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Expert Opinion Article

Awareness and Practice of Ultrasound-Guided Procedures among Junior Doctors: A Cross-Sectional Study

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Abstract

Background: Ultrasound-guided (USG) procedures have revolutionized clinical practice by enhancing accuracy, improving patient safety, and reducing complication rates. Despite growing evidence supporting its utility, the extent of awareness and practice among junior doctors remains unclear in many healthcare settings.

Objective: To assess the level of awareness and practice of ultrasound-guided procedures among junior doctors in a tertiary care teaching hospital and to identify perceived barriers to their utilization.

Methods: A cross-sectional questionnaire-based survey was conducted among 150 junior doctors (interns and residents). The tool assessed demographics, awareness, practice, and barriers to ultrasound use. Data were analyzed using descriptive statistics and chi-square tests (SPSS v25).

Results: Most participants (94%) had heard of ultrasound-guided procedures, and 78% recognized its role in improving safety. However, only 32% had received formal training, and just 25% reported independently performing central venous cannulation under ultrasound guidance. Familiarity with international guidelines was low (24%). Lack of training (54%), limited machine availability (38%), and inadequate supervision (28%) emerged as major barriers.

Conclusion: Junior doctors demonstrated high theoretical awareness but limited practical exposure to USG procedures. Expanding structured training, ensuring machine availability, and fostering mentorship are essential to bridge this knowledge–practice gap and enhance patient outcomes.

Keywords: ultrasound-guided procedures, junior doctors, awareness, training, barriers, cross-sectional study

Introduction

Ultrasound (US) guidance has become a cornerstone of modern clinical practice, especially for invasive bedside procedures such as central venous catheterization, pleural aspiration, peripheral nerve blocks, and lumbar puncture. Its use has been shown to enhance procedural safety and accuracy while significantly reducing complication rates compared to landmark-based techniques (1,2). In particular, US-guided central venous catheterization has been associated with up to an 86% reduction in mechanical complications, reaffirming its importance in improving patient outcomes (2). Meta-analytic evidence further supports that ultrasonic locating devices substantially decrease risks associated with vascular access (1).

Despite strong clinical evidence and endorsement by international guidelines, the integration of ultrasound into routine practice remains inconsistent (3). Although its use is strongly recommended for vascular access and other bedside procedures, multiple barriers such as inadequate training, lack of mentorship, limited machine availability, and time constraints continue to impede its universal adoption in clinical environments (3–5).

Traditional training methods have also contributed to the gap between awareness and competence. The conventional "see one, do one, teach one" model is increasingly recognized as inadequate for building procedural expertise (4). In contrast, recent educational innovations such as structured simulation, cadaveric workshops, and tele-education have demonstrated superior outcomes in developing procedural proficiency. For example, cadaver simulation-based learning and remote tele-mentoring have both shown to enhance trainee confidence and skill acquisition in ultrasound-guided interventions (6,7).

Furthermore, the barriers to ultrasound adoption are not limited to specific regions or specialties. National and international surveys have consistently

reported discordance between trainee preparedness and program expectations in fields such as anesthesiology and critical care (8). Even in well-resourced healthcare systems, training gaps, cost-related limitations, and insufficient access to ultrasound machines persist as significant obstacles (5,9).

Given the essential role of junior doctors as frontline healthcare providers, inadequate ultrasound training can directly impact patient safety and procedural efficiency. Therefore, the present study aimed to assess the awareness, practice, and perceived barriers regarding ultrasound-guided procedures among junior doctors in a tertiary care setting, with the objective of identifying gaps and proposing strategies to strengthen ultrasound-based training programs (10).

Materials and Methods

This was a cross-sectional, questionnaire-based study conducted between August 2024 and January 2025 at a tertiary care teaching hospital in India. The study population consisted of 150 junior doctors, including interns and postgraduate residents from clinical departments such as medicine, surgery, anesthesia, and emergency medicine. Doctors with more than three years of postgraduate experience or those unwilling to participate were excluded. Participants were recruited using purposive sampling until the desired sample size was reached.

The sample size was calculated assuming a 50% awareness rate of ultrasound-guided procedures, with a 95% confidence interval and 8% allowable error, yielding a minimum requirement of 138, which was rounded to 150 to account for non-response.

Data were collected using a structured, pre-tested questionnaire that was developed after reviewing published literature on ultrasound-guided procedures (Hind et al., 2003 [1]; Troianos et al., 2012 [2]; Saugel et al., 2017 [3]; Ginsburg et al., 2023 [5]; Arnold et al., 2023 [9]; Theophanous et al., 2024 [10]). The tool comprised four sections: demographic data, awareness of ultrasound-guided procedures, practice patterns, and perceived barriers to utilization.

The questionnaire was self-administered in both print and digital formats. Participants were approached during their routine clinical postings and departmental sessions, and responses were collected anonymously after obtaining written informed consent. The average time for completing the questionnaire was approximately 15 minutes.

