

ORIGINAL ARTICLE

Frequency of Hypoxia in patients handed over between operating room team and post anesthesia Care Unit team using PATH (Post-Anesthesia Team Handover) Checklist.

Zuhair Ali Rizvi¹, Muhammad Ashraf², Muhammad Hussan Farooq³, Maria Yaqub⁴, Zeeshan Asif Kayani⁵, Muhammad Nasir Ayub Khan⁶

ABSTRACT... Objective: To determine the frequency of hypoxia in patients handed over from Operating Room (OR) team to Post-Anaesthesia Care Unit (PACU) team using Post-Anesthesia Team Handover (PATH) checklist. **Study Design:** Observational Study. **Setting:** Department of Anaesthesiology & Pain Medicine, Shifa International Hospital. **Period:** 6 months from 25th March 2025 to 25th September 2025. **Methods:** A total of 2016 patients were included. Data was collected for Pre and Post Implementation phase when patients were handed over using institutional practices and PATH Checklist respectively. Frequency of hypoxia was noted as primary outcome. Data was entered and analyzed using SPSS v27.0. **Results:** Mean SpO₂ was 94.0±4.7% in Pre Implementation phase in contrast to 94.9±2.9% in Post Implementation phase. Frequency of Hypoxia was noted to be 11.2% during the whole study period. Before implementation of PATH Checklist, it was 16.2% while after implementation of PATH Checklist for handover in PACU, it was reduced to 6.9%. The decline in frequency of hypoxia was statistically significant. (p<0.001). **Conclusion:** Use of PATH checklist significantly reduces frequency of Hypoxia in PACU.

Key words: Handover, Hypoxia, PACU, PATH Checklist, Recovery.

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INTRODUCTION

Patient handovers between various departments in a hospital like Operation Room (OR), Intensive Care Unit (ICU) and Post Anesthesia Care Unit (PACU) is a routine matter.¹

Effective communication between healthcare professionals during handover and transfer of complete relevant information ensures patient safety.¹ The consequences of mid-surgery handovers from one anesthesiologist to other have been attributed to increased risk of perioperative complications, morbidity and even mortality.²

Therefore, different techniques and checklists for effective handover from anesthesiologist to anesthesiologist during surgery, OR Team to PACU Team and OR Team to ICU Team have been proposed.³ In fact, implementation of standard handovers improves caregiver involvement, reduce

omission of critical information without affecting time commitment.⁴

Various Handover patterns like SBAR (Situation-Background-Assessment-Recommendation)⁵, iSoBAR (Identify-Situation-Observations-Background-Agreed plan-Read back)⁶, COLD (Connect-Observe-Listen-Delegate).⁷ ABCDEFP (Airway-Breathing-Circulation-Disability-Exposure-Focus-Plan)⁷ and PATH checklist (Post-Anesthesia-Team-Handover) have been proposed.⁸ Standardization of handover like in PATH checklist, not only ensures effective communication but also improves nurse's satisfaction and patient outcomes like incidence of post-operative hypoxemic events. The frequency of hypoxia in PACU has been reported to be 4.1% in patients handed over with conventional techniques while 0.8% in patients handed over using PATH checklist.⁸

1. BSc, MBBS, Chief Resident Anaesthesiology, Shifa International Hospital, Islamabad.

2. MBBS, DA, FCPS, Associate Professor Anaesthesiology, Shifa Tameer e Millat University, Islamabad.

3. MBBS, FCPS, Assistant Professor Anaesthesiology, Shifa Tameer e Millat University, Islamabad.

4. BSN, Team Leader PACU, Shifa International Hospital, Islamabad.

5. MBBS, Resident Anaesthesiology, Shifa International Hospital, Islamabad.

6. MBBS, FCPS, PhD, Associate Professor Anaesthesiology, Shifa Tameer e Millat University, Islamabad.

Correspondence Address:

Dr. Zuhair Ali Rizvi
Department of Anaesthesiology, Shifa International Hospital, Islamabad.
dr.zarizvi@gmail.com

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While that study advocates effectiveness of PATH checklist in terms of hypoxia in PACU, yet it's the only study of its kind that has implemented the checklist in Pre and Post implementation study design.

Hence the role of PATH checklist in reduction of post-operative adverse events like hypoxemia is still understudied. Therefore, the objectives of this study were to determine the frequency of hypoxia in patients handed over from Operating Room (OR) team to Post Anaesthesia Care Unit (PACU) team using Post-Anaesthesia Team Handover (PATH) checklist at a tertiary care teaching hospital.

