

Point-of-Care Ultrasound in a Department of Pediatric and Adolescent Surgery

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ABSTRACT: **Background:** Point-of-care ultrasound (POCUS) is becoming a common tool for routine use in emergency medicine, anesthesiology and intensive care for diagnostic and interventional purposes. When a portable ultrasound device became available for the department of Pediatric and Adolescent Surgery at the Schneider's Children Medical Center of Israel, we added POCUS assessments to the physician's daily rounds. POCUS is performed by pediatric surgeons trained in basic ultrasonography skills. Starting September 2015 all POCUS examinations were documented.

Objectives: To describe the current use and the diagnostic and therapeutic impacts of POCUS in a department of pediatric and adolescent surgery.

Methods: We conducted an observational study of all the documented POCUS procedures performed during a half-year period. Data regarding patient condition and the POCUS procedures were collected, as well as data on the use of other diagnostic modalities, mainly formal ultrasound exams (by radiologists) and computed tomography scans and their correlation with the POCUS assessment.

Results: Fifty-one POCUS exams were performed during the study period, most of which served to define the presence and resolution of a collection – intraabdominal (34%) and subcutaneous (31%). Despite a high rate for formal diagnostic studies (65%), probably due to a relative lack of confidence of surgeons performing the POCUS exams during this initial period, most results (92%) were compatible.

Conclusions: The ability and availability to perform multiple POCUS exams by the attending physician proved to be a valuable aide to the classical physical and laboratory examinations of surgical patients, and we predict its increasing use in daily practice.

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KEY WORDS: bedside ultrasound, point-of-care ultrasound (POCUS)

tomography (CT), fluoroscopy and magnetic resonance imaging (MRI). With technological advances, ultrasonographic devices have become more compact and portable and as a result are more readily available outside the imaging department. This has enabled the routine use of the point-of-care ultrasound (POCUS) examination [2,3].

Many emerging current surgical guidelines are being adapted to the availability of POCUS examinations by surgeons [4,5], and ultrasound training is offered in many medical schools for the new generation of physicians [6]. The Department of Pediatric and Adolescent Surgery at Schneider's Children Medical Center of Israel incorporated a portable ultrasound device in the past year and POCUS assessment became a part of the patient's examination during the medical routine rounds. The attending physicians were all offered technical instruction on operating the instrument, and some participated in a 2 day course that included simulator practice using an ultrasound device (Simultech, Clalit Health Care Services Center for Medical Simulation at Meir Medical Center, Kfar Saba, Israel).

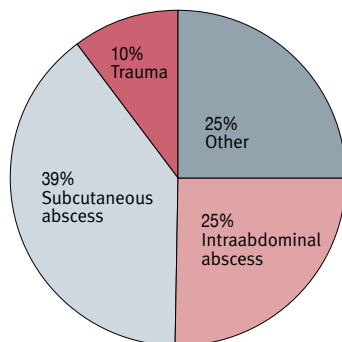
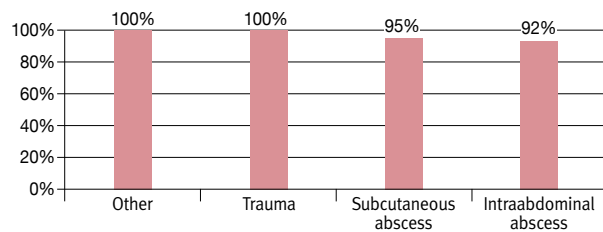
PATIENTS AND METHODS

For the purpose of assessing the value of POCUS exams, we documented all POCUS exams performed by surgeons in the department. POCUS assessment was performed using a Mindray M7 (Mindray Inc. Shenzhen, China) with a 6–14 MHz linear transducer and a 2–5 MHz curved transducer. The exam results were correlated with the clinical follow-up, and with the use and results of other, formal, accessory imaging studies performed in the radiology department.

RESULTS

During a 6 month period we documented 51 examinations. The average patient age was 8.9 years (range 4 months–16 years). Most of our POCUS exams were done for the identification of an abscess, either subcutaneous or intraabdominal, as well as FAST (focused assessment with sonography for trauma) exams for trauma patients and other etiologies [Figure 1].

