



## Perioperative Considerations for Hip Fractures in the Elderly- A Retrospective Analysis

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### Abstract

**BACKGROUND:** Hip fractures are common in older individuals as femur suffer 50% of osteoporotic changes and any low energy ground level falls often results in proximal femur fractures. University of Pittsburg conducted large studies and discussed multidisciplinary approach for evaluation and management of hip fractures in the elderly. Aging itself manifests structural and functional changes both internally and externally thus suggesting significant modifications in anesthesia and perioperative care. Frailty delirium and causes of fall could all affect the outcome of surgical management. Prediction of outcome and anticipation of complications are aided by various scoring systems and special issues such as delirium, emotional support, postoperative independence, and mobility. In this study we have analyzed 35 elderly patients all of whom had good surgical outcome while the overall success of treatment needed multidisciplinary or Multi perspective management. **AIMS AND OBJECTIVES:** 1. To evaluate perioperative considerations for hip fractures in the elderly. 2. To highlight importance of clinical frailty score in management. 3. To offer recommendations and options to reduce cognitive dysfunction and delirium in the elderly patients appearing for surgery. **MATERIALS AND METHODS:** Retrospective observational study. All patients included in this study who satisfied our criteria underwent thorough pre-anesthetic check apart from those parameters mentioned above as required were noted and tabulated, fractures neck of femur and intertrochanteric fractures were included in the study. The type of surgery was decided by the orthopedic team. The type of anesthesia- subarachnoid block with or without Epidural was decided based on the duration of surgery and post-operative pain relief for physiotherapy. Patients with open fractures, multiple fractures impending hypoxia and anticipated hemodynamic instability underwent surgery under general anesthesia. The details were taken from the case sheets retained by the medical records department. The fall risk assessment form was followed by the orthopedic staff nurses. The results were tabulated and analyzed. **RESULTS:** 1. In the study population most patients were between 70 and 75 years of age. 2. According to John Hopkins clinical assessment for frailty, maximum score was around 11 and maximum number of patients had a frailty score of 9. 3. The frailty score increased with age irrespective of comorbidities. 4. Females had a higher frailty score than males but not statistically significant. **CONCLUSION:** Frailty score as an assessment of physiological reserve and vulnerability to derangements is an essential tool to predict outcome and manage the elderly patients. Increase in frailty score is not a contraindication to surgery as the later improves postoperative independence and standard of living in the elderly. Physical, mental and social well-being of the elderly in the postoperative period needs involvement of various medical disciplines right from admission to discharge. No statistically significant differences were observed across gender, type of surgical procedure or mode of anesthesia in patients with increasing frailty score due to multi perspective, evaluation and management.

**Keywords:** Hip Fracture, Elderly, Frailty, Delirium, Cognitive Impairment.



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### INTRODUCTION

Femur fractures constitute 30 % of the workload of Orthopedics worldwide, elderly females are more prone

for hip fractures than males. Apart from spontaneous pathological fractures the fractures are more due to falls.

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Stimson and Colleagues,[1] analyzed fracture epidemiology and tabulated fracture prevalence over 130 years. The prevalence of fracture proximal femur increased from 8.9% in the year 2000 to 14.7% in 2015-2018 period. There is an ever-increasing incidence of fragility fractures.

Frailty refers to loss of physiological reserve that makes a person more vulnerable to disability during and after stress. Frailty scores and fall assessment charts have been designed as frailty is predictive of disability, hospitalization and death,[2] social, domestic, and environmental factors are operational apart from purely orthopedic reasons about the treatment outcome.

In this study we have analyzed 40 cases of hip fractures in patients more than 65 years of age to suggest improvements to fill the gaps in evaluation that may enhance safe and smooth outcome without disconnection and delirious states in post-operative period.

While focus on orthopedic management is more in the perspective of evaluation and instrumentation logistics, frailty pre-operative delirium, mental and emotional rehabilitation have inadequate light. Cognition derangement and delirium in the elderly dims the success of perfect orthopedic management.

Anaesthesia revolves round pain relief, sedation, narcotics and supplementary drugs which may have considerable effects especially in the elderly.

Large multicentric randomized pragmatic trials examining neuraxial versus general anesthesia on delirium and total outcome at the sixtieth day of postoperative period focused on ambulation, analgesia, cognition, mental status. These trials have surprising results to offer with recommendations on future directions.

This study analysis the fracture types, management and outcome in a retrospective manner and discusses options for improvement.

### Aims and Objectives

1. To evaluate perioperative considerations for hip fractures in the elderly.
2. To highlight importance of clinical frailty score in management.

3. To offer recommendations and options to reduce cognitive dysfunction and delirium in the elderly patients appearing for surgery.

## MATERIALS AND METHODS

### Study Population

All patients referred for pre-anesthetic assessment towards surgery for hip fractures.

