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Short Communication

Diagnostic Performance of Emergency Physician-Performed Point-of-Care Ultrasound Compared with Radiologist-Performed Ultrasound in Adults with Acute Abdominal Pain

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Abstract

Introduction: Acute abdominal pain is a common emergency department (ED) challenge requiring rapid imaging. This study compared emergency physician (EP)-performed point-of-care ultrasound (POCUS) with radiologist ultrasound in adults with acute abdominal pain at a tertiary Iranian hospital.

Methods: This cross-sectional study enrolled 144 hemodynamically stable adults with non-traumatic acute abdominal pain. Trained EPs performed POCUS, followed by radiologist ultrasound as the gold standard.

Results: POCUS demonstrated excellent performance, with a sensitivity of 96%, a specificity of 98%, a positive predictive value of 92%, a negative predictive value of 99%, and an accuracy of 97%. Sensitivity reached 100% for free fluid, cholecystitis, and hydronephrosis. Discrepancies involved only non-emergent conditions without altering management.

Conclusion: EP-performed POCUS revealed excellent accuracy comparable to radiologist ultrasound, supporting routine ED integration.

Keywords: Point-of-care systems, Ultrasonography, Abdominal pain

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Introduction

Non-traumatic abdominal pain is one of the most frequent chief complaints in emergency departments (ED) worldwide, encompassing a broad spectrum of etiologies from benign self-limiting conditions to life-threatening surgical emergencies (1). In addition, this diagnostic challenge is compounded by time constraints and the need for rapid, accurate clinical decision-making. While computed tomography (CT) offers high diagnostic accuracy, concerns regarding radiation exposure, cost, and availability limit its routine use as a first-line imaging modality (2). However, point-of-care ultrasound (POCUS) has emerged as a valuable tool in emergency medicine, offering rapid, non-invasive, and radiation-free bedside assessment of intra-abdominal pathology. According to some previous studies, POCUS can improve diagnostic accuracy, reduce unnecessary CT scans, decrease hospitalization rates, and enhance patient satisfaction without increasing adverse outcomes (3-5). However, its diagnostic performance is operator-dependent, and concerns persist regarding its reliability when performed by non-radiologists (6).

Despite the growing body of evidence supporting POCUS in acute abdominal pain, limited data exist comparing emergency physician (EP)-performed POCUS with comprehensive radiologist-performed ultrasound in real-world ED settings, particularly in resource-constrained environments such as Iran. Moreover, variations in operator training, equipment availability, and patient demographics underscore the need for local validation studies.

Therefore, this study aims to compare the diagnostic performance of EP-performed POCUS with radiologist-performed ultrasound as the gold standard in adults presenting with acute abdominal pain at a tertiary Iranian hospital, focusing on providing practical evidence to guide clinical protocols and enhance patient care.

Materials and Methods

Study Procedure and Techniques

This descriptive cross-sectional study was conducted at the ED of Kashani Hospital (a level-3 referral university hospital). All hemodynamically stable adult patients presenting with acute abdominal pain during shifts staffed by participating emergency medicine specialists were eligible for inclusion in this study. After initial clinical evaluation (history and routine laboratory tests), bedside POCUS was performed by the EP. Within 12 hours, a comprehensive ultrasound examination was conducted by a board-certified radiologist and served as the gold standard. Participating EPs had completed a short-term

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advanced POCUS training course and possessed at least five years of bedside ultrasound experience. Furthermore, radiologists had specialized training in ultrasonography. POCUS was also performed with a Toshiba Aplio 300 device; radiologist-performed examinations were conducted using a GE S7 device.

Inclusion criteria were acute abdominal pain lasting less than 24 hours, age over 18 years, undiagnosed cause of pain, hemodynamically stable condition (not requiring immediate surgery), no prior imaging (ultrasound or CT) at other centers, non-pregnant status, and willingness to undergo ultrasonography. On the other hand, the exclusion criterion was patient withdrawal of consent or departure from the ED before completing the ultrasound.

POCUS was performed and interpreted before the radiologist's examination. Radiologists were blinded to POCUS findings. However, EPs were not blinded to the subsequent radiologist report (routine care), and this did not affect the initial POCUS interpretation.

Data Analysis

Descriptive statistics and diagnostic performance metrics (sensitivity, specificity, positive predictive value [PPV], negative predictive value [NPV], and accuracy) were calculated using SPSS, version 25. Additionally, 95% confidence interval (CIs) for sensitivity and specificity were computed via the Wilson score method.

Results

In this study, diagnostic outcomes of POCUS performed by emergency medicine specialists were compared with comprehensive ultrasonography by board-certified radiologists in 144 patients with acute abdominal pain (mean age: 41.04 ± 17.58 years; 77 males [53.7%], 67 females [46.6%]). According to the radiologists' findings, 36 patients had normal ultrasounds and 108 had pathological findings. Clinically insignificant common findings (simple renal cysts [Bosniak I] and small uterine fibroids) were excluded from further evaluation.

Table 1 summarizes diagnostic performance of POCUS versus radiologist ultrasonography for the evaluated pathologies.

