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Incidence and Risk Factors of Post-Operative Delirium in Elderly Patients Who Underwent Spinal Anesthesia in Orotta, Halibet and Sembel Hospitals: A Cross Sectional Study in Eritrea

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ABSTRACT

Background: Delirium is a common but often underdiagnosed set of transient symptoms often seen in elderly patients following surgeries under spinal anesthesia. With early recognition and diagnosis based on the established standard criteria delirium can be improved. Early identification of the possible contributingfactors and the magnitude of the burden will help in the management of the fragile elderly patients. The aim of this study is to determine the incidence of postoperative delirium and associated risk factors in elderly patients who have done surgery under spinal anesthesia.

Method: This cross sectional study was conducted in the National Referral Hospitals and Sembel PrivateHospital, in Asmara, Eritrea from February to May, 2019. The study participants were elderly patients (age ≥65 years) having no known history of dementia or delirium or no mental disorder, no history of acute cerebrovascular disease. Basic background and clinical characteristics of the patients was collected. To assess the status of cognitive impairment level, the Mini Mental State Examination and Confusion Assessment Method tools were used. Data was collected through an interview method. After the data was entered into SPSS version 22 software, data was analyzed with frequency, percentage, bivariate and multivariate logistic regression analysis method as appropriate. P value <0.05 was considered as statistically significant.

Results: The mean age of the participants was 74 ±6.62 and 102 (79.1%) of the participants were males. POD occurred in 14 (10.9%) of the patients. Adjusting all the potential factors, age was identified as arisk factor for developing POD.

Conclusion: Age was determined to be a significant risk factor of delirium. Elderly patients require more attention and care and the findings might help to develop preventive strategies to the occurrence of POD.

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List of abbreviations

AGS: American Geriatric Society; AOR: Adjusted Odds Ratio; ASA: American Society of Anesthesiologist; CAM: Confusion Assessment Method; CI: Confidence Interval; COR: Crude Odds Ratio; DM: Diabetes Mellitus; DRS: Delirium Rating Scale; DSM-III-R: Diagnostic and Statistical Manual of Mental Disorder Revision 3; DSM-IV: Diagnostic and Statistical manual of Mental Disorder 4th edition; HNRH: Halibet National Referral Hospital; ICU: Intensive Care Unit; ICD-10: International Classification of Disease 10thEdition;IQR: Inter Quartile Range; MMSE: Mini Mental State Examination; MOH: Ministry of Health; VAS: Visual Analogue ScaleOCMHS: Orotta College of Medicine and Health Sciences; OMSNRH: Orotta Medical Surgical National Referral Hospital; POCD: Post-Operative Cognitive Dysfunction; POD:Post-Operative Delirium; POP: Post-Operative Pain; RASS: Richmond Agitation Sedation Scale; SA: Spinal Anesthesia; SD: Standard Deviation; SPSS: Statistical Package for Social Sciences; TURP: Transurethral Resection of Prostate

Background

Delirium is a temporary mental disorder characterized by changes in consciousness and attention [1]. It is also aneuro-inflammatory condition characterized by disturbance in attention (that is reduced ability to direct, focus, sustain and shift attention), disturbance in awareness (i.e. reduced orientation to the environment [2]. Postoperative delirium (POD) is a form of delirium that manifests in patients who have undergone surgical procedures and anesthesia [3]. The causes of POD are complex. Multiple risk factors for POD have been documented, including cognitive and functional impairment, polypharmacy and multiple comorbidities [4, 5]. It is one of the most common complications following anesthesia and surgery especially in elderly patients usually occurring one up to three days postoperatively [3, 6, 7]. Although it is common, it

remains either unrecognized or undiagnosed in substantial number of patients [8]. As elderly are easily vulnerable to many surgical complications, meticulous assessment and observations of such individuals is highly crucial. It is increasingly evident that delirium in elderly is associated with poor outcome, longer hospital stay, decreased functional capacity, and increased health care costs. So, its early diagnosis is crucial to prevent patients from developing severe long-lasting complications. Unfortunately, only a fraction of patients with delirium are quickly recognized by care-givers [1, 8, 9].

