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A Study on the Knowledge and Confidence Levels of House Officers in Performing Focused Assessment with Sonography in Trauma

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ABSTRACT

Focused Assessment with Sonography in Trauma (FAST) is a quick, cost-effective, and radiation-free diagnostic tool widely used in trauma care by emergency physicians and surgeons. Although it is operator-dependent, studies show that non-radiologist physicians can perform FAST with accuracy comparable to trained radiologists. Hence, there is a need to measure the knowledge and confidence levels of house officers in performing FAST pre-, immediately after, and four weeks post-workshop. A total of 41 house officers participated in this prospective cohort study. The participants were instructed to take similar questionnaires consisting of three domains: sociodemographics, knowledge, and confidence pre-, immediately after, and four weeks post-workshop. Knowledge was measured based on total scores, while confidence was measured using a Likert scale. Overall, 80.5% of the participants were in their second year of training, with the majority of them having not attended any ultrasound course before this study (97.6%). The total knowledge score showed a significant increment from pre-workshop to immediately after the workshop, with $p < 0.001$. Respondents' confidence levels significantly improved in controlling the ultrasound machine and detecting free fluid over time ($p < 0.001$), but had consistent results from immediately after the workshop to four weeks post-workshop. We concluded that a short-course FAST workshop can help house officers enhance their knowledge and confidence levels in performing FAST. The combination of theoretical and practical sessions is a feasible curriculum to be integrated into their training.

Keywords: *FAST, House officers, Workshop, Knowledge retainment, Curriculum*

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INTRODUCTION

Focused Assessment with Sonography in Trauma (FAST) serves as a rapid, cost-effective, radiation-free, and easily accessible diagnostic tool within trauma care. It has gained widespread adoption among emergency physicians (EPs) and surgeons. FAST involves the identification of free fluid, typically blood, through four fundamental sonographic views: pericardial, perihepatic, perisplenic, and pelvic (1).

FAST, when conducted in the Emergency Department (ED), provides vital information within a short period of time. The Advanced Trauma Life Support (ATLS) protocol outlines FAST as one of the main adjuncts, following the primary survey. This foundational step guides urgent decisions regarding the patient's ongoing evaluation and management (2). FAST relies on the operator's skill in ensuring the precise interpretation of ultrasound imaging. Numerous studies have demonstrated that non-radiologist physicians can conduct FAST examinations with comparable accuracy to professionally trained radiologists (3, 4).

A study conducted by Zawadka et al. (5) evaluated the effectiveness of a one-day Point-of-Care Ultrasonography (POCUS) course on diagnostic proficiency and confidence levels of final-year medical students. The findings showed a significant improvement, with pre-training and post-training test scores increasing from 41.78% to 58.13%. The post-training assessment also showed a substantial boost in student confidence. Similarly, a pilot study conducted at Queen's University demonstrated a notable enhancement and sustained retention of FAST knowledge. This improvement was achieved through a combination of a one-hour online instructional video and a two-hour hands-on session. However, this confidence level declined four months later, averaging at 3 ± 1.2 ($p < 0.005$) (6).

According to a study by Ang et al. (7), there was a significant improvement in ultrasound knowledge, with the median score increasing from 14.0 on the pre-test to 23.0 on the post-test ($p < 0.001$). Similarly, Connolly et al. (8) concluded that clinical knowledge improved with an ultrasound symposium. Subsequently, there was an increment in confidence levels across all aspects of performing FAST, as reported by Crouch et al. (9).

Assessing knowledge retention is crucial for improving patient care outcomes. A study by Kaltenmeier et al. (10) showed a significant increment in the knowledge of nursing providers on nasogastric tube handling after an educational session, with retention of this knowledge over a four-week period. This study contributes to the field of medical education research by assessing the effectiveness of a short-duration, structured FAST workshop in enhancing both knowledge and confidence among house officers. While previous research has primarily focused on FAST training for medical students and residents, there remains a paucity of literature examining its impact at the house officer level—a cohort at the frontline of acute patient care. Furthermore, this study examines the retention of knowledge and confidence over four week, an aspect that remains underexplored in existing literature. Thus, the main goals of this study were to determine the levels of knowledge and confidence among house officers in performing FAST pre-, immediately after, and four weeks post-workshop.

METHODS

Study Design

This was a prospective cohort study, conducted at a single centre, Hospital Pakar Universiti Sains Malaysia (HPUSM), Kubang Kerian, Kelantan. It involved house officers undergoing their two-year compulsory service at HPUSM who volunteered to participate in this study.