### Study Criteria

Age group more than 65 years diagnosed with fractured neck of femur and intertrochanteric fracture.

### Study Place

DSMCH, Perambalur.

### Study Period

December 2024 to December 2025.

### Study Tools

Fall assessment chart John Hopkin's Clinical frailty scores.

### Parameters

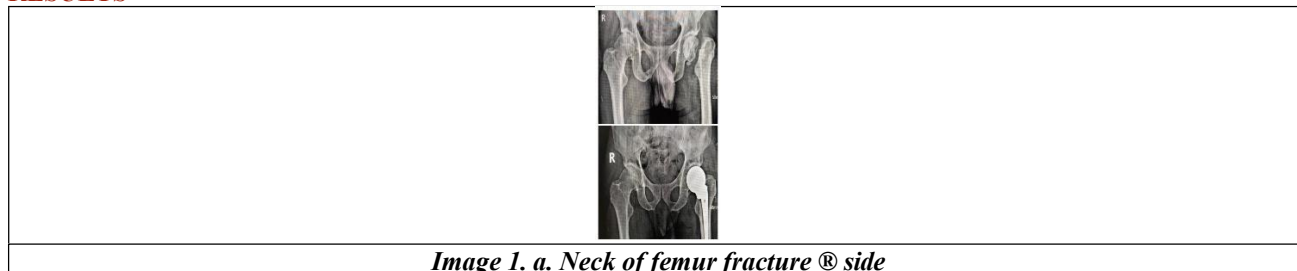
Age, gender, type of fracture, type of surgery, comorbidities, preoperative frailty and delirium, John Hopkin's frailty score.

### Methods

Retrospective observational study. All patients included in this study who satisfied our criteria underwent thorough pre-anesthetic check apart from those parameters mentioned above as required were noted and tabulated, fractures neck of femur and intertrochanteric fractures were included in the study.

The type of surgery was decided by the orthopedic team. The type of anesthesia- subarachnoid block with or without Epidural was decided based on the duration of surgery and post-operative pain relief for physiotherapy. Patients with open fractures, multiple fractures impending hypoxia and anticipated hemodynamic instability underwent surgery under general anesthesia. The details were taken from the case sheets retained by the medical records department. The fall risk assessment form was followed up by the orthopedic staff nurses. The results were tabulated and analyzed

## RESULTS



*Image 1. a. Neck of femur fracture @ side*



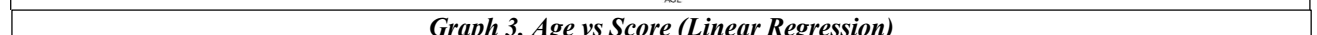
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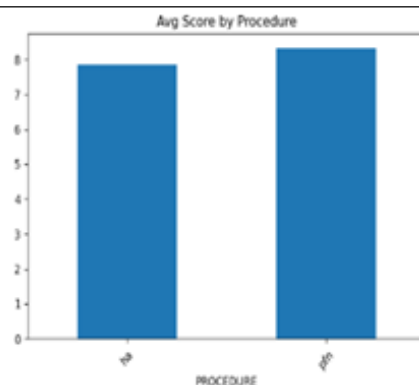
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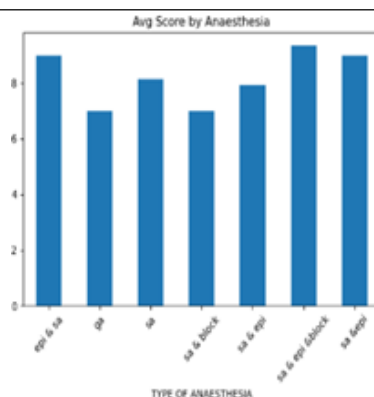
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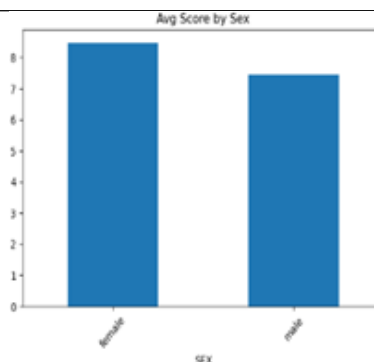
**Table 1. Regression Results for the Effect of the 2008 Election on the Demand for Health Insurance**



