



Point of Care Ultrasound in Geriatric Patients at the Emergency Department

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Abstract

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BACKGROUND: Point of care ultrasound (POCUS) plays an important role as a crucial tool for the diagnosis of various conditions in emergency and critical ill patients. However, POCUS examination in elderly populations has not been well studied.

AIM: This was a retrospective observational study of elderly patients at the Department of Emergency Medicine who had received POCUS examination at a tertiary university hospital, Thailand.

METHODS: The study was conducted throughout January 2020–December 2020. Patients' characteristics and ultrasonography findings were recorded.

RESULTS: A total of 191 elderly patients were evaluated. Median patient age was 75.65 years; 56.02% of patients were female. Chief complaints where POCUS scans were applied were respiratory (36.65%) and cardiovascular system-related (21.99%). The most frequent procedures performed were cardiac, lung, and inferior vena cava examinations. Abnormal ultrasound findings were discovered in 133 patients (68.91%). The 66.17% of abnormal ultrasound findings were associated with final diagnosis. The admission rate of elderly patients (56.82%) was highest among patients with positive ultrasound findings associated with final diagnosis.

CONCLUSIONS: POCUS utilization in elderly patients was useful in aiding emergency physicians amid diagnosis of various diseases, especially life-threatening ones.

Introduction

Nowadays, more than half of 75-year-olds have had at least one visit to an emergency department [1] in the United States. Statistics showed that elderly patients made up 10–20% of the emergency population [2], [3]. In Thailand, 6.6% of overall patients who attended the ED were aged more than 65 years [4]. As demographics have changed, people are living longer. Hence, the number of elderly persons has increased [5]. The healthcare system should be prepared to take care of these people as the medical care required is of greater sophistication. A survey revealed that over 45% of emergency physicians have been faced with greater difficulty in the management of elderly patients compared with younger patients [6].

Point of care ultrasound (POCUS) is essential in the care of patients at the emergency department [7]. It can be used to improve diagnosis, perform procedures, rapidly assess patients in the emergency department, and improve patient outcomes [8], [9], [10], [11]. POCUS is being applied more widely in emergency patients and critically ill patients – including the elderly population [12].

Previous ultrasound studies have examined selected groups of elderly patients such as those exhibiting life-threatening conditions such as aortic dissection [13], acute myocardial infarction [14], and abdominal aorta aneurysm [15]. Ultrasound findings in elderly patients in undifferentiated medical conditions in the Emergency Department have never been documented. Hence, the present study aimed to determine POCUS findings in the geriatric population who came to visit the Accident and Emergency Department of Srinagarind Hospital, Faculty of Medicine, Khon Kaen University.

Methods

Study design

This was a retrospective, single-centered, and observational study at a tertiary university hospital in Thailand. Ethical approval was provided by the Khon Kaen University Ethics Committee for Human Research and registered with the Thai Clinical Trials Registry (HE641197).

Sample size

We included patients aged ≥ 65 years who had received POCUS and had ultrasound video clips and images recorded by the ultrasound machine at the emergency department throughout January 2020–December 2020. Patients with no ultrasound documents were excluded from the study. The sample size for the analysis of the estimated sample size was determined. Prevalence was 0.854 [16]. Standard normal value was 1.96. Power analysis was determined using an alpha of 0.05 and absolute precision was 0.05. This resulted in an estimated desired effect sample size of at least 191 subjects.

Study protocol

The study was performed throughout January 2020–December 2020. We collected data from patients aged ≥ 65 years who visited the emergency department and completed POCUS examination with convenience sampling. Ultrasound was performed by emergency medicine residents and the attending physician. Data collected for the present study included ultrasound findings from video clips and images recorded using the ultrasound machine at the emergency department, as well as patients' characteristics, final diagnosis, and patients' disposition. This study was conducted with a standard ultrasound machine (Mindray M9) which we used at the emergency department. All ultrasound video clips and images were reviewed by the emergency ultrasound expert. If ultrasound findings and final diagnosis were the same, the ultrasound finding was considered as associated with the final diagnosis. The primary outcome of this study aimed to determine the ultrasound findings of elderly patients who visited the emergency department.

Statistical analysis

The authors employed means and standard deviations to describe continuous variables. Counts and percentages were applied for categorical variables. All statistical analyses were performed using the software Stata version 10.1 (Stata Corp, College Drive, TX, USA). Statistical significance was defined as a two-sided p-value of 0.05 or less.

Results

From January to December 2020, this study included 191 patients (Table 1). Median age was 75.65 ± 7.68 years and 56.02% were female. All patients in this study were non-trauma patients. Most patients exhibited triage at level 2 (36.6%) and 3 (39.79%) according to the emergency severity index triage system index (ESI). The most common chief complaint was associated with the respiratory system (36.65%). Most patients had the ultrasound performed at their

