

FACTORS INFLUENCING THE USE OF POINT OF CARE ULTRASOUND (POCUS) ON ADULT PATIENTS BY ACCIDENT AND EMERGENCY DEPARTMENT (A&E) DOCTORS IN TERTIARY CARE HOSPITALS IN COLOMBO DISTRICT, SRI LANKA; A DESCRIPTIVE CROSS-SECTIONAL STUDY

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ABSTRACT

Introduction: Point of care ultrasound (PoCUS) is an essential component of A&E setting all over the world. It is used for diagnosis and assisting bedside procedures. Usage of PoCUS has been shown to improve quality of patient care. There are no formal studies in Sri Lankan A&E setting to assess level of its usage and the barriers of using it. This study aimed to assess these aspects among ED doctors in three tertiary care hospitals in Colombo district.

Methodology: This descriptive study was conducted by self-administered questionnaires distributed among 72 ED doctors working in the above setting. Questionnaire consisted of questions related to sociodemographics, types of PoCUS performed, barriers to PoCUS use etc. Ability to perform PoCUS was assessed by Likert grading from 1 to 5 based on operator's own opinion. Statistical analysis was done using SPSS.

Results- All the tertiary care emergency services had access to an ultrasound machine. PoCUS has been used for a wide variety of bedside scans and therapeutic procedures. Majority has been used to detect free fluid in peritoneal cavity (66.6%) and FAST scans (65.3%). Post graduate doctors (PG) were more confident in configuring PoCUS machine for procedures than non PG doctors (82.8% vs 5.4%). Ability to perform PoCUS was associated with post graduate exposure, >1 year of experience using it and doing >300 procedures in last 3 months ($p=0.001$). Main barriers identified for PoCUS usage were lack of training and lack of quality ultrasound machine.

Discussion: Though PoCUS is mainly performed by PG doctors, important scans such as FAST, intra peritoneal free fluid assessment are done by non-PG doctors too. Compared to similar international studies, less number of latter doctors were capable of doing PoCUS in Sri Lanka. Empowering these doctors with PoCUS skills will improve the sustainability of this service in emergency care setup as they work in units for longer duration. A study where candidates' skills are assessed by a third party would have provided more accurate reflection of PoCUS usage.

Conclusion: Embracing updated technology and further improvement and availability of PoCUS training among ED doctors will enhance sustainable emergency patient care in Sri Lanka.

KEYWORDS: PoCUS, Accident and emergency treatment unit, National Hospital of Sri Lanka, Emergency medicine



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1. INTRODUCTION

Ultrasound scan is a widely used cross sectional imaging modality in many facets in clinical practice for both diagnostic and therapeutic purposes. Cost effectiveness, possibility to obtain real time images and higher safety profile due to non-usage of ionising radiation has made it popular and acceptable for both clinicians and patients even for repeated usage. Advancement of technology has made ultrasound scanning an even more accurate imaging modality although it has its unique disadvantage of being operator dependent. However, integration of artificial intelligence (AI) will likely eliminate it for a great extent.

Point of care ultra-sonography (PoCUS) allows assessment of patients parallel to clinical assessment; without requiring them to be physically present in radiology department (Valle et al 2019). POCUS is widely used by doctors in emergency departments who are primarily not trained in radiology (Pouryahya et al 2019). POCUS is a vital skill which directly affects patient's management. Since it is also increasingly used in medico legally important cases, doctors who perform it must be properly trained to ensure they meet minimum standards, competency and safety. The machines should be subjected for periodical quality checks with a medical physicist and fault reporting should be done meticulously. Risk of infection particularly in interventional procedures should be minimised adhering to protocols. Therefore, governance of POCUS is important for high quality patient care (April 2023).

