

Short Communication

Assessment of injection safety practices among anesthesiologists in tertiary care hospitals in Karachi

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Abstract

Background: Injections play a critical role in the medical management of patients, particularly those with severe health conditions, across hospitals and healthcare institutions. However, ensuring adherence to proper injection safety protocols is essential to prevent avoidable medical errors and infections. The objective of this study was to evaluate the compliance with injection safety protocols among anesthesiologists working in tertiary care institutions in Karachi.

Methodology: A cross-sectional study was conducted in tertiary care hospitals in Karachi between November 2021 and April 2022, with a study duration of six months. A total of 200 anesthesiologists participated in the study. Data were collected through a pre-designed questionnaire, which was completed by the participants. All responses were kept confidential to ensure anonymity. The study aimed to assess adherence to injection safety protocols among anesthesiologists working in these institutions.

Results: Among the 200 anesthesiologists surveyed, 18.5% were found to engage in malpractice regarding injection safety practices, while the remaining 81.5% adhered to acceptable injection safety protocols. Statistical analyses were performed to explore the relationship between age, years of experience, and other demographic factors, revealing no significant differences between those following acceptable practices and those engaging in malpractice.

Conclusion: The study concludes that enhancing awareness and providing training on injection safety for healthcare professionals can significantly improve compliance and reduce the incidence of needle-stick injuries. It is recommended that regular training sessions and updated safety protocols be implemented in all healthcare facilities to further minimize the risks associated with unsafe injection practices.

Keywords

Anesthesiologists, Injection Safety, Needlestick Injuries, Healthcare Workers' Safety, Patient Safety



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Introduction

Injections are integral to the medical management of patients, particularly in hospitals and healthcare institutions where a large volume of patients with complex health conditions are treated¹. These practices, while vital, carry inherent risks that require careful handling to ensure patient safety. The growing emphasis on patient safety and the systematic implementation of safe medical practices highlights the need for proper training and adherence to established guidelines across healthcare settings^{2,3}.

In this context, the safe management of pharmaceuticals, especially in high-stakes environments like anesthesiology, is critical. The term 'drug' in safety literature is often used interchangeably with 'medication,' and the proper handling of both is central to minimizing errors^{4,5}.

Unlike other healthcare professionals who often work within systems involving double-checks, anesthesiologists typically perform drug preparation alone⁶. This includes transferring medications from labeled ampoules into unlabeled syringes, a practice that introduces a significant risk of error. The General Medical Council (GMC) provides overarching guidelines for medical practice, emphasizing professional conduct in clinical settings. However, unsafe practices, such as the use of unsterile needles and syringes, continue to pose a significant threat to patient health, contributing to the spread of infectious diseases like hepatitis B, hepatitis C, and HIV, which are transmitted through improper injection methods⁷.

In fact, improper injection practices remain a major concern, particularly in relation to the transmission of bloodborne viruses and other complications such as epidural abscesses^{8,9}. Research in developing countries indicates that healthcare workers often have insufficient knowledge of hepatitis B virus transmission and lack adherence to preventive measures^{10,11}. Furthermore, anesthesiologists in such settings may unknowingly engage in high-risk practices, such as the reuse of single-dose vials, infusion sets, syringes, and

needles¹², thereby exacerbating the risk of infection.

Given the critical nature of injection safety, it is essential to understand how frequently anesthesiologists adhere to safety protocols when administering injections^{13,14}. In Pakistan, there is limited data on the adherence rates of anesthesiologists to these safety protocols. As such, assessing the awareness and compliance of anesthesiologists with injection safety guidelines is key to identifying gaps in knowledge and shaping effective educational interventions^{15,16}. This study seeks to evaluate the level of adherence to injection safety practices among anesthesiologists, thereby informing strategies to enhance training and prevent adverse outcomes in clinical settings.

Methodology

Study Design

This was a cross-sectional study aimed at investigating the adherence to injection safety precautions among anesthesiologists working in tertiary care hospitals in Karachi. The study was designed to evaluate the knowledge, attitudes, and practices regarding injectable safety among anesthesiologists, with a focus on identifying factors that influence compliance. Data collection occurred over a period of 6 months, from November 2021 to April 2022.