Study Criteria

An invitation via an advertisement poster was forwarded to all house officers at HPUSM across seven departments (internal medicine, surgery, orthopaedics, paediatrics, anaesthesiology, family medicine, and emergency medicine). House officers who consented to participate in the research received instructions via email on the next steps, whereas those who refused participation at any stage were excluded from this study. A sample of 40 respondents was taken using a two-correlated proportion formula. A 40% proportion of confidence levels among house officers and an expected difference of 0.18 were included in the sample size calculation, as derived from a study by Ang et al. (7).

Research Tool

The questionnaires were retrieved from a thesis by Dr. Mohamed Abdallah Mohamed Ahmed and reviewed by the USM Emergency and Critical Care Ultrasound Unit Committee (11). Internal consistency reliability testing was conducted using statistical analysis, and the Cronbach's alpha score was 0.7 for the knowledge domain and 0.9 for the confidence domain.

The questionnaires consisted of three domains:

a. Sociodemographic domain: Age, gender, working experience, and previous attendance at ultrasound courses.
b. Knowledge domain: Assessment of knowledge about basic physics and knobology, abdominal anatomy, and FAST scan using either multiple choice questions (MCQs) or interpretation of printed ultrasound images. The total score was 23.
c. Assessment of participants' confidence levels using a 5-point Likert scale and a closed-ended question on ways to improve participants' ultrasonography skills.

The knowledge level was interpreted based on the total score obtained by participants for each item in the assessment. For knowledge items, they were presented as either true or false, with an additional 'don't know' option. Incorrect or uncertain (don't know) responses were scored as zero, and correct answers were scored as one. The total score ranged from zero to 23, with higher scores indicating better knowledge. The confidence level was interpreted into two categories: confident (participants who were 'strongly agree' and 'agree') and not confident (participants who were 'strongly disagree', 'disagree', and 'neutral').

Study Protocol

The ultrasound workshop consisted of two parts, in which participants received 2 hours and 45 minutes of training, which consisted of a 45-minute lecture and a 2-hour practical session. Participants were required to complete assessment tests pre-, immediately after, and four weeks post-workshop. Each assessment had to be completed within 25 minutes. We enrolled house officers from various departments in the university hospitals. The training duration was determined based on a literature review and actual FAST courses (6, 7).

All the participants went through lectures and hands-on sessions. Before the theoretical teaching, they were required to sit for the pre-assessment test. The lecture session was given by an emergency resident credentialed in POCUS. The lecture was delivered within 45 minutes. The lecture materials were provided by the USM Emergency and Critical Care Ultrasound Unit. After the lecture, participants proceeded with the practical session. It was held in a 1:5 ratio of instructors to learners, with four scanning stations, human models, and emergency residents with credentials as instructors (based on common practice by the USM Emergency and Critical Care Ultrasound Unit). All the participants were required to complete the same questionnaire immediately after the workshop and were then allowed to go home. The participants retook the same questionnaire four weeks after the workshop via Google Forms. They were required to fill out the questionnaire within the given time. Google Forms was chosen in view of the challenge of gathering 40 house officers at the same time. Participants were advised not to refer to books or the internet while answering the questionnaire (12).

Comparison of the knowledge differences between three sets of normally distributed numerical data within the same group was analysed using the repeated measures ANOVA. While confidence level differences were analysed using Cochran's Q test.

RESULTS

Demographic Details

The total number of respondents in this study was 41 house officers who completed their two-year compulsory service at HPUSM, Kubang Kerian, Kelantan. They were voluntarily recruited for this study, which involved 13 males and 28 females. The average age of the respondents was 26.9 years and 80.5% of them were in their second year of training as house officers. The majority (97.6%) of them had not attended any ultrasound course before this study (Table 1).

Table 1: Sociodemographic of respondents (n = 41)

Variables	Mean (SD)	n (%)
Age	26.9 (1.01)	
Gender		
Male		13 (31.7)
Female		28 (68.3)

(*Continued on next page*)

Table 1: (*Continued*)

Variables	Mean (SD)	n (%)
Working experience		
< 1 year		8 (19.5)
> 1 year		33 (80.5)
Have you attended any ultrasound courses before?		
Yes		1 (2.4)
No		40 (97.6)

Notes: SD = standard deviation, n = frequency

Knowledge Levels of Respondents

Respondents' levels of knowledge regarding FAST are presented in Table 2. The total score of knowledge was significantly different over time. The mean total score for four weeks post-workshop showed an increment compared to pre-workshop. Knowledge was divided into two sections: ultrasound and image interpretation. Both sections showed a significant difference over time ($p < 0.001$).

