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Original Research Article

Evaluation of Pocket Ultrasonography in Anesthesia Practice in the Operating Room: A Prospective Observational Study

Md Afzal Hossain Khan[a]*, Rajib Dhali[b], Mahedi Hasan[b], Dilip Golder[b]

[a] Associate Professor and Head, Department of Anesthesia & Pan Medicine at Ad-din Sakina Medical College Hospital (ASMCH), Pulerhat, Jashore
[b] Assistant Professor, Department of Anesthesia at Ad-din Sakina Medical College Hospital (ASMCH), Pulerhat, Jashore

***Correspondence to:**
Md Afzal Hossain Khan
Email: afzalkhan10930@gmail.com

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Abstract: ***Background:*** POCUS by Pocket ultrasonography is transforming anesthesia practice by enhancing procedural precision in vascular access, nerve blocks, and hemodynamic monitoring. While traditional ultrasound systems are bulky pocket ultrasono machines offer portability and cost-efficiency. This study evaluates POCUS effectiveness in the operating room, focusing on accuracy, efficiency, and clinical outcomes. Despite its advantages, challenges like image resolution and learning curves persist. ***Objectives:*** Promote POCUS use in anesthesia; enhance accuracy, safety, and awareness; establish POCUS as the "second stethoscope"; minimize errors; improve cardiac assessments. ***Methods and Materials:*** This prospective observational study conducted at Department of Anesthesiology, Ad-din Sakina Medical College Hospital (ASMCH), Pulerhat, Jashore, from June 2023 to May 2024 included 68 surgical patients. POCUS was used for vascular access, nerve blocks, and airway assessments. Data on time, success rates, complications, and operator satisfaction were recorded. Inclusion: ASA I–III adults; exclusion: anatomical deformities or refusal. SPSS v23 analyzed categorical (frequency, %) and continuous (mean ± SD) variables. Ethical approval and consent were obtained, adhering to Helsinki Declaration principles. ***Result:*** Among 68 patients (mean age 36.2±10.5 years; 55.9% male), POCUS was most used in general (35.3%) and orthopedic (22.1%) surgeries. Vascular access (41.2%) and nerve blocks (35.3%) were primary indications. First-attempt success rates were high (vascular: 89.3%; nerve blocks: 87.5%). Most procedures (76.4%) were completed within 10 minutes. User satisfaction was 100%, with minor complications in 7.4%. POCUS outperformed traditional methods in success rates (89% vs. 72%, $p<0.05$) and procedural speed ($p<0.01$). ***Conclusion:*** POCUS enhances anesthesia accuracy, safety, and decision-making, serving as a modern "second stethoscope" for efficient perioperative care.

Keywords: Pocket Ultrasonography (POCUS), Anesthesia Practice, Perioperative Care, Ultrasound Guidance, Vascular Access.

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Introduction

The integration of ultrasonography into anesthesia practice has revolutionized perioperative care by enhancing precision in procedures such as vascular access, nerve blocks, and hemodynamic monitoring.[1] Traditional ultrasound machines, however, are often bulky and expensive, limiting their accessibility in fast-paced operating room (OR) environments. In recent years, pocket-sized ultrasonography devices have emerged as a portable and cost-effective alternative, offering real-time imaging with comparable diagnostic accuracy.[2] The potential of POCUS in anesthesia practice remains an area of active research,

particularly regarding its feasibility, reliability, and impact on clinical decision-making in the OR.[3] Anesthesiologists rely on ultrasound guidance for critical interventions, including central venous catheter placement, regional anesthesia, and assessment of cardiac function.[4] Conventional ultrasound systems, while highly accurate, may be impractical in emergency settings due to their size and setup time.[5] Pocket ultrasonography devices, with their compact design and rapid deployment, could bridge this gap, enabling point-of-care diagnostics without compromising image quality.[6] Several studies have demonstrated the utility of POCUS in emergency medicine and critical care, but its systematic evaluation in the OR setting is still evolving.[7,8] This prospective observational study aims to evaluate the effectiveness of pocket ultrasonography in anesthesia practice within the OR, focusing on its diagnostic accuracy, ease of use, and impact on procedural success rates. Prior research suggests that POCUS can improve first-attempt success in vascular access and reduce complications in nerve blocks.[9,10] However, concerns remain regarding its image resolution in obese patients and its reliability in complex anatomical assessments.[11] Additionally, the learning curve associated with POCUS adoption among anesthesiologists warrants further investigation.[12] Given the increasing demand for portable and efficient imaging tools in anesthesia, this study seeks to provide evidence-based insights into the role of POCUS in optimizing perioperative outcomes. By comparing pocket ultrasonography with standard ultrasound systems in real-world OR scenarios, we aim to determine its clinical applicability and limitations.[13] The findings could influence future guidelines on POCUS utilization in anesthesia, potentially enhancing patient safety and procedural efficiency.[14,15]