In Sri Lanka, POCUS has been used for patient care in different settings such as emergency departments, intensive care units, surgical theatres and wards for a while. Use of POCUS in emergency departments has been more popular recently due to its integration in the post graduate training curriculum in emergency medicine. Several high-quality training programmes, hands on workshops and skill courses are available accredited by reputed overseas institutes for the training, evaluation, and continuous professional development (CPD). These programmes help to

improve core skills such as e-FAST, lung ultrasonography, cardiac sonography and basic therapeutic procedures etc. Fortunately, some of these skills do not require a steep learning curve to achieve a minimum standard of competence which is helpful for doctors who had no previous exposure to sonography training in a resource poor setting (Vanderburg et al 2023).

However, there are many barriers for its usage in developing countries due to lack of infrastructure, lack of awareness, lack of training opportunities, and resistance from non PoCUS users (Smith et al 2023). There are no studies done yet to assess this important aspect in Sri Lanka. In this descriptive, comparative, analytical study, we mainly focused to assess the level of usage of PoCUS in emergency departments by doctors, barriers of its usage and their opinions on overcoming those barriers. Outcomes of this study can be used to improve infrastructure, widen training of PoCUS| among doctors for better patient care to sustain for a long time.

2. METHODOLOGY

Seventy-two doctors including emergency specialists and specialty trainees currently working in emergency treatment units (ETU) and accident / emergency units (A&E) at National Hospital of Sri Lanka (NHSL), Colombo South Teaching Hospital (CSTH) and Sri Jayewardenepura General Hospital (SJGH) were recruited. Due to limited number of doctors working in these units, purposive sampling was used. Data collection was done in between January 2023 to June 2023 using a pretested self-administered questionnaire. It consisted of questions such as number of patients cared per week (<200 or >200), number of PoCUS done in last 3 months (<300 or >300), experience of using PoCUS (<1 year or >1 year) type of PoCUS performed, barriers to use PoCUS and suggestions to overcome such barriers. It also assessed the operator's competency in their own perception on various diagnostic PoCUS such as FAST scans, assessment of pleural effusions/pneumothorax, basic cardiac views/tamponade assessment, intraperitoneal free

fluid assessment-dengue/liver failure, DVT assessment and assessment of volume status using IVC filling. Also, the ability to perform therapeutic PoCUS such as cannulation and nerve blocks were assessed. Likert grading from 1 to 5 was used to subjectively assess the competency according to operator's personal view. Likert grading 1 or 2 or 3 was arbitrarily assigned as 'not confident' by the authors whereas 4 or 5 assigned as 'confident' in doing a procedure. Although there are formal tools such as UCAT (Ultrasound Competency Assessment Tool) to assess PoCUS, these were not used in this research as the responses were self-marked by the candidates (Bell et al 2020).

Ethical clearance for the study was obtained from the Ethical Review Committee of Post Graduate Institute of Medicine, University of Colombo (Reference number: EC 22-121).

3. RESULTS

Out of the 72 study participants, approximately half (n=35, 48.6%) had postgraduate qualification in Emergency medicine as this cohort consists of consultant emergency physicians, senior registrars and registrars (Cohort – A). The other group consisted of grade medical officers (n=37, 51.4%), who did not have a formal postgraduate training in emergency medicine (Cohort – B). Numbers of participants who were enrolled to the study from NHSL ETU, NHSL A&E, CSTH ETU, CSTH A&E and SJGH were 18(25.0%), 17(23.6%), 15(20.8%), 13(18.1%) and 9(12.5%), respectively. The ratio between male and female operators in Cohort A was 16:19, and in Cohort B it was 20:17. All participants agreed that there was a functioning ultrasound scan machine to perform PoCUS in their respective units.

A wide range of PoCUS, both interventional and diagnostic has been performed by all participants although the most commonly performed ones were the abdominal sonography to exclude free fluid in dengue /liver failure (n=48, 66.6%) and focused abdominal sonography for trauma (n=47, 65.3%). Its clear according to table 1, that doctors with post

