Original Article

Indian Journal of Trauma and Emergency Pediatrics
Volume 8 Number 2, May - August 2016
DOI: http://dx.doi.org/10.21088/ijtep.2348.9987.8216.1

Point of Care Ultrasound in Pediatric Emergency Department - An Emerging Modality for Improving Patient Care

Prasad Arun, Kumar Sanjeev, Paswan Anil K., Prasad Abhiranjan

Abstract

Point of care ultrasound is a quick and focused ultrasonography of any patient bedside and is helpful in managing patients in certain emergency situations like blunt abdominal trauma, cardiogenic shock and chest conditions like pleural effusion and hemothorax. It should be widely used bedside in pediatric emergency to improve patient care.

Keywords: Point of Care Ultrasound; Pediatric Emergency; Developing Countries.

Introduction

Point-of-care ultrasonography is a focused ultrasonography performed bedside that enables clinicians to integrate clinical examination findings with real-time sonographic imaging. General emergency physicians and other specialists have used point-of-care ultrasonography for many years, and during last few years this is being utilized in pediatric emergency medicine (PEM). It helps in making a quick and accurate diagnosis in conjunction with the clinical findings, in certain clinical conditions. For example, a case of viral myocarditis with congestive cardiac failure can be diagnosed on the basis of history and clinical features but if you see a poor ventricular systolic function, which takes a few seconds in point of care ultrasonography, it makes you confident about your diagnosis which ultimately results in significantly improved patient care. Although developed countries are using it and have found it helpful in management of pediatric patients with emergency medical and surgical conditions, this modality is still to be adopted in many institutions of India like other developing countries.

History

In 1990, the American College of Emergency Physicians (ACEP) published a position statement supporting the performance of ultrasonography by appropriately trained emergency physicians [1]. The next year, the Society for Academic Emergency Medicine endorsed that statement and called for a training curriculum, which Mateer and colleagues published in 1994 [2,3]. By 1996, the published emergency medicine core content included point-of-care ultrasonography for residency graduates [4]. Point-of-care ultrasonography in pediatric patients by PEM providers has recently been adopted into practice, and the literature is still evolving. Nonetheless, there are numerous studies demonstrating the accuracy of point-of-care ultrasonography by PEM physicians [5-8] and the ability of PEM physicians to become proficient in point-of-care ultrasonography after adequate training. Although the point-of-care ultrasonography examinations performed should be specific to the needs of the department, the most common indications for which point-of-care ultrasonography is being used in PEM are for focused assessment with sonography in trauma, soft tissue evaluation, and vascular access.

Indications

Point-of-care ultrasonography is used for various clinical situations, particularly the evaluation of blunt abdominal trauma, soft tissue infections, cardiac dysfunction, pleural effusion and procedural guidance like putting central lines aspirating fluid from soft tissue or cavity. Recently its use has been extended in evaluating pulmonary pathology like consolidation, pleural effusion, hemothorax,

Author Affiliation: Department of Pediatrics, All India Institute of Medical Sciences, Patna.

Reprint Request: Arun Prasad, 107, Type-4, Block -2, AIIMS Residencial complex, Khagaul, Patna, 801105.
E-mail: drarunpd@gmail.com

pneumothorax and papilledema. It is also helpful in assessing patients of raised intracranial tension by doing ultrasound examination of optic disc. Studies have demonstrated that PEM providers are able to identify an array of other diseases including intussusception, pyloric stenosis and appendicitis. Novel applications of ultrasound such as identification of skull fracture in the assessment of head injury have shown excellent promise in recent studies [9].

Point of Care Ultrasound is a Safe Procedure

One of the appealing aspects of ultrasonography is its inherent safety. It uses sound waves and not x-rays to generate images. In many instances, computed tomography (CT) imaging or radiography are the optimal diagnostic modalities in the evaluation of the pediatric patient; however, there is an increasingly large body of literature emphasizing and delineating the risks of ionizing radiation, particularly from CT [10–12]. Pediatric patients are particularly sensitive to ionizing radiation. They have increased chances of radiation-induced cancer because of increased life span [11]. In response to this risk, several national campaigns have been initiated to reduce the use of unnecessary CT imaging in pediatric patients. These include efforts by the Society for Pediatric Radiology, the National Council on Radiation Protection and Measurements, the Food and Drug Administration, and the National Cancer Institute.

