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Assessment of postoperative cognitive dysfunction and its impact on the quality of life among elderly patients. Running title- POCD and quality of life among elderly

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Abstract

Background: The ever-increasing fraction of older adults who requires operative care, needs not just longer life, but an active and good quality of life. The postoperative cognitive dysfunction (POCD) is well known complication of surgery and anaesthesia in elderly patient. Enhance recovery protocol helps in minimizing the stress response and in effect the onset of POCD. In current study, we made an attempt to reduce the prevalence of postoperative cognitive dysfunction in elderly patients by implementing enhanced recovery protocol, and evaluated the association with quality of life.

Methods: The current study was observational, prospective study conducted on patients aged above 70 of years. Cognitive function was assessed with Trail making test (TMT), Stroop color word test (SCWT) and Visual verbal learning test (VVLT), at preoperatively (T0) and postoperatively at 24 hours (T24), 96 hours (T96) and 3 months (T3). Quality of life was assessed in patients using WHO quality of life BREF Questionnaire, which was done at T0 and T3.

Results: Total forty-five patients were enrolled in the study, out of which 25 (55.5%) patients developed postoperative cognitive dysfunction (POCD) at T24 and T 96, while at T3, 14 (31.1%) had POCD. Major surgery was significantly associated with onset of POCD. Patients who developed POCD had significantly low quality of life, especially psychological component.

Conclusions; The incidence of POCD was 31.1% at 3 months after using Enhanced recovery protocol, so it should be made mandatory especially for elderly patients as POCD leads to worsening in the quality of life.

Keywords: Postoperative cognitive dysfunction (POCD); Visual verbal learning test (VVLT); Trail making test (TMT); Stroop colour word test (SCWT)

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Introduction

The recent advances in medical facilities have led to the increase in life expectancy and more elderly patients are in need of operative care. The clinical outcome of such surgical intervention cannot be just the correction of the ailment for which surgical procedure was performed. The emphasis for the patient is always to achieve independent life or pre illness conditions. Post-operative cognitive dysfunction (POCD) is a new cognitive impairment which arises after anaesthesia and surgery [1]. The POCD is a disorder of thought process and affects learning, verbal memory, visual memory, attention, orientation, language, comprehension, visuospatial abstraction and consciousness [2], [3]. It is an alarming complication which arise postoperatively due to synaptic degenerative impairment which accompany aging and stress response associated with surgery and anaesthesia in non-cardiac surgeries [4], [5], [6]. The incidence and severity of POCD increases in cardiac and orthopaedic surgeries due to cerebral microemboli formed during surgery [7], [8]. The major non modifiable factors which affect the onset of POCD are advanced age [9], educational level [2], history of alcohol abuse [10], anticholinergics [11] and opioids [12] use. The regulation of modifiable factors is the only preventive measure to limit the stress response of surgery and onset of POCD, till further progress in therapeutic interventions [2]. Enhanced Recovery (ER) protocols or "fast track" programs are evidence-based care bundles which include preoperative, intraoperative, and postoperative components to improve the post-operative outcome [13], [14].

The POCD is diagnosed by comparing the pre and post-

operative findings on neuro-psychological tests, which have limitations of specificity and sensitivity [15]. To compensate for these limitations, various tests are performed to determine the cognitive disorders so that several domains of cognitive functions are covered. As the basic cognitive functions varies among individuals, so pre-operative cognitive function of each patient was taken as baseline and any postoperative decline was considered as POCD [16].

The cognitive decline leads to inability to conduct daily activities, losing their jobs, their independence, increased mortality and furthermore there is significant reduction in their quality of life. The risk of POCD increases as the age increases and considering this, the present study inducted patients of more than 70 years age. Furthermore, Enhanced recovery protocol and care bundles were applied to all the patients, which is standard of care and observed the incidence of POCD and effect of it on quality of life.

Methodology

The approval from Institutional Ethics committee of Srinivas Institute of Medical Science & Research Centre, Mangalore, India was obtained, with ref no. 2019/11/6/4. Written informed consent was obtained from the patients after briefing them about the objective of the study using participant information sheet. The study was conducted from November 2019 to July 2020.