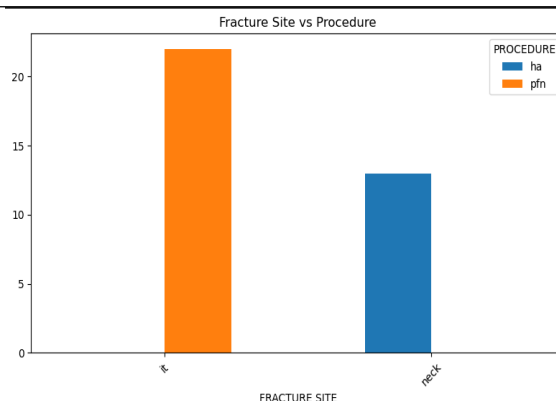
**Graph 4. AVG score by procedure**



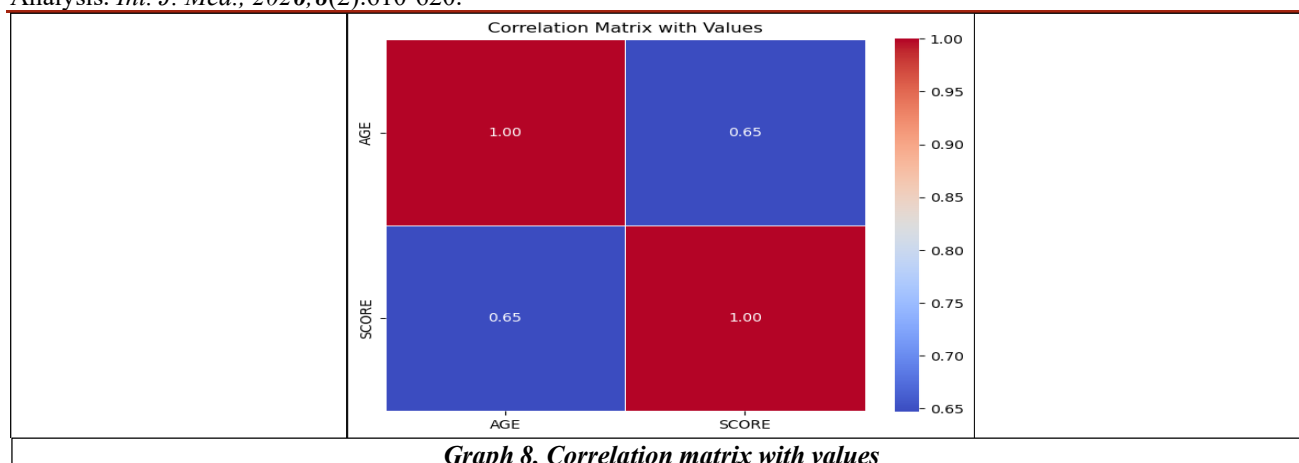
**Graph 5. Avg Score by Anesthesia**



**Graph 6. Avg Score by Gender**



**Graph 7. Fracture site vs Procedure**



1. In the study population most patients were between 70 and 75 years of age.
2. According to John Hopkins clinical assessment for frailty, maximum score was around 11 and maximum number of patients had a frailty score of 9.
3. The frailty score increased with age irrespective of comorbidities.
4. Females had a higher frailty score than males but not statistically significant.

35 elderly patients who underwent internal fixation or hemiarthroplasty for proximal femur or intertrochanteric fractures. Demographic and clinical variations and frailty score according to John Hopkin's criteria were evaluated and tabulated. The distribution of frailty score was assessed by Shap wilk test. The variable was not normally distributed ( $W= 0.828$   $p< 0.001$ ).

No statistically significant difference in mean frailty score between genders were noted ( $f= -1.2$   $p= 0.247$ ).

The calculated effect size (Cohen's  $d = -0.48$ ) suggested moderate magnitude of difference. One way analysis of variance was performed to assess difference in frailty affecting across different surgical procedure. The analysis revealed no statistically significant differences among procedure groups ( $f= 0.384$ ,  $p=0.540$ ).

One way ANOVA was also conducted to examine differences in frailty score and type of anesthesia. No statistically significant difference were observed ( $f= 0.446$   $p=0.841$ ).

Chi square test of independence to evaluate association between fracture site and surgical procedure selection showed  $X^2= 30.85$   $df=1$   $p<0.001$ .

Pearson correlation analysis demonstrated positive correlation between age and frailty ( $r= 0.647$   $p< 0.001$ ).

## DISCUSSION

Hip fractures in the elderly are often due to fall which is multifactorial in etiology. Hip fractures offer significant impact on quality of life and healthy life expectancy.<sup>[3]</sup> The combined health and care cost is greater than stroke or myocardial infarction. The incidence of hip fracture includes non-modifiable, modifiable, and secondary causes or comorbidities. Age, gender, ethnicity and family history are non-modifiable. Weight, smoking, alcohol, sedentary lifestyle, diet, and nutrition are modifiable. Diabetes, chronic kidney disease, immobility are modifiable.

Cumming's et al conducted a large study of bone density scans and concluded that each standard deviation in femoral neck bone density is 2.6 times after adjustment for age during an average follow-up of 1.8 years.<sup>[4]</sup> The risk of falling increases with increasing age, on an overview include muscle weakness, abnormal gait or balance, neurologic disease, diminished eye sight, poor domestic care and cardiovascular problems.<sup>[5]</sup>

The overall goals of hip fracture are simple. Early surgery to reduce complications especially delirium early mobility to enable to return to previous function and palliation to support dignity and support nursing care.

