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Transition from emergency department to intensive care: the contribution of detailed anamnesis and early imaging to diagnosis and treatment processes

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ABSTRACT

Aims: The overcrowding of emergency departments (EDs) is a significant public health issue that diminishes the quality of healthcare services and increases mortality and morbidity rates both nationally and internationally. This study aims to emphasize the importance of detailed anamnesis and early bedside non-invasive imaging (ultrasonography) in patients transferred from the ED to the intensive care unit (ICU). It also addresses the impact of ED overcrowding on healthcare services and proposes solutions to enhance healthcare quality.

Methods: Between June 20, 2024, and November 25, 2024, patients over 18 years admitted to the ICU via the adult ED at Mardin Training and Research Hospital for various reasons were included in the study. A detailed anamnesis and non-invasive ultrasonographic imaging were performed for all ICU-admitted patients.

Results: Among the 242 patients admitted to the ICU, additional findings that influenced treatment decisions were identified in 21 patients through detailed anamnesis and imaging. Of these patients, 11 were male and 10 were female. The most frequent admission diagnoses were traffic accidents [8/21, (38.1%)] and respiratory distress [6/21, (28.6%)].

Conclusion: Our study demonstrates that performing detailed anamnesis and utilizing non-invasive imaging techniques in patients transferred from the ED to the ICU provides critical contributions to diagnosis and treatment. Strategies should be developed to reduce unnecessary ED visits and promote the appropriate use of emergency services.

Keywords: Emergency department, intensive care unit, ultrasonography, detailed anamnesis, echocardiography

INTRODUCTION

The overcrowding of emergency departments (ED) constitutes a significant public health issue that adversely affects the quality of healthcare services and leads to increased mortality and morbidity rates globally. This overcrowding has become a serious public health problem, preventing patients from receiving adequate health services and contributing to rising mortality and morbidity rates.[1,2] EDs are critical units in hospitals where patient stabilization and emergency care are provided. It is crucial to transfer critically ill patients to the intensive care unit (ICU) as quickly as possible, ensuring that the underlying issues are appropriately diagnosed. However, many patients who present to the ED do not require emergency intervention, which negatively affects access to care for critically ill patients and leads to diminished quality of healthcare services, resulting in misdiagnosis and inappropriate treatment.[3]

In the United States, the ratio of physicians to the population is 2.7 per 1.000 people, while the United Kingdom has 2.1, and Turkey reports 1.5.[4] The global average is 3.03. The high patient-to-physician ratio in EDs and the lack of qualified personnel limit the time available for patient assessment, negatively impacting diagnostic accuracy and treatment outcomes.[5]

The quality of care provided prior to admission to the ICU directly affects patient outcomes. A study by McQuillan et al.[6] reported significantly higher morbidity and mortality rates in patients who received inadequate care before ICU admission.

In recent years, learning and interpreting non-invasive imaging applications, especially ultrasonography (USG), has become an important area for physicians in the diagnosis, treatment and clinical observation processes of intensive care (IC) patients. In particular, the fact that USG and echocardiography can be performed at the bedside and non-invasively provides great advantages for patients.[7,8] The use of echocardiography as a non-invasive method in

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bedside evaluation of cardiovascular structures is of critical importance for IC patients and provides ease of use due to its portability.[9,10]

The goal of this study is to assess the negative effects of increased patient volume in EDs on healthcare services and to emphasize the importance of using non-invasive imaging methods like bedside USG and detailed anamnesis in improving early diagnosis, treatment, and clinical monitoring for patients admitted to the ICU.

METHODS

Ethics

The study was conducted with the permission of Mardin Artuklu University Non-interventional Clinical Researches Ethics Committee (Date: 11.06.2024, Decision No: 2024/6-1). All procedures were carried out in accordance with the ethical rules and the principles of the Declaration of Helsinki.

Study Design

Between 20.06.2024 and 25.11.2024, patients over 18 years admitted to the ICU via the adult ED for various reasons were included in the study.