A total of forty-five patients undergoing elective major and minor non cardiac surgery were inducted in the study. The sample size was calculated based on previous study [6], [17] taking the proportion of patient developing POCD as 70%, with the power of 80%. Patients with American Society of Anaesthesiologists physical status 1 and 2 were included in the study, while patients with Parkinson's disease, visual disorder, auditory disorder, alcohol dependence, dementia, drug dependence, history of cerebro-vascular accident, previous psychiatric illness and patients on antidepressants and tranquillizers were excluded from the study. Patients posted for second operation within same stay, planned for cardiac surgery, neurological surgery and emergency surgery were not included in the study.

The preoperative cognitive function was assessed by mini mental state examination (MMSE) [18], as a screening test. Patients who scored >23 were included in the study. Baseline (T0) neuro cognitive function were assessed a day prior to the surgery in a comfortable atmosphere by battery of tests consisting of trial making test (TMT), visual verbal learning test (VVLT) and Stroop colour word test (SCWT).

TMT, which is a test of dexterity and of the ability to combine tasks [18], was performed in two parts A and B. To perform VVLT, patients were asked to memorise and reproduce a list of 15 words. Two such consecutive trials were performed, the first part involved immediate recall after 5 minutes and the second part assessed delayed recall after 20 minutes. This test assesses measurement of learning ability and memory retrieval, respectively [18]. The dependent variable was the number of words recalled in the trial. SCWT is a test of attention and concentration in the presence of distracters [19]. The time taken to complete the task were noted. These battery of Neuro cognitive functions tests were repeated after 24 hours, 96 hours and 3 months after surgery.

The quality of life was assessed preoperatively (T0) by WHO quality of life BREF questionnaire [20] and repeated after 3 months (T3) from surgery. The questionnaire consisted questions broadly assessing four domains i.e.; physical health (D1), psychological (D2), social relationships (D3) and environmental factors (D4) to assess quality of life. There were two separate questions which assessed an individual's overall perception of quality of life and overall perception of their health. Each item was scored on a Likert scale ranging from 1 to 5. To standardize the domain scores for comparison, the average score of each domain was calculated and then multiplied by 4, as was recommended by the WHOQOL. Thus, each domain scores ranged from 4 to 20, and a higher score indicated a better quality of life on the corresponding domain.

Based on the recommendations of Enhanced recovery protocol, precautions were taken to decrease the stress response of surgery and anaesthesia. The decision of anaesthesiologist for regional and general anaesthesia for the particular surgery was not influenced for the research. After receiving the patients in operation theatre pre-warming was done to avoid any hypothermia. Intraoperatively for general anaesthesia short acting opioids (Fentanyl), graded dose of Inj Propofol and Sevoflurane was used as inhalational agent. Multimodal analgesia was used for all the patients and postoperative pain was taken care. Any intraoperative hypotension was managed by vasoactive drugs rather than loading fluid. In postoperative period adequate analgesia, early mobilisation, thrombo-prophylaxis were take care in all the patients. Intra operatively and post-operatively vitals including heart rate, blood pressure, oxygen saturation (SpO2) and capnography (general anaesthesia) were recorded. Any complication developed in intra-operative and postoperative period was recorded.

Data collected was entered and analysed using Statistical Package for Social Science (SPSS) version 21.0. Results on continuous measurements were expressed in mean ± standard deviation (SD) and as proportions and percentages. Chi-square test was performed to find out the association between various parameters assessed and onset of POCD, p value ≤0.05 was considered statistically significant. Student t test (two tailed, dependent) was used to find the significance of change in various domains of quality of life at different point of time within same group and Student t test (two tailed, independent) was used to find the significance of changes in quality of life among patients who developed POCD to patients who did not develop POCD.

Results

The present observational study was conducted among forty-five patients for incidence of POCD and its effect on quality of life. As shown in table no.1, based on battery of neurocognitive function tests, at early postoperative time, T24 and T96, twenty-five (55.5%) patients developed POCD. After 3 months postoperatively (T3), eleven patients recovered while fourteen (31.1%) continued to have late POCD. Total twenty-two (48.9%) females were included in the study, out of which 54.5% had undergone major surgery and maximum female patients (63.6%) had not completed their secondary education. The POCD developed in thirteen (59%) female patients at postoperative period of 24 and 96 hours. In 3 months, neurocognitive functions improved but eight (36.3%) patients continued to have POCD. Out of 51.1% male patients, 65.2% were posted for major surgery and 69.5% had completed their secondary and higher secondary education. At T24 and T96 postoperatively, twelve (52.1%) patients developed decline in cognitive functions and at 3 months, six (26%) patients continued to have POCD.