Table 2: Questionnaire scores (total and sub-total of knowledge) pre- and post-workshop (n = 41)

Item	Pre-workshop	Immediately after the workshop	4 weeks post-workshop	*p*-value*
Total score	10.8 (3.90)	17.0 (2.77)	17.2 (2.80)	< 0.001
Ultrasound knowledge	4.0 (1.67)	5.5 (1.25)	5.7 (1.26)	< 0.001
Image interpretations	6.8 (3.20)	11.5 (2.04)	11.6 (2.15)	< 0.001

Note: *Repeated measure ANOVA test

Confidence Levels of Respondents

Table 3 presents the confidence levels of respondents in performing FAST. A few items in this section were used to evaluate the confidence level of house officers. One of the items, which was controlling the knobs on the ultrasound device, showed an improvement from 9.8% to 43.9% after attending the workshop, but slightly decreased four weeks post-workshop. Respondents' confidence level in detecting free fluid at the splenorenal area was the highest at four weeks post-workshop, as compared to immediately after and pre-workshop ($p < 0.001$).

Table 3: Confidence levels pre- and post-workshop (n = 41)

Item	Pre-workshop	Immediately after the workshop	4 weeks post-workshop	*p*-value*
Controlling knobs on the ultrasound device				
Confident	4 (9.8)	18 (43.9)	17 (41.5)	< 0.001
Not confident	37 (90.2)	23 (56.1)	24 (58.5)	

(*Continued on next page*)

Table 3: (*Continued*)

Item	Pre-workshop	Immediately after the workshop	4 weeks post-workshop	*p*-value*
Detecting pericardial effusion				
Confident	1 (2.4)	18 (43.9)	14 (34.1)	< 0.001
Not confident	40 (97.6)	23 (56.1)	27 (65.9)	
Detecting free fluid in the Morrison's pouch				
Confident	2 (4.9)	26 (63.4)	26 (63.4)	< 0.001
Not confident	39 (95.1)	15 (36.6)	15 (36.6)	
Detecting free fluid at the splenorenal				
Confident	2 (4.9)	22 (53.7)	24 (58.5)	< 0.001
Not confident	39 (95.1)	19 (46.3)	17 (41.5)	
Detecting free fluid in the pelvis				
Confident	1 (2.4)	22 (53.7)	20 (48.8)	< 0.001
Not confident	40 (97.6)	19 (46.3)	21 (51.2)	

Note: *Cochran's Q test

DISCUSSION

FAST is widely used in hospital settings today to help physicians rule in intra-abdominal bleeding rather than exclude it. It has no radiation and can be performed repetitively at low cost, and carries fewer complications without any contraindications. It has a high specificity of 95% to 100% and a moderate sensitivity between 69% and 98%. Sensitivity increases with repeated FAST exams when the first examination shows negative findings. FAST is likely capable of detecting as little as 250 ml of free fluid in the Morrison pouch. It is intended to complement clinical assessment, not replace it. Even though it is not a standard diagnostic tool like computed tomography (CT) in diagnosing intra-abdominal injury, it helps expedite patient management and disposition. Hence, there is a need for physicians to acquire the skill to perform FAST (13).

Our study population consisted of house officers from various departments. House officers, as early-career medical practitioners, undergo a two-year internship (housemanship) to develop essential clinical competencies. Given their frontline role in patient care, proficiency in FAST is crucial for effective trauma assessment. However, structured ultrasound training is often lacking at this level, highlighting the need for targeted educational interventions (14).

Based on the demographic data, majority of the participants had not attended an ultrasound course before enrolling in this study. Studies by Prosch et al. (15) and Teichgräber et al. (16) found that only 17% of universities in Europe and 62% medical schools in the USA incorporated ultrasonography teaching in their curriculum, while only 19% prioritised it. In Malaysia, to our knowledge, no study has been conducted to evaluate the number of such incorporations. To date, no structured ultrasonography curriculum has been integrated into HO training, primarily due to time constraints, inadequate equipment, and limited funding.