METHODS

This observational study was conducted in Department of Anesthesiology & Pain Medicine, Shifa International Hospital for a period of 6 months from 25th March 2025 to 25th September 2025 after ethical approval from Institutional Review Board of Shifa International Hospital (IRB# 494-24) and College of Physicians & Surgeons of Pakistan (CPSP/REU/ANS-2022-250-2861)

Frequency of hypoxia in patients handed over using PATH checklist has been reported to be 0.8%.⁸ WHO sampling size calculator was used to calculate sample size using population proportion of 0.008 with Confidence level set at 95% and Precision required to be 0.004%. The sample size was calculated to be 1906.

However a total of 2016 patients were included using Non-probability consecutive sampling technique during the pre and post implementation study period. Patients of age 18-70, American Society of Anesthesiology (ASA) Status 1-4 undergoing surgeries in General Anesthesia, Regional Anesthesia and Monitored Anesthesia Care were included. However, based on history, physical examination and medical records, patients preoperatively diagnosed as cases of acute or chronic respiratory disease, patients either preoperatively or post operatively on ventilator as they were directly shifted from OR to ICU and not stationed in PACU and patients with excessive shivering as shivering interferes with breathing pattern were excluded. Data was collected for Pre-Implementation phase

when patients were handed over using institutional practices. Hypoxia was noted as primary outcome. A series of educational sessions were conducted for attending anesthesiologists, operating room anesthesia practitioners, nursing team and PACU Team regarding implementation of PATH checklist. In post implementation phase, patients were handed over from Operating Room Team to PACU team using PATH⁸ checklist which includes completion of urgent tasks before verbal handoff, determination of readiness of in-charge of team, general condition, patient identity, known allergies, relevant history, type of surgery, anesthesia, ASA score, positioning, airway management, vascular access, fluid management, intraoperative events, medications for analgesia, anti-emesis, paralysis, important laboratory values along with post-operative concerns, do's and don'ts. The verbal handover ended with closure of loop of communication.

Oxygen Saturation (SpO₂) was measured using Pulse Oximeter placed on index finger of the arm other than the one with blood pressure monitoring cuff. It was ensured that the hand with pulse oximeter is under blanket with warmer on so as to minimize artifacts. Accurate finger plethysmograph was used to confirm correct placement and reliability of pulse oximeter. Incidence of Hypoxia i.e., SpO₂<90% for more than 30 seconds during post-operative period was considered the primary outcome of this study.

Patient ASA score, type of surgery, minimum SpO₂ recorded and Frequency of Hypoxia were noted. Independent observer monitored patient primary outcome i.e., hypoxia. The data was collected for post implementation phase as well.

When patients became hypoxemic, oxygen therapy was initiated along with optimization of patient position. Moreover, attending anesthesiologist assessed underlying cause of hypoxia and addressed accordingly.

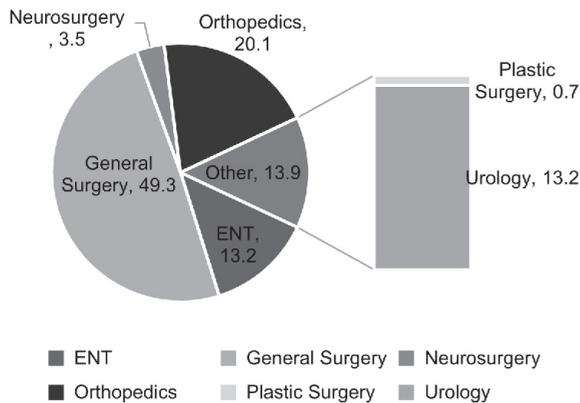
Data was entered and analyzed using SPSS v27.0. Frequencies and Percentages were calculated for qualitative variables like ASA score, type of surgery and frequency of hypoxia. Mean and Standard Deviation was calculated for quantitative variables like minimum SpO₂. Frequency of hypoxia was

stratified for pre and post implementation phase and ASA Status. Post stratification chi-square test was applied, p-value ≤0.05 was considered statistically significant.

RESULTS

A total of 2016 patients were included in the study. 770 (38.2%) patients were ASA I, followed by 686 (34.0%) patients with ASA II and 560 (27.8%) patients with ASA III status. Majority of patients underwent General Surgical procedures followed by Orthopedics, Urology, ENT, Neurosurgery and Plastic Surgery. The distribution of patients as per surgical procedures performed is shown in Figure-1.

