

CROSS-SECTIONAL STUDY COMPARING EMERGENCY CHEST X-RAY INTERPRETATION BETWEEN EMERGENCY PHYSICIANS AND RADIOLOGISTS IN KSUMC

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Abstract

Background: X-ray imaging is a vital part of emergency diagnostics because of its speed, cost-effectiveness, and ability to provide critical information about a patient's condition. This cross-sectional study assessed the competence of resident physicians in emergency and radiology departments in common emergency chest X-ray interpretation and compared the types of errors made by emergency physicians and radiologists.

Background: X-ray imaging is a vital part of emergency diagnostics because of its speed, cost-effectiveness, and ability to provide critical information about a patient's condition. This study assessed the competence of resident physicians in emergency and radiology departments in common emergency chest X-ray interpretation. In addition, it compared the types of errors made by emergency physicians and radiologists in common emergency chest X-ray interpretation

Methods: This was a single-centre cross-sectional study conducted at King Khalid University Hospital among emergency and radiology physicians from July 2023 to March 2024. The data were collected through personal interviews with radiology and emergency department residents. A total of 54 radiology and emergency department residents were interviewed after being informed about the aim and methods of the study.

Results: The results showed no significant differences in gender, age, residency level, occupation, or primary source of knowledge between radiology and emergency department residents. From the radiology department, 18 male residents (64.3%) and 10 female radiology residents (35.7%) were interviewed; from the emergency department, 14 male residents (53.8%) and 12 female residents (46.2%) were interviewed. In the radiology

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department, the primary source of knowledge was books (12 residents, 42.9%), followed by the internet (25%), experience (21.4%), and other sources (10.7%). Furthermore, the results showed no significant difference in the answers regarding tension pneumothorax X-rays between radiology and emergency residents. These findings suggest the need for improved communication and training between radiology and emergency departments to ensure the accurate and timely diagnosis and treatment of medical conditions.

Conclusion: Although emergency and radiology residents have similar skills in interpreting chest X-rays, improved communication is needed between departments and specialized training programs. By prioritizing these areas, healthcare professionals can ensure more accurate and timely diagnoses, thus improving the quality of care provided to patients in emergency settings.

Keywords: X-ray interpretation, Radiology, Emergency department.

Introduction

Emergency rooms (ERs) are crucial in providing immediate and precise medical care, and timely and accurate diagnosis in the ER can be a matter of life and death (1). One of the most important tools for ER residents is X-ray imaging (2), which is readily available and highly effective in diagnosing a wide range of conditions. Mastering X-ray interpretation is vital for ER residents (3). It greatly improves the prognosis and diagnosis of critical cases, and it ensures timely and appropriate patient management (4).

X-ray imaging is a vital part of emergency diagnostics because of its speed, cost-effectiveness, and ability to provide critical information about a patient's condition (5). X-ray plays a vital role in clinical decision-making by identifying fractures, dislocations, pneumonia, pneumothorax, and intestinal blockages (6). In the fast-paced and demanding setting of the ER a doctor's ability to quickly and accurately analyze X-rays can significantly impact patient outcomes (7).

Multiple studies have assessed the accuracy of emergency medicine attending physicians' interpretation of plain radiographs, and viewpoints and findings vary greatly on this matter (8). According to some studies, the likelihood of misdiagnosis is quite low, with an overall discrepancy rate of less than 1%. However, other studies have shown higher rates of discrepancy, even in widely used imaging techniques such as chest radiography (8). Notably, studies focusing on residents report a much greater likelihood of errors in interpretation, even among experienced residents (9). Residents' knowledge

of radiography greatly improves as their learning process continues and they progress toward becoming attending physicians. Recent graduates must rely on the knowledge they acquire from their residency when making clinical judgments, although their level of expertise may be lower than that of their more experienced colleagues (2, 8). Possible approaches to improve radiology education in emergency residents include structured presentations by radiologists, offering specialized rotations in radiology, and conducting systematic examinations of inconsistencies (10). This study assessed the competence of emergency and radiology residents in common emergency chest X-ray interpretation. In addition, it compared the types of errors made by emergency physicians and radiologists in common emergency chest X-ray interpretation.

