessment of the POSSUM system in orthopaedic surgery. J Bone Jt Surg(Br) 2002;84B:735–9.
[4].    Moran CG, Wenn RT, Sikand M, Taylor AM Early mortality after hip fracture: is delay before surgery important? J Bone Jt Surg (American) 2005;87:483–9.
[5].    Kehlet H. Manipulation of the metabolic response in clinical practice. World J Surg 2000;24:690–5.
[6].    Hedstro¨m M. Hip fracture patients, a group of frail elderly people with low bone mineral density, muscle mass and IGF levels. Acta Physiol Scand 1999;167:347–50
[7].    Karlsson M, Nilsson JA, Sernbo I, Redlund-Johnell I, Johnell O, Obrant KJ. Changes of bone mineral mass and soft tissue composition after hip fracture. Bone 1996;18:19–22.
[8].    Orosz GM, Magaziner J, Hannan EL,Morrison RS, Koval K, Gilbert M et al. Association of timing of surgery for hip fracture and patient outcomes. J Am Med Ass 2004;291:1738–43.
[9].    Schuurmans MJ, Duursma SA, Shortridge-Baggett LM, Clevers GJ, Pel-Littel R. Elderly patients with a hip fracture: the risk for delirium. Appl Nurs Res 2003;16:75–84.
[10].   Simunovic N, Devereaux PJ, Sprague S, Guyatt GD, Schemitsch E, Justin DeBeer J, Bhandari M. Effect of early surgery after hip fracture on mortality and complications: systematic review and meta-analysis. Canad Med Ass J 2010;182:1609–16.
[11].   Hamlet WP, Lieberman JR, Freedman EL et al. Influence of health status and the timing of surgery on mortality in hip fracture patients. Am J Orthop 1997;26:621–7.
[12].   Smektala R, Endres H, Dasch B, Maier C, Trampisch HJ, Bonnaire F et al. The effect of time to- surgery on outcome in elderly patients with proximal femoral fractures. BMC Musculoskelet Disord 2008;9:171.