The incidence rate of postoperative delirium varies widely depending on the population and type of surgery [10]. Delirium is common in hospitalized patients with the incidence ranging from 14% on general medical ward to 82% in the intensive care unit [11]. In the elderly population, the prevalence varies between 14% and 56% for inpatient while the range goes up to 20–79%[3]. The incidence of POD depends on type of surgery, type of anesthesia, preoperative hypoxia, hypoalbuminemia, low serum sodium, potassium, glucose or blood sugar level [12]. It is also associated with higher mortality, increased incidence of postoperative complication, longer duration of hospital stay, greater utilization of social financial assistance and earlier retirement [13-17].

Delirium is preventable in 30–40% of case, and this holds significant public health relevance as a target for intervention to prevent the associated burden of downstream complications and costs. Accordingly, delirium has been increasingly used as an indicator of health-care quality for elderly people [11]. No study has been conducted to relate to the status of delirium especially in postoperative delirium patients. Therefore, the purpose of this paper is to assess the incidence and magnitude of POD among elderly patients undergoing surgeries under spinal anesthesia and to identify factors affecting its occurrence.

Method

Study Design & Setting

A descriptive cross sectional study design was used. The study was conducted in the two Medical Surgical National Referral Hospital, namely Halibet and Orotta Hospitals as well as Sembel Private Hospital between February and May 2019. All these three hospitals are found in Asmara, the capital city of Eritrea. The surgical departments of these hospitals have General, Gynecology, Maternity, Orthopedic and Burn wards which provides service to all age groups.

Study Participants

All surgical patients of 65 years of age & above who underwent any type of surgery under spinal anaesthesia with in the 3 months study period were included in the study. The eligibility to participate in the study was based on the respondent's willingness to take part in the study. Patients who declined to participate in the study, those with preoperative history of dementia, psychosis, cerebral vascular disease, brain surgery, traumatic brain injury, hemodynamic instability, patients of ASA classification > II, patients with serious renal insufficiency, those who underwent dialysis before surgery, those with serious hepatic insufficiency, patients with history of alcohol abuse and patients with problems of communication and those with hearing impairment were excluded from the study (Fig. 1).

Data Collection tool and method

The key elements of socio-demographic and clinical characteristics of the patients were obtained using a socio-demographic and clinical form. The details were age, gender, marital status, occupation, educational status, type of surgery, drug administered intraoperatively, intensity of pain, duration of surgery, amount of blood loss, ASA classification, and MMSE score. Preoperative cognitive status of the patients was scored using the MMSE (Mini Mental State Examination) tool. The tool was initially developed by Folstein et al., and is useful to assess and identify if there has been an existing cognitive impairment [18]. The presence and severity of POD among the patients was then evaluated with the CAM (Confusion Assessment Method) tool during the post-operative 1st, 2nd and 3rd days. At the same time, the intensity of pain was measured when the participants were evaluated for delirium postoperatively using VAS (Visual Analogue Scale) tool. The data collectors were the researchers themselves.

Data collection procedure

After permission was sought and obtained from OCMHS and MOH scientific research and ethical committee, the researchers visited each hospital and explained the purpose of the study and its clinical significance to the hospital directors and permission was then granted from each hospital director. Afterfull explanation of the objectives of the study and assurance of confidentiality and anonymity, written informed consent was taken from each participant during the preoperative period. Questionnaire was filled by document their socio-demographic and clinical characteristics. Their preoperative cognitive status was scored using the MMSE tool and this was done in order to identify if there is any existing cognitive impairment. Every researcher was trained on how to fill the MMSE tool prior to the start of the data collection. After the patient underwent anesthesia and surgery, the presence and severity of POD among the patients was then evaluated using the CAM assessment tool during the postoperative 1st, 2nd and 3rd days after surgery. The data was again collected by the researchers themselves. During the data collection process nursing staff and relatives were encouraged any unusual behavior that could be due to delirium.