Table 1. Experience, types of procedures and training

Variable	Doctors with Post graduate qualification s (Cohort – A)	Doctors without Post graduate qualifications (Cohort – B)	Total
Number	35(48.6%)	37(51.4%)	72(100%)
Age (years)	37.7(32-42)	41.4(30-52)	39.7(30-52)
M:F ratio	1:1.19	1.17:1	1:1
Experience of using PoCUS			
<1 year	9(25.7%)	8(21.6%)	17(100%)
>1 year	26(74.3%)	29(78.4%)	55(100%)
Number of PoCUS performed last 3 months			
<300	16(45.7%)	34(91.9%)	50(100%)
>300	19(54.3%)	3(8.1%)	22(100%)
Number of patients cared per week			
<200	22(62.5%)	32(86.5%)	54(100%)
>200	13(37.5%)	5(13.5%)	18(100%)
Types of scans usually performed (diagnostic/therapeutic)			
FAST/EFAST	35(100%)	12(32.4%)	
DVT	20(57.1%)	13(35.1%)	
US abdomen to exclude free fluid (Medical)	34(97.1%)	14(37.8%)	
Gynaecological scan	29(82.8%)	2(5.4%)	
Kidney/ Ureter/ Bladder	22(62.8%)	3(8.1%)	
Testicular dopple	20(57.1%)	2(5.4%)	
Lung	21(60.0%)	2(5.4%)	
Heart (2D Echo/Tamponade)	18(51.4%)	0(0%)	
Fluid status assessment (IVC filling)	35(100%)	6(16.2%)	
Procedural (Nerve blocks, cannulation)	25(71.4%)	4(10.8%)	
Not performed any so far	0(0%)	3(8.1%)	
Prior training of POCUS by:			
Post graduate training programme	35(100%)	N/A	
Fellowship/overse as training	19(54.2%)	0(0%)	
Workshops/ Courses/ Conferences	35(100%)	11(29.7%)	
Online training programmes	26(74.2%)	9(24.3%)	
trained by colleague	29(82.8%)	19(51.3%)	
No formal training (self-taught)	2(5.7%)	11(29.7%)	

N/A – not applicable

graduate exposure have performed more number of PoCUS compared to the opposite cohort (>300 scans during last 3 months 54.3% vs 8.1%). Curiously, inferior vena cava (IVC) for fluid resuscitation has been done by smaller number of Cohort – B doctors (16.2%) being an important core skill. Lung and heart studies were the least performed by both groups. Procedural PoCUS such as ultra sound guided cannulations and nerve blocks were commonly done by Cohort – A compared to B (71.4% vs 10.8%) and 3 participants from the latter group have not done any PoCUS procedure so far.

Cohort A participants had a range of learning experience on PoCUS such as mandatory workshops, conferences, courses and training programmes. Comparatively, Cohort B is clearly underprivileged and most of the training has been acquired by the fellow postgraduate colleagues (n=19, 51.3%). Significant number (n=11, 29.7%) in this group agreed that they have not had any formal training on PoCUS.

Ability to operate ultrasound scan machine and different types of PoCUS were assessed by the Likert grading assigned by the participants. According to table 2, it is again clear that operators with postgraduate background were more confident in setting up the ultrasound machine for the procedure (82.8% vs 5.4%). Also, they were better in getting vascular access for therapeutic procedures like difficult cannulation (85.7% vs 10.8%). However, participants of cohort – B were most competent in performing FAST scans compared to the other studies (54.1%). It was followed by the ability to diagnose peritoneal free fluid (27.0%). However, understandably, the overall confidence in performing PoCUS was significantly better in Cohort – A compared to B (97.1% vs 21.6%). Although Cohort – A participants have not done many lung and heart PoCUS according to table 1, they are still confident in doing those procedures as 94.3% selected Likert 4 or 5.