**FALL RISK ASSESSMENT FORM**

Name: \_\_\_\_\_ Age: \_\_\_\_\_ Sex: M / F P/B/D/C: D / N / O ID No.: \_\_\_\_\_  
 Consultant: \_\_\_\_\_ Date: \_\_\_\_\_ Unit: \_\_\_\_\_ Ward: \_\_\_\_\_ Bed No.: \_\_\_\_\_

Instructions:  
 Every patient should be assessed:

- On admission
- On receiving patient from other unit
- When patient's condition changes (E.g. Post operative, changes in consciousness etc.)
- When patient's treatment plan changes (E.g. IV therapy, drugs, etc)
- Others

TICK THE APPROPRIATE BOX

☐ Patient in CCU, ICU, EMR, HDU, Labor Unit, Recovery room and Renal Ward, Most High Risk Fall Prevention Interventions

☐ Completely paralysed, immobilised, vulnerable patients and visually impaired, Most High Risk Fall Prevention Interventions

☐ If patient has experience a fall during his hospitalisation, Most High Risk Fall Prevention Interventions (depending hospitalization)

| RISK LEVEL                                                                                                                                         | MEASURES      | SCORE | Yes | No | Yes | No | Yes | No |
|----------------------------------------------------------------------------------------------------------------------------------------------------|---------------|-------|-----|----|-----|----|-----|----|
| 1. Memory of fall incidents or within 6 months                                                                                                     | Score 1<br>No |       |     |    |     |    |     |    |
| 2. Secondary disease (e.g. Cerebral Vascular Disease, stroke, seizures, loss of consciousness, urinary retention, COPD, reduced consciousness etc) | Score 1<br>No |       |     |    |     |    |     |    |
| 3. History of falls                                                                                                                                | Score 1<br>No |       |     |    |     |    |     |    |
| 4. History of falls                                                                                                                                | Score 1<br>No |       |     |    |     |    |     |    |
| 5. History of falls                                                                                                                                | Score 1<br>No |       |     |    |     |    |     |    |
| 6. History of falls                                                                                                                                | Score 1<br>No |       |     |    |     |    |     |    |
| 7. History of falls                                                                                                                                | Score 1<br>No |       |     |    |     |    |     |    |
| 8. History of falls                                                                                                                                | Score 1<br>No |       |     |    |     |    |     |    |
| 9. History of falls                                                                                                                                | Score 1<br>No |       |     |    |     |    |     |    |
| 10. History of falls                                                                                                                               | Score 1<br>No |       |     |    |     |    |     |    |

Remarks:

Below 14 pts  
 Above 14 pts  
 Severe fall risk  
 Patient with severe or chronic fall risk  
 Woman experiencing symptoms of pregnancy  
 Patient with unstable psychiatric disorder  
 Patient suspected of drug or alcohol dependency  
 Patient receiving chemotherapy  
 Patient whose immune system are compromised

**STANDARD FALL RISK PREVENTION INTERVENTIONS (SCORE: 0-24)**

|                                                                            | Date | Date | Date | Date | Date |
|----------------------------------------------------------------------------|------|------|------|------|------|
| Lock all movable equipment before transferring                             |      |      |      |      |      |
| Provide adequate lighting                                                  |      |      |      |      |      |
| Orient patient to surroundings and hospital context                        |      |      |      |      |      |
| Orient patient about exit bed rail and make sure patient is able to use it |      |      |      |      |      |
| Signature of RN                                                            |      |      |      |      |      |
| Signature of Nursing Supervisor                                            |      |      |      |      |      |

**LOW FALL RISK PREVENTION INTERVENTIONS (SCORE: 25-50)**

|                                                                                   | Date | Date | Date | Date | Date |
|-----------------------------------------------------------------------------------|------|------|------|------|------|
| Implement all standard fall prevention interventions                              |      |      |      |      |      |
| Correct patient to call for help before getting out of bed                        |      |      |      |      |      |
| Place bed gear - wheel brakes - away from bed                                     |      |      |      |      |      |
| Position the bed at low level with lockers locked position that most need in gait |      |      |      |      |      |
| Instruct the patient and family about the significance of fall prevention         |      |      |      |      |      |
| Educate patient to use grab bar                                                   |      |      |      |      |      |
| Signature of RN                                                                   |      |      |      |      |      |
| Signature of Nursing supervisor                                                   |      |      |      |      |      |