Variables and Measures

The scale of the MMSE score provides information about the degree of cognitive impairment.The tool includes categories that evaluate orientation (10 points), registration (3 points), language (9 points), attention and calculation (5 points), and recall (3 points). The maximum score is 30 in which 24 points and above is considered normal, 19-23 points as mild, 10-18 points as moderate and 9 and below is considered severe cognitive impairment. The CAM tool assesses the presence and degree of severity of the postoperative cognitive impairment. It involves nine delirium features which are acute onset, inattention, disorganized thinking, altered level of consciousness, disorientation, memory impairment, perceptual disturbance, psychomotor agitation or retardation and altered sleep cycle. The VAS (Visual Analogue Scale) was also used to assess the severity of pain. The measurement of the scale extended from zero to ten centimeters and patients asked to indicate at which level they feel their pain was. Intensity of pain was defined as 'No pain' (0cm – 0.4cm), 'Mild pain' (>0.4cm – 3cm), 'Moderate pain' (>3cm – 6cm), and 'Severe pain' (>6cm – 10cm). These tools are standard and valid which have been widely utilized in several clinical studies for the assessment of cognitive impairment, delirium, and pain. They were pretested among ten patients for the purpose of assessing the comprehension and degree of understandability of the questions.

Data Analysis

Data was coded and entered into Statistical Package for Social Sciences (SPSS, version 22). Preliminary cleaning of the entered data was performed before conducting the main analysis. Descriptive analysis for categorical variables was performed using frequency and percentage. Summary result for continuous variables was done using mean (SD) after checking normality of the data. Incidence rate of delirium was computed and potential

risk factors were identified using bivariate logistic regression. Variables withp-value less than 0.05 at bivariate level were further analyzed at multivariate level to identify the most significant risk factors for developing POD. Both Crude odds ratio (COR, 95% CI) and Adjusted odds ratio (AOR, 95% CI) were reported. Tables and figures were used to present the results. A p-values less than 0.05 was considered as significant in all the analyses.

Results

Population Characteristics

In this study, a total of 155 participants were selected to participate in the study. Sixteen participants did not fulfill the inclusion criteria. The remaining 139 consented to be included in the study. Six were discharged early and four changed to general anaesthesia. This left a total of 129 participants in the study. The eligibility of the participants is presented in figure one.

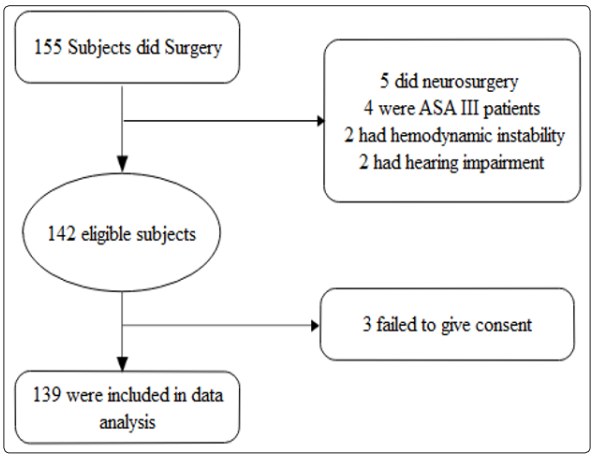

Figure 1: Participants Eligibility

As it is indicated in table 1, majority of the participants 102 (79.1%) were males and the remaining 27(20.9%) were females. The Mean age of the participants was 74 (SD=±6.62). Most of the participants were married covering 94(72.9%) and concerning their educational status, 52(40.3%) were illiterate, and only 19(14.7%) were secondary and above, and the remaining 58(45%) participants were elementary & junior. The majority of the participants were employed, in which self-employed comprises 45 (34.9%) and employed 30 (23.3%). The rest of participants were unemployed 54 (41.9%).

