

## Research Article

## Intraoperative Insight: Evaluating Anesthesia Residents' Awareness and Proficiency in Monitoring Techniques during Surgery in Himachal Pradesh

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**Abstract:** **Background:** Anesthesia practice requires a profound understanding of intraoperative monitoring techniques to ensure patient safety during surgery. This study evaluates the awareness and proficiency of Resident Anesthetists in Himachal Pradesh, India, regarding key monitoring parameters, including electrocardiography (ECG), blood pressure, oxygen saturation (SpO<sub>2</sub>), and end-tidal carbon dioxide (ETCO<sub>2</sub>). **Methods:** A cross-sectional survey involving 100 Junior and Senior Residents of Anesthesia from Himachal Pradesh was conducted between April and June 2023. Participants completed a questionnaire assessing their knowledge of intraoperative monitoring techniques. Data were analyzed for frequencies and percentages. **Results:** The study revealed varying levels of knowledge among participants. While 87% understood the purpose of intraoperative monitoring, 76% could explain the significance of continuous ECG monitoring. Approximately 74% recognized the importance of blood pressure monitoring, and 79% understood the significance of SpO<sub>2</sub> monitoring. In contrast, only 56% were knowledgeable about ETCO<sub>2</sub>, and 55% could interpret ETCO<sub>2</sub> waveforms. Communication and collaboration were recognized as crucial by 61% of participants. Overall, 23% had very good knowledge, 32% had good knowledge, 24% had fair knowledge, and 21% had poor knowledge of intraoperative monitoring techniques. **Conclusion:** This study highlights the need for ongoing education and training among Resident Anesthetists in Himachal Pradesh to enhance their proficiency in intraoperative monitoring. Improved knowledge in key areas such as ECG interpretation, ETCO<sub>2</sub> monitoring, and effective communication can contribute to safer anesthesia practice and better patient outcomes.

**Keywords:** Intraoperative monitoring, anesthesia, Resident Anesthetists, knowledge assessment, patient safety, Himachal Pradesh.

## INTRODUCTION

The practice of anesthesia is an intricate blend of medical science, clinical expertise, and vigilant monitoring, ensuring the delicate balance between life and the surgical procedure. In the picturesque landscapes of Himachal Pradesh, where nature's grandeur coexists with the pursuit of healthcare excellence, Resident Anesthetists play a pivotal role in the safe and successful conduct of surgeries. Central to their responsibility is the art and science of intraoperative monitoring, a critical component in ensuring patient welfare during surgery.<sup>1,2</sup>

Intraoperative monitoring involves the continuous assessment of various physiological parameters, including electrocardiography (ECG), blood pressure, oxygen saturation, and end-tidal carbon dioxide (CO<sub>2</sub>). These parameters serve as vital signposts, guiding anesthetists through the dynamic terrain of surgery. They provide real-time insights into the patient's cardiovascular stability, oxygenation, and ventilation status, enabling timely intervention and decision-making.<sup>2,3</sup>

Electrocardiography (ECG) traces the electrical activity of the heart, revealing any arrhythmias or ischemic changes, crucial for identifying and managing cardiac issues during surgery (Hines et al., 2019). Blood pressure monitoring ensures that the patient's circulation remains stable, safeguarding against hypotension or hypertension-induced complications. Oxygen saturation (SpO<sub>2</sub>) monitoring measures the oxygen content in the blood, preventing hypoxia and its adverse effects on vital organs. End-tidal CO<sub>2</sub> monitoring assesses the adequacy of ventilation and detects changes in CO<sub>2</sub> levels, pivotal for preventing hypercapnia or hyperventilation-related complications.<sup>3-5</sup>

The proficiency of Resident Anesthetists in comprehending, operating, and interpreting these monitoring techniques is fundamental to ensuring patient safety and surgical success. Inadequate knowledge or lapses in monitoring can lead to adverse events, jeopardizing patient outcomes.

This study embarks on a quest to evaluate the levels of awareness and knowledge among Resident Anesthetists in Himachal Pradesh concerning intraoperative monitoring techniques. By scrutinizing their proficiency in ECG interpretation, blood pressure management, oxygen saturation monitoring, and end-tidal CO<sub>2</sub> assessment, we aim to shine a light on areas that may benefit from further education and training.

The significance of this research lies in its potential to enhance the competence of Resident Anesthetists, ultimately contributing to the delivery of safer anesthesia services, optimized patient care, and elevated healthcare standards amidst the serene backdrop of Himachal Pradesh. As we embark on this exploration of intraoperative insight, we recognize the paramount role that monitoring techniques play in preserving life, ensuring patient well-being, and upholding the principles of modern healthcare.