Out of forty-five patients, with major surgery there was statistically significant increase in both early and late POCD, with p value of 0.001 and 0.002 respectively. Furthermore, gender, duration of surgery, mode of anaesthesia, educational status and American Society of Anaesthesiologists physical status had no significant effect on onset of POCD.

Table 1: Baseline characteristics of patients recruited in the study (n=45)

Variables	Total N (%)	POCD at Early stage (n=25)	POCD at late stage (3 months) n= 14
Age in years			
• 70-72	21(46.7%)	9(36%)	3(21.4%)
• 73-75	13(28.9%)	8(32%)	4(28.6%)
• 76-78	6(13.3%)	3(12%)	2(14.3%)
• 79-81	3(6.7%)	3(12%)	3(21.4%)
• 82-84	2(4.4%)	2(8%)	2(14.3%)
Gender			
• Male	23(51.1%)	12(48%)	6(42.9%)
• Female	22(48.9%)	13(52%)	8(57.1%)
Education			
• ≤ Secondary education	18(40%)	11(44%)	8(57.1%)
• Higher secondary education	16(35.5%)	9(36%)	3(21.4%)
• Graduate	8(17.8%)	4(16%)	3(21.4%)
• Higher education	3(6.7%)	1(4%)	0(0%)
Duration of Surgery			
• < 2 Hours	21(46.7%)	9(36%)	4(28.6%)
• 2-4 Hours	22(48.9%)	15(60%)	9(64.3%)
• >4 Hours	2(4.4%)	1(4%)	1(7.1%)
Anesthesia			
• General Anaesthesia (GA)	3(6.7%)	2(8%)	0(0%)
• GA + Epidural analgesia	6(13.3%)	4(16%)	2(14.3%)
• Nerve Block	3(6.7%)	1(4%)	0(0%)
• Subarachnoid Block (SAB)	21(46.7%)	9(36%)	6(42.9%)
• SAB + Epidural analgesia	12(26.7%)	9(36%)	6(42.9%)
Type of surgery			
• Major	26(57.8%)	21(84%)	13(92.9%)
• Minor	19(42.2%)	4(16%)	1(7.1%)

The neurocognitive functions, as shown in Table 2, mean of TMT A, TMT B, VVLT 5, VVLT 20 and SWCT followed trend in which there was maximum decline present at T96 postoperatively and gradual improvement at T3, but not reaching the baseline values. The decline in neuro cognitive functions were statistically significant compared to preoperative (baseline) tests with p value of <0.05.

Table 2: The comparison of neurocognitive functions at different timelines and comparison with T0

Results (mean±SD)	T0	T24	P value (compared to T0)	T96	P value (compared to T0)	T3	P value (compare to T0)
TMT A	3.52±1.84	4.60±2.28	0.001	4.80±2.40	0.001	4.02±2.29	0.001
TMT B	6.03±2.70	7.26±3.36	0.001	7.52±3.44	0.001	6.48±3.32	0.002
VVLT 5	9.80±2.57	8.27±2.66	0.001	7.71±2.81	0.001	9.31±2.64	0.012
VVLT 20	7.69±2.94	5.36±2.94	0.001	4.82±2.94	0.001	6.71±3.22	0.001
SCWT	7.91±3.35	9.46±4.23	0.001	9.87±4.22	0.001	8.76±4.10	0.003

The quality of life was assessed by WHOQOL BREF questionnaire, and change in quality of life assessed based on changes at T3 compared to T0. The question 1(Q1) was a direct question to patient perception about their quality of life. As depicted in table no.3, the mean score of Q1 was 3.00±0.78 at T0, and at T3 it was 2.07±0.73 in patients with POCD, this decreased score was found to be statistically significant with p value of 0.001. The question 2(Q2) dealt with patient's satisfaction with their health in last one month, D1 with physical health, D2 with psychological and D4 with environmental factors, a significant decline in these parameters were found in patients with POCD. D4 which dealt with social relationship was not affected with the onset of POCD.

Table 3: Comparison of quality of life from preoperative conditions (T0) to 3 months postoperatively(T3) in patients who developed POCD

WHOQOL-BREF	T0	T3	P value
Q1 (Quality of life)	3.00±0.78	2.07±0.73	0.001
Q2 (Satisfaction with health)	3.00±0.67	2.50±0.85	0.03
D1 (Physical health)	11.29±1.72	10.86±1.83	0.028

D2 (Psychological evaluation)	10.43±2.24	8.93±2.30	0.001
D3 (Social relationship)	10.14±1.99	9.71±1.63	0.54
D4 (Environmental factors)	10.43±1.60	10.14±1.67	0.04

The patients who did not develop POCD at three months, there was no significant change noted in quality of life including physical, psychological and environmental components as shown in table number 4.

