Original Article

Factors Affecting Mortality in Nonagenarian Population following Surgery for Fragility Hip Fractures: An Experience from a Tertiary Level Trauma Center in India

Aditya Jain, Devansh Goyal, Samarth Mittal, Puneet Khanna[1], Chhavi Sawhney[1], Vivek Trikha

Department of Orthopaedics, Jai Prakash Narayan Apex Trauma Centre, All India Institute of Medical Sciences, [1]Department of Anaesthesiology, Pain Medicine and Critical Care, All India Institute of Medical Sciences, New Delhi, India

Abstract

Introduction: Fragility hip fractures in nonagenarian patients pose a great challenge in management. To the best of our knowledge, no study has previously evaluated the outcomes and risk factors for mortality after hip fractures in this subgroup of population from the Indian subcontinent. **Materials and Methods:** A retrospective observational study was performed on nonagenarian patients (aged ≥90) who underwent surgery for hip fractures between March 2016 and March 2019. The patients were divided into two groups: "survivor group" (Group A) and "mortality group" (Group B). The demographic data, type of fracture, side of fractured limb, preinjury ambulatory status, American Society of Anesthesiologists (ASA) status, comorbidities, time interval from injury to surgery, operative time, length of hospital stay, and postoperative ambulatory status were recorded from hospital medical records and were studied between the two groups. The follow-up duration of the study was 1 year. **Results:** Thirty-four patients were included in the study. Both the groups had 17 patients each. Cardiac dysfunction was the most common cause of mortality. The time interval from injury to surgery (odds ratio [OR] = 11.2), gender (OR = 0.23) and postoperative mobility status (OR = 0.07) were found to be significantly different between the two groups. No significant difference in ASA grade, comorbidities, fracture type, preinjury ambulatory status, operative time, and length of hospital stay was seen between the two groups. **Conclusions:** Risk factors for mortality after hip fracture surgery in the nonagenarian population are male gender, delay in surgery (>3 days) and poor ambulatory status in the postoperative period. Hence, the aim for such patients with hip fractures should be to perform an early surgery and encourage an early ambulation.

Keywords: Fragility fractures, hip fractures, mortality, nonagenarians

Introduction

The advancements in medicine have led to an improvement in the care and management of the geriatric population throughout the world, hence leading to an increase in the survival of this population group. According to the WHO, by 2050, the population of people aged 65 years and above is estimated to be about 1.5 billion, which will be around 16% of the global population and approximately 6.5 million hip fractures will occur around the world.[1,2] Therefore, the burden on the health care system will further increase. In India, with the improvement in life expectancy, the present population of nonagenarians (90 years or above) was reported to be over 1.33 million in 2019.[3]

Though nonagenarians represent a small subgroup, fragility hip fractures in them pose a great challenge to both orthopedic surgeons and physicians, as they frequently suffer from multiple comorbidities and functional impairment. Care for these patients is complex and requires a multidisciplinary approach.[4] The literature has shown that the 1-year mortality rates after hip fracture in nonagenarians are as high as 24%–50%.[4-10]

Submitted: 20-Jul-2022 **Revised:** 20-Aug-2022 **Accepted:** 07-Sep-2022 **Published:** 22-Oct-2022

Access this article online

Quick Response Code:

Website: www.jiag.in

DOI: 10.4103/jiag.jiag_34_22

Address for correspondence: Dr. Samarth Mittal, Department of Orthopaedics, Jai Prakash Narayan Apex Trauma Centre, All India Institute of Medical Sciences, New Delhi - 110 029, India.
E-mail: samarthmittal@gmail.com

How to cite this article: Jain A, Goyal D, Mittal S, Khanna P, Sawhney C, Trikha V. Factors affecting mortality in nonagenarian population following surgery for fragility hip fractures: An experience from a tertiary level trauma center in India. J Indian Acad Geriatr 2022;18:97-102.

It has been stated in literature that advancing age in patients with hip fracture is associated with a significant increase in postoperative complications, high mortality rate, and poor functional prognosis.[2,11-16] Also, the limitation of activity after a fracture adds to the risk of increased complications and hence increased mortality rate. These fractures should therefore be managed urgently as surgery aids in early mobilization, optimal nursing care, rehabilitation, which in turn leads to better functional outcomes, shorter duration of hospital stay, and decreased mortality compared to nonsurgical treatment.[4,8,10,17,18] The timing of the surgery in these patients has been a topic of debate. Nevertheless, literature suggests that early surgical fixation is associated with better outcomes and less mortality.[11,19-21]

There have been various studies published worldwide, evaluating the outcomes and risk factors for mortality after hip fractures in the nonagenarian population. But as per our knowledge, no such study has evaluated the same from the Indian subcontinent from a single center. Hence, we conducted this study in nonagenarians who were surgically managed for hip fractures at our institute to evaluate the risk factors associated with poor outcomes in them.