Study Environment

The study was conducted at Mardin Training and Research Hospital, which is a teaching hospital with a total capacity of 80 IC beds. The hospital has 38 adult ICU beds, 9 of which are designated for ICU. All ED patients were triaged by trained nurses. The ED staff includes emergency medicine specialists and resident doctors. Transfers to the ICU were made by consulting the ICU specialists during working hours and the on-duty specialists outside of working hours. When patients were admitted to the ICU, a detailed anamnesis was taken by the relevant specialist physician, along with bedside USG conducted, and any imaging that was lacking for the diagnosis was carried out.

Patient Selection

After obtaining ethical approval, patients admitted to the ICU between June 20, 2024, and November 25, 2024, were analyzed. Patients who were admitted directly from the ED to the ICU were included in the study.

The inclusion criteria were as follows: Adults over the age of 18 who were admitted directly to the ICU from the ED were included. Patients under 18 years of age, those transferred from other facilities, patients requiring postoperative IC, patients admitted to our clinic due to a need for IC from other departments, and patients transferred from other ICUs were excluded from our study.

Data Collection and Analysis

The patients admitted to the ICU from the ED between June 20, 2024, and November 25, 2024, were examined, and demographic and clinical data were collected and analyzed.

Statistical Analysis

The obtained data were analyzed using the SPSS software program. Descriptive statistics included frequencies and percentage distributions.

RESULTS

Between June 20 and November 25, 2024, a total of 158.000 patients from all departments presented to the ED, of which 242 critical patients were admitted to the 9-bed ICU. Among these, 21 patients were prospectively evaluated.

The most common complaints among patients admitted to the ICU from the ED were respiratory distress [34/242 (14%)], respiratory distress with altered general condition [7/242 (2.9%)], cardiac arrest [11/242 (4.5%)], gastrointestinal bleeding [11/242 (4.5%)], acute ischemic heart disease [11/242 (4.5%)], acute decompensated heart failure [6/242 (2.5%)], altered consciousness [15/242 (5.2%)], stroke [2/242 (0.8%)], dyspnea [7/242 (2.9%)], falls [6/242 (2.5%)], postoperative femur fracture [7/242 (2.9%)], and other causes [125/242 (52.8%)].

Of the admitted patients, 61 (25.2%) had no comorbidities, while 181 (74.8%) had at least one underlying condition. The most common comorbidities were hypertension [107/242 (42.2%)], type 2 diabetes mellitus [64/242 (26.6%)], chronic obstructive pulmonary disease (COPD) [30/242 (12.4%)], chronic kidney disease [27/242 (11.2%)], neurological disorders (Alzheimer's, dementia, epilepsy, Parkinson's disease, cerebrovascular accident) [50/242 (20.7%)], and coronary artery disease [46/242 (19%)].

Among these patients, 104 (43%) were female and 138 (57%) were male, with a mean age of 62.29±21.61 years. Patients with missed diagnoses had a mean age of 54.29±16.77 years (range: 24–78), with 11/21 (52.4%) male and 10/21 (47.6%) female.

The most frequent admission diagnoses were traffic accidents [8/21 (38.1%)], respiratory distress [6/21 (28.6%)], and other causes [7/21 (33.3%)], including abdominal pain (1), simple fall (1), gastrointestinal bleeding (1), cardiac arrest (1), liver disease (1), postoperative cesarean preeclampsia (1), and snake bite (1).

Table 1, 2 provide details on initial ICU admission diagnoses and general patient analysis.

Table 1. Patients' initial admission diagnoses to the intensive care unit

Admission diagnosis	Frequency	Percentage
Acute renal failure	1	4.8
Fall	1	4.8
Gastrointestinal bleeding	1	4.8
Ischemic heart disease	1	4.8
Liver disease	1	4.8
Postoperative cesarean preeclampsia	1	4.8
Respiratory distress	6	28.6
Traffic accident	8	38.1
Snake bite	1	4.8
Total	21	100