Free fluid: 16 true positives (including cases with appendicitis, ruptured ovarian cysts, cirrhosis, perforated peptic ulcer, ectopic pregnancy, and suspected malignancy). Acute appendicitis: 26 of 27 radiologist-confirmed cases detected, including two false positives and one false negative. Gallbladder/biliary: Perfect concordance for acute cholecystitis (6/6); high performance for isolated gallstones. Renal/urinary: 27 of 30 stones detected; hydronephrosis showed near-perfect agreement. Aortic aneurysm: 4 of 5 cases detected. Intestinal: Complete agreement for obstruction and perforated peptic ulcers; two missed findings (diverticulitis and mesenteric lymphadenopathy). Gynecological: All ectopic pregnancies and ruptured cysts detected (with free fluid); three missed findings (adenomyosis and ovarian cysts). Hepatic (hemangiomas, cirrhosis, and hydatid cysts), splenic, and most hernia findings showed high concordance; isolated misses included a porta-hepatis mass, a pancreatic mass, and one inguinal hernia.

Discussion

Given the wide spectrum of causes of acute abdominal pain and the time constraints in the ED, POCUS performed by emergency medicine specialists can enhance patient evaluation and management, reduce complications, and support rapid clinical decision-making. Likewise, its rapid accessibility, safety, and lack of adverse effects make it particularly suitable for addressing specific urgent diagnostic questions. Accuracy, however, remains highly dependent on operator skill, underscoring the need for advanced training and continuous professional development.

In this study of 144 patients (mean age: 41.04 ± 17.58 years; 53.7% male), POCUS demonstrated high overall diagnostic performance compared with radiologist ultrasonography (sensitivity: 96%, specificity: 98%, PPV: 92%, NPV: 99%, and accuracy: 97%). Condition-specific results were strong, including 100% sensitivity for free fluid, acute cholecystitis, and hydronephrosis; 90–100% metrics for gallstones and renal pathologies; and good performance for intestinal (sensitivity 81%) and gynecological (sensitivity 75%) findings. These results are

Table 1. Diagnostic Performance of Emergency POCUS Compared With Radiologist-Performed Ultrasound as the Reference Standard for Various Pathologies in Patients With Acute Abdominal Pain

Pathology	TP	FP	FN	TN	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)	Accuracy (%)
Free abdominal fluid	16	1	0	127	100	99	94	100	99
Acute appendicitis	26	2	1	115	96	98	92	99	97
Gallstones (without acute cholecystitis)	10	2	1	131	90	98	83	99	97.9
Gallstones with acute cholecystitis	6	0	0	138	100	100	100	100	100
Renal stones/suspected renal colic	27	2	3	112	90	98	93	97	96
Hydronephrosis	23	1	0	120	100	99	95	100	99
Abdominal aortic aneurysm	4	0	1	139	80	100	100	99	99
Intestinal pathologies	9	0	2	133	81	100	100	98	98
Gynecological pathologies	9	0	3	132	75	100	100	97	97

Note. TP: True positive; FP: False positive; FN: False negative; TN: True negative; PPV: Positive predictive value; NPV: Negative predictive value; POCUS: Point-of-care systems.

consistent with previous reports. Karimi et al reported sensitivity and specificity of 72.97% and 83.10% for EPs in diagnosing appendicitis (7). Brau et al found no significant difference in diagnostic accuracy between the two groups (8), while Jang et al observed a lower POCUS accuracy of 45% (9). High agreement for gallbladder assessment was noted by Dupriez et al (10), Summers et al (11), and Shekarchi et al (12). For hydronephrosis, the sensitivity of 100% in our study exceeded the 76.3% reported by Smith et al (13). Gynecological performance was lower than the 99.3% sensitivity for ectopic pregnancy reported by Stein et al (14). Free-fluid detection aligns with the findings of Shojaee et al and Arhami Dolatabadi et al (15-17). Similarly, Hasani et al concluded that bedside ultrasound by EPs can accurately identify causes of acute nontraumatic abdominal pain (16). These comparisons are supported by a recent meta-analysis showing pooled sensitivity of 91% and specificity of 97% for acute appendicitis, as well as American College of Emergency Physicians guidelines recommending POCUS integration into routine ED practice (18).

Clinically, the high sensitivity for critical findings enabled faster triage, urgent intervention prioritization, reduced reliance on CT, and more confident decision-making, particularly during off-hours. Finally, observed discrepancies (missed ovarian cysts and variations in renal stone number/size) were minor, did not alter acute management, and likely stemmed from time pressure, patient factors, and differences in equipment resolution.

Limitations of the Study

This study had some limitations, including single-center design, convenience sampling, modest sample size, and lack of blinding to radiologist reports, limiting the generalizability of our findings. Moreover, inter-operator variability was not assessed in this study.

Conclusion

EP-performed POCUS demonstrated excellent diagnostic accuracy (97%) comparable to radiologist ultrasound in acute abdominal pain, with 100% sensitivity for critical findings. Additionally, discrepancies were limited to non-emergent conditions without affecting patient management. These findings support routine POCUS integration, though multicenter studies are warranted for validation.

Artificial Intelligence Disclosure

The authors used Grammarly solely to improve the English language, grammar, spelling, and overall readability of the manuscript. It should be noted that these tools were not used for study design, data collection, data analysis, interpretation of the results, or generation of scientific content, conclusions, or references.

Authors' Contribution

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Competing Interests

The authors declare that they have no conflict of interests.

Ethical Approval

This study was approved by the Ethics Committee of Shahrekord University of Medical Sciences (approval code: IR.SKUMS.MED.REC.1403.088).

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