Focused Assessment with Sonography in Trauma (FAST)

One of the important clinical utility of point of care ultrasound is its use in assessing patients with blunt abdominal trauma. It can be used as a rapid screen for intraperitoneal fluid or blood. In one review of 313 patients younger than 18 years sensitivity and specificity of FAST were 92.5% and 97.2% respectively [13]. It concluded that FAST is an effective tool in screening pediatric trauma patients for blunt abdominal trauma. In another prospective cohort of 224 children younger than 16 years who had sustained blunt trauma, sensitivity was 82% and specificity was 95%. However among a subset of 13 patients who were hypotensive, ultrasound identified intraperitoneal fluid in all 7 hypotensive patients with intraabdominal injury and hemoperitoneum with 100% sensitivity. FAST was negative in all six hypotensive patients without hemoperitoneum, with 100% specificity [13].

Point of Care Ultrasound for Pediatric Emergency in India

Point of care ultrasound is not widely used in pediatric emergency in India like other developing countries, till now. The patient care can be improved by incorporating point of care ultrasound in pediatric emergency. The course module can be designed for training point of care ultrasound, for residents and paramedical staffs. The necessary equipment, ultrasound machine should be made available for providing training and giving point of care ultrasound services.

Experience at our Institute

Recently we have started point of care ultrasound in our institute AIIMS Patna, for pediatric patients coming with emergency clinical conditions [Table 1]. We have trained our residents for doing point of care ultrasound. An example of using point of care ultrasound at our institute is – we diagnosed a case of viral myocarditis with cardiogenic shock in a 10 year old child. Patient was brought with very severe respiratory distress. History of coryza, body swelling and hepatomegaly pointed towards the possibility of viral myocarditis. A quick ultrasonography revealed very poorly contracting ventricles. A guarded fluid bolus given and simultaneously inotropic support started. Patient recovered with the conservative treatment.

Table 1: Diagnostic use of point of care ultrasound

Diagnosis	Number	Male	Female
Atrial septal defect	4	1	3
VSD	4	3	1
ASD + VSD	3	2	1
TOF	2	1	1
Large pericardial effusion	1	1	0
RHD with CHF	2	1	1
Viral Myocarditis with shock	1	0	1
Multiple pyaemic abscess	1	1	0
Dilated cardiomyopathy	2	1	1
Pleural effusion	1	0	1
Total	21	11	10

Fig. 1: Large pericardial effusion diagnosed by point of care ultrasound

Conclusion

Point of care ultrasound is an important modality of investigation in quickly assessing various medical and surgical emergencies. Across institutions in India like other developing countries, it is not being widely used for patient management in pediatric emergency. There is need of providing necessary equipment for doing point of care ultrasound in institutions involved in pediatric emergency care along with proper training to residents and paramedical staffs for quick assessment of relevant emergency clinical problems to improve overall patient care.

References

1. American College of Emergency Physicians. Council resolution on ultrasound. ACEP News. 1990; 9(11).
2. Society for Academic Emergency Medicine. Ultrasound position statement. SAEM Newsletter. Summer. 1991; 3: 3.
3. Mateer J, Plummer D, Heller M et al. Model curriculum for physician training in emergency ultrasonography. Ann Emerg Med. 1994; 23(1): 95–102
4. Hall M, DD P, Heller M et al Model curriculum for physician training in emergency ultrasonography. Ann Emerg Med. 1994; 23(1): 95–102.
5. Iverson K, Haritos D, Thomas R, Kannikeswaran N. The effect of bedside ultrasound on diagnosis and management of soft tissue infections in a pediatric ED. Am J Emerg Med. 2012;30(8):1347–1351.
6. Shah VP, Tunik MG, Tsung JW. Prospective evaluation of point-of-care ultrasonography for the diagnosis of pneumonia in children and young adults. JAMA Pediatr. 2013;167(2):119–125.
7. Riera A, Hsiao AL, Langhan ML, Goodman TR, et al. Diagnosis of intussusception by physician novice sonographers in the emergency department. Ann Emerg Med. 2012;60(3):264–268.
8. Pershad J, Myers S, Plouman C, et al. Bedside limited echocardiography by the emergency physician is accurate during evaluation of the critically ill patient. Pediatrics. 2004;114(6).
9. Gallagher RA, Levy JA. Curr Opin Pediatr. 2014 June; 26(3):265-71.
10. Pearce MS, Salotti JA, Little MP, et al. Radiation exposure from CT scans in childhood and subsequent risk of leukaemia and brain tumours: a retrospective cohort study. Lancet. 2012; 380(9840): 499–505.
11. Brenner DJ. Estimating cancer risks from pediatric CT: going from the qualitative to the quantitative. Pediatr Radiol. 2002; 32(4): 228–1; discussion 242–244.
12. Rajaraman P, Simpson J, Neta G, et al. Early life exposure to diagnostic radiation and ultrasound scans and risk of childhood cancer: case-controlstudy. BMJ. 2011; 342.
13. Soudack M, Epelman M, Maor R et al. J Clin Ultrasound. 2004 Feb; 32(2): 53-61.