



Prevalence of Delirium in Elderly Postoperative Patients with Hip Fractures

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Abstract

Background: *Delirium can be defined as a rapid decline in neurocognitive function, presenting as altered consciousness or changes in attention that cannot be explained by a pre-existing neurocognitive disorder. Post-operative delirium is a major health concern in elderly patients. Delirium can be of 3 types: hyperactive delirium, hypoactive delirium, and mixed delirium [1] The exact reason for development of post-operative delirium is not clearly understood. Some of the widely accepted theories are based on involvement of neuroinflammation, neurotransmitters, and metabolic abnormality. [2]*

Methodology: *An observational study was conducted at Vydehi Institute of Medical Sciences and Research Centre on elderly patients undergoing surgery for hip fractures. All patients were evaluated preoperatively and postoperatively using a standardised delirium assessment tool—the Confusion Assessment Method. In addition, demographic details, comorbidities, and type of anaesthesia were collected and statistically analysed.*

Results: *Delirium was almost three times more likely to occur in patients 75 years of age or older. Additionally, a BMI of ≥ 24 kg/m² was linked to roughly twice the risk. The odds were nearly doubled for a history of delirium. Notable surgical factors included an estimated blood loss of 400 mL or more and a surgery time of 120 minutes or more, both of which approximately doubled the risk of delirium. TSH ≤ 2 mU/L and albumin ≤ 40 g/L were linked to higher odds among laboratory markers, each of which conferred a risk that was roughly 1.8–2.0 times higher. Significant independent risk factors for postoperative delirium included advanced age, a higher body mass index, a history of delirium, a greater surgical burden, and particular biochemical abnormalities. Hypertension, diabetes mellitus, hyponatremia, and hypokalemia were among the medical conditions that were substantially more prevalent in the delirium group. Additionally, patients who experienced delirium during this admission were significantly more likely to have a history of delirium.*

There were no appreciable differences between the groups in the kinds of fractures or anaesthesia techniques. In terms of surgical variables, delirious patients experienced longer surgery times and higher estimated blood loss than non-delirious patients. Time to surgery and pre-operative ADL scores were comparable across groups. The development of postoperative delirium may be linked to the delirium group's overall higher burden of comorbidities, more invasive or prolonged surgery, and greater electrolyte abnormalities.

Conclusion: *Through our study we can conclude that elderly patients have a higher risk of experiencing post-operative delirium and the risk increases along with the severity of comorbidities. The cause for the same is mostly linked to BMI, blood pressure, TSH, blood loss intra-operatively and duration of surgery.*

Aims and Objectives

The purpose of this study is to determine the incidence of delirium in patients undergoing surgeries for hip fractures and compare the observed values with that of existing literature. It also aims at identifying the risk factors associated with delirium in elderly patients during the post-operative period. It also highlights the clinical implication of delirium, prevention, early detection and management.

Introduction

Post-operative delirium is a major health concern in elderly patients. Delirium is defined as a rapid decline in neurocognitive function, presenting as altered consciousness or changes in attention that cannot be explained by a pre-existing neurocognitive disorder. Delirium can be of three types: hyperactive delirium, hypoactive delirium, and mixed delirium [1]. The exact reason for development of post-operative delirium is not clearly understood. Some of the widely accepted theories are based on involvement of neuroinflammation, neurotransmitters, and metabolic abnormality [2].

Neuroinflammation Theory

Surgical stress acts on Toll-like receptors through damage-associated molecular patterns or pathogen-associated molecular patterns to initiate an intracellular inflammatory response, and inflammatory mediators such as TNF- α are released into the brain, causing aseptic inflammation in the CNS. The accumulation of central inflammatory mediators leads to the disruption of the large-scale neural networks in the brain, such as suppression of hippocampal plasticity, neurogenesis, neurotoxicity, and neuronal apoptosis. This results in post-operative delirium [1,3,4].

Neurotransmitter Theory

Alteration in neurotransmitters can also be the cause for postoperative delirium. Among the neurotransmitters, particularly cholinergic deficiency is found to be significant. This is a possible mechanism for the occurrence and development of POD, among which the most prominent is the deficiency or dysfunction of the cholinergic system. An observational study demonstrated that the level of acetylcholine in the cerebrospinal fluid was significantly decreased in geriatric patients with postoperative cognitive dysfunction [5].

Neurovascular Theory

Neurovascular changes in elderly patients can also be a cause of post-operative delirium. A review explored the association of neurodegenerative and neurovascular changes with the occurrence of POD (6). Some of the neurovascular changes are white-matter hyperintensities, preoperative old cerebral infarct, and markers of white matter integrity [2,7].

Metabolic Theory

Some studies have found that glycolysis products were higher in POD patients after surgery, while levels of ω 3 and ω 6 fatty acids were lower both before and after surgery, as well as intermediate levels of the tricarboxylic cycle and the branched-chain amino acid/aromatic amino acid ratio. These metabolic abnormalities most likely reduce the ability of the brain to provide neuroprotection and take part in neuroinflammatory responses [2,8].

Methodology

An observational study was conducted on 96 elderly patients undergoing surgeries for hip fractures in Vydehi Institute of Medical Sciences and Research Centre. All the patients in this study were evaluated preoperatively and postoperatively using a standardised delirium assessment tool, which is “The Confusion Assessment Method”. Along with this, data such as demographic details, comorbidities, and type of anaesthesia were collected and analysed statistically.