**HIGH FALL RISK PREVENTION INTERVENTION (SCORE: >50)**

|                                                                                            | Date | Date | Date | Date | Date |
|--------------------------------------------------------------------------------------------|------|------|------|------|------|
| Implement all standard fall prevention interventions                                       |      |      |      |      |      |
| Call for help before leaving the room                                                      |      |      |      |      |      |
| Discuss nursing needs of the patient and implement bowel and bladder programs if necessary |      |      |      |      |      |
| Place secondary devices within reach                                                       |      |      |      |      |      |
| Develop a schedule for turning and positioning                                             |      |      |      |      |      |
| Increase frequency of patient rounds                                                       |      |      |      |      |      |
| Instruct the patient on side effect of drugs                                               |      |      |      |      |      |
| Increase surveillance frequency to every 15 minutes, close doors behind                    |      |      |      |      |      |
| Keep water basin dry                                                                       |      |      |      |      |      |
| Consider obtaining doctor's orders for physical therapy                                    |      |      |      |      |      |
| Signature of RN                                                                            |      |      |      |      |      |
| Signature of Nursing Supervisor                                                            |      |      |      |      |      |

Note: In the event return intervention, notify with the primary consultant and document the note's notes.

- Nature of fall
- Past medical history
- Osteoporosis assessment
- Social history- family, housing/floor, assistance for mobility
- Function
- Frailty
- Medication history
- Bowel/ bladder care
- Skin involvement
- Respiratory and cardiac reserve

| Score                  | Description                                                                                                                                                                                                                                                  |
|------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Very fit            | People who are robust, active, energetic and motivated. These people commonly exercise regularly. They are among the fittest of their age                                                                                                                    |
| 2. Well                | People who have no active disease symptoms but are less fit than category 1. Often, they exercise or are very active e.g., seasonally                                                                                                                        |
| 3. Managing well       | People whose medical problems are well controlled, but are not regularly active beyond routine walking                                                                                                                                                       |
| 4. Vulnerable          | While not dependent on others for daily help, often symptoms limit activities. A common complaint is being “slowed up”, and /or being tired during the day                                                                                                   |
| 5. Mildly Frail        | These people often have more evident slowing, and need help in high orders IADLs (finances, transportation, heavy house work, medications) Typically, mild frailty progressively impairs shopping and walking outside alone, meal preparation, and housework |
| 6. Moderately Frail    | People need help with all outside activities and with keeping house. Inside, they often have problems with stairs and need help with bathing and might need minimal assistance (cuing, standby) with dressing                                                |
| 7. Severely Frail      | Completely dependent for personal care, from whatever cause (physical or cognitive). Even so, they seem stable and not at high risk of dying (within 6 months)                                                                                               |
| 8. Very Severely Frail | Completely dependent, approaching the end of life. Typically, they could not recover even from a minor illness                                                                                                                                               |
| 9. Terminally ILL      | Approaching the end of life. This category applies to people with a life expectancy <6 months, who are not otherwise evidently frail                                                                                                                         |

**Table 1. Clinical Frailty Scale**

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*International Journal of Medicine*

### **Pathophysiology of the Older Individuals**

Pre-operative screening for older patients is essential to optimize and plan post-operative care. The needs must be individualized and tailored for every patient. An understanding of organ specific age related physiologic and pathologic changes is critical for caring the older population.

### **Central Nervous System**

Structural and functional changes in the brain and neuronal connectivity have been widely possible to the advances in imaging modalities and neurophysiological and neurochemical studies. Aging is associated with a decrease in white matter density in the prefrontal cortex and anterior corpus callosum. Decrease in synaptic function in the pre-frontal cortex may contribute to decline in cognitive functions. Decreased neuronal connectivity occurs particularly in the hippocampus, frontal/prefrontal, cortex and temporal lobe.<sup>[7]</sup> Age related dysregulation of neuronal transmission, baseline neuronal firing, calcium metabolism, and gene expression diminishes both connectivity and plasticity. Age related decline in many domains such as executive function, cognitive processing speed, working and spatial memory and maintenance of circadian rhythm.

Mild cognitive impairment is pathologic process thought to be a precursor to dementia. 10 to 20% of patients over the age of 65 years have mild cognitive impairment though not obvious during standard preoperative evaluation.<sup>[8]</sup> Cognitive function is the most consistent risk factor for post-operative delirium.<sup>[9]</sup> Similarly pre-operative depression is associated with in-hospital delirium, major adverse cardiac events, increased post-operative analgesic use and suboptimal postoperative outcomes. Contribution of antidepressants or antipsychotics shall benefit post-operative pain management by reducing requirements and also prevent risks of discontinuation syndrome.

### **Cardiovascular System**

Age related death of myocytes and increase in myocyte size both occur resulting in myocardial thickening and decreased elasticity. This results in left ventricular hypertrophy and diastolic dysfunction. 50 percent of the elderly over the age of 70 years have diastolic dysfunction and more than 2/3<sup>rd</sup> of patients above 80 years have diastolic dysfunction.<sup>[10]</sup> The consequence of diastolic dysfunction is that geriatric patients are increasingly dependent on preload and atrial contraction or atrial kick to maintain cardiac output.