Ethics

The study was conducted in accordance with ethical guidelines and received approval from the Institutional Review Board (IRB) of The Indus Hospital Karachi. The ethical principles of respect for persons, beneficence, and justice were upheld throughout the study. Informed consent was obtained from all participants before data collection, ensuring that participation was voluntary and anonymous. Confidentiality of all personal and professional information was maintained.

Setting

The study was conducted in multiple tertiary care hospitals in Karachi, including The Indus Hospital Karachi (TIH), Jinnah Postgraduate Medical Center

Karachi (JPMC), Dr. Ruth Pfau Civil Hospital Karachi, Liaquat National Hospital Karachi (LNH), Sindh Institute of Urology and Transplantation, and Abbasi Shaheed Hospital. These hospitals were selected due to their prominence and capacity to provide a diverse sample of anesthesiologists practicing in the city. The setting provided a representative snapshot of anesthesiology practice across a range of institutions.

Participants

The study included anesthesiologists working at the aforementioned hospitals, who met the inclusion criteria. The inclusion criteria were: (1) anesthesiologists with postgraduate degrees such as FRCA, FCPS, MCPS, or DA; (2) a minimum of two years of experience after obtaining their qualifications; (3) residents in their fourth year of training in the field of anesthesia; and (4) currently employed at a tertiary care hospital. Exclusion criteria were individuals who did not provide consent to participate and those who had not been actively practicing anesthesia for the previous year.

The sampling method used was non-probability consecutive sampling. This approach allowed the study to capture a wide range of anesthesiologists who met the eligibility criteria, without the need for random selection. The final sample size was calculated to be 191 anesthesiologists based on assumptions of a 95% confidence interval, a desired precision of 7%, and an estimated proportion of anesthesiologists practicing injection safety precautions at 58.5%.

Variables

The primary outcome variable of the study was the injection safety score, which was based on the responses to a 16-item self-designed questionnaire. The scores ranged from 0 to 16, with a score below the median of 8 indicating poor adherence to injection safety precautions, and a score of 8 or higher indicating satisfactory adherence.

Other variables of interest included:

- **Demographic variables:** Age, gender, years of experience, qualification, position in the institution.
- **Institutional variables:** Type of institution (public or private), availability of Post Anesthesia Care Units (PACU).
- **Operational variables:** Number of operating rooms, current position (resident, consultant).

Data Sources/Measurement

Data was collected using a self-administered questionnaire designed specifically for this study. The questionnaire consisted of 16 binary questions about injectable safety practices. For each question, participants selected "yes" or "no", with a "yes" response scoring 1 point and a "no" response scoring 0 points. The data collected from the questionnaires were input into SPSS version 26.0 for analysis.

Bias

Efforts were made to minimize bias during data collection and analysis. Selection bias was reduced by ensuring that the study included anesthesiologists from diverse hospitals across Karachi. Information bias was minimized by ensuring that the questionnaire was clearly explained to participants before they filled it out. To control for response bias, the survey was anonymous, and participants were assured that their responses would not affect their professional standing. Additionally, the self-reported nature of the data was acknowledged, and analysis was conducted with this in mind.

Study Size

The study's sample size was calculated using the Open Epi software based on the estimated proportion of anesthesiologists practicing injection safety precautions (58.5%)¹⁶, with a confidence level of 95% and a desired precision of 7%. The calculated sample size was 191, and this number was deemed sufficient to achieve statistically significant results. Given that there were approximately 200 anesthesiologists practicing in the Karachi area, the study sample was considered representative of the target population.

Statistical Methods

Descriptive statistics, including the mean, standard deviation (SD), and frequency distributions, were calculated for demographic and operational variables. The injection safety score was analyzed using measures of central tendency (mean, median) and variability (standard deviation). To assess differences between groups based on adherence to injection safety practices, an independent samples t-test or the Mann-Whitney U test was used as appropriate, depending on the distribution of the data. Categorical variables (e.g., gender, qualification, type of institution) were analyzed using chi-square tests or Fisher's exact test. Stratification was performed based on key demographic variables such as age group, gender, qualification, years of experience, and position, to account for potential effect modification. The stratified analyses were followed by chi-square tests for associations between these variables and injection safety practices. A p-value of less than 0.05 was considered statistically significant. All statistical analyses were performed using SPSS version 26.0.