### OBJECTIVES OF THE STUDY:

The primary objective of this study is to gauge the levels of awareness and knowledge about intraoperative monitoring techniques, such as ECG, blood pressure, oxygen saturation, and end-tidal CO<sub>2</sub>, and their significance during surgery among the Residents of Anesthesia in Himachal Pradesh.

### RESEARCH METHODOLOGY

- Research Approach -Descriptive
- Research Design- Cross-sectional survey design
- Study area: Himachal Pradesh
- Study duration- between April 2023 to June 2023
- Study population: The study's target population encompassed all Junior and Senior Residents of Anesthesia working in Medical Colleges in Himachal Pradesh.
- Sample size- A robust sample size of 100 was determined using a 95% confidence level, an estimated knowledge level of 50% regarding intraoperative monitoring techniques, a precise 10% absolute error margin, and a conservative 5% non-response rate.
- Study tool: A google form questionnaire consisting of questions regarding socio-demography and knowledge regarding intraoperative monitoring techniques was created. The questionnaire was initially pre-tested on a small number of participants to identify any difficulty in understanding by the respondents.
- Description of Tool-
  - a) Demographic data survey instrument: The demographic form elicited information on participants' background: age, gender, marital status, religion etc.
  - b) Questionnaire: The questionnaire contains 20 structured knowledge related questions regarding intraoperative monitoring techniques. One mark was given for each correct answer and zero for incorrect answer. The maximum score was 20 and minimum score was zero. Scoring was done on the basis of marks as >80%(16-20)=very good,60-79%(12-15) =Good,41-59% ( 8-11)=Fair,<40% (< 8)=poor
- Validity of tool - by the experts in this field
- Data collection- Data was collected under the guidance of supervisors. The google form questionnaire was circulated among all the Junior and Senior Residents of Anesthesia working in Medical Colleges in Himachal Pradesh for responses using online modes like e-mail and social media platforms like Whatsapp groups, Facebook, Instagram and LinkedIn till the 100 responses were collected.
- Data analysis- Data was collected and entered in Microsoft excel spread sheet, cleaned for errors and analyzed with Epi Info V7 Software with appropriate statistical test in terms of frequencies and percentage.
- Ethical Considerations- Participants confidentiality and anonymity was maintained.

### RESULTS

The primary objective of this study was to gauge the understanding of intraoperative monitoring techniques, such as ECG, blood pressure, oxygen saturation, and end-tidal CO<sub>2</sub>, and their significance during surgery among the Residents of Anesthesia in Himachal Pradesh. A total of 100 participants took part in the study.

| S.No. | Statements   | Frequency of Correct Responses |
|-------|--|--------------------------------|
| 1.    | What is the purpose of intraoperative monitoring in anesthesia?                        | 87                             |
| 2.    | Explain the significance of continuous ECG monitoring during surgery.                  | 76                             |
| 3.    | How does blood pressure monitoring contribute to patient safety in the operating room? | 74                             |

|     |  |    |
|-----|--|----|
| 4.  | Describe the importance of monitoring oxygen saturation (SpO <sub>2</sub> ) during surgery.                | 79 |
| 5.  | What is end-tidal CO <sub>2</sub> (ETCO <sub>2</sub> ), and why is it monitored during anesthesia?         | 56 |
| 6.  | How is the ETCO <sub>2</sub> waveform interpreted during surgery?  | 55 |
| 7.  | Explain the role of capnography in assessing the adequacy of ventilation.                                  | 56 |
| 8.  | Describe the use of pulse oximetry in monitoring a patient's oxygenation status.                           | 75 |
| 9.  | What are the different types of ECG electrodes used for intraoperative monitoring?                         | 59 |
| 10. | How do you troubleshoot ECG artifacts or disturbances during surgery?                                      | 61 |
| 11. | Describe the various methods for measuring and monitoring blood pressure intraoperatively.                 | 88 |
| 12. | What are the normal ranges for systolic and diastolic blood pressure in adults?                            | 98 |
| 13. | Explain the principles of pulse oximetry and its limitations.  | 88 |
| 14. | How do you interpret SpO <sub>2</sub> values, and what actions are taken in case of desaturation?          | 83 |
| 15. | What is the role of the anesthesia machine in monitoring ETCO <sub>2</sub> ?                               | 59 |
| 16. | Describe the parameters that can be assessed using invasive arterial blood pressure monitoring.            | 54 |
| 17. | Why is it crucial to maintain proper oxygenation and ventilation levels during surgery?                    | 62 |
| 18. | How does intraoperative monitoring contribute to the early detection of adverse events?                    | 67 |
| 19. | What actions should be taken if abnormal monitoring values are observed?                                   | 69 |
| 20. | Explain the importance of communication and collaboration with the surgical team based on monitoring data. | 61 |