Spontaneous atrial fibrillation is common in the elderly which may lead to inadequate filling and reduced cardiac output. Pulmonary artery pressure and resistance also increase with age,<sup>[11]</sup> thickened calcified aortic valve occurs with aging. 25 % of patients over 65 years of age have degenerative aortic disease. 1 in 8 patients above 75 years have moderate to severe aortic stenosis.<sup>[12]</sup> In such patients hypotension and tachycardia reduces the length of diastole and further impair coronary perfusion resulting in myocardial ischemia.<sup>[13]</sup>

### **Sympathetic and autonomic system**

The ability of sympathetic system to respond to physiologic derangements decrease with age. Baroreceptors impairment increases the incidence of orthostatic hypotension. Reduced beta-adrenergic sensitivity, reduced maximal heart rate, limitation cardiac output and aging of conductive system further reduces the heart rate. Vascular changes include increased arterial stiffening, increased afterload, increased myocardial oxygen consumption and wall stress. 600 people over the age of 80 years per 1 lakh population are at the risk of venous thromboembolism every year.<sup>[14]</sup> This is due to the contribution of all components of Virchow's triad- venous stasis, hypercoagulability and aberrant blood flow prevailing in the older individuals.

### **Respiratory system**

Age induced arthritic changes in costovertebral joints, calcification of intercostal cartilage weakening of intercostal muscles, loss of vertebral height due to osteoporosis all affect respiratory mechanics. Elastic recoil decreases as lung compliance increases. Total lung capacity is unchanged. Functional residual capacity increases 1-3% per decade, leading to increase in residual volume by 5 to 10 % per decade and overall decrease in vital capacity.<sup>[15]</sup>

By the age of 70 years the ratio of residual volume to total lung capacity increases to 40%. Increased alveolar airspace results in increased ventilation perfusion mismatch and reduced gas exchange. The volume at which small airways close increases with age which may result in atelectasis, pulmonary shunting, and hypoxemia.

Loss of airway reflexes, sleep apnea, malnutrition, polypharmacy, dysphagia, depression, delirium, and alcohol abuse are also major concerns in the elderly.

### **Renal System**

Aging is associated with increase in fibrotic glomeruli that decreases renal function. Renal blood flow decreases after age of 40 and declines 10% per decade. In spite of altered renal function serum creatinine tends to remain low or normal due

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to reduced muscle mass. Hence GFR is more reliable than creatinine levels. Age related decreased responsiveness to renin aldosterone and vasopressin reduces the older patients ability to regulate their volume status and results in deranged acid base and electrolyte balances. Several factors contribute to perioperative hyponatremia in the elderly, reduced renal perfusion, inappropriate sodium excretion, reduced response to aldosterone, reduced intake of sodium and medications such as serotonin antagonists and loop diuretics precipitate hyponatremia.

### Gastrointestinal and Hepatic Systems

20- 40% decrease in liver size and 40- 60% decrease in hepatic blood flow in the older adults affect drug clearance. Hepatic drug clearance is limited by flow or capacity. Drugs with high hepatic clearance are flow limited. Hence when hepatic blood flow is reduced they are cleared slowly in older adults. Drugs such as ketamine, morphine, fentanyl, flumazetil and lignocaine are flow limited and experience slow metabolism proportional to reduction in blood flow. The drugs which have low extraction through the liver are capacity limited and dependent on protein binding. Frailty is associated with liver dysfunction and incidence of non-alcoholic fatty liver disease increases with age. The risk of post-operative nausea and vomiting reduces after the age of 50. This is a blessing as the need to use antiemetics which act through anticholinergic pathways that promote delirium in the elderly, is reduced.

### Musculoskeletal System

Age related dysregulation of cutaneous micro- circulation delays wound healing. Muscle mass and strength decrease with age at the rate of 3-5% for every decade after 30.<sup>[17]</sup>

Frailty is a global syndrome marked by decreased physiological function and reserve increasing the vulnerability to stressors. Simple tools are repeating a list of words, clock drawing and verbal fluency.