Results

Participants

The study enrolled 200 anesthesiologists from various tertiary care hospitals in Karachi. The participants' mean age was 32.81 ± 5.68 years, with ages ranging from 24 to 47 years. A majority of the participants were female (55.5%, $n=111$), while males constituted 44.5% ($n=89$). In terms of professional qualifications, 60% of the participants had successfully completed the FCPS examination. The sample also included individuals with other qualifications, such as MCPS, FRCS, and diplomas in anesthesia. Of the 200 participants, 135 (67.5%) were employed in public hospitals, and 65 (32.5%) worked in private hospitals.

Descriptive Data

The distribution of participants across various demographic categories is summarized as follows:

- **Age Group Distribution:** 82 participants were aged ≤ 30 years (41%), 99 participants

were aged between 31-40 years (49.5%), and 19 participants were aged >40 years (9.5%).

- **Gender:** 111 participants (55.5%) were female, and 89 participants (44.5%) were male.
- **Professional Qualifications:** 119 participants (59.5%) held an FCPS qualification, 37 (18.5%) had an MCPS, 5 (2.5%) held an FRCS, and 39 (19.5%) had other qualifications, including diplomas.
- **Institute Type:** 135 participants (67.5%) were employed in government hospitals, while 65 (32.5%) were employed in private hospitals.
- **Position:** 27 participants (13.5%) held consultant positions, 86 (43%) were specialists, and 87 (43.5%) were fourth-year residents.

Outcome Data

The study assessed adherence to injection safety protocols. Overall, 18.5% ($n=37$) of the participants were found to have engaged in malpractice with regard to injectable safety precautions, while 81.5% ($n=163$) adhered to acceptable practices.

The analysis revealed no significant differences in adherence to injection safety precautions based on various demographic and professional characteristics:

- **Age:** The rate of malpractice was 17.1% among those ≤ 30 years, 21.2% among those aged 31-40 years, and 10.5% among those >40 years, with no statistically significant differences ($p=0.498$).
- **Gender:** Males had a malpractice rate of 15.7%, while females had a rate of 20.7%, with no significant difference between the two groups ($p=0.366$).
- **Qualification:** The malpractice rates across different qualifications were as follows: FCPS 20.2%, MCPS 16.2%, FRCS 20%, and diploma holders 15.4%. There were no significant differences in adherence based on qualification ($p=0.895$).
- **Position:** Among consultants, 14.8% engaged in malpractice, compared to 16.3% of specialists and 21.8% of fourth-year residents,

but this difference was not statistically significant ($p=0.558$).

- **Experience:** Participants with less than 5 years of experience had a malpractice rate of 22.6%, those with 5-10 years of experience had 12.2%, and those with over 10 years had 15.6%. No significant difference was found ($p=0.255$).
- **Institute Type:** The malpractice rate in private hospitals was 12.3%, while in government hospitals, it was 21.5%, but this difference was not statistically significant ($p=0.126$).

Main Results

The findings revealed that most anesthesiologists (81.5%) followed appropriate injection safety precautions, but a significant portion (18.5%) still engaged in malpractice. The study found no significant associations between adherence to injection safety practices and factors such as age, gender, qualification, position, experience, or type of institution. These results highlight areas where interventions might be needed to improve adherence to safety protocols, particularly in government hospitals and among residents with less experience.

Table 1: Distribution of injection safety practices among anesthesiologists by demographic and professional characteristics.

Variables		Malpractice (n=43)	Acceptable (n=157)	P-value
Age Groups (Years)	≤30	14 (17.1)	68 (82.9)	0.498
	31-40	21 (21.2)	78 (78.8)	
	>40	2 (10.5)	17 (89.5)	
Gender	Male	14 (15.7)	75 (84.3)	0.366
	Female	23 (20.7)	88 (79.3)	
Qualification	FCPS	24 (20.2)	95 (79.8)	0.895
	MCPS	6 (16.2)	31 (83.8)	
	FRCS	1 (20)	4 (80)	
	Diploma	6 (15.4)	33 (84.6)	
Current Position	Consultant	4 (14.8)	23 (85.2)	0.558
	Specialist	14 (16.3)	72 (83.7)	
	4th-year Resident	19 (21.8)	68 (78.2)	
Experience	<5 Years	24 (22.6)	82 (77.4)	0.255
	5-10 Years	6 (12.2)	43 (87.8)	
	>10 Years	7 (15.6)	38 (84.4)	
Institute	Private	8 (12.3)	57 (87.7)	0.126
	Government	29 (21.5)	106 (78.5)	

Values are presented as n(%).