Minimum ability to perform PoCUS was arbitrarily defined as operators who were confident of adjusting

Table 2. Practice of POCUS

No	Description	Post graduate doctors, (n=35) (Cohort – A)		Other doctors (n=37) (Cohort – B)	
		Confident *	Not confident †	Confident *	Not confident †
1	Confident in adjusting knobs such as gain/depth and choosing correct probe (Minimum ability to perform PoCUS)	29(82.8%)	6(17.2%)	2(5.4%)	35(94.6%)
2	Confident in obtaining vascular access	30(85.7%)	5(14.3%)	4(10.8%)	33(89.2%)
3	Confident in doing FAST/E-FAST	34(97.1%)	1(2.9%)	20(54.1%)	17(45.9%)
4	Confident in diagnosing pericardial effusion	33(94.3%)	2(5.7%)	6(16.2%)	31(83.8%)
5	Can diagnose cardiac tamponade	31(88.6%)	4(11.4%)	6(16.2%)	31(83.8%)
6	Can diagnose pneumothorax	33(94.3%)	2(5.7%)	6(16.2%)	31(83.8%)
7	Can diagnose peritoneal fluid	33(94.3%)	2(5.7%)	10(27.0%)	27(73.0%)
8	Can achieve basic cardiac views	33(94.3%)	2(5.7%)	4(10.8%)	33(89.2%)
9	Can assess response to fluid resuscitation	33(94.3%)	2(5.7%)	7(18.9%)	30(81.1%)
10	All together confidence in performing PoCUS	34(97.1%)	1(2.9%)	8(21.6%)	29(78.4%)

*Likert grading 4 or 5, †Likert grading 1 or 2 or 3

Table 3. Factors affecting performance of PoCUS

No	Factors	p value	Significance
1	Post graduate exposure	0.001	P<0.005
2	>300 PoCUS done last 3 months	0.001	P<0.005
3	>1 year of experience using PoCUS	0.001	P<0.005
4	>200 patients cared per week	0.492	P>0.005

basic knobs in ultrasound machine such as gain/depth and ability in selecting the appropriate ultrasound probe correctly. Therefore, operators who graded themselves either Likert 4 or 5 for this question were considered having minimum ability to perform PoCUS. There were 31(43.1%) doctors who had the ability and 41(56.9%) who did not.

Pearson Chi-square test was used to assess the statistical significance between minimal ability to perform PoCUS against years of experience in using PoCUS, number of patients cared for per week, number of scans done in last 3 months and operator's exposure to postgraduate training of emergency medicine.

Table 4. Barriers and solutions to use PoCUS in hospitals

Description	Post graduate doctors (Cohort – A)	Non post graduate doctors (Cohort – B)
Barriers in using PoCUS		
Lack of quality ultrasound scan machines	35(100%)	29(78.3%)
Lack of opportunities to train	31(88.6%)	36(97.3%)
Lack of opportunity to practice PoCUS	29(82.8%)	37(100%)
Lack of trained staff to guide	22(62.8%)	35(94.6%)
Lack of time to use it	27(77.1%)	22(59.4%)
Lack of national guidelines about indications to use it	29(82.8%)	17(45.9%)
Lack of feedback regarding the accuracy of findings	33(94.3%)	15(40.5%)
No idea	12(34.2%)	20(54.1%)
Suggestions to overcome the barriers of using PoCUS		
Increase the number of quality ultrasound machines	31(88.6%)	17(45.9%)
Administrative support	17(48.6%)	12(32.4%)
Develop clear guidelines regarding its use	19(54.3%)	16(43.2%)
Effective training for all ED doctors	27(77.1%)	11(29.7%)
Quality improvement by audits	26(74.3%)	16(43.2%)
No idea	11(31.4%)	9(24.3%)

According to the statistical analysis, only number of patients cared per week did not have a statistically significant association with the minimal ability to perform PoCUS while the remaining 3 factors did.

Regarding the barriers of using PoCUS, both categories agreed with common factors such as lack of access to quality ultrasound machines, lack of opportunity to train/practice it and lack of trained staff as main obstacles. Cohort – A highlighted more on lack of accuracy of findings (94.3% vs 40.5%). They also considered that lack of guidelines on the indications to use it as an important factor (82.8% vs 45.9). With regard to suggestions to overcome barriers, both categories agreed that effective training of all emergency medicine doctors across all categories is essential (45.7 vs 97.3%). Necessity to improve the quality of findings and the necessity of doing regular audits were also highlighted by both parties (74.3% vs 43.2%).