In this study John Hopkins list to assess frailty has been used to evaluate frailty.

| <b>BEER's Criteria 2025<sup>[16]</sup></b>              |                                                   |
|---------------------------------------------------------|---------------------------------------------------|
| Potentially inappropriate medications in elderly (PIME) |                                                   |
| 1. Antibiotics                                          | Ciprofloxacin                                     |
| 2. Antiseizures                                         | Carbamazepine                                     |
| 3. Antihistamines                                       | Phenothiazines, brompheniramine, prochlorperazine |
| 4. Antihypertensives                                    | Alpha blockers                                    |
| 5. Antiplatelets                                        | Edoxaban                                          |
| 6. Antipsychotics                                       | Metoclopramide                                    |
| 7. Cardiac drugs                                        | Disopyramide                                      |
| 8. CNS agents                                           | Dimenhydrinate                                    |
| 9. GI agents                                            | H2 blockers                                       |
| 10. Hormones                                            | Estrogen                                          |
| 11. Barbiturates                                        | Aspirin, desmopressin, ergoloids                  |

| <b>John Hopkin's Clinical Assessment<sup>[18]</sup></b>          |   |
|------------------------------------------------------------------|---|
| 1. Barriers to access of care                                    | A |
| 2. Decubitus Ulcer                                               | B |
| 3. Dementia                                                      | C |
| 4. Difficulty walking                                            | D |
| 5. Falls                                                         | E |
| 6. Impaired vision                                               | F |
| 7. Malnutrition                                                  | G |
| 8. Poverty                                                       | H |
| 9. Urinary problems                                              | I |
| 10. Weight loss                                                  | J |
| 11. Chronic illness                                              | K |
| 12. Hearing impairment                                           | L |
| <b>Table 2. John Hopkin's Clinical Assessment<sup>[18]</sup></b> |   |

| AGE | SEX    | FRACTURE SIDE | FRACTURE SITE | PROCEDURE | TYPE OF ANAESTHESIA | FRAILTY SCORE |
|-----|--------|---------------|---------------|-----------|---------------------|---------------|
| 74  | male   | right         | IT            | PFN       | SA & epi            | 9             |
| 65  | female | right         | Neck of Femur | HA        | SA & epi            | 4             |
| 70  | female | left          | IT            | PFN       | SA & epi            | 9             |
| 78  | female | left          | IT            | PFN       | GA                  | 10            |
| 69  | female | left          | Neck of Femur | HA        | SA & epi            | 9             |
| 73  | male   | right         | IT            | PFN       | GA                  | 4             |
| 87  | male   | right         | Neck of Femur | HA        | SA & epi            | 11            |
| 62  | female | right         | IT            | PFN       | SA                  | 4             |
| 75  | female | right         | IT            | PFN       | SA & epi            | 9             |
| 62  | female | left          | Neck of Femur | HA        | SA & epi            | 4             |
| 76  | male   | left          | IT            | PFN       | SA & epi            | 4             |
| 70  | female | left          | IT            | PFN       | SA & epi            | 9             |
| 65  | female | left          | Neck of Femur | HA        | SA & epi            | 7             |
| 65  | female | left          | IT            | PFN       | SA & block          | 7             |
| 65  | male   | left          | IT            | PFN       | SA & epi            | 8             |
| 70  | female | left          | Neck of Femur | HA        | SA                  | 9             |
| 80  | female | left          | Neck of Femur | HA        | SA & epi & block    | 10            |
| 70  | female | right         | IT            | PFN       | SA & epi & block    | 9             |
| 74  | male   | right         | IT            | PFN       | SA                  | 9             |
| 75  | female | right         | IT            | PFN       | SA & epi            | 9             |
| 67  | male   | left          | Neck of Femur | HA        | SA & epi            | 8             |
| 76  | female | right         | IT            | PFN       | SA                  | 11            |
| 63  | male   | left          | Neck of Femur | HA        | SA                  | 4             |
| 68  | female | right         | IT            | PFN       | SA & epi            | 8             |
| 74  | female | right         | IT            | PFN       | SA & epi            | 10            |
| 75  | female | left          | Neck of Femur | HA        | SA & epi            | 10            |
| 65  | female | left          | IT            | PFN       | SA & epi            | 8             |
| 70  | male   | left          | Neck of Femur | HA        | SA & epi & block    | 9             |
| 68  | female | left          | Neck of Femur | HA        | SA                  | 8             |
| 72  | male   | left          | IT            | PFN       | SA & epi            | 9             |
| 70  | female | left          | IT            | PFN       | SA                  | 9             |
| 69  | male   | right         | IT            | PFN       | GA                  | 7             |
| 75  | female | right         | IT            | PFN       | SA & epi            | 10            |
| 73  | female | left          | Neck of Femur | HA        | Epi & SA            | 9             |
| 80  | female | right         | IT            | PFN       | SA                  | 11            |

**Table 3.**

Frailty is associated with morbidity, increased hospital stay, postoperative delirium and postoperative discharge to a care facility. Frailty is a dynamic state and can improve.

