

## AWARENESS DURING CORONARY ARTERY BYPASS GRAFTING SURGERY

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### ABSTRACT

**Objectives:** To determine the frequency of awareness in patients undergoing coronary artery bypass grafting (CABG) with cardiopulmonary bypass (CPB).

**Design:** Cross-sectional Survey

**Place of Study:** Armed Forces Institute of Cardiology, Rawalpindi - Pakistan

**Methods:** A total of 100 patients (both males and females) of age > 18 years, undergoing elective CABG, were interviewed 24-72 hours after anesthesia using a modified Brice questionnaire. Patient's anesthesia record was consulted and the drugs and doses used at induction and maintenance of Anesthesia at different stages of the surgery were noted down.

**Results:** Overall frequency of awareness was found to be 5%. It was found to be less in patients who received propofol infusion during CPB compared to the patients who did not.

**Conclusion:** Regular use of sedation with propofol infusion during CPB can reduce the frequency of awareness. Bispectral index (BIS) monitoring can prove to be a helpful monitor of the depth of anesthesia during CPB.

**Key words:** Awareness, Bispectral Index (BIS), Cardiopulmonary Bypass, Coronary Artery Bypass Surgery

### INTRODUCTION

A frequency of awareness during anesthesia and surgery is either determined by formally interviewing patients postoperatively<sup>1</sup> or patients reporting themselves. Some patients may not recall events shortly after surgery but may recall even one to two weeks after surgery<sup>2</sup>. A possible contributing factor for a low frequency of awareness is under reporting. A study by Moerman<sup>3</sup> showed that people do not tell anesthetists about awareness because of fear of disbelief or ridicule, fear of insanity or dementia and misunderstanding of events, until later.

Certain group of patients and surgical procedures are at high risk for intra-operative awareness, and prevention would be difficult in these cases. These include trauma patients and surgical procedures like coronary artery bypass grafting (CABG) and cesarean section<sup>4-6</sup>. So far, trauma patients have reported the highest frequency of intra-operative awareness (11% - 43%)<sup>4</sup>. A study from Finland<sup>4</sup> investigated

awareness in 929 patients who had cardiac surgery. The frequency of definite awareness with recall was 0.5%, and the frequency of possible recall was 2.3%. Additionally, in a survey of 3,000 patients who had general anesthesia for cesarean section, a frequency of about 0.9% for any recall and 7% for dreaming, was reported<sup>6</sup>. At Beijing Chaoyang Hospital, the frequency of awareness of patients with CABG under cardiopulmonary bypass (CPB) was 4.7%; in off-pump CABG 9.6% and 4% in septal repair or valve replacement under CPB<sup>7</sup>.

So far the medical literature about awareness during cardiac surgery in Pakistani population is rare. We conducted this cross sectional survey to find the frequency of awareness during CABG surgeries on cardiopulmonary bypass (CPB) in our patients.

### PATIENTS AND METHODS

It was a cross-sectional survey conducted at the Department of Anesthesia and Intensive Care, Armed Forces Institute of Cardiology / National Institute of Heart Diseases, Rawalpindi Pakistan from January 1 to June 30, 2009. After approval from the hospital ethics committee and obtaining informed consent from the patients, 100 patients were recruited.

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All consecutive patients undergoing coronary artery bypass grafting (CABG) surgery on cardiopulmonary bypass (CPB) under general anesthesia (GA) were included in the study. Patients undergoing off-pump coronary artery bypass (OPCAB), CABG with valve replacement and CABG with VSD repair were excluded from the study. Patients requiring prolonged post-operative ventilation (more than 6 hours) due to any reason; patients undergoing re-opening under general anesthesia for persistent blood loss or temponade; and patients going into post-operative delirium or psychosis were also excluded from the study to remove any chance of recall bias by the patient at the time of interview.

In the post-cardiac surgery ICU, patients were interviewed 24-72 hours after surgery by a senior registrar in cardiac anesthesia who did not know the anesthesia technique used. A modified version of the Brice questionnaire<sup>8</sup> was used as a screening tool for awareness (Table-1). We chose to elect the substituted questions as used by Pollard et al in their study<sup>9</sup>. The two of the original questions, "What was the worst thing about your operation?" and "What was the next worst," with the more process-oriented "Were you put to sleep gently?" and "Did you have any problems going to sleep?". If the patient seemed to have memory, further questions were used to obtain a detailed account of the experience as possible. Patients with possible

memories of intra-operative events were further questioned to obtain data on awareness (Table-2). Cases with awareness were classified as one of three groups according to the likelihood of true recall: group 1, definite cases required that the recalled event was confirmed by attending personnel; group 2, probable cases, the investigators were convinced that the memory was real, but no confirmation could be obtained; group 3, possible cases who were unable to recall any event definitely indicative of true awareness<sup>10</sup>. The classification was used as diagnostic criteria of awareness under general anesthesia where group 1 and 2 patients were considered as positive for anesthesia awareness. Patient's anesthesia record was consulted and the drugs and doses used at induction and maintenance of anesthesia at different stages of the surgery were noted down in a performa.

**RESULTS**

Data was available for all 81 male and 19 female patients that underwent CABG surgery. Overall frequency of awareness was found to be 5% in our patients.