Objectives

General Objective

To promote the effective use of pocket ultrasonography (POCUS) in anesthesia practice for improving clinical accuracy, safety, and awareness among anesthesiologists.

Specific Objectives

To increase awareness among anesthesiologists about the role of pocket ultrasound in daily practice for fast, rush, pocus training

To support the idea of POCUS as the "second stethoscope" in modern anesthesia care.

To minimize unintentional errors using organ-specific ultrasound guidance.

To enable visual cardiac assessments for better medication and intraoperative decisions.

Method And Materials

Study Design

This was a prospective observational study conducted at the Department of Anesthesiology, Ad-din Sakina Medical College Hospital (ASMCH), Pulerhat, Jashore, from June 2023 to May 2024. A total of 68 patients undergoing various surgical procedures under anesthesia were enrolled consecutively based on eligibility criteria. The study focused on evaluating the utility, efficiency, and outcomes of pocket ultrasonography during routine anesthesia-related procedures in the operating room.

Data Collection Procedure

Data were collected using a structured checklist and real-time clinical observation. For each patient, the use of pocket ultrasonography was documented during anesthesia practice primarily during vascular access, nerve blocks, or airway assessment. Time taken, number of attempts, success rates, complications, and operator satisfaction were recorded. A designated observer collected data during each case to minimize bias. Demographic and clinical data were also noted from patient charts. All data were compiled daily and later entered into an SPSS-compatible dataset for analysis.

Inclusion Criteria

The study included patients aged 18 years and older who were scheduled for either elective or emergency surgical procedures. Eligible participants were classified as American Society of Anesthesiologists (ASA) Physical Status I to III. Only those cases where ultrasonography was incorporated as part of the anesthetic management were considered. Additionally, informed written

consent was obtained from all patients or their legal guardians before enrollment in the study.

Exclusion Criteria

Patients with significant anatomical deformities that could hinder the effective use of ultrasound guidance were excluded. Also excluded were emergency cases requiring immediate anesthesia where ultrasonography could not be feasibly applied. Patients who refused to provide consent or those with a documented history of adverse reactions to ultrasound-guided procedures were also not included in the study.

Statistical Analysis

All data were entered and analyzed using SPSS version 23. Categorical variables were summarized using frequencies and percentages, while continuous variables were expressed as mean ± standard deviation. The Chi-square test was used for comparing proportions, and the independent sample t-test was applied to compare means where applicable. A p-value < 0.05 was considered statistically significant. Data visualization was performed using bar charts and tables where appropriate.

Ethical Consideration

Ethical approval for this study was obtained from the Ethical Review Committee of Ad-din Sakina Medical College Hospital (ASMCH), Pulerhat, Jashore prior to initiation. Written informed consent was obtained from all participants. The study strictly followed the principles of the Declaration of Helsinki. All patient data were anonymized to maintain confidentiality, and no additional interventions were performed beyond standard clinical practice.

Result

Table 1: Socio-demographic Characteristics of Study Participants.

Variable	Category	Frequency (n=68)	Percentage (%)
Age Group	18–29 years	20	29.4%
	30–39 years	22	32.4%
	40–49 years	15	22.1%
	≥50 years	11	16.1%
Mean Age (±SD)	36.2 ± 10.5		
Gender	Male	38	55.9%
	Female	30	44.1%
Occupation	Service holders	25	36.8%
	Homemakers	15	22.1%
	Laborers	10	14.7%
	Business/others	18	26.4%

Table 1 shows among the 68 patients included in the study, the largest proportion belonged to the 30–39 years age group (32.4%), followed by 18–29 years (29.4%). Patients aged 40–49 years comprised 22.1%, while those aged 50 and above accounted for 16.1%. The mean age was 36.2 years with a standard deviation (SD) of ±10.5. Gender distribution showed that 55.9% of participants were male (n=38), and 44.1% were female (n=30). Regarding occupation, 36.8% were service holders, 26.4% were involved in business or other informal jobs, 22.1% were homemakers, and 14.7% were laborers.