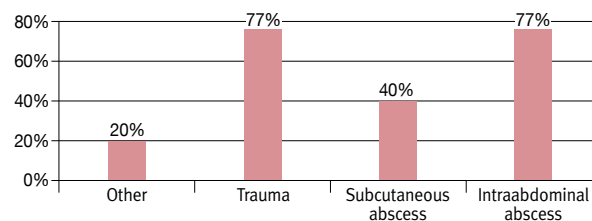
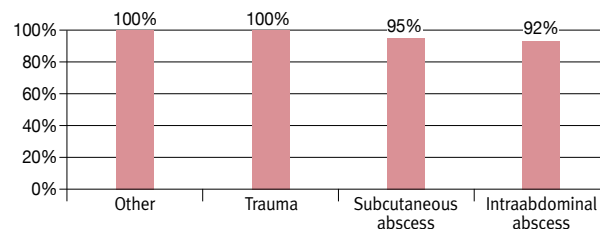
Since ultrasonic sound waves were first employed in medicine and surgery [1], the traditional use of ultrasound examination was restricted to the radiology department, along with other accessory studies such as plain X-ray film, computed

Figure 1. POCUS exams, by suspected diagnosis**Figure 2.** Consistency with clinical follow-up

Most examinations demonstrated good correlation with the observed clinical follow-up [Figure 2]. Observed utilization of other accessory imaging examination varied with the suspected diagnosis [Figure 3], but the consistency remained high, also when compared with accessory imaging studies (formal ultrasound and CT scan) [Figure 4].

Some specific cases in which POCUS assessment provided a unique insight to a clinical problem are briefly described:

- A 12 year old girl was admitted for a recurrent wound infection post-appendectomy performed in another hospital. POCUS on admission demonstrated an enterocutaneous fistula, confirmed by a CT scan performed the following morning. Pathological examination of the appendectomy specimen was consistent with the presence of inflammatory bowel disease.
- A 2 year old boy continued to suffer bouts of mild abdominal pain after hydrostatic enema reduction of intussusception. A true intussusception was not demonstrated on POCUS; nonetheless, wall edema and an intraluminal finding were imaged. These elements were found to be an intussuscepted appendix on surgery.
- A 2 year old boy with a known mesenteric cyst was admitted for elective laparoscopic surgery the night before his scheduled operation. The parents were concerned that the lesion may have disappeared, but POCUS confirmed the presence of the lesion and it was successfully removed the following morning.

Figure 3. Utilization of accessory studies**Figure 4.** Consistency with accessory studies

DISCUSSION

While formal ultrasound training is not yet an established practice in every medical specialty and in every institution, it is becoming increasingly common and the advantages of its rapid and accessible utilization are apparent. We therefore began to use a portable ultrasound device even though we had only basic training. As we have learned from observing our use of POCUS examinations, they supplement but do not replace the formal radiological examination. The convenience it offers is appealing for our routine practice, i.e., when formal radiological examination is not readily available, for a closer and frequent follow-up of a known or previously observed occult lesion (e.g., intraabdominal abscess), and as a confirmatory examination when clinical findings rule out a surgical condition (such as cellulitis vs. abscess).

One major concern with the increasing use of POCUS is the medico-legal implications of its use. The performing surgeon is not expected to perform a complete thorough sonographic examination as a trained radiologist since POCUS is used for specific conditions and as an adjunct to physical examination. Therefore, concern about missed diagnosis might arise. Indeed, our own studies do not show a 100% correlation with the formal studies, although higher than 90% for most examinations is a very satisfactory result considering the little formal training our staff had.

The fact that legal issues have not yet been fully defined in Israel should not prevent physicians from using the best tools available for the benefit of their patients. As shown in this series, generous use of accessory studies was still employed despite the valuable information gained from POCUS examinations, partly

to avoid any missed diagnosis. POCUS examination should take its place as a part of the full clinical assessment and we strongly advise against relying exclusively on it.

We believe that the practice we have initiated – using POCUS assessments to complement the physical examination, regardless of formal radiological examinations – is a proper and suitable way to take full advantage of this available technology. Pediatric surgeons should not be reluctant to add POCUS to their daily practice for any reason.

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