Anesthesia was conducted by consultant cardiac anesthetists in 62 cases and by senior registrars in cardiac anesthesia (second fellowship trainees in cardiothoracic anesthesia) in 38 patients. All patients received midazolam with either morphine or nalbuphine on induction and additional dose of the same opioid during CPB. None of the patients

**Table-1: Questions Used to Elicit Frequency of Recall**

1. What was the last thing you remember before surgery?
2. What is the first thing you remember once you woke up?
3. Did you have any dreams while you were asleep for surgery?
4. Were you put to sleep gently?
5. Did you have any problems going to sleep?
Used with permission Pollard <i>et al</i> <sup>9</sup>

**Table-2: Questions for Anesthesia awareness screening.**

1. What do you remember from your time of surgery?
2. Did you experience pain during surgery? No / Yes
3. If Yes, what sort of pain and where in your body you experienced most?
4. Did you hear any noises during your surgery? No / Yes
5. If yes, what sort of noises were those?

received sevoflurane during cardiopulmonary bypass. All patients received pancuronium as muscle relaxant during the surgery except in 26 patients, who had a low creatinine clearance (50ml/min or less) and were given atracurium infusion (6 to 7 µg/Kg/min) for muscle relaxation during the surgery.

Fifty nine patients received propofol infusion during CPB in a dose ranging from 10 to 25 µg/Kg/min with mean dose of 20.64 µg/Kg/min. Awareness was reported more (10.8%) in patients who did not receive propofol infusion during CPB whereas it was 1.7% in patients who received propofol.

## DISCUSSION

Awareness is defined as the situation that occurs when a patient under general anesthesia becomes aware of some or all events during surgery or a procedure, and has direct recall of those events<sup>11</sup>. Over half of these patients are reported to experience mental distress following surgery and some of them even needing psychotherapy<sup>3</sup>. Patients may have severe after-effects like anxiety and nightmares and symptoms of post-traumatic stress disorder (PTSD)<sup>12,13</sup>.

In the cardiac surgery population, the frequency of awareness and recall has been found to be higher and reported between 0.3-4%<sup>14-16</sup> as compared to non cardiac surgeries where the reported incidence is as low as 0.9%<sup>17</sup>. A slightly higher frequency of awareness (5%) has been found in our population. The reason for this higher frequency appears to be multi-factorial: lack of sevoflurane vaporizers on the heart lung machines; low dose or no propofol infusion during CPB because of associated low perfusion pressures; and most importantly lack of feedback from patients regarding recall and awareness. Celebioglu et al studied 59 patients and found 5 (16.6%) patients giving positive history of awareness who received dehydrobenzperidol during CPB compared to none who received sevoflurane<sup>18</sup>. One of the 3 patients with probable awareness during anesthesia in our study, received lower (20 µg/Kg/min) than recommended dose of

propofol for maintenance of anesthesia (50-200 µg/Kg/min). Ranta et al have shown that the frequency of awareness and recall during cardiac surgery can be reduced from 4 to 1.5%, if feedback is available<sup>19</sup>.

Another important factor for high frequency of awareness in our patients is lack of monitoring. In the United States, approximately 60% of all operating rooms use Bispectral Index (BIS) technology<sup>20</sup>, whereas its use in Pakistan has been very limited so far due to the high cost of its electrodes. The Food and Drug Administration (FDA) of the United States recommend that "use of BIS monitoring . . . may be associated with the reduction of the frequency of awareness with recall in adults during general anesthesia and sedation"<sup>21</sup>. An interesting recent publication randomised 2000 high risk patients to receive either BIS guided anaesthesia (targeted range between 40 and 60) or end-tidal guided anaesthesia (maintained above 0.7 MAC - actually targeted range 0.7 to 1.3 MAC). The study showed an identical frequency of awareness in both groups leading the authors to suggest that their findings did not support the use of BIS monitoring in standard practice<sup>22</sup>. However, its use has been demonstrated in cardiac surgery with CPB<sup>23</sup> as well as in Off Pump Coronary Artery Bypass (OPCAB) surgeries<sup>24,25</sup>.

The Brice Questionnaire is acknowledged to be the accepted tool for detecting awareness post operatively<sup>8</sup>. We chose to use the modified version of Brice Questionnaire. This open-ended questioning technique has been previously described by Fleisher et al<sup>26</sup> and is designed to elicit information in a non-alarming way and used by Pollard et al<sup>9</sup>. This modification of the Brice questionnaire differs from that used by Sandin et al<sup>10</sup> and Sebel et al<sup>13</sup>. The frequency of awareness reported by Pollard using this modified Brice questionnaire is 0.0068% (6 out of 87,361), which is quite less than the published frequency. If it is thought that this modification of the questionnaire might have caused an underestimation of the frequency of recall in the study by Pollard et al, the actual frequency of awareness might be

higher. However, the primary questions that Brice used to elicit recall are unchanged in this questionnaire.

In our patients, we conducted the interview only once, 24 to 72 hours after the surgery. A single interview has also been used by Yun<sup>7</sup>, Muralidhar<sup>24</sup> and Bestas<sup>25</sup>, however, it has been reported that almost one third of the patients have been identified to have awareness at follow-up interviews, conducted at least 1 week after anesthesia<sup>10,13</sup>.

The frequency of awareness in our patients undergoing CABG with cardiopulmonary bypass has been found to be considerably higher than that published in international studies. This may be because 41% patients in our study did not receive any form of sedation during cardiopulmonary bypass.

## CONCLUSION

Regular use of sedation with either propofol or sevoflurane during CPB may reduce frequency of awareness and selective use of BIS monitoring in high risk patients (elderly and patients with poor left ventricular functions) may be cost-effective. Recognition of awareness and accepting it with a regular feedback can definitely help reduce its frequency. Further studies are recommended to compare different anesthetic regimens in CABG surgeries and evaluate role and cost-effectiveness of BIS monitoring in patients undergoing open heart surgeries.

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