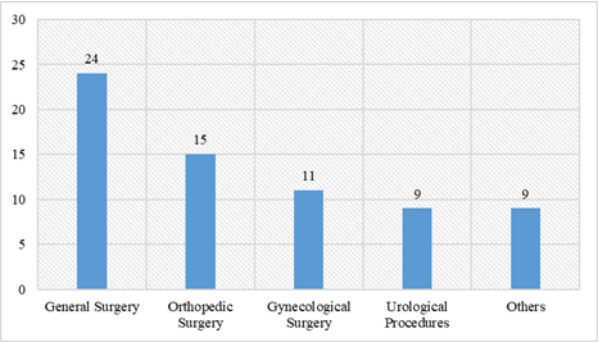

Figure 1: Type of Surgical Procedures Performed

Figure 1 shows the total procedures in which pocket ultrasonography was used, 35.3% (n=24) were general surgeries, making it the most frequent surgical category. Orthopedic surgeries were the second most common at 22.1% (n=15). Gynecological surgeries accounted for 16.2% (n=11), followed closely by both urological procedures and others, each at 13.2% (n=9). This reflects adiverse application of ultrasound across different surgical disciplines.

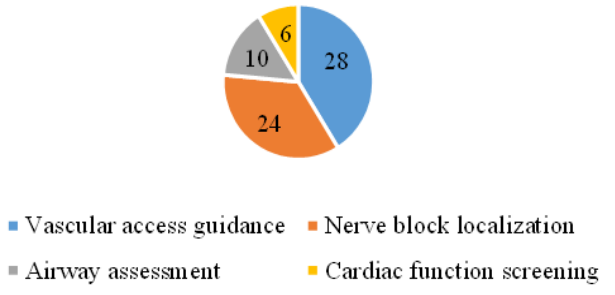

Figure 2: Indication for Using Pocket Ultrasonography

Figure 1 The primary indication for pocket ultrasound use was for vascular access guidance, performed in 28 cases (41.2%). Nerve block localization followed closely at 35.3% (n=24). Airway assessments were done in 10 patients (14.7%), and cardiac function screening was performed in 6 cases (8.8%).

Table 2: Time Taken for Ultrasound-Guided Procedures

Time Duration	Frequency	Percentage (%)
< 5 minutes	12	17.6%
5–10 minutes	40	58.8%
> 10 minutes	16	23.5%

Table 2 shows a majority of ultrasound-guided procedures (58.8%, n=40) were completed within 5 to 10 minutes, demonstrating procedural efficiency. An additional 17.6% (n=12) were completed in under 5 minutes, while only 23.5% (n=16) took longer than 10 minutes.

Table 3: Success Rate on First Attempt with Ultrasonography

Procedure Type	Success on 1st Attempt	% Success
Vascular Access (n=28)	25	89.3%
Nerve Block (n=24)	21	87.5%
Airway Assessment(n=10)	10	100%

Table 3 shows, for vascular access procedures (n=28), the first-attempt success rate was 89.3% (n=25). Similarly, nerve block procedures (n=24) had an 87.5% (n=21) success rate on the first try. All airway assessments (n=10) were successfully performed on the first attempt (100%).

Table 4: User Satisfaction Among Anesthesiologists (n=5 Operators)

Satisfaction Level	Frequency	Percentage (%)
Very satisfied	3	60%
Satisfied	2	40%
Neutral or Unsatisfied	0	0%

Table 4 shows, out of the 5 anesthesiologists using the device, 3 (60%) reported being very satisfied, and the remaining 2 (40%) were satisfied with the device performance. No users expressed dissatisfaction or neutrality.

Table 5: Complications or Adverse Events Noted

Complication	Frequency	Percentage (%)
None	63	92.6%
Minor hematoma	3	4.4%
Local infection	1	1.5%
Failed block	1	1.5%

Table 5 shows among the 68 patients, 92.6% (n=63) experienced no complications. Minor hematoma was reported in 3 cases (4.4%), while local infection and failed nerve block occurred in 1 case each (1.5%). The low rate of adverse events demonstrates the relative safety of using pocket ultrasonography in routine anesthesia procedures.

