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Impact of emergency department ultrasound in diagnosing patients with right upper quadrant pain in a tertiary hospital in the Kingdom of Bahrain: A cross-sectional study

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ABSTRACT

Introduction: Patients presents to the emergency department commonly with complaints of right upper quadrant pain. Ultrasound is widely used in diagnosis; thus, emergency physicians should be able to interpret bedside ultrasound results for optimal patient management and outcomes. *Aim:* This study aimed to determine the diagnostic accuracy between emergency and radiology physicians in patients complaining of right upper quadrant pain in Bahrain Defense Force Hospital, Kingdom of Bahrain. *Methods:* Following a one-day abdominal ultrasound skills workshop, 10 emergency physicians performed bedside ultrasound examinations on patients presenting with right upper quadrant abdominal pain at the emergency department. The emergency physicians' diagnoses were compared with those of the radiology department. *Results:* The emergency physicians had 62.5% accuracy. In 9 cases, they had 100% accuracy and 6 got the lowest accuracy (37.5%–50%). Regarding the ultrasonographic findings, the highest accuracy (over 80%) was in detecting gallstones and the lowest (67.3%) was for distended gallbladder. The physicians could identify over 80% of the cases accurately. *Conclusion:* The ability of emergency physicians to perform and identify the ultrasound within a short training period raised the need for more professional training courses to improve the outcome by reducing the time needed for diagnosis and initiating management and treatment.

Keywords: Abdominal pain, Radiologists, Bahrain, Cross-sectional studies, Surveys and questionnaires

1. INTRODUCTION

The emergency department is the frontage that receives patients in hospitals with varieties of complaints and most frequently they presented with abdominal pain, especially (Right Upper Quadrant (RUQ)) pain, which can be due to various causes, with a 3–11% possibility of admission for gallbladder diseases (Menu and Vuillerme, 2002). Abdominal pain affects 50 to 200 thousand patients annually and has a mortality rate of 0.8%. Many of these patients are diagnosed with biliary colic, cholecystitis or cholangitis. We must strive to find the causes of abdominal pain to avoid complications (Kimura et al., 2007).

Patient history, physical examination and laboratory results are insufficient to confirm a diagnosis in these patients. Thus, imaging studies are required to initiate effective management that may reduce mortality rates and shorten hospital stays (Hiatt et al., 2020). (Ultrasound (US)) is considered the standard top of line between imaging tool worldwide, including for patients with signs and symptoms of hepatic and biliary diseases and gallstones (Spence et al., 2009). Compared to other modalities (Ultrasound (US)) is cost-effective due to its accessibility (Nicola and Dogra, 2016; Mateer et al., 1994). Hence, proper training for physicians must be done to enhance diagnostic accuracy and their ability to recognize life-threatening conditions using this imaging modality, as it depends on operator skills (Al-Rabiah et al., 2021).

A study involving 342 patients in Iran showed great agreement between the sonography reports of emergency physicians and radiologists on the subject of existence of acute cholecystitis with results of 89.58 sensitivity and 96.59 specificity of emergency physicians' (Right Upper Quadrant (RUQ)) sonography (Shekarchi et al., 2018). Furthermore, Jang TB concluded that emergency (Ultrasound (US)) has a sensitivity and specificity of 89.8 and 88%, respectively (Seyedhosseini et al., 2017). However, a recent study conducted in King Saud hospital, Saudi Arabia, showed only 55.2% diagnostic accuracy between emergency physicians' and radiologists' results, which was not encouraging, as described by Al-Rabiah et al., (2021).

The role of our study is to determine the diagnostic accuracy between emergency and radiology physicians in patients presenting with (Right Upper Quadrant (RUQ)) abdominal pain in (Bahrain Defense Force (BDF)) Hospital, Kingdom of Bahrain. This research will increase our understanding of emergency physicians' familiarity with (Ultrasound (US)) techniques as it may affect final diagnosis and patient management.

2. MATERIAL AND METHODS

Study design, population and sample size

This prospective, cross-sectional study was conducted at the emergency and radiology departments of (Bahrain Defense Force (BDF)) Hospital from July 2021 to June 2022. The research ethics committee at (Bahrain Defense Force (BDF)) Hospital approved the study (BDF/R & REC/2021-626). The researchers abided by all aspects of ethical practice and patient confidentiality and privacy.