FIGURE-1
Percentage distribution of various procedures performed



Mean SpO₂ was 94.0±4.7% in Pre Implementation phase in contrast to 94.9±2.9% in Post Implementation phase. Frequency of Hypoxia was noted to be 11.2% during the whole study period. Before implementation of PATH Checklist, it was 16.2% while after implementation of PATH Checklist for handover in PACU, it was reduced to 6.9%. The decline in frequency of hypoxia was statistically significant. (p<0.001)

Further stratification for ASA Status of was

performed. Hypoxia was more commonly reported in patients with ASA III status as compared to ASA I and ASA II patients in pre-implementation phase. However, ASA Status was not associated with frequency of hypoxia in post-implementation phase. (P=0.012, p=0.905 respectively). Table-I

DISCUSSION

The role of a standardized checklist and handover tool in terms of improvements in patient outcomes, minimized information loss, reduction in morbidity and mortality has been well established with the global acceptance of WHO Safe Surgical Checklist that efficiently covers perioperative care.⁹⁻¹¹ Yet, the process of handover from operating room team to PACU team is overlooked by many esteemed patient safety and quality measures.

It's quite evident that there is a significant reduction in frequency of hypoxia noted in Post Anaesthesia Care Unit after implementation of PATH checklist for handover. The results of present study suggest that with PATH checklist hypoxia was noted in 6.9% of patients in comparison to 16.2% prior to its application. These results are in coherence with Jaulin et al who reported a decline from 4.1% to 0.8% with use of PATH checklist. The improvement in patient outcomes is prominent in both studies. However, the difference in pre and post implementation incidence of 16.2% and 6.9% in comparison to 4.1% and 0.8% (Jaulin et al.) could be attributed to differences in setting and types of surgical procedures performed.⁸ The present study has highlighted various surgical interventions performed as well.

The role of PATH checklist in terms of hypoxia has also been investigated by Astilia et.al., A Quasi experimental study was conducted comparing PATH checklist with SBAR technique.

TABLE-I
Stratification of incidence of hypoxia in both phases in terms of ASA Status of patients

		Pre-Implementation			Post Implementation		
		ASA I	ASA II	ASA III	ASA I	ASA II	ASA III
Hypoxia	Absent	88.0%	81.8%	80.0%	93.3%	92.6%	93.3%
	Present	12.0%	18.2%	20.0%	6.7%	7.4%	6.7%

It's been reported that hypoxia was noted in 41.2% patients in intervention group (PATH) compared to 73.5% in control group. These outcomes are significantly higher than present study. However the significant improvement with utilization of PATH checklist is comparable. Moreover, we chose to conduct Pre and Post implementation study compared to experimental research on purpose as authors believed that it's practically not possible to segregate study groups as same staff and team members are working over the course of study duration. If parallel groups are carried out in same frame of time, the overlap of components of both tools was rendered unavoidable.¹²

The higher frequency of hypoxia in ASA III patients in pre implementation phase is consistent with findings of Tang et.al., who identified higher ASA status as a risk factor of hypoxia in PACU. With implementation of PATH checklist, it was noted in present study that patient's ASA status was not found to be associated with frequency of hypoxia which can be explained by the enhanced confidence and approach of attending nurse in PACU in terms of patient management owing to better transfer of information.¹³

Bang et.al., reports post-operative hypothermia and major abdominal surgeries as significant risk factors for hypoxia and failed weaning off oxygen in PACU. It should be highlighted that present study excluded patients with post-operative shivering but patients with all kinds of surgeries were included.¹⁴

Up to 14% of PACU related events have been attributed to communication errors.¹⁵ Anesthesia Patient Safety Foundation (APSF) recommends standardized handovers during perioperative period.¹⁶ With conventional handover techniques, loss of information regarding vital factors is well documented.¹⁷ In fact, standardized handovers in pediatric population has been shown to effectively reduce communication errors in PACU.¹⁸ Moreover, a standardized tool adds on to staff satisfaction as well.¹⁹

Authors believe that this study lacks details pertaining to nurse's satisfaction, quality of handover, improvement in loss of information and other patient

related outcomes in PACU. Although it's a larger scale study in comparison to studies done before, yet, multi-centered studies need to be conducted to validate utilization of PATH checklist.

CONCLUSION

Utilization of PATH checklist for handover from Operating Room to PACU significantly reduces the frequency of hypoxia.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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AUTHORSHIP AND CONTRIBUTION DECLARATION

1	Zuhair Ali Rizvi: Methodology, manuscript writing.
2	Muhammad Ashraf: Clinical supervision.
3	Muhammad Hussan Farooq: Research methodology.
4	Maria Yaqub: Data collection.
5	Zeeshan Asif Kayani: Data analysis.
6	Muhammad Nasir Ayub Khan: Data interpretation.