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Research Article

CORRELATION OF POST-OPERATIVE DELIRIUM WITH BIS GUIDED DEPTH OF ANESTHESIA IN ADULT CARDIAC SURGICAL PATIENTS

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A B S T R A C T

Background: Following cardiac surgery, postoperative delirium is a common acute neurocognitive illness with serious repercussions for patients. BIS is a simple approach for continuously measuring brain activity when anesthetic, hypnotic, or sedative medications are administered. BIS monitoring is thought to be a more trustworthy approach for determining awareness levels. As a result, we conducted this study to see if the depth of anesthesia, as measured by the bispectral index, impacts post-operative neural cognitive performance in patients undergoing cardiac surgery.

Settings and Design: It is a descriptive and observational study carried out in 90 patients planned for cardiac surgeries were divided into 2 groups of 45 patients each as Group A and Group B. Group A with lower BIS (less than 60) and group B with higher BIS (more than 60).According to the Richmond agitation sedation scale, delirium was diagnosed (RASS).

Results: Delirium was seen among 4.4% of group 1 and 2.2% of group 2 participants when assessed by RASS scale at 30 minutes after surgery. 68.9% of group 1 and 22.2% of group 2 participants had delirium at 4hrs after surgery. Even at next day morning delirium was assessed among both the groups, 44 participants of group 1 and 18 of group 2 participants had delirium next day morning. The next day evening delirium was seen in all the study participants among group 1 where as in group 2, 22 participants had delirium.

Conclusions: During cardiac procedures, anesthesia regulated by bispectral index monitoring reduces the risk of post-operative delirium and makes titration of anesthetic agents easier.

INTRODUCTION

The most common cause of postoperative delirium is major surgery, and it often goes undiagnosed.[1] Following cardiac surgery, postoperative delirium is a common acute neurocognitive illness with serious repercussions for patients.[2,3]Following heart surgery, a number of poorly defined psychiatric diseases have been reported, including acute brain syndrome, post-cardiotomy syndrome, and postoperative psychosis, all of which have been lumped together as post-cardiac surgery delirium.[4,5]

After heart surgery, neurological complications are a major source of concern, and it's unclear which perioperative factors are to blame for this negative outcome. Cardiac surgery is now safer than it has ever been, thanks to significant advancements in all aspects of intraoperative and postoperative care. [6]

Post-cardiac surgery delirium is identified in 26 percent to 52 percent of patients, depending on methodology, with some studies showing percentages as high as 70.[7-9] With the aging of the world's population and the growing number of heart surgeries conducted each year, post-cardiac surgery delirium has become a serious epidemiological and clinical issue.

Intraoperative monitoring of the processed electroencephalogram (EEG), such as the bispectral index (BIS), has been proven to aid anesthetic drug administration titration. The BIS is a simple approach for continuously measuring brain activity when anesthetic, hypnotic, or sedative medications are administered. BIS monitoring is thought to be a more trustworthy approach for determining awareness levels. Currently, it is accepted that inducing and maintaining anesthesia lowers the BIS value, and that increasing the doses of volatile or injectable anesthetics lowers the BIS value even more. The usage of BIS monitoring in patient care has exploded because to its safety and low cost, as well as the fact that it requires no additional training. Because it is safe and affordable, and it does not require particular expertise, BIS monitoring has become increasingly popular in-patient care.

As a result, during anesthesia, the doses of hypnotic drugs were reduced by 11 percent to 27 percent by aiming for a BIS value between forty and sixty. [10,11] This, in turn, is linked to a better general recovery and a quicker recovery from

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anesthesia. [12,13] As a result, we conducted this study to see if the depth of anesthesia, as measured by the bispectral index, impacts post-operative neural cognitive performance in patients undergoing cardiac surgery.

MATERIALS AND METHODS

Study design: Descriptive and observational study

Study area: Department of Anesthesiology and

Study period: Research study was conducted for 2 years from July 2019 to September 2021.

Sample size*:* Assuming co-relation co-efficient of 0.3 between BIS and the Delirium Scale at power of 80% and significance level of 5%. The calculated Sample size was 85. This was divided into two groups with 45 each.

Inclusion criteria

1. ASA Grade 2, 3.
2. Ages between 18- and 75-years female and male patients.
3. Patients undergoing any cardiac surgery.
4. Hemodynamically stable patients with all routine investigations within normal limits.
5. Availability of informed consent.

Exclusion criteria

1. Patients with known allergy to drug.
2. Patients who are not consenting to the above study.
3. Patients who were difficult to follow up after hospital discharge.
4. Patients with another operative procedure planned within 1 week.
5. Patients with known major psychiatric disease and sensitivity to any component of study anesthetic regime.
6. Patients below 18 years of age.

