Postoperative Cognitive Dysfunction in Indian Patients
Undergoing Total Knee Replacement Under Spinal Anesthesia

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Abstract

Introduction: Total knee replacement is a common surgical procedure among older population. The number of surgeries has increased owing to the increasing life expectancy of the population and better functional outcomes postsurgery. Postoperative cognitive dysfunction (POCD) is an identified entity postsurgery in elderly but most of the studies have been on patients undergoing cardiac and other nonorthopaedic surgeries. The studies have shown variable incidence due to selection bias. We studied the incidence and probable predictive factors of POCD in elderly Indian population undergoing total knee replacement under spinal anesthesia. Materials and Methods: We designed a prospective, observational study at a single center including patients above 60 years of age undergoing total knee replacement under spinal anesthesia. Preoperative mini-mental scale examination, electrolytes, urea and creatinine levels were recorded. Postoperatively, mini mental scale evaluation (MMSE) was done 2 days postsurgery, at 3 months, 6 months, and 1 year follow-up. Laboratory values postoperatively were recorded. Results: The average preoperative MMSE was 27 and declined to 25.4 on second postoperative day the value increased to 25.9, 26.6, and 27 at 3 months, 6 months, and 1-year follow-up, respectively. Sixty-three out of 600 patients developed POCD at second postoperative day. Forty-three patients showed recovery in subsequent visits and 20 patients had persistent dysfunction at the end of 1 year. Electrolyte imbalance, oxygen saturation, and age over 80 years were factors that showed statistically significant difference in multiple comparison analysis. Conclusion: In our study, we have found POCD to be a definitive entity which can cause short- and long-term cognitive defect in elderly Indian population undergoing total knee replacement and electrolyte imbalance, age, and oxygen saturation were the significant factors in the patients who developed POCD.

Keywords: Cognitive dysfunction, postoperative cognitive dysfunction, spinal anesthesia, total knee replacement

Multiple theories have been postulated on the pathology of POCD. Hypotension, electrolyte dysfunction, cerebral hypoperfusion, preexisting hypertension, and microemboli are some of the causes attributed to the development of POCD. There is lack of scientific evidence to attribute POCD to one or many of these causes. POCD among patients undergoing total joint replacement has been not been studied extensively.

POCD has been theoretically associated with general anesthesia and postoperative opioid analgesics. Regional anesthesia is commonly administered for total joint replacement. A study which exclusively includes elderly patients undergoing total

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joint replacement under regional anesthesia would avoid selection bias seen in many preliminary studies and can give a better understanding about the incidence and predisposing factors of POCD. We conducted this study exclusively including patients who underwent total knee replacement under regional anesthesia to identify the incidence and probably predictive factors of POCD among Indian patients undergoing total knee replacement.

**Materials and Methods**

We designed a prospective, observational study at a single center. The study population included patients above 60 years of age undergoing total knee replacement under regional anesthesia. Written consent was obtained from all participating patients. The institutional ethical committee approved the study. Patients who have had any form of anesthesia 90 days before arthroplasty or history of alcohol consumption of above 35 units weekly, visual or hearing impairment, preoperative mini-mental scale evaluation (MMSE) score <24, having any psychiatric or neurological illness or undergoing bilateral TKR were excluded from the study.

Preoperative MMSE, electrolytes, urea, and creatinine levels were recorded. Postoperatively, MMSE was done 2 days postsurgery, at 3 months, 6 months, and 1 year follow-up. Laboratory values postoperatively were recorded.

Statistical analysis was done and student’s t-test was used to identify statistical significance of parameters on continuous scale. Tukey HSD post hoc test was used for multiple comparisons. P < 0.05 was considered statistically significant.