Percentage: %

Table 2. The general analysis of 21 patients evaluated in intensive care

Patient	Gender	Age	Reason for admission	Pre-existing conditions	Reason for ICU	Examination and imaging methods	Missed diagnosis (new diagnosis)	Procedure (treatment)
1	Male	42	Abdominal pain	None	Gastrointestinal bleeding	Abdominal ultrasound suspicious lesion	CT scan showed widespread mass	Further investigation and treatment were performed
2	Female	67	Nausea, vomiting, abdominal pain	Hypertension, diabetes mellitus	Acute kidney failure	Ultrasound showed full bladder	Catheter obstructed	Catheter irrigated
3	Female	65	Shortness of breath	Chronic kidney disease	Respiratory distress	Ultrasound showed full bladder	Catheter clamped	Clamp opened
4	Female	66	Shortness of breath, confusion	Hypertension, chronic obstructive pulmonary disease	Respiratory distress	Ultrasound showed full bladder	Catheter obstructed	Catheter replaced
5	Male	76	Fever, shortness of breath	Chronic kidney disease, chronic obstructive pulmonary disease	Respiratory distress	Ultrasound showed full bladder	Catheter obstructed	Catheter irrigated
6	Male	71	Shortness of breath, general weakness	Hypertension, diabetes mellitus	Respiratory distress	Ultrasound showed full bladder	No catheter	Urinary catheter inserted
7	Male	42	Road traffic accident	None	Road traffic accident	Tenderness in wrist	Direct radiograph showed radius fracture	Immobilized in a splint
8	Male	58	Snake bite	None	Snake bite	Wound on face	CT scan showed sphenoid fracture	Consulted with relevant specialist
9	Male	24	Shortness of breath, fever	None	Respiratory distress	Ultrasound showed pneumothorax	Confirmed by direct radiograph	Chest tube inserted
10	Female	37	Road traffic accident	None	Road traffic accident	Tenderness in wrist	Direct radiograph showed radius fracture	Immobilized in a splint
11	Male	28	Road traffic accident	None	Road traffic accident	Tenderness in hand	Direct radiograph showed finger fracture	Immobilized in a splint
12	Male	62	Road traffic accident	Hypertension, chronic obstructive pulmonary disease	Road traffic accident	Tenderness in foot	Direct radiograph showed fibula fracture	Immobilized in a splint
13	Male	41	Road traffic accident	Hypertension, diabetes mellitus	Road traffic accident	Swelling in toe	Toe fracture	Immobilized in a splint
14	Female	78	Shortness of breath, loss of appetite	Hypertension, diabetes mellitus	Respiratory distress, pneumonia	Pleural effusion, effusion: 20-25%	Patient was fluid overloaded and had abdominal pain	Fluid overload reduced
15	Female	34	Hypertension, pregnancy	Hypertension	Postoperative cesarean pre-eklampsia	Drug allergy	Incorrect drug identified	Drug changed
16	Female	72	Respiratory distress	Hypertension, diabetes mellitus, chronic kidney disease	Liver cirrhosis	Cardiac echo showed low EF, pleural effusion	Consulted with cardiology	Heart failure diagnosis
17	Male	75	Chest pain, loss of consciousness	Hypertension, chronic kidney disease	Ischemic heart disease+ chronic kidney disease	Substance use	Withdrawal syndrome	Consulted with psychiatry
18	Female	52	Road traffic accident	Hypertension	Road traffic accident	Back pain	CT scan showed T8 fracture	Steel corset applied
19	Female	38	Road traffic accident	None	Road traffic accident	Tenderness in forearm	Direct radiograph showed radius fracture	Immobilized in a splint
20	Female	54	Fall	None	Fall	Ultrasound showed fluid in abdomen	Splenic laceration	Followed up
21	Male	58	Road traffic accident	None	Road traffic accident	Swelling in nose	Nasal fracture	Treated by ENT department

CT: Computed tomography, ICU: Intensive care unit

The bedside ultrasonography (USG) results and treatments applied to the two evaluated sample patients are shown in **Figure 1, 2.**