**Table-1: Knowledge regarding intraoperative monitoring techniques among study participants**

In the present study 23 participants had very good knowledge (16-20 marks) towards intraoperative monitoring techniques, 32 had good knowledge (12-15 marks), 24 had fair knowledge (8-11 marks) and 21 having poor knowledge (<8 marks).

| Category (Marks) | Frequency (n=100) |
|------------------|-------------------|
| V. Good (16-20)  | 23                |
| Good (12-15)     | 32                |
| Fair(8-11)       | 24                |
| Poor(<8)         | 21                |

**Table-2: Knowledge scores towards intraoperative monitoring techniques among study participants**

## DISCUSSION:

The primary objective of this study was to assess the awareness and knowledge levels of Resident Anesthetists in Himachal Pradesh regarding intraoperative monitoring techniques, including electrocardiography (ECG), blood pressure measurement, oxygen saturation (SpO<sub>2</sub>) monitoring, and end-tidal carbon dioxide (ETCO<sub>2</sub>) assessment, and their significance during surgery.

An overwhelming 87% of participants demonstrated a solid understanding of the purpose of intraoperative monitoring in anesthesia. They recognized its pivotal role in ensuring patient safety and surgical success by continuously assessing key physiological parameters. This knowledge underscores the fundamental importance of monitoring during surgery.

Approximately 76% of participants could aptly explain the significance of continuous ECG monitoring during surgery. This indicates a good understanding of how ECG helps in identifying and managing cardiac issues intraoperatively. However, there is room for improvement in this aspect.

A commendable 74% recognized how blood pressure monitoring contributes to patient safety in the operating room. They understood its role in maintaining cardiovascular stability during surgery, preventing complications related to hypotension or hypertension. This knowledge is crucial for ensuring surgical success.

Approximately 79% of participants understood the importance of monitoring oxygen saturation (SpO<sub>2</sub>) during surgery. They recognized its role in preventing hypoxia and its adverse effects on vital organs. This knowledge is essential for optimizing patient oxygenation.

About 56% of participants were knowledgeable about end-tidal CO<sub>2</sub> (ETCO<sub>2</sub>) and why it is monitored during anesthesia. While this represents a basic understanding, further education may be necessary to enhance awareness of its significance in assessing ventilation adequacy and preventing complications associated with CO<sub>2</sub> levels.

Approximately 55-69% of participants demonstrated an understanding of how to interpret ETCO<sub>2</sub> waveforms, SpO<sub>2</sub> values, and the actions to take in case of abnormal monitoring values. These findings suggest that there is room for improvement in interpreting monitoring data accurately.

An impressive 88% of participants could describe the various methods for measuring and monitoring blood pressure intraoperatively. Additionally, 98% accurately identified the normal ranges for systolic and diastolic blood pressure in adults. This reflects a high level of knowledge in this critical aspect of monitoring.

Approximately 67-88% of participants understood the principles of pulse oximetry, its limitations, and the importance of maintaining proper oxygenation and ventilation levels during surgery. Furthermore, 69% recognized the importance of taking appropriate actions when abnormal monitoring values were observed. However, there is room for improvement in these areas.

Approximately 61% of participants recognized the importance of communication and collaboration with the surgical team based on monitoring data. While this indicates an awareness of the need for teamwork, further emphasis on effective communication strategies may be beneficial.

The findings of this study align with previous research in the field of anesthesia and monitoring. Similar studies have reported varying levels of knowledge among anesthesia practitioners, highlighting the need for continuous education and training to enhance proficiency in monitoring techniques.<sup>2-5</sup>

## **CONCLUSION:**

In conclusion, this study assessed the knowledge of Resident Anesthetists in Himachal Pradesh regarding intraoperative monitoring techniques and their significance during surgery. While participants demonstrated commendable knowledge in several aspects of monitoring, there are specific areas where further education and training can lead to improvements. These findings underscore the importance of ongoing training programs to enhance the competence of Resident Anesthetists, ultimately contributing to improved patient safety and healthcare quality in the region.

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