Table 1: Socio-demographic characteristics of the patients

Variables		Frequency	Percentage
Age (mean=74, SD=±6.62)			
	65-74	71	55
	75-84	49	38
	>85	9	7
Gender			
	Male	102	79.1
	Female	27	20.9
Marital Status			
	Married	94	72.9
	Single	1	0.8
	Divorced	8	6.2
	Widowed	26	20.2
Educational Status			
	Illiterate	52	40.3
	Elementary & Junior	58	45
	Secondary & above	19	14.7
Occupational Status			
	Employed	30	23.3
	Self employed	45	34.9
	Unemployed	54	41.9

Fifty two (40.3%) of the participants underwent urologic surgery and 48 (37.2%) underwent orthopedic surgery. Of all the surgeries 85 (65.9%) were completed in less than one hour and the rest 44 (34.1%) were completed between one and two hours. Most of

the participants (76%) were in ASA I classification. The majority of the participants (49.6%) scored no pain and 0.8% (only one patient) scored severe pain. The remainder of the patients showed mild (35.7%) and moderate (14%) pain scores. Regarding the drugs administered during the intraoperative period, only 2(1.6%) patients were given analgesic drugs (fentanyl and pethidine) and 6(4.7%) patients were given benzodiazepine (midazolam and diazepam). The majority of the patients, 125(96.9%) experienced less than 2000ml blood loss (Table 2).

Table 2: Clinical characteristics of the patients

Variables		Frequency	Percentage
Type of surgery			
	Orthopedic	48	37.2
	Hernia surgery	13	10.1
	Urology	52	40.3
	Others	16	12.4
Duration of surgery			
	<one hour	85	65.9
	one upto two hour	44	34.1
ASA classification			
	Class I	98	76
	Class II	31	24
Postoperative pain			
	No pain	64	49.6
	Mild pain	46	35.7
	Moderate pain	18	14
	Severe pain	1	0.8
Drug administered			
	Analgesia	2	1.6
	Benzodiazepine	6	4.7
	None	121	93.8
Analgesia			
	Fentanyl	1	0.8
	Pethidin	1	0.8
	None	127	98.4
Hypnotics			
	None	129	100
Benzodiazepine			
	Midazolam	6	4.7
	Diazepam	1	0.8
	None	122	94.6
Blood loss			
	<2000ml	125	96.9
	2000ml	4	3.1

Preoperative cognitive impairment level

The participants were assessed for any cognition impairment preoperatively using the MMSE score. The majority, 99 (76.7%) were within the normal cognition score. The remaining were found with mild, moderate and severe cognition by 22 (17.1%), 7 (5.4%) and 1 (0.8%) scores respectively (Table 3).

Table 3: Preoperative MMSE (Mini-mental state examination) score

Variables		Frequency	Percentage
MMSE score	Normal cognition	99	76.7
	Mild cognition	22	17.1
	Moderate cognition	7	5.4
	Severe cognition	1	0.8

Incidence of Postoperative Delirium

Participants were observed in the first, second and third postoperative days and out of the 129 participants, 14(10.9%) were found to develop delirium and the remaining 115(89.1%) did not show any sign of delirium (Fig. 2).

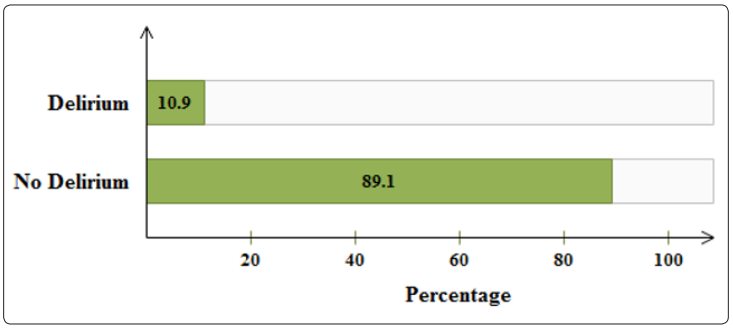

Figure 2: Incidence of postoperative delirium

Association of postoperative delirium with participant variables

The results of the logistic analysis performed to identify the possible association between different variables and postoperative delirium at bivariate level is shown in Table 4. Of all the patient characteristics, age, educational level, marital status, postoperative pain, and cognitive impairment status were found to be significantly associated with incidence of delirium. For unit increase in age, the odds of delirium was found to increase by 1.19 ($p<0.001$). The odds of delirium among illiterate was 4.92 times more than those who were elementary and junior ($p=0.020$).