Patient selection: After obtaining informed written consent from patients in their own understandable language, 90 patients planned for cardiac surgeries were divided into 2 groups of 45 patients each as Group A and Group B. The patient was allotted to a respective group by lottery method.

GROUP A: With lower BIS (less than 60) with general anesthesia.

GROUP B: With higher BIS (more than 60) with general anesthesia.

Preoperative evaluation

Pre-operatively, one day before surgery, all patients were thoroughly assessed. It included a thorough medical history, as well as a general, physical, and systemic examination. Prior to surgery, all necessary and relevant laboratory investigations were completed, including CBC, urine routine, RFTs, RBS, CXR, and ECG, and proper written consent was confirmed. To reduce the risk of aspiration and other anesthesia-related problems, all patients were kept nil per oral (NPO) for at least 6 hours prior to surgery.

Outcome: Measures incidence of delirium as assessed by Richmond agitation sedation scale (RASS)

Stastistical Analysis

Data was entered in excel sheet and analyzed using the Statistical Package for the Social Sciences 20 (SPSS Inc. Chicago). Results were presented in tabular and graphical forms Mean, median, standard deviation and ranges were calculated for quantitative data. Qualitative data will be expressed in terms of frequency and percentages. Pearson correlation was used to test co-relation between two continues variables and P value <0.05 was considered significant.

RESULTS

In our study among 90 cases, 45 cases had BIS<60 (Group 1) and 45 cases BIS>60 (Group 2). Hemodynamically following parameters were assessed (PR, SBP, DBP, MAP, Spo2, etco2, temperature) intraoperatively and postoperatively and post-operative RAAS scale was assessed.

There was statistical difference of hemodynamic parameters between group A and group B showing higher values in group B (BIS more than 60), however it was within normal range, it was not clinically significant even though it was statistically significant.

Table 1 RASS scale scoring at 30 minutes and 4 hours after surgery

RASS scale scoring		Group 1	Group 2	p value
30 minutes	0 (Alert and calm)	43 (95.56%)	44 (97.78%)	0.557
	1 (Restless)	02 (04.44%)	01 (02.22%)	
4 hours	0 (Alert and calm)	14 (31.11%)	35 (77.78%)	<0.01
	1 (Restless)	20 (44.45%)	10 (22.22%)	
	2 (Agitated)	10 (22.22%)	0	
	3 (Very agitated)	01 (02.22%)	0	

Table 2 RASS scale scoring at next day morning and evening after surgery

RASS scale scoring		Group 1	Group 2	p value
At next day morning	0 (Alert and calm)	01 (02.22%)	27 (60%)	<0.01
	1 (Restless)	18 (40.00%)	18 (40%)	
	2 (Agitated)	26 (57.78%)	0	
At next day evening	0 (Alert and calm)	0	23 (51.11%)	<0.01
	1 (Restless)	09 (20%)	19 (42.22%)	
	2 (Agitated)	33 (73.33%)	03 (06.67%)	
	3 (Very agitated)	03 (06.67%)	0	

Table 3 RASS scale scoring at 5th and 10th day after surgery

RASS scale scoring		Group 1	Group 2	p value
5th day	0 (Alert and calm)	0	24 (53.33%)	<0.01
	1 (Restless)	17 (37.78%)	19 (42.22%)	
	2 (Agitated)	24 (53.33%)	02 (04.45%)	
	3 (Very agitated)	03 (06.67%)	0	
	4 (Combative)	01 (02.22%)	0	
10th day	0 (Alert and calm)	0	35 (77.78%)	<0.01
	1 (Restless)	18 (40%)	10 (22.22%)	
	2 (Agitated)	22 (48.89%)	0	
	3 (Very agitated)	05 (11.11%)	0	

Among two groups mean SBP were compared and it was found that there was significant difference between two groups as the time passed except at 10 and 15 minutes. (p<0.05) Among two groups mean DBP were compared and it was found that there was significant difference between two groups as the time passed. (p<0.05) Among two groups mean MAP were compared and it was found that there was significant difference between two groups as the time passed. (p<0.05)

Among two groups when temperature was monitored frequently, there was no much significant difference between groups along the time also. In our study, ETCO2 was also monitored every 5 minutes, among two groups mean ETCO2 were compared and it was found that there was no significant

difference between two groups as the time passed. There was not much change in ETCO2 in group 2 as time passed, but there was fluctuation in group 1.