The results showed a significant increase ($p < 0.001$) in participants' knowledge immediately after the workshop. The majority of the participants were able to retain their knowledge four weeks post-workshop. These data are supported by multiple studies (13, 17, 18) that demonstrated improvements in post-test knowledge following educational interventions.

The most interesting aspect is that each study used a different time frame for training. For example, Blackstock et al. (17) implemented a four-week formal curriculum course for participants, a combination of web-based and hands-on teaching methods. In contrast, Shokoohi et al. (18) divided participants into two phases. Phase 1 consisted of 45 minutes of didactic presentations and a one-hour practical session using a normal model, followed by Phase 2, where participants performed the FAST examination at the bedside under expert supervision. Our study designed a workshop with a 45-minute lecture and a two-hour hands-on session. Despite these varying time frames, the results of these studies did not differ. Therefore, requiring less time to improve participants' knowledge appears to be advantageous.

Participants' confidence in controlling the ultrasound device increased from 9.8% to 43.9%, following the FAST workshop. Moreover, after the educational intervention, participants felt more assured in detecting free fluid in all views, with a p-value of < 0.001. The absence of formal ultrasound training results in low confidence levels among medical practitioners in performing FAST, making this lack of confidence a key factor in the infrequent daily use of FAST (19). An introduction to hands-on and labour-intensive projects for second-year medical students in the Procedural Skills Lab (PSL), including performing FAST, has been shown to boost their confidence levels both pre- and post-participation, thus supporting our data (20).

The majority of the participants retained their knowledge and confidence levels within four weeks post-FAST workshop. However, skills such as controlling the ultrasound device and detecting free fluid in the pericardial and pelvic region declined after four weeks. Hence, there is a need to discuss strategies for sustaining skills over time. These include implementing follow-up training sessions at regular intervals, incorporating simulation-based practice, encouraging structured supervised FAST scanning opportunities, providing self-directed learning resources, and introducing competency-based assessments such as Objective Structured Clinical Examination (OSCE) or direct observation of procedural skills (DOPS). Studies show varied time frames for knowledge retention, where Kelm et al. (21) found minimal differences in ultrasound image identification between residents exposed to a curriculum and a control group after six months. Similarly, Town et al. (22) reported that mean knowledge scores decreased to 73% at 12 months post-workshop. Generally, participants retain their knowledge up to six months post-workshop, but retention beyond this period remains uncertain.

The integration of FAST training into house officer programmes is both practical and achievable, even in resource-constrained settings, due to its relatively brief training duration. Evidence from similar studies indicates that knowledge retention can extend up to six months, underscoring the potential advantages of incorporating periodic refresher courses to reinforce competency and sustain skill proficiency.

LIMITATIONS

There were several limitations in this study. Firstly, it did not explore factors associated with house officers' knowledge and confidence levels, such as years of training, prior ultrasound courses, and undergraduate education. Further research should address these factors. Secondly, the sample size was limited due to the inflexible work schedules of house officers, and the study was conducted at a single centre. The small number of participants may have limited the statistical power. The recruitment strategy relied on voluntary participation, which could introduce selection bias. Future research should aim for larger sample sizes across multiple centres. Thirdly, there was no control group in this study. Future studies should consider including a control group to isolate the effects of the workshop from other learning sources.

Next, confidence was measured using a Likert scale. However, self-reported confidence measures may not fully reflect clinical competence. Future studies should integrate objective assessments of FAST performance, such as hands-on practical skill evaluations. Lastly, although there was an increase in house officers' knowledge and confidence levels after four weeks, it remains uncertain whether they can perform FAST competently beyond this period. We recognise that standardising exposure to FAST practice between the initial training and the four-week follow-up assessment was not feasible. Differences in clinical rotations, patient caseloads, and individual engagement with ultrasound practice may have affected skill retention and confidence levels. To mitigate the impact of these inconsistencies, future studies should incorporate structured refresher sessions or supervised practice opportunities to reinforce learning and enhance long-term competency.

CONCLUSION

In summary, an experiential workshop consisting of a 45-minute theoretical session and a 2-hour hands-on session effectively enhances house officers' knowledge and confidence in performing FAST for up to four weeks, as proven by statistically significant results. Integrating brief FAST training into the house officers' curriculum would provide a solid foundation for their medical officer years, despite challenges such as limited time and funding.

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ETHICAL APPROVAL

This study was approved by the Human Research Ethics Committee of USM (HREC): USM/JEPeM/22120767.

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