Table 4: Association of post-operative delirium patient variables

Variables		Delirium		
		Non(%)	Yes n(%)	COR (95% CI)
Age				1.19 (1.08, 1.31)
Gender				
	Male	90 (90.0)	10 (10.0)	Reference
	Female	25 (86.2)	4 (13.8)	1.44 (0.42, 4.98)
E/Status				
	Elementary & Junior	55 (94.8)	3 (5.2)	Reference
	Illiterate	41 (78.8)	11 (21.2)	4.92 (1.19, 18.77)
	Secondary & above	19 (100)	0 (0.0)	*
Marital Status				
	Married	88 (93.6)	6 (6.4)	Reference
	Single	27 (77.1)	8 (22.9)	4.35 (1.39,13.63)
Occupation				
	Unemployed	46 (85.2)	8 (14.8)	Reference
	Employed	29 (96.7)	1 (3.3)	0.20 (0.02, 1.67)
	Self Employed	40 (88.9)	5 (11.1)	0.72 (0.22, 2.37)
Surgery Type				
	Others	15 (93.8)	1 (6.3)	Reference
	Orthopedic	38 (79.2)	10 (20.8)	3.95 (0.46, 33.58)
	Hernia	13 (100)	0 (o.o)	*
	Urology	49 (94.2)	3 (5.8)	0.92 (0.09, 9.50)
Surgery Duration				
	Less than 1 hour	73 (85.9)	12 (14.1)	Reference
	1 to 2 hours	42 (95.5)	2 (4.5)	0.29 (0.06.1.36)
ASA Class				
	Class II	26 (83.9)	5 (16.1)	Reference
	Class I	89 (90.8)	9 (9.2)	0.53 (0.16.1.71)
POP				
	Moderate to severe	15 (78.9)	4 (21.1)	Reference

	Mild Pain	45 (97.8)	1 (2.2)	0.08 (0.01, 0.81)
	No pain	55 (85.9)	9 (14.1)	0.61 (0.17. 2.27)
Drug Administered				
	Yes	8 (88.9)	1 (11.1)	Reference
	No	107 (89.2)	13 (10.8)	0.97 (0.11, 8.40)
Cognitive Impairment				
	Normal	94 (94.9)	5 (5.1)	Reference
	Mild	17 (77.3)	5 (22.7)	5.53 (1.44, 21.18)
	Moderate to severe	4 (50.0)	4 (50.o)	18.80 (3.60, 98.11)

Association was also conducted at multivariate level to assess the main predictors of postoperative delirium and of all the variables, only age was found to be a significant predictor (AOR=1.15, 95% CI: 1.01, 1.31) (table 5).

Table 5: Predictors of postoperative delirium at multivariate level

Variables		AOR (95% CI)	p-value
Age		1.15 (1.01, 1.31)	0.042
Educational Status			
	Elementary and Junior	Reference	
	Illiterate	*	-
	Secondary and above	*	-
Marital Status			
	Married	Reference	
	Single	1.59 (0.27, 9.31)	0.605
POP			
	Moderate to severe	Reference	
	Mild Pain	1.34 (0.22, 8.33)	0.754
	No pain	0.08 (0.01, 1.15)	0.063
Cognitive Impairment			
	Normal	Reference	
	Mild	1.52 (0.18, 12.72)	0.702
	Moderate to severe	4.03 (0.37, 43.67)	0.252

*=AOR could not be computed at multivariate level

Discussion

POD remains one of the most common, yet least reported, complications after surgery, especially in elderly patients[19]. This study is the first of its nature conducted in Eritrea which is envisioned to address the impact of spinal anesthesia on postoperative delirium in elderly patients in the major Eritrean Hospitals.