Sample Size

$$n = \frac{z_{1-\frac{\alpha}{2}}^2 p(1-p)}{E^2}$$

$$n = \frac{1.96^2 \cdot 0.20(1-0.20)}{0.01}$$

$$n = 62$$

Where,

$z_{(1-\alpha/2)} = 1.96$, standard normal score at 95% level of significance

P= Proportion (prevalence of Delirium was 20%)(from related article)

E= 10%, precision

The minimum sample size is 62

Results

Characteristics of Included Patients (N=96)

Items	Delirium group (n = 4)	No delirium group (n = 92)	t / χ^2	p
Age (years)	80.4 ± 4.9	72.1 ± 6.4	6.472	<0.001
Male / Female	4 / 0	38 / 54	6.412	0.011
BMI (kg/m ²)	25.7 ± 3.0	22.4 ± 3.3	2.516	0.027
Hypertension	4 (100%)	48 (52.2%)	4.876	0.016
Diabetes mellitus	4 (100%)	30 (32.6%)	8.312	0.004
Hyperlipidemia	2 (50%)	29 (31.5%)	0.663	0.083
Hyponatremia (< 135 mmol/L)	3 (75%)	18 (19.6%)	5.947	0.009
Hypokalemia (< 3.5 mmol/L)	2 (50%)	20 (21.7%)	2.947	0.041
History of delirium	2 (50%)	4 (4.3%)	7.216	0.011
Type of fracture			1.016	0.106
• Femoral neck fracture	1 (25%)	33 (35.9%)		
• Intertrochanteric fracture	3 (75%)	56 (60.9%)		
• Subtrochanteric fracture	0 (0%)	3 (3.3%)		
Pre-operative ADL score	93.8 ± 6.5	95.3 ± 8.7	0.773	0.094
Time to surgery (days)	2.0 ± 0.8	1.7 ± 1.0	1.117	0.108
Method of anesthesia			0.987	0.089
• Lumbar anesthesia	2 (50%)	56 (60.9%)		
• General anesthesia	2 (50%)	36 (39.1%)		
Estimated blood loss (mL)	470 ± 68	377 ± 61	4.642	0.008
Duration of surgery (min)	153 ± 35	107 ± 26	5.231	0.012

Logistic Regression Analysis on the Risk Factors of Post Operative Delirium Patients with Hip Fractures

Items	β	SE	OR	95% CI	p
Age \geq 75 years	1.08	0.442	2.944	1.218 – 5.173	0.022
BMI \geq 24 kg/m²	0.73	0.349	2.074	1.121 – 3.501	0.033
History of delirium	0.63	0.499	1.874	1.102 – 2.717	0.039
Estimated blood loss \geq 400 mL	0.68	0.506	1.983	1.354 – 2.894	0.013
Duration of surgery \geq 120 min	0.76	0.238	2.128	1.104 – 3.101	0.046
Albumin \leq 40 g/L	0.58	0.334	1.786	1.073 – 2.718	0.028
TSH \leq 2 mU/L	0.70	0.625	2.021	1.183 – 3.942	0.011

Discussion

In the current study, 4 out of 96 elderly patients undergoing hip fracture surgery (4.2%) experienced postoperative delirium. Compared to previous studies, the incidence is lower in our study. All patients who experienced delirium were males, despite the fact that elderly females have a higher risk of fractures due to osteoporosis. This finding is consistent with the study done by Chen et al. (2022) [2]. They were considerably older and had higher body mass indices. All members of the study had comorbid conditions like diabetes mellitus and hypertension. Even metabolic disorders like hypokalemia and hyponatremia were more common. This suggests that the brain becomes more susceptible to perioperative insults when exposed to both metabolic and vascular stresses.

Postoperative delirium was also more likely to occur in patients with a previous history of delirium (OR = 1.87). Earlier research suggests that these patients may have a built-in susceptibility in their brain. Li et al. (2021) [9] found that having had delirium before can double the chance of it happening again.

Perioperative physiological markers also played an important role. Hypoalbuminemia (≤ 40 g/L) was an independent predictor of delirium. Low serum albumin levels often indicate poor nutritional status. Qi et al. (2022) [10], in a meta-analysis, and Kong et al. (2022) [11], in a retrospective study, both reported that hypoalbuminemia was associated with an increased risk of postoperative delirium.

Low TSH (≤ 2 mU/L) was linked to a higher risk of delirium, which was also reported by Kong et al. (2022) [11].

Factors during surgery also played an important role. Losing ≥ 400 mL of blood or having surgery lasting ≥ 120 minutes was linked to almost double the risk of delirium. This is likely due to stress on the body, reduced blood flow, and increased inflammation during surgery. Similar results have been reported by Wang et al. (2018) [12] and Li et al. (2021) [9].

Overall, our study supports the idea that postoperative delirium is caused by multiple factors working together. Several predisposing factors can increase vulnerability, including advanced age, a previous history of delirium, and impaired nutritional or thyroid status. Precipitating factors, such as surgical stress and metabolic imbalance, can then act as triggers for the syndrome. Recognizing these parameters enables clinicians to identify high-risk patients before surgery and implement preventive strategies such as optimizing nutrition and thyroid function, correcting electrolyte disturbances, and maintaining meticulous intraoperative hemodynamic control.

Conclusion

Post-operative delirium in the elderly is a multifactorial complication. In this study, certain factors such as advanced age, higher BMI, hypoalbuminemia, low TSH levels, excessive intraoperative blood loss and prolonged duration of surgery were found to be significant. This emphasises the need for assessing nutritional, metabolic and endocrine status of the patient and optimising them prior to surgery. In addition, careful intraoperative monitoring is also necessary. By doing so, the incidence of delirium in elderly post-operative patients can be reduced significantly.

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