Materials and Methods

After obtaining clearance from the institutional ethics committee, we conducted a retrospective observational study of patients who underwent surgery for hip fractures at our level 1 trauma center in India between March 2016 and March 2019. Patients with ages equal to or more than 90 years were included in the study. Patients with pathological fractures (due to tumors) and high-velocity injuries were excluded from the study. The patient details such as age, gender, type of fracture, side of the fractured limb, preinjury ambulatory status, American Society of Anesthesiologists (ASA) status, comorbidities, the time interval from injury to surgery, operative time, and length of hospital stay were recorded from hospital medical records. The patients whose records were not or partially available were excluded from the study.

ASA scale was used to evaluate preoperative physical status at admission.[22] The comorbidities assessed were diabetes mellitus, hypertension, renal disease, coronary artery disease, chronic obstructive pulmonary disorder (COPD), cognitive impairment, history of prior myocardial infarction (MI), stroke, and any malignancy.

Fractures were divided into extracapsular and intracapsular type, treated with closed reduction and internal fixation with cephalomedullary nail and replacement arthroplasty, respectively, as per hospital records. All the surgeries were performed by two senior surgeons, and the reduction quality was acceptable in all the patients needing fixation as per Chang's reduction criteria.[23] All the patients were generally mobilized full weight-bearing with the help of a walker on the next day after the surgery and were encouraged to do knee range of motion and quadriceps exercises. They were also started on deep vein thrombosis prophylaxis with pneumatic compression pumps, compression stockings, and oral aspirin 75 mg from the immediate postoperative period for 2 weeks.

The patients were followed up in outpatient clinic at 4 weeks, 3 months, 6 months, and 1 year, and postoperative ambulatory status at 4 weeks (without support, with support, nonambulatory or bedridden) was assessed along with any complications. The patients who did not turn up in the clinic were contacted telephonically and enquired about the ambulatory status and the survival status as per departmental policy. The patients were divided into two groups: those who survived were classified as "survivor group" (Group A) and 17 patients who died were classified as "mortality group" (Group B). Group B was further divided into three subgroups: mortality within 30-day, within 90-day, and within 1 year, and the cause for mortality were also documented.

Statistical analysis was performed using R statistical software version 3.6.1. For continuous data, the Student's *t*-test was used if data followed a normal distribution, and the Wilcoxon rank-sum test was used for nonparametric data. For ratios, we used the Chi-squared test, while Fisher's exact test was used if the expected frequency in any cell was <5. Univariate logistic regression analysis was done to assess the factors associated with mortality and the odds ratio (OR) was calculated with a 95% confidence interval.

Results

A total of 34 patients were included in the study. The mean age of the patient population under study was 92.5 ± 2.8 years. Sixteen (47.06%) were male and 18 (52.94%) were female. Of the 34 patients, 17 patients had died by 1-year (1-year mortality of 50%), constituted the Group B. Out of these 17, 5 (29.4%) patients died within 30 days and 16 of the 17 (94.1%) patients had died by 90 days postsurgery. Within this group, cardiac dysfunction (MI and cardiac arrest) was the most common cause of mortality (n = 11, 64.71%). The demographic data are shown in Tables 1 and 2.

The two groups (A and B) were compared to evaluate the factors affecting mortality. There was no significant difference in the age of the patients between the two groups (92.3 ± 2.6) versus (92.8 ± 3.1), respectively. In group B, 11 were male in contrast to five males in group A. This difference was statistically significant (P = 0.039) and the univariate logistic regression analysis showed that female sex was a protective factor against mortality (OR = 0.23) (P < 0.05). The statistical analysis showed no significant difference in ASA grade, comorbidities, fracture type, preinjury ambulatory status, operative time, and length of hospital stay between the two groups. However, there was a significant difference in the time interval from injury to surgery between the two groups. The mean time interval from injury to surgery in group B was 5.1 ± 2.9 days, which was significantly higher than group A which was 2.8 ± 1.7 days (P < 0.05). Furthermore, univariate logistic regression analysis also