The findings of the study revealed that the overall incidence of POD after spinal anesthesia in elderly patients aged 65 years and above was 10.9%. This score was low compared to the finding of the Turkish study conducted by the MMSE and DRS tools,in which the incidence of postoperative delirium among patients who did orthopedic surgeries was 15%[3]. Similar result was also reported by a study in Italy. The study was conducted on 351 patients of which 47 (13.2%) had POD [16]. Moreover, higher was also reported in a study in Albania in which the incidence rate was found to be 26%. The study was done on patients who underwent surgery for TURP and were assessed using the DRS and CAM tools [20]. Lowered scores were also reported. One recent study assessed the status of POD among patient who took spinal anesthesia for total knee arthroplasty using DSM-V, and 6% of the patients were found to experience POD[21]. Similarly, a report from one Chinese study reported that the incidence of POD was 7.8% [20] and 52 (9.6%) of patients in a Taiwanese study were diagnosed with POD[22]. However, it should be remembered many of the studies used different tools which could influence the variation in the results obtained.However, it is possible that the difference in the reported incidence could be due to the difference in the data collecting techniques, scales, or tools utilized to diagnose delirium.

Patient socio-demographic and clinical characteristics including age, sex, cognitive impairment, type and duration of surgery, general anesthesia, anesthetic time, POP, hypothermia and blood transfusion were among the mentioned risk factors of POD [3, 23]. Moreover, labaratory reoptors such as preoperative and postoperative hemoglobin, serum sodium levels, and postoperative PaO2 are also reported as risk factors[24].

In this current study, multivariable analysis revealed age as a main predictor for the occurrence of POD. Such result goes with the fact that delirium is mentioned to be common among aged people which is associated with the more susceptible physiologic compensatory capability of aged people to adjust the physical stress of surgery. Previous studies have also demonstrated that

advanced age is a consistent, well-established, significant risk factor for the development of delirium [25]. A Chinese study showed the occurrence rate of POD to increase by 2% with a two years increase in the age of elderly patients [26]. Furthermore, a review of 80 studies identified age as an overlapping risk factor of delirium[27].Consistent with previous reports, this current study identified age as an independent risk factor of POD and for unit increase in age, the odds of delirium was found to increase by 1.19 times(AOR=1.15, 95% CI: 1.01, 1.31). Gender was also reported as significant risk factor [22]. Moreover, Wang et al., identified ASA class and blood loss to be significantly associated factors with the occurrence of delirium [28]. Meanwhile, in this current study, none of these factors has significant influence on the incidence of postoperative delirium.

Postoperative pain (POP) is also known to be an important risk factor for POD[21]. A study done by Ozbaset al, indicated that POP is associated with the high incidence of delirium, those with moderate to severe pain score were found to experience higher incidence of POD. In this study, we found the incidence of delirium to be higher in patients with preoperative cognitive impairment whose scores from moderate to severe MMSE. This result was backed up by the study done in Italy in which they found preoperative cognitive impairment was an independent variable associated with POD in elderly patients[29]. Contrary to these findings, another study concluded cognitive impairment to be significantly associated with POD[25]. Medications given during the intraoperative period are also explained to have an influence on the occurrence of postoperative delirium. A study done in Ethiopia found intraoperative benzodiazepines to be significantly associated with the occurrence of POD. Those who took the drug were found to be 11.3 times more likely to develop delirium as compared [30]. Meanwhile in this study the use of intraoperative benzodiazepines was few (seven patients) and no association and no significant delirium was seen among those who took the medication. Regarding the type of surgery patients underwent, a meta-analysis of five studies showed the likelihood of delirium to increase in patients who underwent total hip prosthesis surgery[31].This findings is supported by the higher rate of incidence reported in elderly participants undergoing spinal anesthesia after hip surgery[3].Another study done in urological surgery found a definite correlation with the incidence of POD[32].

Finally, it can be stated that being an old aged participant by itself have many physiological and psychological deteriorations. Anticipating the possible contributing factors and planning to control them is the priority. As prevention is better than facing the situation after occurrences, focusing on the possible contributing elements is vital.

Limitation of the study

Patients were followed only for three days postoperatively and as it is indisputably true that postoperative delirium could be seen several days after surgery hence some positive findings might have been missed.

Conclusion

Identifying the predictor factors can be used to identify patients at increased risk of postoperative delirium and Age of the patient was found to be a significant risk factor for the development of postoperative delirium. Therefore, aged patients may require more attention and care with regard to the occurrence of postoperative delirium.

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