A total of 52 patients were enrolled in the study. The inclusion criteria were age 14 years and above and no history of cholecystectomy. Patients with a history of cholecystectomy or younger than 14 years old were excluded.

Data collection

Before commencing the study, 10 randomly selected emergency physicians with no (Ultrasound (US)) experience volunteered to be trained by a consultant radiologist on abdominal (Ultrasound (US)) basic principles and skills. A one-day workshop was held at the radiology department for the volunteer physicians. The topics covered were: Principles of (Right Upper Quadrant (RUQ)) abdominal (Ultrasound (US)), how to operate the (Ultrasound (US)) machine and normal hepatobiliary (Ultrasound (US)). The physicians were trained to use a 1–5 MHz broad spectrum convex transducer (Ultrasound (US)) machine (LOGIQ E9; GE Healthcare, Chicago, IL, USA) on a 31-year-old healthy male who presented with no complaint. Each physician performed five successful (Right Upper Quadrant (RUQ)) (Ultrasound (US)) examinations before patients' enrollment.

In the emergency department, (Ultrasound (US)) was performed on patients in the supine or lateral decubitus position using a 2–5 MHz curved array transducer (SonoSite edge II; Fujifilm, Bothell, WA, USA). The results were collected using a written self-administered questionnaire from the emergency room (ER) and substantiated by three of the researchers. The questionnaire included the patient's hospital file number, age, gender, (Ultrasound (US)) findings, diagnosis and the physician's position. Meanwhile, radiologists' results were collected via BDF hospital electronic medical records.

Data analysis

SPSS version 26.0 (Chicago, IL, USA) software was applied for analyses the entire data. Categorical variables were represented as frequencies and percentages. Chi-square and Fisher's exact tests were used to assess associations between the categorical variables. A p-value of less than 0.05 was considered statistically significant.

3. RESULTS

The analyses included 52 cases that went through the emergency and radiology departments for ultrasonic evaluation of (Right Upper Quadrant (RUQ)) pain. Among the patients, there were 32 (61.5%) females and 20 (38.5%) males (Table 1). Most (37, 71.2%) were 15–47 years old. The most common emergency department (Ultrasound (US)) findings were gallstones (71.2%) and distended gallbladder (34.6%). The most common (Ultrasound (US)) findings in the radiology department were gallstones (59.6%) and no abnormal findings (34.6%). Eventually, Cholethiasis was the first final diagnoses for either.

Table 1 Demographics and clinical findings

Demographics and clinical findings	N (%)
Gender	
Female	32 (61.5)
Male	20 (38.5)
Age	
15 – 47	37 (71.2)
47 – 64	8 (15.4)
> 64	7 (13.5)
Emergency department findings: †	
Gallstone	37 (71.2)
Distended gallbladder	18 (34.6)
Sonographic murphy sign	14 (26.9)
Thickened gallbladder wall	14 (26.9)
Sludge	11 (21.2)
Pericholecystic fluid	8 (15.4)
No abnormal findings	7 (13.5)
Dilated (Common Bile Duct (CBD))	4 (7.7)
Emergency department final diagnosis	
Cholelithiasis	20 (38.5)
Cholecystitis	12 (23.1)
Biliary colic	8 (15.4)
Normal	6 (11.5)
Sludge	6 (11.5)
Emergency physician's position	
Junior resident	26 (50.0)
Chief resident	14 (26.9)
Senior resident	7 (13.5)
Consultant	5 (9.6)
Radiology department findings: †	
Gallstone	31 (59.6)
No abnormal findings	18 (34.6)
Dilated (Common Bile Duct (CBD))	11 (21.2)
Distended gallbladder	11 (21.2)
Pericholecystic fluid	9 (17.3)
Thickened gallbladder wall	8 (15.4)
Sludge	8 (15.4)
Sonographic Murphy sign	1 (1.9)
Radiology department final diagnosis	
Cholelithiasis	24 (46.2)

Normal	17 (32.7)
Cholecystitis	9 (17.3)
Sludge	2 (3.8)
Radiologist's position	
Chief resident	32 (61.5)
Junior resident	20 (38.5)

†: Some patients had more than one finding.