Table 1: Patients' characteristics

Patient characteristics (n = 191)	Number
Sex	
Female, n (%)	107 (56.02)
Age	
Mean \pm SD	75.65 \pm 7.68
Patient type	
Non-trauma, n (%)	191 (100)
Triage level, n (%)	
ESI level 1	5 (2.61)
ESI level 2	70 (36.6)
ESI level 3	76 (39.79)
ESI level 4	40 (20.94)
ESI level 5	0
Chief complaint, n (%)	
Respiratory system	70 (36.65)
Cardiovascular system	42 (21.99)
Immunology system	37 (19.37)
Gastrointestinal system	25 (13.09)
Neurology system	11 (5.76)
Hepatobiliary system	3 (1.57)
Kidney and urinary bladder system	2 (1.05)
Bone and musculoskeletal system	1 (0.52)
Area of ultrasound examination, n (%)	
Cardiac	151 (79.06)
Lung	78 (40.84)
Inferior vena cava	53 (27.75)
Abdomen (liver, gall bladder)	21 (10.99)
Abdominal aorta	7 (3.67)
Kidney and urinary bladder	5 (2.62)
Femoral vein	5 (2.62)
Skin and soft tissue	4 (2.09)
Abnormal findings amid POCUS examination, n (%)	133 (68.91)

POCUS: Point of care ultrasound.

cardiac region (78.53%) followed by the lung region (40.3%). Accordingly, most patients received ultrasound in more than one area. Most ultrasound examinations combined cardiac, lung, and inferior vena cava imaging. This study revealed abnormal ultrasound findings in 133 patients (68.91%).

This study revealed 88 patients with abnormal ultrasound findings which were associated with the final diagnosis (66.17%) (Table 2).

Table 2: Ultrasound findings associated with final diagnosis categorized by disease (n = 88)

Final diagnosis	Abnormal ultrasound findings, n (%)
Pneumonia	24 (27.27)
Heart failure	18 (20.45)
Myocardial infarction	14 (15.91)
Hypovolemia	10 (11.36)
Acute cholangitis	4 (4.55)
Urinary tract infection with obstructive uropathy	4 (4.55)
Cardiac arrest	4 (4.55)
Gall stone	2 (2.27)
Cellulitis	2 (2.27)
Pericardial effusion	1 (1.14)
Liver mass	1 (1.14)
Renal abscess	1 (1.14)
Necrotizing fasciitis	1 (1.14)
Abdominal aortic aneurysm	1 (1.14)
Aortic dissection	1 (1.14)

Besides that, the disposition of patients presenting abnormal ultrasound findings associated with the final diagnosis was shown as admitted to hospital (50/88, 56.82%), discharged from the emergency room (18/88, 20.45%), referred to another hospital (14/88, 15.91%), and death (4/88, 4.55%).

Discussion

The present study described 191 elderly patients who underwent POCUS examination at the

emergency department. Moreover, the present study was comprised predominantly of females which was comparable to prior studies [2], [4]. All patients in this study were non-trauma patients, which was a contrast to other studies [2], [3] that indicated 20–30% of elderly patients as trauma patients. The most common injury type was falls. However, this may be explained by the fact that most patients in our ER were non-trauma patients (80%). Overall, 79% patients who had undergone POCUS were triaged as urgent, emergency, and critical level, which was consistent with a study by Latham *et al.* [2]. In the author's opinion, most elderly patients had a lot of comorbid diseases which were of greater severity than in other age groups [17]; thus, these patients were triaged as a higher level and required greater complexity of investigation such as POCUS examination. The most common chief complaint in this study was categorized as respiratory system related, which was consistent with other studies [2], [4], [18]. A study by Fröhlich *et al.* demonstrated that the main indication for the ultrasound examinations was dyspnea (44.6%). Our study revealed that most ultrasound areas of examination were in the cardiac and lung regions, which was congruent with a prior study [12]. Nevertheless, that study reported the area of ultrasound examination in critically ill patients, that is, a different population.

Our study revealed abnormal ultrasound findings at the rate of 68.91%. Moreover, patients with abnormal ultrasound findings accounted for 66.17% which was associated with the final diagnosis. Nevertheless, our study stated a lower rate than a previous study which reported that 85.42% of scans provided useful information in confirming or refuting a suspected diagnosis [16]. The present study detected various life-threatening conditions in elderly patients which was similar to a previous study [19], including pneumonia (27.27%), heart failure (20.45%), and myocardial infarction (15.91%) [20]. Furthermore, the POCUS examination detected vascular emergency conditions, including abdominal aortic aneurysm and aortic dissection [21] despite there being a small number of subjects in this study. In terms of musculoskeletal and obstetrics and gynecology examination, our emergency physicians were not familiar with these examinations due to our ultrasound curriculum. Thus, there were no POCUS examinations of these types in this study. However, POCUS examination to diagnose musculoskeletal-related injuries was reported as a potentially useful tool in elderly patients [22].

The strengths of this study were: (1) The study findings demonstrated the impact of applying POCUS in the elderly population at the Emergency Department. Our study revealed greater than 60% of POCUS findings which were useful to produce evidence of final diagnosis. Limitations of the study were first, due to the nature of the retrospective study, some data were missing or incomplete [23], [24], [25], [26].

Second, the setting of the present study was in a tertiary university hospital, which may exhibit different patterns of patients to primary or secondary care hospitals. The last limitation was, we reported solely on the relationship between POCUS findings and final diagnosis/dispositions, thus, the results of this study cannot be evaluated for diagnostic accuracy amid POCUS examination.

Conclusion

POCUS utilization in elderly patients was applicable. POCUS allows for sufficient information to aid the clinical diagnosis of emergency physicians. In addition, POCUS can be employed to identify life-threatening conditions. Further research is warranted to clarify diagnostic accuracy in certain diseases in the elderly population.

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