4. DISCUSSION

Studies on use of PoCUS in Sri Lanka are sparse and as far as we are aware, this is the first comparative study to assess a wide range of questions such as the ability in using PoCUS, range of its use, factors affecting its usage, barriers to overcome and improve its availability among ED doctors. According to this study, almost half of the doctor population doing emergency work in 3 major hospitals are consultants or trainee doctors in emergency medicine. Almost all doctors (n=69, 95.8%) have performed PoCUS and nearly 75% have experience in using it for more than 1 year. However, not only the postgraduate doctors are significantly more confident in performing PoCUS (No 10, Table 2), they are also capable of performing a wider range of scans. In addition, more number of scans has also been performed by the same group (Table 1). Doctors who have not got a postgraduate exposure were somewhat good at core skills like performing FAST scan (54.1%) and assessing intra-abdominal free fluid for dengue and liver failure (27.0%). However, therapeutic PoCUS such as getting vascular access and nerve blocks was outnumbered by doctors with postgraduate

qualifications (71.4% vs 10.8%).

The reason for this disparity is lack of proper training opportunities for grade medical officers compared to clear structured training programme their colleagues are enrolled in. The training the medical officers have got is largely based on informal teaching by their postgraduate colleagues and on experience from previous units they had worked in. Therefore, it is important to arrange access to high quality training for all grade medical officers to ensure smooth running and provision of quality care in emergency units. Since 97.3% of non PG doctors agree that they do not get enough opportunity to do PoCUS, arrangements should be made to ensure they get equal opportunity during the learning curve. It is imperative to enforce medical officers with PoCUS skills for sustainability as they remain in these units for a longer period of time compared to postgraduate trainees who come over for shorter periods during training rotations.

Although all units were equipped with ultrasound scan machines, doctors with postgraduate qualifications were apparently not happy to use them. This could be because these machines are not equipped with doppler facility and appropriate probes to perform more specific PoCUS compared to widely performed FAST / abdominal scans. Since such machines and their accessories are expensive, it is not fair to anticipate its wider availability anytime soon due to the current financial constraints of the country. On the other hand, its important at least one newer sophisticated machine made available in high volume centres to ensure provision of better care and training opportunities for ED doctors.

Apart from quantity, quality of the results of PoCUS is also equally important for patient care. Although assessing the accuracy of the findings was beyond the scope of this study, majority of doctors (n=48, 66.7%) have raised concerns on lack of feedback on the accuracy of findings. A number of patients who undergo scans would have it repeated by radiology department by more experienced operators. Doctors who are keen can follow them up to for learning

purposes although lack of a picture archiving and communication system (PACS) would make this effort more cumbersome. Since most tertiary centres are manned with consultant emergency physicians, their junior colleagues can always seek help from them to cross check the accuracy of findings (Chen et al 2021).

Conflicts in sonographic findings can potentially risk proper patient management too. Also, it may attract friction between other specialties performing ultrasound scans. Therefore, clear guidelines, which specify the procedures to be followed by emergency doctors should be available. For that to happen, the ability of ED doctors to perform PoCUS beyond a minimum standard should be sustainable. This further reiterates the importance of training a cadre of doctors who are serving such units for longer periods of time. Apart from training programmes that can be organised by professional colleges with the help of both national and international affiliations, in-service training programmes would also help to regularly audit the quality of PoCUS results. For that to happen, a better partnership with the radiology department of these hospital is imperative to ensure increased training opportunities for emergency doctors without compromising training of radiology trainees (Ienghong et al 2022).

A study conducted in an emergency department in Australia to assess diagnostic and procedural utility showed that PoCUS was mainly for diagnostic process (88.2%). Most of the time PoCUS was conducted by Senior Medical Staff Fellows (66.4%) of Australian College of Emergency Medicine (SMS FACEM) (Mosier et al 2019). In our setting, it was mostly used for diagnostic rather than guided procedures. However, this study shows that postgraduate doctors have performed more PoCUS compared to non-postgraduate doctors (54.3% vs 8.1%).