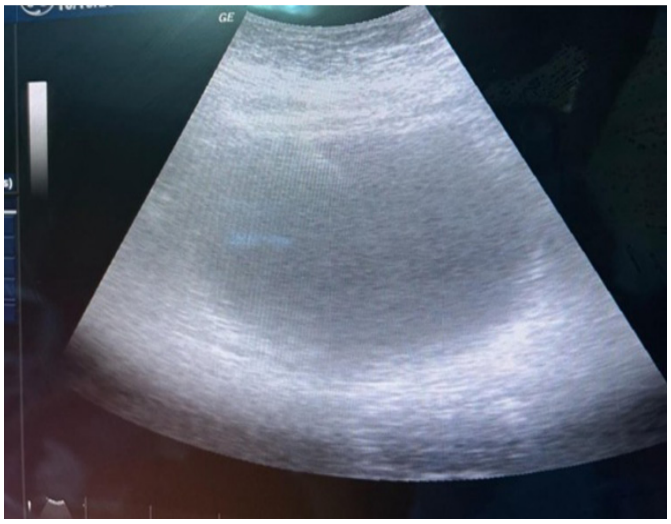

Figure 1. Female patient presenting to the emergency department due to respiratory failure

Figure 2. Male patient presenting to the emergency department due to respiratory distress

In one case, bedside ultrasound revealed a full bladder. The catheter was found to be blocked, and after flushing, 800 cc of urine was drained, leading to an improvement in respiratory distress and the discontinuation of diuretic therapy.

In another case, a patient admitted with pneumonia was diagnosed with pneumothorax via ultrasound. After a thoracic surgery consultation, a chest tube was placed, significantly improving respiratory status.

DISCUSSION

This study, which examined patients transferred from the ED to the ICU, identified missed diagnoses in 21 out of 242 patients (8.677%). In alignment with the literature, the rate of missed diagnoses in critically ill patients ranges between 8% and 10%, reaching up to 65% in complex cases.[11,12] Our findings are consistent with these reports, emphasizing the critical importance of early diagnosis and comprehensive patient assessment.

According to the 2011 World Health Organization (WHO) statistics, the number of physicians per 1.000 people was 2.7 in the United States, 2.1 in the United Kingdom, and 1.5 in Turkey, with a global average of 3.0. The increasing number of patients in EDs, combined with a shortage of qualified healthcare professionals, has led to a disproportionate physician-to-patient ratio. Consequently, the time allocated for thorough patient evaluation has significantly decreased, affecting the quality of emergency care.[4]

The misuse of ED services, an increase in ED visits, and a shortage of hospital beds contribute to ED and ICU overcrowding.[13,14] Delays in laboratory and radiology results, prolonged consultation times, and staff shortages further exacerbate this situation. Additionally, the growing population of critically ill patients, rising life expectancy, and an increase in comorbid diseases have led to prolonged hospital and ICU stays. Delayed diagnosis and misdiagnosis in the ED significantly increase mortality and morbidity rates.[15] Studies have demonstrated that ED overcrowding negatively impacts patient assessment, with delayed laboratory and radiological evaluations, prolonged consultations, and staff shortages hindering the timely diagnosis and management of critically ill patients.[15-17]

According to data from the National hospital ambulatory medical care survey (NHAMCS) in the United States, the average age of patients requiring ICU admission has been increasing over the years.[18] Aging is associated with an increased prevalence of chronic diseases, leading to higher rates of hospital admissions, including ICU stays.[19] In our study, the mean age of patients admitted to the ICU was 62 years, with a mean age of 66 years for females and 59 years for males, consistent with both national and global data. The aging population and the rising prevalence of chronic diseases continue to increase ICU admission rates.[17,19]

Recognizing the severity of illness early and ensuring optimal medical care for patients admitted directly to the ICU may contribute to reduced mortality rates. Some studies suggest that interventions before ICU admission are the most effective means of reducing ICU mortality, as once the underlying pathology becomes too severe or irreversible, ICU interventions may have limited impact on outcomes.[20] Based on this principle, our study incorporated detailed anamnesis, additional diagnostic tests, and imaging techniques to identify potentially missed diagnoses. As a result, 21 missed diagnoses were identified, corresponding to an 8.677% rate, which aligns with findings reported in the literature.

Among ICU admissions, the most common patient groups include trauma patients and those presenting with respiratory distress. In a study conducted in France by Fassier et al.[21], the most frequent reason for ICU admission was respiratory diseases, particularly acute pulmonary edema. Similarly, Flaatten et al.[22] reported that respiratory failure was the leading cause of ICU admission in patients aged 80 years and older. In our study, respiratory distress was the most common complaint among patients transferred from the ED to the ICU (34/242, 14%). Among the 21 missed diagnoses, respiratory distress was present in six patients (6/21, 28.6%).