Table 4: Comparison of quality of life from preoperative conditions (T0) to 3 months postoperatively(T3) in patients who did not developed POCD

WHOQOL-BREF	T0	T3	P value
Q1 (Quality of life)	3.03±0.79	3.32±1.85	0.418
Q2 (Satisfaction with health)	2.97±0.70	3.00±0.73	0.70
D1 (Physical health)	11.93±1.61	11.53±2.12	0.077
D2 (Psychological evaluation)	11.20±2.04	10.91±2.44	0.091
D3 (Social relationship)	11.10±1.75	10.74±1.63	0.009
D4 (Environmental factors)	11.58±1.54	11.32±1.83	0.07

Discussion

POCD has a considerable impact on quality of life and many a times results in withdrawal from the society. The present study, depicted that after following Enhanced Recovery Protocol, in more than 70 years age group, POCD developed in 55.5% in early postoperative period (T24 and T96). After 3 months of follow up, the neuropsychological test results showed improvement and POCD was detected among 31.1% of patients. This finding was in line with other published study [6], where in 70-80 years age group POCD developed in 40.9% and in more than 80 years age group it was found to be 100%. In International Study of Post-Operative Cognitive Dysfunction [21] (ISPOCD) 1 and 2, POCD was found in 19.8% patients at 3 months among more than 40years age group. This finding was lower than the present study, the difference could be due to the effect of lower age group of the patients studied is ISPOCD.

Interestingly, the present study depicted that all neuropsychological tests showed same trend, with poorest score at 24 and 96 hours and improvement at 3 months, which shows that with time cognitive functions can improve in patients, the same finding was portrayed in other studies [6], [22]. But POCD was not temporary event in 31.1% patients, and major surgery were found to be other potential risk factor for POCD.

The previous studies [6], had shown association between lower educational status and onset of POCD. In present study 80% patients who developed POCD at early stage and 78.5% at T3 had studied up to secondary education.

One major component of good quality of life is good physical health, which in current study was assessed by patient's sleep, capacity, ability and energy to do day to day activity and their dependence on medical treatment for that. These parameters were found to be in compromised state in patients with POCD, in current study. This finding was in concurrence with study done by Borges et al [22], where any improvement in bodily pain and general health was not seen in patients with POCD, they also found increased level of dependence on them. In ISPOCD [21] study 1 and 2, POCD was found to be associated with loss of job and independence, due to interfere with memory and concentration, and lead to premature withdrawal from economically productive life. POCD also has known association with postoperative complications like decubitus ulcer, infections and falls, which compromises the physical health of the patients [23]. After coronary artery bypass surgeries, the onset of POCD in both early and late stage, diminishes the improvement in quality of life [24].

Other foremost component of quality of life is psychological health, which was assessed by patient's perception about meaningfulness and satisfaction with his life and his own bodily appearance. Patients ability to enjoy life, depressive mood and negative feelings were also taken in consideration in Domain 2. In present study, patients with POCD were found to be in poorer psychological health compared their preoperative conditions. The freedom to do physical activity, participation in recreation, health and social care accessibility were assessed as environmental factors in D4, where decrement in scores were found.

So, in present study out of four components of quality of life, physical health, psychological health and environmental factors were affected whereas social relationship was not affected due to development of POCD. The result of current study was found in close relation with previous study, where all the components of quality of life including physical health, role physical, bodily pain, general health, vitality, social functioning, emotional role and mental health were compromised due to development of POCD [22]. Moreover, these cognitive decline leads to inability to conduct daily activities and loss of independence, and ultimately significant reduction in their quality of life. Henceforth, in elderly patients, Enhanced recovery protocol should be made mandatory to prevent the onset of POCD, and further deterioration of quality of life.

Author contribution

Dr Smriti Sinha – Conceptualization, Methodology, Formal analysis, Investigation, Data curation, Original draft preparation, Review, Editing

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Dr Shaila S Kamath – Conceptualization, Methodology, Review, Editing

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Dr Rashmi K S- Review and Editing

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Declaration of interest

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