Table 1: Comparative data on pre- and post-operative variables

Variable	Total (*n*=34), *n* (%)	Group A (alive) (*n*=17), *n* (%)	Group B (died) (*n*=17), *n* (%)	*P*
Age (years) (mean)	92.5±2.8	92.3±2.6	92.8±3.1	0.775
Gender				
Male	16 (47.06)	5 (29.41)	11 (64.71)	0.039
Female	18 (52.94)	12 (70.59)	6 (35.29)	
Fractured side				
Right	14 (41.18)	8 (47.06)	6 (35.29)	0.486
Left	20 (58.82)	9 (52.94)	11 (64.71)	
Preoperative mobility				
No support	23 (67.65)	12 (70.59)	11 (64.71)	>0.999
With support	11 (32.35)	5 (29.41)	6 (35.29)	
Comorbidities				
DM	6 (17.65)	5 (29.41)	1 (5.88)	0.175
HTN	19 (55.88)	10 (58.82)	9 (52.94)	>0.999
Renal disease	2 (5.88)	0	2 (11.76)	0.227
CAD	4 (11.76)	2 (11.76)	2 (11.76)	>0.999
Prior MI	3 (8.82)	2 (11.76)	1 (5.88)	>0.999
COPD	2 (5.88)	0	2 (11.76)	0.227
Prior stroke	2 (5.88)	1 (5.88)	1 (5.88)	>0.999
Dementia	3 (8.82)	0	3 (17.65)	0.103
Malignancy	1 (2.94)	1 (5.88)	0	>0.999
ASA grade				
1 or 2	18 (52.94)	9 (52.94)	8 (47.06)	>0.999
3 or 4	16 (47.06)	8 (47.06)	8 (47.06)	
Fracture type				
Extracapsular	28 (82.35)	15 (88.24)	13 (76.47)	0.656
Intracapsular	6 (17.65)	2 (11.76)	4 (23.53)	
Time to surgery (days)	3.9±2.6	2.8±1.7	5.1±2.9	0.003
Operative time (min)	37.7±13.1	35.9±11.9	39.4±14.3	0.532
Length of hospital stay (days)	7.4±4.0	6.2±2.6	8.6±4.9	0.086
Postoperative mobility				
No support	5 (14.71)	4 (23.53)	1 (5.88)	0.014
With support	20 (58.82)	12 (70.59)	8 (47.06)	
Bedridden	9 (26.47)	1 (5.88)	8 (47.06)	

MI: Myocardial infarction, COPD: Chronic obstructive pulmonary disease, ASA: American Society of Anesthesiologists, DM: Diabetes mellitus, HTN: Hypertension, CAD: Coronary artery disease

Table 2: Mortality at different time points

Timepoint	Mortality (%)
Within 30 days	5 (14.71)
Within 90 days	16 (47)
Within 1 year	17 (50)

showed that a delay in surgery of more than 3 days since the injury was significantly associated with higher mortality (OR [95% CI] = 11.2 [2.20–56.92]) ($P < 0.05$).

Ambulatory status was evaluated 4 weeks postoperatively. In group A, four patients were ambulatory without support, 12 patients were ambulatory with support, and one was nonambulatory, in contrast to group B, where one patient was ambulatory without support, eight were ambulatory with support, and eight were nonambulatory, and this difference was statistically significant ($P = 0.014$). For the patients who died prior to the 4-week follow-up, their postoperative ambulatory status was assessed using hospital records and telephonically with patients' family. Moreover, univariate logistic regression analysis showed that patients who were ambulatory in the 1-month postoperative period had a protective effect against mortality (OR = 0.07) ($P < 0.05$).

Discussion

Hip fractures are associated with a high rate of mortality in the older adults.[1,2] Nonagenarians being severely osteoporotic and more prone to accidental falls are more likely to present with a hip fracture. They require a multidisciplinary approach for their management due to the presence of associated comorbidities.[4] Moreover, these patients have an elevated risk of higher postoperative complications, poor surgical outcomes, and higher mortality rates.[11-16] Many studies have been conducted throughout the world assessing hip fractures in the nonagenarian population and the associated factors affecting the outcomes and mortality in such patients. However, no

similar study has been conducted in India as per our knowledge in the nonagenarian population.