The diagnoses of 39 (75%) cases were similar between both departments. And 14 cases were the highest frequency with 62.5% accuracy, while only 9 cases had 100% exact match between both departments (Figure 1).

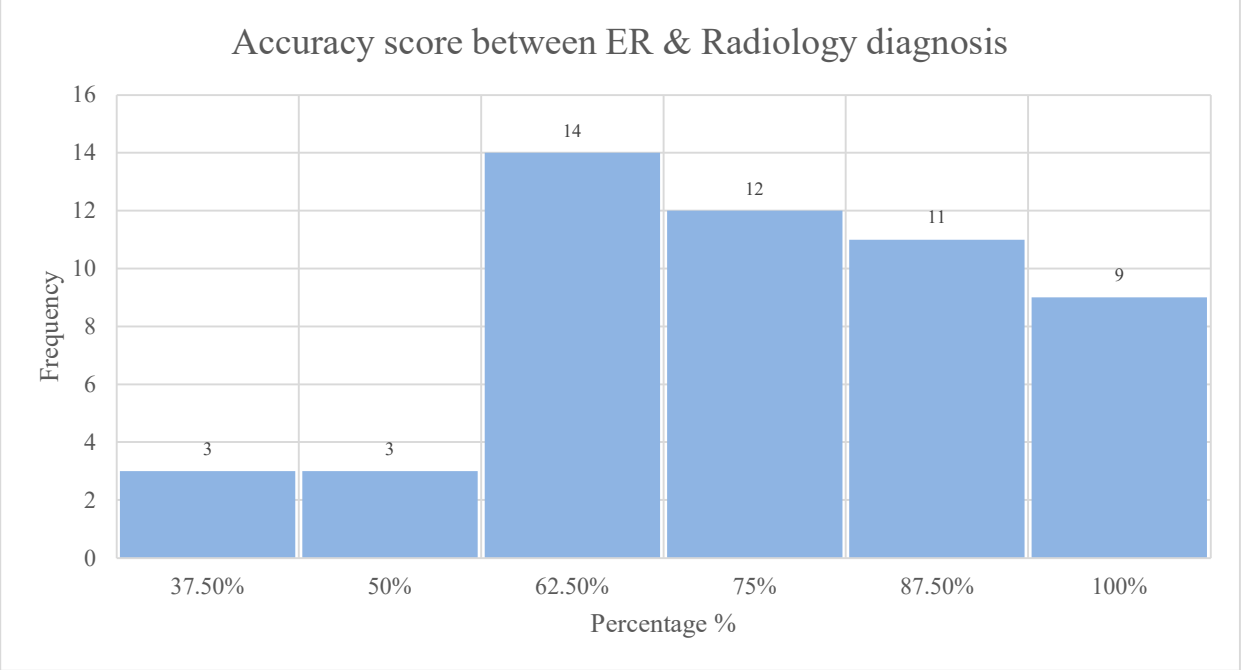

Figure 1 Accuracy score between the emergency and radiology departments

Junior residents in both departments and consultants in the (Emergency Room (ER)) correctly identified over 80% of the cases (Figure 2). The accuracy of diagnosis between the two departments is illustrated (Figure 3).

Distended gallbladder had the lowest match rate between both departments (67.3%) (Figure 3) and gallstone had the highest (>80%). The percentage of accuracy between demographics is illustrated (Table 2). There were no statistically significant differences in findings based on the accuracy.