Methods

This was a single-centre cross-sectional study conducted at King Khalid University Hospital (KKUH) among emergency and radiology physicians between July 2023 and March 2024. The data were collected through personal interviews with radiology and emergency residents to determine their ability to interpret X-rays. The interview included questions about the X-ray parameters of tension pneumothorax, pleural effusion, pulmonary edema, aortic dissection, diaphragmatic rupture, lung collapse, rib fracture, pericarditis, and pulmonary embolism (PE). A total of 54 physicians participated in the study (28 radiology physicians and 26 emergency physicians).

Data were analyzed using Statistical Program for the Social Sciences (SPSS) version 24. The data were expressed as frequency and percentage. The Chi-square test (χ^2) was used to compare categorized data regarding specialty. A p-value of <0.05 was considered significant, a p-value of <0.001 was considered highly significant, and a p-value of >0.05 was considered nonsignificant. All participants were informed about the aim and the study design and agreed to participate.

Results

Table 1 presents the comparison of demographic data between specialties. The results are summarized as follows:

- Gender did not differ significantly between the two specialties ($p = 0.435$). Of the participants from the radiology department, 18 residents (64.3%) were men and 10 (35.7%) were women, and of those from the emergency department, 14 (53.8%) were men and 12 (46.2%) were women.

Table 1. Comparison of demographic data between specialties.

		Specialty				X ²	P-value
		Radiology		Emergency			
		(N = 28)		(N = 26)			
Gender	Male	18	64.3%	14	53.8%	0.6	0.435 NS
	Female	10	35.7%	12	46.2%		
Age	25 – 27 years	17	60.7%	20	76.9%	2.17	0.338 NS
	28 – 30 years	10	35.7%	6	23.1%		
	31 – 33 years	1	3.6%	0	0%		
Residency level	R1	9	32.1%	14	53.8%	5.7	0.122 NS
	R2	11	39.3%	3	11.5%		
	R3	6	21.4%	6	23.1%		
	R4	2	7.1%	3	11.5%		
Occupation	KKUH	17	60.7%	18	69.2%	0.42	0.513 NS
	Outside rotator	11	39.3%	8	30.8%		
Primary source of knowledge	Books	12	42.9%	16	61.5%	2.57	0.461 NS
	Internet	7	25%	6	23.1%		
	Experience	6	21.4%	3	11.5%		
	Other	3	10.7%	1	3.8%		

S: p-value < 0.05 is considered non-significant.

T: independent sample T test.

X²: Chi-square test.

HS: p-value < 0.001 is considered highly significant.

NS: p-value > 0.05 is considered non-significant.

- Age did not differ significantly between specialties (p = 0.338). Of the participants from the radiology department, 17 residents (60.7%) were 25–27 years old, 10 (35.7%) were 28–30 years old, and 1 (3.6%) was 31–33 years old. Of the interviewees from the emergency department, 20 residents (76.9%) were 25–27 years old and 6 (23.1%) were 28–30 years old.

- The residency level did not differ significantly between specialties (p = 0.122). Of the participants from the radiology department, 9 (32.1%) were R1 residents, 11 (39.3%) were R2 residents, 6 (21.4%) were R3 residents, and 2 (7.1%) were R4 residents. Of the participants from the emergency department, 14 (53.8%) were R1 residents, 3 (11.5%) were R2 residents, 6 (23.1%) were R3 residents, and 3 (11.5%) were R4 residents.

- Occupation did not differ significantly between specialties (p = 0.513). Of the participants from the radiology department, 17 residents (60.7%) were occupied by KKUH and 11 (39.3%) were occupied outside of KKUH. Of the participants from the emergency department, 18 residents (69.2%) were occupied by KKUH and 8 (30.8%) were occupied outside of KKUH.

- The primary source of knowledge did not differ significantly between specialties (p = 0.461). Among the participants from the radiology department, the primary sources of knowledge were books (12 residents, 42.9%), the internet (7 residents, 25%), experience (6 residents, 21.4%), and other sources (3 residents, 10.7%). Among the participants from the emergency department, the primary sources of knowledge were books (16 residents, 61.5%), the internet (6 residents, 23.1%), experience (3 residents, 11.5%), and other sources (1 resident, 3.8%).

Table 2 presents a comparison of the answers to the interview questions between specialties. The results are summarized as follows:

- The number of correct answers for tension pneumothorax X-ray did not differ significantly between radiology and emergency residents (p = 0.165). Among radiology residents, 26 (92.9%) answered correctly and 2 (7.1%) answered incorrectly. Among emergency residents, all participants (100%) answered correctly.