After surgery pulse rate, SBP, DBP, MAP was monitored at 30 minutes, 4 hours, next day morning, evening, 5th day and 10th day. It was found that there was significant difference between two groups among mean values of PR at all the intervals. Pulse rate increased along the time in two groups. Among two groups mean SBP were compared and it was found that there was significant difference between two groups as the time passed at 30 minutes and 4 hours. ($p<0.05$) When two groups were compared during early time in group 2 (BIS>60) SBP was lower than group 1, later in time there was not much difference. The mean DBP was found that there was significant difference between two groups next day morning and at 5th day. ($p<0.05$) As the time passed diastolic blood pressure went on decreasing in group 2, but in group 1 it‘s increasing. When two groups were compared at all the intervals for post-operative DBP there was not much difference.

We found that there was significant difference between two groups in MAP at 4 hours, morning and on 5th day. ($p<0.05$) As the time passed mean arterial blood pressure went on increasing in both the groups. When two groups were compared at all the intervals in group 2 (BIS>60) MAP was lower than group 1. On 10th day MAP had come to normal levels.

RASS scale scoring was recorded at 30 minutes, 4 hours, next day morning and evening and at 5th and 10th day after surgery to assess the delirium. At 30 minutes, 4.44% in group 1 and 2.22% in group 2 had RASS score 1 (restless) and at 4 hours majority (44.45%) scored 1 in group 1 and majority were alert and calm in group 2(77.78%). On next day morning, the RASS scores deteriorated in group 1 and majority (57.8%) were agitated and group 2 had only 40% restless patients on RASS. Next day evening, 6.7% scored 3 on RASS in group 1 and none in group 2.

On 5th post-operative day, in group 1 53.3% were agitated, 6.7% were very agitated and 2.2% were combative and in group 2. 4.5% were agitated and none were scored 3 or 4 on RASS. On post-operative day 10, 48.9% of group 1 patients scored 2 on RASS and 11.1% scored 3 on RASS and 22.2% scored 1 in group 2.All these differences was statistically significant ($p<0.01$)

We considered highest RASS score attained during follow-up days and tabulated table 27 to see the overall effect of RASS, BIS and age. We found that, majority of the patients scored as delirium were aged more than 55 years in group 1 and vice-versa in group two.

When we tested for significant difference between age and delirium by RASS scoring irrespective of BIS depth, we found that among 65 patients aged >55 years, about 20% patients had RASS score ≥3 and this was only 4% in those aged <55 years. This difference was statistically significant when chi-square test was applied ($p<0.001$)

DISCUSSION

One of the goals of general anesthesia is to render patient asleep, oblivious to the events of the surgery, and unable to recall them in the postoperative period. The patient's awareness is defined as being awake during the procedure, having a bad dream, or recalling significant events. [14] 0.9-7% consciousness has been documented in some general anesthetic applications where muscle relaxants are employed. Anesthesiologists titrate anesthetic medication doses based on hemodynamic responses to painful stimuli — which does not always imply awareness, and a lack of hemodynamic change does not always imply unconsciousness. [15] This method is possible in healthy people, but it does not guarantee patient safety in those with damaged cardiopulmonary systems.

The BIS has been shown to be a safe and effective pharmacodynamic measure of anesthetic central effects during brief surgical procedures. [16] Because both 'too deep' and 'too light' anesthesia can be harmful to patients, it is important to see how the index functions over protracted surgical procedures, where drug pharmacokinetics will shift.

The study included 90 patients with ASA physical status II and III, who were scheduled for cardiac surgeries under general and epidural anesthesia. A descriptive and observational study with two groups of 45 patients each was done after receiving Institutional Ethics Committee clearance and informed and signed consent from every case selected for the trial.

In this study, we compared hemodynamic abnormalities for time period more than 5 minutes. All major changes in arterial pressure and heart rate were handled right away with a systematic protocol that included epidural anesthesia, adjusting the volatile anesthetic concentration and administering hypnotics, analgesics, intravenous fluids, vasopressors, and ionotropic agents.

CONCLUSION

1. During cardiac procedures, anesthesia regulated by bispectral index monitoring reduces the risk of post-operative delirium and makes titration of anesthetic agents easier.
2. Routine BIS monitoring during cardiac surgeries with general and epidural anesthesia keeping BIS value more than 60 reduces the risk of post-operative delirium
3. Post-operative delirium was seen most commonly in the age group of 55-75 years

Conflict of Interest: None declared

Author's Contribution:

Conceptualization of the study was done by CL, VS and SS. CL, VS and SS were involved in this study to design and draft the research and the manuscript. CL, VS and SS provided the qualitative design. CL wrote the first and second drafts of the paper. CL, VS and SS reviewed the first and second drafts of the paper and improved them. All authors have read and approved the final version of the manuscript. Conceptualization: CL, VS and SS, Data curation: CL, VS and SS Formal analysis: CL, VS Methodology: CL, VS and SS Visualization: CL, VS Writing–original draft: CL Writing review & editing: CL, VS and SS

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