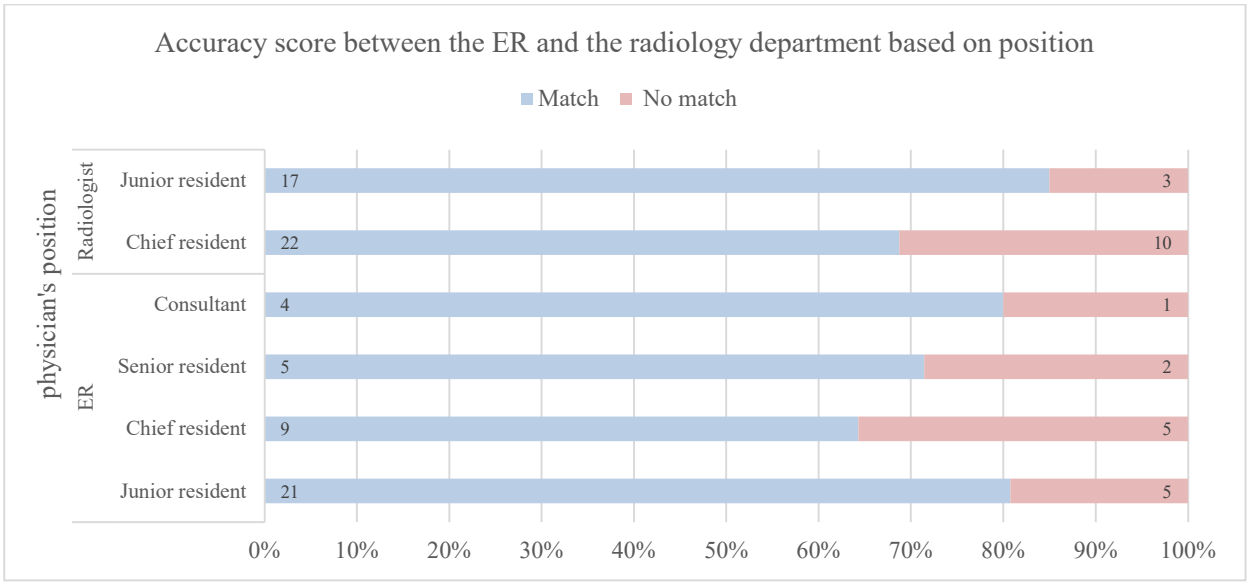

Figure 2 Accuracy score between the emergence and radiology departments based on position

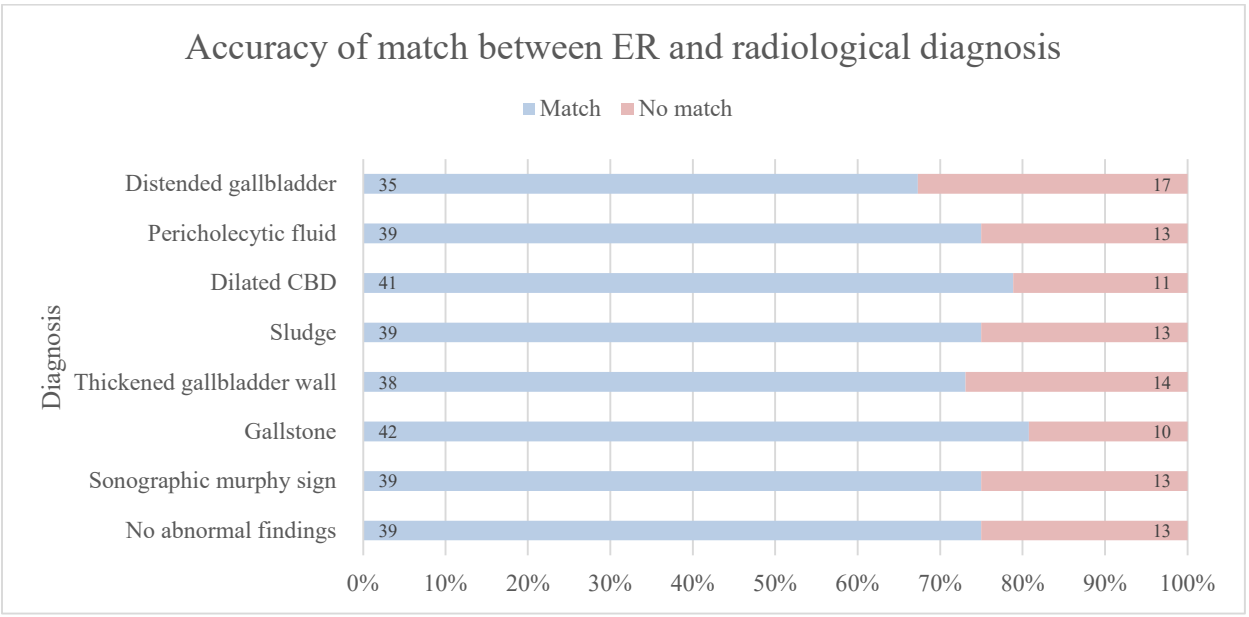

Figure 3 Frequency and percentage of diagnostic accuracy in the emergency and radiology departments