All data were compiled and entered into Microsoft Excel and subsequently analyzed using SPSS version 25.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics were used to summarize demographic characteristics, awareness levels, and practice frequencies, while associations between awareness, practice, and demographic variables were assessed using the chi-square test. A p-value < 0.05 was considered statistically significant.

Results

A total of 150 junior doctors participated in the study, with a mean age of 25.6 ± 2.1 years. The gender distribution included 82 males (54.7%) and 68 females (45.3%). Among the participants, 70 (46.7%) were interns and 80 (53.3%) were residents (**Table 1**).

The majority of respondents (94%) had heard of ultrasound-guided procedures, and 78% believed that ultrasound improves procedural safety. However, only 32% had received formal training, and just 24% were familiar with international guidelines such as NICE or ASA recommendations (**Table 2**, **Figure 1**).

With respect to practice, only 25% of participants reported independently performing central venous cannulation under ultrasound guidance, while 41% had assisted in the procedure and 34% had never performed it. Pleural aspiration (12% independent), nerve blocks (7%), and lumbar puncture (4%) were even less frequently performed. A large proportion of doctors reported having never performed these procedures (**Table 3**, **Figure 2**).

The most frequently cited barrier was lack of training (54%), followed by limited access to ultrasound machines (38%), lack of supervision or mentorship (28%), and time constraints in emergency settings (23%) (**Table 4**, **Figure 3**).

Table 1:

Characteristic	Frequency (%)
Male	82 (54.7)
Female	68 (45.3)
Mean Age (years)	25.6 ± 2.1
Interns	70 (46.7)
Residents	80 (53.3)

Table 2:

Awareness Parameter	Yes (%)	No (%)
Heard of ultrasound-guided procedures	141	9
Believe ultrasound improves safety	117	33
Received formal training	48	102
Familiar with guidelines (NICE/ASA)	36	114

Figure1:

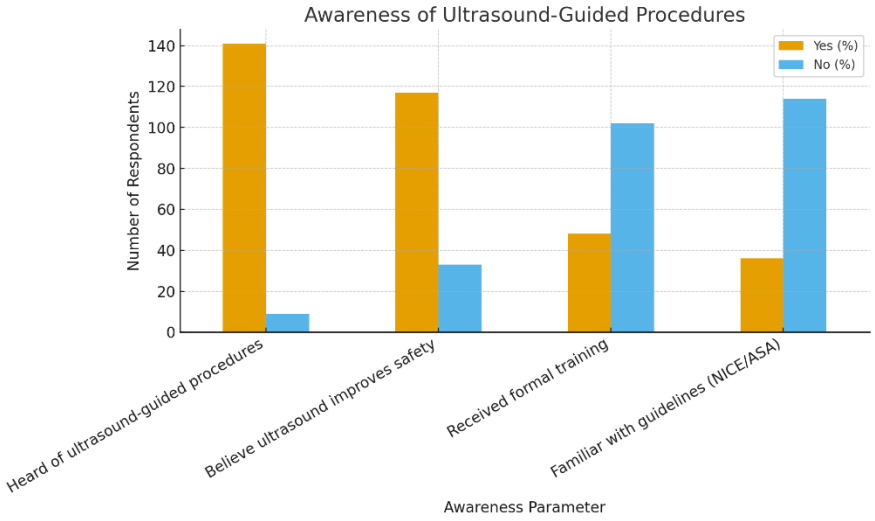


Table 3:

Procedure	Performed Independently (%)	Assisted (%)	Never Performed (%)
Central venous cannulation	37	61	52
Pleural aspiration	18	46	86
Nerve blocks	11	21	118
Lumbar puncture	6	29	115

Figure 2:

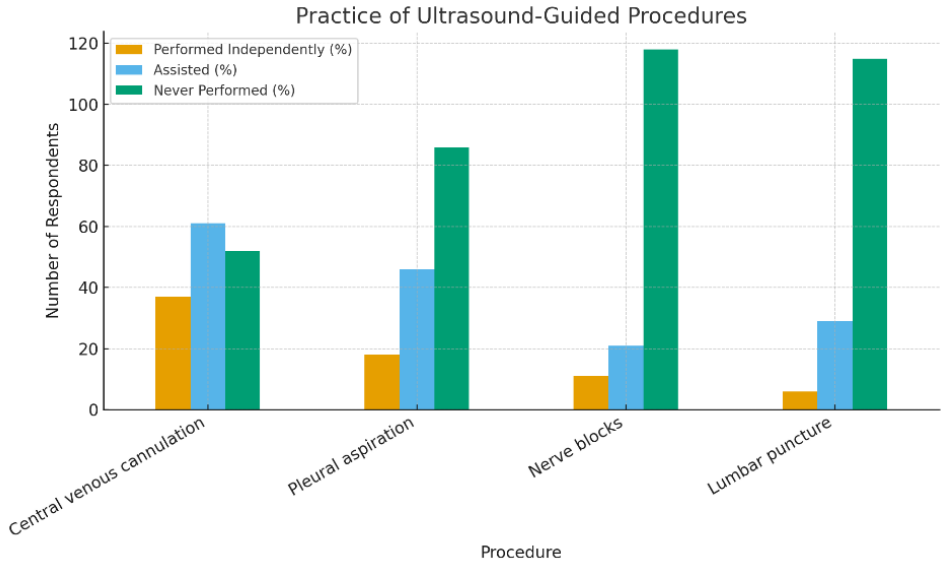
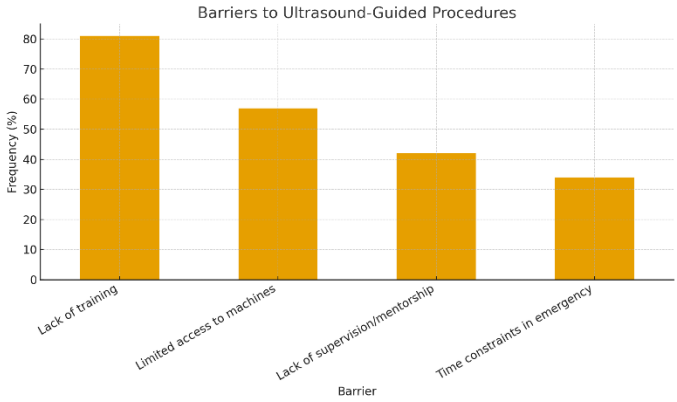


Table 4:

Barrier	Frequency (%)
Lack of training	81
Limited access to machines	57
Lack of supervision/mentorship	42
Time constraints in emergency	34

Figure 3:



Discussion

The present study assessed the awareness and practice of ultrasound-guided procedures among junior doctors in a tertiary care setting between August 2024 and January 2025. Our findings indicate that while awareness was relatively high (94%), hands-on experience and independent performance of ultrasound-guided procedures remained limited, with only 25% of participants having independently performed central venous cannulation. This discrepancy between theoretical understanding and practical skill underscores a persistent gap in medical training.

Similar findings have been reported previously. Hind et al. (2003) [1] demonstrated that ultrasound guidance significantly reduces complications during central venous catheterization compared with the traditional landmark method. Nevertheless, limited adoption persists due to a lack of structured training. In our study, only 32% of junior doctors had formal training, consistent with earlier evidence from Thomas (1994) [4], who emphasized that procedural education remains insufficiently emphasized in many training programs.

Our findings are further supported by Troianos et al. (2012) [2] and Saugel et al. (2017) [3], who both highlighted that despite strong guideline recommendations and proven efficacy, ultrasound use in clinical practice remains inconsistent due to limited access, inadequate training, and poor integration into curricula. These barriers were reflected in our study, where participants cited lack of formal training (54%), restricted access to machines (38%), and insufficient mentorship (28%) as primary obstacles.

Globally, similar trends have been observed in recent years. Ginsburg et al. (2023) [5] reported that clinicians in low- and middle-income countries face considerable equipment shortages and training constraints, which limit ultrasound adoption. Arnold et al. (2023) [9] noted comparable challenges in rural Australia, where limited mentorship and institutional support were identified as major barriers to point-of-care ultrasound (POCUS) utilization. Likewise, Theophanous et al. (2024) [10] found that even experienced emergency physicians within the U.S. Veterans Affairs system reported systemic and cultural barriers affecting ultrasound implementation.

The need for structured educational interventions is well supported by recent evidence. Reusz et al. (2020) [6] demonstrated that supervised ultrasound training programs significantly improve skill retention and procedural confidence among junior physicians. Similarly, Ailon et al. (2021) [7] showed that simulation-based mastery learning enhances competence in ultrasound-guided procedures, underscoring the importance of hands-on, mentored training. Furthermore, Sørensen et al. (2022) [8] emphasized that introducing POCUS training at the undergraduate level improves both clinical decision-making and skill transfer to postgraduate practice.

Taken together, our results reinforce that while awareness of ultrasound-guided procedures among junior doctors is encouraging, practical competency remains limited. A multifaceted approach integrating structured training, simulation, and

continuous mentorship is essential. By embedding ultrasound education across undergraduate and postgraduate curricula, medical institutions can bridge the awareness–practice gap and ultimately enhance procedural safety and patient outcomes.

Conclusion

Our study demonstrated that while junior doctors have a high level of theoretical awareness of ultrasound-guided procedures, hands-on experience and independent practice remain limited. The main barriers identified were lack of structured training, limited access to ultrasound machines, and inadequate mentorship. These findings highlight the urgent need for integrating structured ultrasound training programs, simulation workshops, and supervised clinical exposure into medical curricula. Strengthening training and accessibility will bridge the awareness–practice gap and enhance patient safety in clinical practice.

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