Extremity injuries, fractures, and dislocations are among the most frequently overlooked diagnoses in the ED.[23-26] A study conducted in Finland reported that ICU admission due to trauma was more common in males than in females.[27] Diagnostic errors in the ED are predominantly related to fractures and/or dislocations (69%), making missed fractures a leading cause of malpractice claims in emergency medicine. According to the literature, musculoskeletal injuries are the most frequently missed diagnoses.[28,29] Guly, in a study analyzing 953 diagnostic cases, reported that the most frequently missed diagnoses involved hand and wrist injuries, followed by ankle fractures.[30] In our study, 8 out of the 21 missed diagnoses were related to traffic accidents, including 3 cases of radius fractures, 2 finger fractures, 1 fibula fracture, 1 T8 vertebral fracture, and 1 nasal fracture.

Early imaging techniques can facilitate rapid diagnosis and timely initiation of appropriate treatment for critically ill patients transferred from the ED to the ICU. Bedside USG and echocardiography play a crucial role in assessing hemodynamic status, enabling early diagnosis, and managing hemodynamically unstable patients.[7] Bedside echocardiography is particularly valuable in reducing complications during the transport of unstable patients.[9,10] In our study, two patients admitted to the ICU with liver cirrhosis and pneumonia were found to have reduced ejection fractions and pleural effusion using bedside echocardiography. Following cardiology consultation, appropriate fluid management was implemented, thereby preventing complications related to fluid overload.

The implementation of non-invasive bedside imaging techniques not only enhances diagnostic accuracy but also plays a pivotal role in patient management. USG is especially effective in detecting structural abnormalities within the chest wall and pleural lesions.[31] In our study, bedside USG enabled the early detection of pneumothorax in a patient admitted to the ICU with pneumonia. A prompt intervention following consultation with a specialist emphasized the significance of these imaging techniques in patient management. If the pneumothorax had been missed, the patient could have faced a life-threatening condition. In alignment with our findings, the literature supports the efficacy of bedside USG in diagnosing pneumonia, pleural effusion, and pneumothorax, as well as in reducing the risks associated with transporting hemodynamically unstable patients.[9,10,31]

Furthermore, in four patients admitted to the ICU with respiratory distress, bedside USG revealed full bladders due to low urine output. Three of these patients had blocked catheters, one had a clamped catheter, and one did not have a catheter inserted. Following catheterization or correction of catheter-related issues, the patients experienced symptomatic relief and a reduction in oxygen requirements.

A multicenter study in Spain on ICU admissions from EDs found that the most common comorbidities were hypertension, respiratory diseases, and diabetes mellitus. Differences in population demographics and lifestyle factors may account for variations in comorbidity patterns.[32] Our findings regarding patient comorbidities align with those reported by García-Gigorro et al.[32]

Limitations

Our study was conducted over a five-month period, and data were collected from 242 patients. The sample size is relatively small, which may limit the generalizability of our findings. In future studies, larger patient populations will be analyzed to further contribute to the existing literature.

CONCLUSION

A detailed evaluation of patients in the ED, along with the strategic use of early imaging techniques, improves diagnostic accuracy and accelerates the transition to the ICU. As emphasized in the literature, early diagnosis and timely intervention are critical in reducing mortality and morbidity rates. Our study highlights the importance of laboratory testing and imaging in critically ill patients requiring ICU admission. Non-invasive bedside imaging techniques serve as indispensable tools for enhancing diagnostic precision and improving treatment outcomes in the ICU. To enhance the quality of emergency care, it is essential to optimize resource allocation, increase personnel support, and expand the use of bedside USG.

ETHICAL DECLARATIONS

Ethics Committee Approval

The study was conducted with the permission of Mardin Artuklu University Non-interventional Clinical Researches Ethics Committee (Date: 11.06.2024, Decision No: 2024/6-1).

Informed Consent

All patients signed and free and informed consent form.

Referee Evaluation Process

Externally peer-reviewed.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

Financial Disclosure

The authors declared that this study has received no financial support.

Author Contributions

All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

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