Discussion

Anesthesia practitioners play a critical role in ensuring patient safety during the administration of medications. However, research has shown that many practitioners continue to perform key procedures such as prescribing, mixing, relabeling, and administering medications without fully adhering to established safety protocols. These

practices, particularly in a high-pressure operating room setting, can increase the risk of errors and adverse outcomes. Despite ongoing educational initiatives, the incidence of unsafe injection practices remains a pressing concern, with recent surveys highlighting an unacceptably high prevalence of dangerous injection methods among healthcare providers.

A study conducted in Iran found that 58.5% of anesthetists adhered to injection safety guidelines, with 55% of participants acknowledging the bloodborne transmission risks of hepatitis B, C, and HIV¹⁶. Notably, the research revealed a statistically significant correlation between age, work experience, and adherence to safety practices ($P = 0.00$). In contrast, our study of 200 anesthesiologists in Pakistan found that 18.5% of participants engaged in injection safety malpractice, while 81.5% followed proper protocols. The incidence of malpractice was consistent across all age groups ($P = 0.498$), and gender did not appear to have a statistically significant impact ($P = 0.366$). Additionally, factors such as qualifications, current position, experience, and workplace setting did not influence the likelihood of injection safety violations.

A key concern highlighted in our study is the prevalence of needle-stick injuries (NSIs), which pose a significant risk of transmission of bloodborne infections in medical settings. Preventing NSIs is a priority across healthcare environments, including surgical and anesthesia teams. To reduce the occurrence of NSIs, it is vital for all healthcare personnel, including consultants and surgical assistants, to adhere strictly to universal precautions. Establishing an infection control committee in every hospital is essential for creating effective infection control programs and guiding professionals on post-exposure prophylaxis. This committee should be an integral part of hospital operations to address the risks posed by needle-stick injuries and bloodborne pathogens¹⁷.

Moreover, healthcare workers who are exposed to bloodborne pathogens must undergo immediate evaluation and appropriate interventions to prevent the spread of infections like Hepatitis C (HCV)¹⁸⁻²¹. This underscores the need for a robust understanding of universal precautions and safety measures, as well as the regular updating and enforcement of infection control protocols. Studies from countries like India have shown that a significant number of healthcare workers are aware of the risks associated with needle-stick injuries and

the transmission of infectious diseases such as hepatitis B, C, and HIV^{17,18}.

While our study provides valuable insights into adherence to injection safety protocols, several limitations should be considered. The relatively small sample size may limit the generalizability of the findings. Additionally, biases may arise from suggestive survey questions and the absence of anonymity in the study design, which could affect participants' willingness to report unsafe practices. Self-reporting, while a common method of data collection, may also be subject to social desirability bias, potentially skewing the accuracy of responses. Furthermore, the lack of comprehensive long-term data and institutional oversight on the implementation of safety measures makes it difficult to evaluate the effectiveness of current interventions fully.

Conclusion

Our study revealed that 81.5% of anesthesiologists adhered to established injection safety procedures. However, there remains a significant opportunity to improve practices across the healthcare workforce. To enhance knowledge and reduce the incidence of needle-stick injuries, it is essential to implement a comprehensive training and awareness campaign targeting all healthcare professionals. This initiative should emphasize the importance of avoiding high-risk behaviors, such as reusing, recapping, bending, and improper handling and disposal of syringes and needles. Additionally, it will promote better understanding of the critical role of hand hygiene and the proper use of gloves in maintaining injection safety. Hospitals should also ensure mandatory hepatitis B vaccination for all personnel to protect both staff and patients. To further enhance safety, timely reporting of needle-stick injuries to hospital management should be prioritized, and preventive measures should be swiftly implemented. These strategies are essential steps toward improving patient and healthcare worker safety and minimizing the risks associated with injection practices.

Conflicts of Interest

The author(s) have no conflicts of interest.

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