Cardiac dysfunction was the most common cause of mortality in our study (n = 11, 64.71%) [Tables 2 and 3]. The 1-year mortality rate in our study was comparable to the studies in literature in the nonagenarian population (24%–50%).[1,4,7,9,10] The 30-day mortality in our study is also comparable to the previous studies (9%–18%).[1,2,10] The literature has mentioned various factors for mortality in older patients. Our study took each of these factors for assessment and looked for their correlation with mortality.

The study showed that females had a better survival rate as compared to males in the postoperative period ($P < 0.05$). The higher mortality rate in males was consistent with previous studies. This may be due to the higher associated comorbidities present in males as compared to females.[11,13,16,20,24] The study showed that there was no significant difference in the preinjury mobility status between the two groups. Although some studies have shown preinjury mobilization status as one of the important risk factors for mortality in hip fractures in the older adults, our study showed that preinjury mobility was not a significant risk factor for mortality ($P = 0.714$).[13,16,25]

We also assessed the preexisting comorbidities in our patients which were diabetes mellitus, hypertension, renal disease, coronary artery disease, Chronic obstructive pulmonary disease (COPD), cognitive impairment, history of previous MI, stroke, or malignancy [Tables 1 and 4]. Hypertension was the most common comorbidity (19 patients) in our study group. The presence of comorbidities was comparable in both the groups. In univariate analysis, none of the comorbidities when individually assessed was found to be a significant risk factor for mortality. This finding may be due to the small sample size of the study. The literature has reflected that the presence of multiple comorbidities (>2), higher Charlson Comorbidity Index, congestive heart failure, MI, renal disease, pulmonary disease, diabetes mellitus, and cognitive impairment are associated with high mortality in this group of patients.[11,14,19,20,26]

Previously studies have shown that the scale of ASA has a major role in predicting mortality in geriatric patients with hip fractures. A higher ASA grade (3 or 4) is associated with higher mortality.[13,25,27-29] However, there was no significant difference in ASA status in both the groups in our study. Furthermore, there was no significant relation between ASA status and mortality ($P < 0.05$). There are few studies in literature stating that extracapsular hip fractures are associated with a high mortality rate.[10,24] In contrast, few studies point out intracapsular fractures as the risk factor for mortality.[16] Ovidiu *et al*. stated that extracapsular fracture had a better survival rate.[2] Our study showed no relation of fracture type to mortality in this age group.

Delay in surgery is a major concern for patients with hip fractures as it may greatly affect the postoperative outcomes as well as mortality. We evaluated the time interval from the fracture to surgery which showed a significant difference in the two groups ($P < 0.05$), which was 2.8 ± 1.7 days in group A as compared to 5.1 ± 2.9 days in group B [Table 1]. The delay of more than 3 days in surgery was associated with a higher rate of mortality, OR = 11.2 ($P < 0.05$) [Table 4]. Previous studies

Table 3: Causes of mortality

Cause	*n* (%)
Cardiac dysfunction	11 (64.71)
Sepsis	2 (11.76)
PE	1 (5.88)
Respiratory failure	1 (5.88)
Stroke	1 (5.88)
Refracture (other limb fracture)	1 (5.88)

PE: Pulmonary embolism

Table 4: Univariate logistic regression analysis of factors associated with mortality

Variable	Odds ratio (95% CI)
Age	1.06 (0.83-1.36)
Gender	
Male	Reference
Female	0.23 (0.05-0.96)*
Fractured side	
Right	1.63 (0.41-6.46)
Left	Reference
Preoperative mobility	
No support	Reference
With support	1.31 (0.31-5.53)
Comorbidities[#]	
DM	0.15 (0.02-1.46)
HTN	0.79 (0.2-3.06)
CAD	1.00 (0.12-8.05)
Prior MI	0.5 (0.04-6.12)
Prior stroke	1.14 (0.07-20.02)
ASA	
1 or 2	Reference
3 or 4	1.13 (0.29-4.41)
Fracture type	
Extracapsular	Reference
Intracapsular	2.31 (0.36-14.72)
Time to surgery	
Within 3 days	Reference
After 3 days	11.2 (2.20-56.92)*
Operative time (per minute increase)	1.02 (0.97—1.08)
Length of hospital stay (days)	
<7	0.27 (0.06-1.19)
>7	Reference
Postoperative ambulatory status	
Nonambulatory	Reference
Ambulatory	0.07 (0.01-0.66)*

*P <0.05. CAD: Coronary artery disease, DM: Diabetes mellitus, HTN: Hypertension, MI: Myocardial infarction, ASA: American Society of Anesthesiologists, CI: Confidence interval

have shown that a delay in surgery significantly affects the rates of mortality in geriatric patients with hip fractures.[11,19,21,25] Few studies quantified 48 h as the cutoff for the delay, beyond which the mortality rate increases.[20,30]