- The number of correct answers for pleural effusion X-ray did not differ significantly between radiology and emergency residents (p = 0.160). Among radiology residents, 17 (65.4%) answered correctly and 9 (34.6%) answered incorrectly. Among emergency residents, 17 (65.4%) answered correctly and 9 (34.6%) answered incorrectly.

- The number of correct answers for pulmonary edema X-ray did not differ significantly between radiology and emergency residents (p = 0.923). Among radiology residents, 25 (89.3%) answered correctly and 3 (10.7%) answered incorrectly. Among emergency residents, 23 (88.5%) answered correctly and 3 (11.5%) answered incorrectly.

- The number of correct answers for aortic dissection X-ray did not differ significantly between radiology and emergency residents (p = 0.509).

Among radiology residents, 27 (96.4%) answered correctly and 1 (3.6%) answered incorrectly. Among emergency residents, 24 (92.3%) answered correctly and 2 (7.7%) answered incorrectly.

- The number of correct answers for diaphragmatic rupture X-ray did not differ significantly between radiology and emergency residents (p = 0.910). Among radiology residents, 24 (85.7%) answered correctly and 4 (14.3%) answered incorrectly. Among emergency residents, 22 (84.6%) answered correctly and 4 (15.4%) answered incorrectly.

- The number of correct answers for lung collapse X-ray differed significantly between radiology and emergency residents (p = 0.007). Among radiology residents, 27 (96.4%) answered correctly and 1 (3.6%) answered incorrectly. Among emergency residents, 18 (69.2%) answered correctly and 8 (30.8%) answered incorrectly.

- The number of correct answers for rib fracture X-ray did not differ significantly between radiology and emergency residents (p = 0.336). Among radiology residents, 2 (7.1%) answered correctly and 26 (92.9%) answered incorrectly. Among emergency residents, 4 (15.4%) answered correctly and 22 (84.6%) answered incorrectly.

- The number of correct answers for pericarditis X-ray differed significantly between radiology and emergency residents (p = 0.004). Among radiology residents, 25 (89.3%) answered correctly and 3 (10.7%) answered incorrectly. Among emergency residents, 14 (53.8%) answered correctly and 12 (46.2%) answered incorrectly.

- The number of correct answers for PE X-ray differed significantly between radiology and emergency residents (p = 0.031). Among radiology residents, 20 (71.4%) answered correctly and 8 (28.6%) answered incorrectly. Among emergency residents, 11 (42.3%) answered correctly and 15 (57.7%) answered incorrectly (Table 2, Figure 1).

Discussion

Every emergency department must have radiographers who are capable of performing routine X-rays around the clock (11). Although the attending emergency physician on call is responsible for prescribing and performing the initial interpretation (12), radiologists must compose reports efficiently. X-rays do not provide any direct therapeutic benefit to patients, but they may lead to unintended harm or misinterpretation of results (13-15). Emergency medicine is prone to errors because of many factors, such as recalcitrant patients, insufficient medical histories, time-sensitive decision-making, high stress levels, the performance of several activities simultaneously, and less experienced staff working night shifts in crowded emergency departments (16). This study assessed the competence of emergency and radiology residents in emergency chest X-ray interpretation. In addition, it compared the types of errors made by emergency physicians and radiologists in interpreting common emergency chest X-rays.

Table 2. Comparison of answers to interview questions between specialties.

		Specialty				X ²	P-value
		Radiology (N = 28)		Emergency (N = 26)			
X-ray of tension pneumothorax	Correct	26	92.9%	26	10%	1.92	0.165 NS
	Wrong	2	7.1%	0	0%		
X-ray of pleural effusion	Correct	23	82.1%	17	65.4%	1.97	0.160 NS
	Wrong	5	17.9%	9	34.4%		
X-ray of pulmonary edema	Correct	25	89.3%	23	88.5%	0.009	0.923 NS
	Wrong	3	10.7%	3	11.5%		
X-ray of aortic dissection	Correct	27	96.4%	24	92.3%	0.43	0.509 NS
	Wrong	1	3.6%	2	7.7%		
X-ray of diaphragmatic rupture	Correct	24	85.7%	22	84.6%	0.013	0.910 NS
	Wrong	4	14.3%	4	15.4%		
X-ray of lung collapse	Correct	27	96.4%	18	69.2%	7.18	0.007 *
	Wrong	1	3.6%	8	30.8%		
X-ray of rib fracture	Correct	2	7.1%	4	15.4%	0.92	0.336 NS
	Wrong	26	92.9%	22	84.6%		
X-ray of pericarditis	Correct	25	89.3%	14	53.8%	8.4	0.004 *
	Wrong	3	10.7%	12	46.2%		
X-ray of pulmonary embolism(PE)	Correct	20	71.4%	11	42.3%	4.6	0.031*
	Wrong	8	28.6%	15	57.7%		

S: p-value < 0.05 is considered non-significant., X2: Chi-square test., NS: p-value > 0.05 is considered non-significant.