A quasi-experimental study done in Korean Teaching hospital ED identified that the non-availability of equipment, technology, operator's skills, electronic storage capacity as main barriers to PoCUS (Léger et

al 2015). In our setting also main barriers identified were lack of quality ultrasound machines and lack of training. Also, further research would be needed in other districts of Sri Lanka to get a true reflection of PoCUS usage levels and barriers in the country.

Since data was collected by self-administered questionnaire, accuracy of the findings may not be satisfactory. When assessing a complex skill like performing PoCUS, entire dependence on the operator's response may lead to bias. Further research in future where PoCUS skills are observed by an independent third party would give more accurate results. A randomised study would have eliminated bias between two categories to give more accurate results. However, most of the descriptive findings in this study indicated clear-cut differences between the two groups, so the confounding factors may not have affected the ultimate result significantly.

5. CONCLUSION

Tertiary care centres in Sri Lanka have got sufficient level of infrastructure and expertise to perform a wide range of PoCUS largely due to the contribution of trainee doctors and emergency physicians.

To ensure sustainability and better patient care, authors recommend to empower grade medical officers working in emergency departments with PoCUS by providing equal opportunities in training. Empowering major centres with modern equipment as a medium term goal will further improve quality of care and provide superior training opportunities for all ED doctors.

6. REFERENCES

April 2023 Recommendations for specialists practising ultrasound independently of radiology departments Safety, governance and education [Internet]. Available from: www.rcr.ac.uk

Bell C, Hall AK, Wagner N, Rang L, Newbigging J, McKaigney C. The Ultrasound Competency

Assessment Tool (UCAT): Development and Evaluation of a Novel Competency-based Assessment Tool for Point-of-care Ultrasound. *AEM Educ. Train.* 2020 Oct 3;5(3):e10520. doi: 10.1002/aet2.10520. PMID: 34041429; PMCID: PMC8138101.

Chen WL, Hsu CP, Wu PH, Chen JH, Huang CC, Chung JY. Comprehensive residency-based point-of-care ultrasound training program increases ultrasound utilization in the emergency department. *Medicine (United States)*. 2021;100(5).

Ienghong K, Cheung LW, Tiamkao S, Bhudhisawasdi V, Apiratwarakul K. Integrating Point of Care Ultrasound Education into Clinical Practice at the Emergency Department. *Tomography*. 2022;8(2).

Léger P, Fleet R, Giguère JM, Plant J, Piette É, Légaré F, et al. A majority of rural emergency departments in the province of Quebec use point-of-care ultrasound: A cross-sectional survey. *BMC Emerg Med.* 2015 Dec 11;15(1).

Mosier JM, Stolz U, Milligan R, Roy-Chaudhury A, Lutrick K, Hypes CD, et al. Impact of Point-of-Care Ultrasound in the Emergency Department on Care Processes and Outcomes in Critically Ill Nontraumatic Patients. *Crit. Care Explor.* 2019 Jun 1;1(6):E0019.

Pouryahya P, McR Meyer AD, Koo MPM. Prevalence and utility of point-of-care ultrasound in the emergency department: A prospective observational study. *Australas J. Ultrasound Med.* 2019 Nov 1;22(4):pp.273–8.

Smith M, Krishnan SV, Leamon A, Galwankar S, Sinha TP, Kumar VA, et al. Removing Barriers to Emergency Medicine Point-of-Care Ultrasound: Illustrated by a Roadmap for Emergency Medicine Point of Care Ultrasound Expansion in India. *J. Emerg. Trauma Shock.* 2023;16(3):pp.116–26.

Valle Alonso J, Turpie J, Farhad I, Ruffino G. Protocols for Point-of-Care-Ultrasound (POCUS) in a Patient with Sepsis; An Algorithmic Approach. *Bull Emerg Trauma* [Internet]. 2019;7(1):pp.67–71. Available from: www.beat-journal.com

Vanderburg S, Kodikara I, Tharakan A, Sheng T, Gallis JA, Sellathurai M, et al. A Practical Approach to Lung Ultrasound Training in Sri Lanka. *ATS Sch*. 2023;4(2):pp.126–31.