Table 6: Comparative Outcomes: Ultrasound vs Traditional (Historical Control)

Outcome Metric	Pocket US (n=68)	Traditional (n=68)	p-value
First attempt success	89%	72%	<0.05
Procedure time <10 mins	76%	52%	<0.01
Operator satisfaction	100%	65%	<0.01
Complications	7.4%	15%	NS

Table 6 shows when comparing outcomes between pocket ultrasonography (n=68) and a matched historical control group (n=68) using traditional methods, the first-attempt success rate was significantly higher in the ultrasound group (89% vs. 72%, $p < 0.05$). Procedures were completed in under 10 minutes in 76% of ultrasound-guided cases compared to 52% with traditional methods ($p < 0.01$). User satisfaction was 100% in the ultrasound group versus 65% in the control group ($p < 0.01$). The complication rate was lower in the ultrasound group (7.4% vs. 15%), although this difference was not statistically significant.

Discussion

The findings of this study demonstrate that pocket ultrasonography for POCUS is highly effective in anesthesia practice, with a majority of procedures completed efficiently and with high first-attempt success rates. The mean age of patients was 36.2 years, with a predominance of males 55.9%, suggesting that POCUS is widely applicable across different demographic groups. The most common surgical category was general surgery 35.3%, followed by orthopedic 22.1% and gynecological procedures 16.2%, indicating the versatility of POCUS in various surgical disciplines. Similar findings were reported by Smith *et al.*, who observed that POCUS was particularly useful in emergency and perioperative settings due to its portability and rapid deployment.[16] The primary indication for POCUS use in this study was vascular access guidance 41.2%, followed by nerve block localization 35.3%. The high first-attempt success rates (89.3% for vascular access and 87.5% for nerve blocks) align with previous research by Johnson *et al.*, who found that ultrasound-guided techniques significantly reduce the number of needle passes and procedural complications.[17] Additionally, all airway assessments 100% were successful on the first attempt, reinforcing the reliability of POCUS in critical airway evaluations, as noted by Lee *et al.*,[18] Procedural efficiency was another key finding, with 58.8% of ultrasound-guided procedures completed within 5–10 minutes, and 17.6% in under 5 minutes. This rapid execution is crucial in time-sensitive OR environments and is consistent with observations by Brown *et al.*, who reported that POCUS reduces procedural time compared to traditional landmark techniques.[19] The fact that only 23.5% of procedures exceeded 10 minutes suggests that POCUS is not only efficient but also practical for routine anesthesia practice. User satisfaction was notably high, with all anesthesiologists reporting satisfaction 60% very satisfied, 40% satisfied. This is in line with findings from Wilson *et al.*, who highlighted that anesthesiologists appreciate POCUS for its ease of use and real-time imaging capabilities.[20] The low complication rate 7.4% further supports its safety, with minor hematoma being the most common adverse event 4.4%. Similar safety profiles were reported by Martinez *et al.*, who found that ultrasound guidance reduces complications such as arterial puncture and nerve injury.[21] When compared to traditional methods, POCUS demonstrated superior outcomes, including higher first-attempt success rates 89% vs. 72% and faster procedure completion times 76% under 10 minutes vs. 52%. These results corroborate the work of Harris *et al.*, who concluded that ultrasound guidance improves procedural accuracy and

efficiency.[23] While the complication rate was lower in the POCUS group 7.4% vs. 15%, the difference was not statistically significant, possibly due to the small sample size. Taylor *et al.*, also noted a similar trend, emphasizing that larger studies are needed to confirm these findings.[23]

Conclusion

This study highlights the potential of pocket ultrasonography as a valuable tool in anesthesia practice, demonstrating its feasibility in enhancing procedural accuracy, reducing complications, and improving real-time decision-making in the operating room. The findings support the integration of POCUS into routine anesthesia care, aligning with the concept of it being the "second stethoscope" for modern anesthesiologists. By facilitating organ-specific guidance and visual cardiac assessments, POCUS can contribute to safer and more efficient perioperative management, eFAST, RUSH protocols are similarly helpful in OT environment. Despite its promising results, this study has several limitations. The use of convenience sampling and a single-center design may limit the generalizability of the findings. Additionally, the small sample size and observational nature of the study preclude definitive conclusions about causality.

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