### Delirium Prevention Strategies

Validated Risk Models for Prediction of Postoperative Delirium in cardiac and non cardiac surgery patients.

| Authors                    | Patients and Surgery                                                                                    | Risk Factors                                                                                                                                                                                                                                                                            | Results                                                                                                                                                                   |
|----------------------------|---------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Rudolph and Colleagues     | Cardiac surgery (n=122 for derivation cohort, n=109 for validation cohort)                              | <ul style="list-style-type: none"> <li>• Previous stroke (1 point)</li> <li>• Geriatric depression scale &gt;4 (1 point)</li> <li>• Abnormal albumin (1 point)</li> <li>• MMSE 24-27(1 point) or MMSE &lt; 24 (2 points)</li> </ul>                                                     | In the validation cohort, the cumulative incidence of delirium for each point level was as follows:<br>0 points, 18%<br>1 point, 43%<br>2 points, 60%<br>>= 3 points, 87% |
| Marcantonio and Colleagues | General, orthopedic, and gynecologic surgery (n=876 for derivation cohort, n=465 for validation cohort) | <ul style="list-style-type: none"> <li>• Age &gt;70</li> <li>• Alcohol abuse</li> <li>• Poor cognitive status</li> <li>• Poor functional status</li> <li>• Markedly abnormal sodium, potassium, or glucose</li> <li>• Noncardiac thoracic surgery</li> <li>• Aortic aneurysm</li> </ul> | In the validation cohort, the cumulative incidence of delirium for each point level was as follows:<br>0 points, < 8%<br>2 points, 19%<br>3>= 45%                         |

**Table 4.**

The recent perioperative quality initiative consensus on intraoperative blood pressure risk and outcome offered three points which could be regarded as starting point for best practice.

1. Intra-operative mean blood pressure below 60-70mmHg are associated with myocardial injury, acute kidney injury and death. Injury is a function of severity and duration of hypotension.
2. No definitive recommendations for upper limit of blood pressure.
3. During cardiac surgery intra-operative blood pressure more than 140mmHg is associated with increase thirty day mortality.

The recommended intraoperative practices for older adults could be discussed under the following headings:

1. Pharmacology, 2. Nervous system, 3. Hemodynamics, 4. Respiratory strategies, 5. Skin care and pressure points protection

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2. Pharmacology: pharmacodynamics and kinetics are altered with aging. The following key points are to be remembered:
  - a. Prolonged circulation time delays onset of intravenous drugs.
  - b. Diminished cardiac reserve manifests as exaggerated hypotension during induction.
  - c. Delayed onset of NM blockade is due to reduced cardiac output and reduced muscle blood flow, MAC and MAC awake decline by 6% per decade after the age 30.
  - d. Reduced liver and renal function necessitate slow and low doses.
  - e. Volatile anesthetics depict lower MAC as it declines by 6% per decade after age 30, due to decreased binding sites for serotonergic adrenergic and GABA receptors. Reduced muscle mass and decreased total body water lead to greater plasma concentrations. Relative increase in body fat, reduced alpha-1-acid glycoprotein lead to extensive spread of give volumes and longer duration of spinal local anesthetic.

Reduced pulmonary gas exchange and relative increase in body fat delay emergence from local anesthetics.

Perioperative delirium prevention should be approached through multipronged and multibundled factor management. Medications as per BEER's criteria recommendations should be avoided. Large randomized trials conducted in North America such as REGAIN did not find difference in incidence of delirium between neuraxial and general anesthesia.<sup>[19]</sup>

Processed EEG guided anesthesia has shown a decrease in delirium following surgery. However severe burst suppression patterns of EEG have been consistently associated with delirium. Thus, reduced doses of induction agents, inhalational agents and avoiding drugs in BEER's list could help in reducing delirium.

Respiratory care includes prolonged preoxygenation adequate mask ventilation and continuous positive airway pressure. Proper care and padding during positioning for surgery prevents pressure sores, cognition function and mobility in the post-operative period is particularly quite poor in frail patients.

## CONCLUSION

Systemic disorders and aging factors often limit the choice of surgical treatment. Hip fractures are extremely common and restrict the independence and mobility of the patient thus demotivating him. Imaging modalities in the pre and intraoperative period helps the surgeons to perform a perfect job. The overall success of surgery needs multidisciplinary approach. Predictive scores of outcomes such as clinical frailty test and fall assessment questionnaire contribute to appropriate decision making and management. Avoiding drugs listed in BEER's criteria and pre-operative counselling and pharmacotherapy reduce cognitive dysfunction and perioperative delirium. Increasing age has an increased frailty score but good surgical outcome in our study population. There was no difference between general and regional anesthesia patients about postoperative delirium.

Hyponatremia is often thought of as a cause of post-operative delirium whereas now it is proved of as an aging and frailty signal needing special care. Larger trials are needed to validate use of appropriate drugs in preventing peri-operative delirium. Processed electroencephalogram guided anesthesia is the future prospective in geriatric anesthesia.

The importance of pre-operative evaluation in a multidisciplinary elaborate manner including, frailty and other scoring system appears to play a major role in the overall success of the surgical management of hip fractures in the elderly.

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