Table 2 Differences in the percentage of accuracy between demographics, represented as N (%)

Variable	Accuracy		P-value
	Match	No match	
Gender			
Female	22 (68.8)	10 (31.3)	0.188
Male	17 (85.0)	3 (15.0)	
Age			
15 – 47	28 (75.7)	9 (24.3)	> 0.05
47 – 64	6 (75.0)	2 (25.0)	
> 64	5 (71.4)	2 (28.6)	
ER doctor who conducted the study			
Junior resident	21 (80.8)	5 (19.2)	0.703
Chief resident	9 (64.3)	5 (35.7)	

Senior resident	5 (71.4)	2 (28.6)	
Consultant	4 (80.0)	1 (20.0)	
Radiologist			
Chief resident	22 (68.8)	10 (31.3)	0.188
Junior resident	17 (85.0)	3 (15.0)	

The P-value was calculated using the Chi-square test or Fisher's exact test as appropriate.

4. DISCUSSION

The major results of this study are as follows: 39 (75%) cases were accurate in diagnosis between the emergency and radiology departments. The highest frequency (14) was (62.5%) accuracy and only 9 cases were (100%) accurate. ER junior residents and consultants correctly identified over 80% of the cases.

These results agree with recent findings from several studies. In Seyedhosseini et al., (2017) prospective observational study, trained emergency residents achieved moderate to perfect agreement with expert radiologists in diagnosing common bile duct dilatation, gallstones and sonographic Murphy. Furthermore, a 2022 study compared the results of ultrasonography done in the ER to the official radiological results. The point-of-care US (POCUS) sensitivity was .33 (95% CI: .0749–.7007), specificity was .94 (95% CI: .8134–.9932), positive predictive value was .6 (95% CI: .2266–.8848) and negative predictive value was .85 (95% CI: .78–.9005) (Mateer et al., 1994). Other studies had different outcomes. Emergency physicians identified only 35.7% of 14 patients who presented with cholecystitis (Hasani et al., 2015). The agreement of previous studies with our findings indicates a strong need for more training and experience for emergency physicians to improve the accuracy of diagnosis.

There were some limitations in this study. First, most of the participating emergency physicians were junior residents, while most of the radiology residents were chief residents. Also, the criteria for US findings depended on data taken from the hospital radiology department reports. Furthermore, it is difficult to generalize the findings as this study had a limited sample size. Finally, the training course duration was too short for the emergency doctors to enhance their performance.

Our recommendations for further studies are to measure the ability of emergency physicians to use US as a diagnostic tool in patients complaining of abdominal pain because it may decrease the use of formal imaging studies and improve the quality of patient care.

5. CONCLUSION

This study revealed that the highest frequency accuracy was 62.5%. Therefore, the ability of emergency physicians to perform and identify the US in a short training raised the need for more professional and longer training courses to improve the outcome by reducing the time needed for diagnosis and initiating the appropriate management for these patients.

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Authors' contributions

Taif Najeebi: Data collection, introduction and discussion.
Lina Aljailani: Data collection and entry, abstract and methods.
Horeya Falamarzi: Data collection and analysis.
Salah Alghanem: Supervision and data collection.

Ethical approval

The study was approved by the Medical Ethics Committee of (Bahrain Defense Force (BDF)) Hospital (Ethical approval code: BDF/R&REC/2021-626).

Informed consent

Oral informed consent was obtained from all individual participants included in the study.

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Conflict of interest
The authors declare that there is no conflict of interests.

Data and materials availability
All data sets collected during this study are available upon reasonable request from the corresponding author.

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