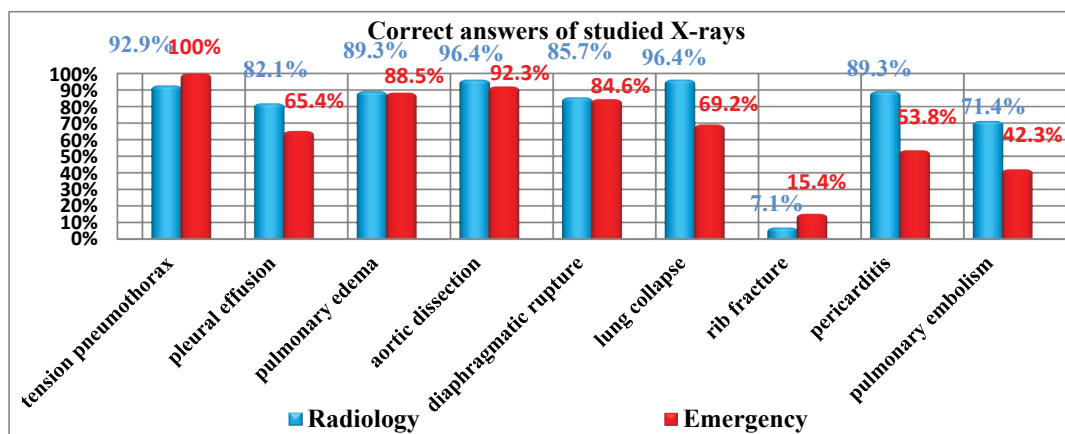


Figure 1. Correct answers of studied X-rays.

The results showed no significant differences in gender, age, residency level, occupation, or primary source of knowledge among radiology and emergency residents. This indicates that the study sample was homogeneous.

Our study found no statistically significant difference between radiology and emergency residents in interpreting X-rays of pleural effusion, pulmonary edema, aortic dissection, or diaphragmatic rupture. This finding may be due to the high rates of these cases in the emergency department (17), which provides emergency residents with the experience needed to interpret these X-rays correctly.

The results found no significant difference in the answers for tension pneumothorax X-rays between radiology and emergency residents. These results indicate that both radiology and emergency residents have the same level of knowledge regarding this type of X-ray. This finding aligns with the results of Hafeez et al. (18), who found a significant level of concurrence (92.5%) between the resident and the attending radiologist in diagnosing pneumothorax on chest radiographs.

The results revealed a statistically significant difference between emergency and radiology residents in interpreting X-rays of lung collapse. Chest X-rays are commonly used to identify this condition, but X-rays of lung collapse may be misinterpreted because emergency residents may not always be able to detect a slight pneumothorax, particularly when the patient is lying down (19).

Regarding pericarditis, X-rays can occasionally detect minor signs of the condition, but they are frequently disregarded because of their lack of clarity (20).

Identifying PE can be challenging when relying solely on chest X-rays (21). Although they can sometimes provide hints, such as a wedge-shaped infarct (Hampton's hump) (22) or dilated pulmonary arteries (Fleischner sign) (23). these signs are not always present in cases of PE, and they may be difficult to detect or absent in many cases. The radiographic signs of PE are often downplayed and lack specificity. Emergency residents, especially those in the midst of their training, might miss these subtle indications if they are not clearly expressed or if they are overshadowed by other more noticeable irregularities.

Conclusion

Our study revealed a high level of accuracy in X-ray interpretation among ER residents for pleural effusion, pulmonary edema, aortic dissection, and diaphragmatic rupture. However, we observed significant differences between emergency and radiology residents' abilities to interpret X-rays for pneumothorax, pericarditis, and PE.

Conflict of interest

The authors declare no conflicts of interest

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