The mean length of hospital stay in Group A was 6.2 ± 2.6 days and 8.6 ± 4.9 days in Group B. This difference was statistically insignificant ($P > 0.05$). Furthermore, the hospital stay of fewer than 7 days was not significantly protective for mortality (OR = 0.27, P - 0.084). However, few studies have highlighted the fact that longer hospital stay is related to increased mortality rate.[25,31] Early ambulation after surgery is associated with better functional outcomes and lower mortality.[8,15] Our study showed lower mortality in patients with early ambulation as compared to nonambulatory patients ($P < 0.05$). The causes behind poor mobilization in some patients were lack of will to walk again, poor dietary intake, generalized frailty, and lack of proper rehabilitative support at home. Higher mortality is associated with delayed or no ambulation and can be attributed to the worsening of the comorbidities that patients already have.[6,24]

There were few limitations of our study. The sample size was small, which has led to a probable lack of correlation between some of the proven risk factors and mortality. The retrospective design of the study is also a limitation. It is possible that patients with high risk factors (e.g., multiple concurrent comorbidities) or those unfit for surgery have not been surgically operated and therefore have not been included in this study leading to a possible selection bias. The follow-up was only 1 year, and a longer study is required to comment upon the 3-and 5-year survival status of these patients. We did not analyze the combination of comorbidities as a risk factor for mortality.

Conclusions

The nonagenarian hip fractures are significantly different from other age groups in terms of functional outcomes and mortality rate, strengthening the point that advancing age is a risk factor of adverse events. Our study highlighted that male gender, delay in surgery (>3 days), and poor ambulatory status in the postoperative period are risk factors for mortality. However, no correlation could be found between mortality and ASA grade, comorbidities, fracture type, preinjury ambulatory status, operative time, and length of hospital stay.

Early ambulation after surgery provides a beneficial outcome and enhances the survival rate significantly. Hence, the aim for such patients with hip fractures should be to perform an early surgery and encourage early ambulation. No significant difference in was seen between the two groups.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