**Results**

We included 600 patients who underwent total knee replacement over a period of 6 months who met the inclusion criteria. The male-to-female ration was 2:3; the average age was 64 years. Patients with MMSE score of 24 or less postoperatively were considered to have POCD. MMSE score between 18 and 24 was considered to have mild-to-moderate POCD and values <18 were categorized as having severe POCD. The average preoperative MMSE was 27 and declined to 25.4 on second postoperative day the value increased to 25.9, 26.6, and 27 at 3 months, 6 months, and 1-year follow-up, respectively [Figure 1].

All 600 patients were available for follow-up at end of study, 63 out of 600 patients developed POCD at second postoperative day. Forty-three patients showed recovery in subsequent visits and 20 patients had persistent dysfunction at the end of 1 year. Predictive indicators were identified for 20 patients who had POCD at 1 year follow-up. Electrolyte imbalance and age over 80 years were found to be the most significant predictive factor in these patients [Table 1]. Contradictory to previously reported studies males were affected more than females in our study.

Statistical analysis showed significant difference between preoperative MMSE score and score at second postoperative day but postoperative scores at 3 months, 6 months, and 1 year failed to show statistically significant difference. Electrolyte imbalance, oxygen saturation, and age over 80 years were factors that showed statistically significant difference in multiple comparison analysis.

**Discussion**

POCD is an established complication of surgery in elderly.[11] The incidence, predictive factors and causes of POCD has not been established with scientific evidence. Total knee replacement surgery is an elective surgery commonly performed in elderly population aiming symptomatic benefit and improving the quality of life. POCD has been shown to affect the quality of life and hence needs to be addressed in total knee replacement.[12-15]

The incidence of POCD was reported to be as high as 41%–76% at 1 week postsurgery and remained high (18%–35%) at 3 months and declined to 6%–9% at 1 year from surgery.[5,6] The international Study of POCD 1 pointed out age to be an independent significant risk factor for developing POCD.[16] In our study, we found 10.3% incidence of POCD at second postoperative day which declined to 3.3% at the end of 1 year. Canet et al., in their study, reported remarkably lower incidence of POCD at 1 week from surgery for minor surgeries (6.8%) compared to major surgeries (25.8%) but they failed to find any statistical significant difference between the groups at after 3 months of follow-up. In our study, we found a significant decline in POCD after 3 months which goes in tandem with other studies on POCD.[17] Chronic cognitive deficit is an established entity and with 10.3% of our study population showing cognitive defect at 1 year of follow-up suggests the same.

Type of anesthesia though theoretically suggested to be a causative factor for POCD has failed to show any association in clinical studies. Inhalational anesthetic use and postoperative opioid analgesia have also been suggested to be a risk factor.
in developing POCD. Rasmussen et al. found no causative relationship between RA and GA in a randomized control trial.[13] None of our patients received inhalational anesthetic or postoperative opioid analgesia. All surgeries were done under regional anaesthesia, but the incidence and pattern or recovery of POCD noticed was similar to the reported range in other studies on POCD.

We found no studies on POCD in total knee replacement to establish preoperative risk factors. Age has been identified as a significant independent risk factor. We found similar results in our study age, electrolyte imbalance, and oxygen saturation proved to be significant risk factors for developing POCD. Other variables such as prolonged hospital stay and cardiopulmonary deterioration did not show significant association.

We did not include preoperative comorbidities as a study parameter and did not use complex neurophysiological tests to assess POCD. The educational and occupational profile of patients has been suggested to be associated with POCD, but we did not include this parameter in our study. We believe the aforementioned to be the shortcomings of our study.

**Conclusion**

Total knee replacement is a commonly performed surgery in elderly aiming at improving the quality of life. The incidence and possible predictive factors of POCD need evaluation to prevent the occurrence and thereby avoiding decline in quality of life postsurgery. In our study, we have found POCD to be a definitive entity which can cause short- and long-term cognitive defect in elderly Indian population undergoing total knee replacement. Electrolyte imbalance, age, and oxygen saturation were the significant factors in the patients who developed POCD.

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**Conflicts of interest**

There are no conflicts of interest.

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