1. Lin WT, Chao CM, Liu HC, Li YJ, Lee WJ, Lai CC. Short-term outcomes of hip fractures in patients aged 90 years old and over receiving surgical intervention. PLoS One 2015;10:e0125496.
2. Ovidiu A, Stefan GT, Dragos P, Bogdan V, Dana AI. Survival of nonagenarian patients with hip fractures: A cohort study. Acta Ortop Bras 2017;25:132-6.
3. Dannykh MA. "World Data Atlas"; 2019. Available from: https://knoema.RU/Atlas/РоссийскаяФедерация/Архангельскаяобласть. [Last accessed on 2017 Nov 15].
4. Holt G, Smith R, Duncan K, Hutchison JD, Gregori A. Outcome after surgery for the treatment of hip fracture in the extremely elderly. J Bone Joint Surg Am 2008;90:1899-905.
5. Clement ND, Aitken SA, Duckworth AD, McQueen MM, Court-Brown CM. The outcome of fractures in very elderly patients. J Bone Joint Surg Br 2011;93:806-10.
6. de Leur K, Vroemen JP, Vos DI, Elmans L, van der Laan L. Outcome after osteosynthesis of hip fractures in nonagenarians. Clin Interv Aging 2014;9:41-9.
7. Holt G, Macdonald D, Fraser M, Reece AT. Outcome after surgery for fracture of the hip in patients aged over 95 years. J Bone Joint Surg Br 2006;88:1060-4.
8. Kadowaki M, Kono M, Nishiguchi K, Kakimaru H, Uchio Y. Mortality in patients with hip fracture aged over 90 years: A report from a progressively aging island. Arch Gerontol Geriatr 2012;54:e113-7.
9. Kang BJ, Lee YK, Lee KW, Won SH, Ha YC, Koo KH. Mortality after hip fractures in nonagenarians. J Bone Metab 2012;19:83-6.
10. van de Kerkhove MP, Antheunis PS, Luitse JS, Goslings JC. Hip fractures in nonagenarians: Perioperative mortality and survival. Injury 2008;39:244-8.
11. Endo A, Baer HJ, Nagao M, Weaver MJ. Prediction model of in-hospital mortality after hip fracture surgery. J Orthop Trauma 2018;32:34-8.
12. Forni C, Gazineo D, D'Alessandro F, Fiorani A, Morri M, Sabattini T, *et al.* Predictive factors for thirty day mortality in geriatric patients with hip fractures: A prospective study. Int Orthop 2019;43:275-81.
13. Hu F, Jiang C, Shen J, Tang P, Wang Y. Preoperative predictors for mortality following hip fracture surgery: A systematic review and meta-analysis. Injury 2012;43:676-85.
14. Karres J, Kieviet N, Eerenberg JP, Vrouenraets BC. Predicting early mortality after hip fracture surgery: The hip fracture estimator of mortality Amsterdam. J Orthop Trauma 2018;32:27-33.
15. Morri M, Ambrosi E, Chiari P, Orlandi Magli A, Gazineo D, D' Alessandro F, *et al.* One-year mortality after hip fracture surgery and prognostic factors: A prospective cohort study. Sci Rep 2019;9:18718.
16. Smith T, Pelpola K, Ball M, Ong A, Myint PK. Pre-operative indicators for mortality following hip fracture surgery: A systematic review and meta-analysis. Age Ageing 2014;43:464-71.
17. Ooi LH, Wong TH, Toh CL, Wong HP. Hip fractures in nonagenarians – A study on operative and non-operative management. Injury 2005;36:142-7.
18. Shah MR, Aharonoff GB, Wolinsky P, Zuckerman JD, Koval KJ. Outcome after hip fracture in individuals ninety years of age and older. J Orthop Trauma 2001;15:34-9.
19. Espinosa KA, Gélvez AG, Torres LP, García MF, Peña OR. Pre-operative factors associated with increased mortality in elderly patients with a hip fracture: A cohort study in a developing country. Injury 2018;49:1162-8.
20. Rosso F, Dettoni F, Bonasia DE, Olivero F, Mattei L, Bruzzone M, *et al.* Prognostic factors for mortality after hip fracture: Operation within 48 hours is mandatory. Injury 2016;47:Suppl 4:S91-7.
21. Ryan DJ, Yoshihara H, Yoneoka D, Egol KA, Zuckerman JD. Delay in hip fracture surgery: An analysis of patient-specific and hospital-specific risk factors. J Orthop Trauma 2015;29:343-8.
22. Daabiss M. American Society of Anaesthesiologists physical status classification. Indian J Anaesth 2011;55:111-5.
23. Chang SM, Zhang YQ, Ma Z, Li Q, Dargel J, Eysel P. Fracture reduction with positive medial cortical support: A key element in stability reconstruction for the unstable pertrochanteric hip fractures. Arch Orthop Trauma Surg 2015;135:811-8.
24. Liu Y, Zhang CW, Zhao XD. Long-term survival of femoral neck

fracture patients aged over ninety years: Arthroplasty compared with nonoperative treatment. BMC Musculoskelet Disord 2020;21:217.
25. Liu Y, Peng M, Lin L, Liu X, Qin Y, Hou X. Relationship between American Society of Anesthesiologists (ASA) grade and 1-year mortality in nonagenarians undergoing hip fracture surgery. Osteoporos Int 2015;26:1029-33.
26. Fisher A, Fisher L, Srikusalanukul W, Smith PN. Usefulness of simple biomarkers at admission as independent indicators and predictors of in-hospital mortality in older hip fracture patients. Injury 2018;49:829-40.
27. Oztürk A, Ozkan Y, Akgöz S, Yalçýn N, Ozdemir RM, Aykut S. The risk factors for mortality in elderly patients with hip fractures: Postoperative one-year results. Singapore Med J 2010;51:137-43.
28. Öztürk A, Özkan Y, Akgöz S, Yalçın N, Aykut S, Özdemir MR. The effect of blood albumin and total lymphocyte counton short-term results in elderly patients with hip fractures. Turk J Trauma Emerg Surg 2009;15:546-52.
29. Xu BY, Yan S, Low LL, Vasanwala FF, Low SG. Predictors of poor functional outcomes and mortality in patients with hip fracture: A systematic review. BMC Musculoskelet Disord 2019;20:568.
30. 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 Orthop Traumatol 2014;15:13-9.
31. Hwabejire JO, Kaafarani HM, Lee J, Yeh DD, Fagenholz P, King DR, *et al.* Patterns of injury, outcomes, and predictors of in-hospital and 1-year mortality in nonagenarian and centenarian trauma patients. JAMA Surg 2014;149:1054-9.