

# POINT-OF-CARE ULTRASOUND IN PEDIATRICS: ARE WE READY?

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## Key points

- POCUS provides additional information that must be interpreted in the overall clinical context
- POCUS changes the way medicine is practiced
- Effort is needed to advance pediatric POCUS training and research in Switzerland

## Introduction

Over the last 30 years «point-of-care» ultrasound (POCUS) has expanded from a screening test in abdominal trauma to being used by clinicians of many different specialties and has been adopted for diagnosis, monitoring or procedural guidance. It arose from the advancement of ultrasound technology to a portable machine that can be used at the bedside. It comprises a rapid, focused assessment that is integrated into the clinical assessment of the patient without impeding, but potentially improving, work flow.<sup>1)</sup>

POCUS provides the clinician with real-time and radiation-free information about anatomy, physiology and pathology. These qualities of POCUS are important in the care of pediatric patients, especially in the Emergency Department (ED), as well as in pediatricians' practices. A policy statement on ultrasound in Pediatric Emergency Medicine (PEM) of the American Academy of Pediatrics states that «PEM physicians should be familiar with the definition and application of point-of-care ultrasonography and the utility for patients in the ED», further advising on various aspects of training, research and credentialing.<sup>2)</sup>

While in America, bed-side ultrasound in Pediatric Emergency Medicine is already well established, the development of dedicated Swiss POCUS training programs and research are still in their early stages. However, awareness is quickly raising for different reasons, not least since ultrasound training is becoming more and more part of university medical education.

This article will provide a better understanding how POCUS can be used effectively in pediatric patients, determining the training and assessment that will be required to ensure competent use and examine future directions of pediatric POCUS in Switzerland.

## Comprehensive Ultrasound versus POCUS

Given that a comprehensive ultrasound service is readily available in Swiss pediatric hospitals, one may ask why we need POCUS here in Switzerland at all. In contrary to POCUS, a radiology-performed ultrasound exam is a systematic regional survey and only

to a certain degree adaptable to the patient's conditions. Therefore, it is time-consuming and repeatedly decelerating patient care. On the other hand, primary care practices and smaller paediatric wards have limited access to such service.

POCUS on the contrary, is a focused examination to answer a specific clinical question. Immediate acquisition of such specific information with POCUS is often sufficient to recognize urgent and fixable problems and guide further management without comprehensive ultrasound performed by a radiologist.<sup>3)</sup> The American Academy of Pediatrics policy statement cautions that «clinicians should be aware that POCUS is better used as a «rule in» and not a «rule out» diagnostic modality».<sup>4)</sup> However, this has forged ahead, with POCUS now considered an extension of the physical examination that can augment clinical findings.<sup>5)</sup>

But it is nevertheless important to state that POCUS does neither replace a thorough clinical history and physical exam nor a traditional comprehensive ultrasound exam! On the other hand, a POCUS examination by an experienced clinician, holding the nuances of physical examination and differential diagnoses in his mind, can allow rapid streaming of probabilities and can be repeated serially to map an evolving clinical picture.<sup>4)</sup>

## Application Range

So how could I really use POCUS in my everyday life as a pediatrician? The uses of pediatric POCUS can be broadly divided into procedural and diagnostic. In table 1, we present an overview of possible clinical applications, as it is established in American and Australian PEM.<sup>4)</sup>

This table is not comprehensive, due to the exponential growth of POCUS, technological progress and the description of new exams, techniques, and indications. An overview about the actual evidence and further information to the different application areas is provided by the pediatric emergency POCUS work group.<sup>6)</sup> The pediatric POCUS learning objectives of the SIWF/ISFM are readily available online.<sup>7)</sup>

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## Formation continue

The applications are numerous, but vary in practicality and efficacy. Level of experience is essential to perform and interpret these applications in a correct and adequate way.<sup>3)</sup> (Table 1)

### Ultrasound Safety

POCUS is a complex skill, consisting of three main components:<sup>3)</sup>

1. Image acquisition
2. Image interpretation
3. Integration of ultrasound findings into clinical practice

Important are not only didactic sessions, but hands-on instructions and scheduled scanning sessions.<sup>2)</sup> Further, a standardised documentation and a systematic archiving are fundamental. Multi-disciplinary image review and timely review of individual scans with feedback on image quality and interpretation are mandatory to set clinical standards and foster collaboration in quality improvement and research.

Partnering with the radiology department ensures that their expertise benefits POCUS users and assures institutional leadership in order to engage qualified stakeholders in the roll out of ultrasound use by novel operators.<sup>3)</sup> Furthermore, a joint-venture between radiology and the ED could avoid resource-consuming redundancies and could advance both departments, as well as promote multidisciplinary cooperation.

Providers in primary care and institutions without paediatric radiology department are committed to keep up their skills through specific continuous medical education as provided by national and international

ultrasound associations (such as the Swiss Society for Ultrasound in Pediatrics SVUPP/ASEPA/ASEPP or the Swiss Society of Ultrasound in Medicine SGUM/SSUM), as well as local and regional group activities. Mandatory regular recertification is defined in the POCUS formation program. Furthermore, internet based, secured platforms (e.g. SVUPP Exchange) and quality circles enable the exchange of images and knowledge on exemplary cases or individual examples for random or systematic quality control and improvement.

The learning curve of POCUS users is rapid. A large retrospective review analysing more than 52 000 ultrasound examinations suggests that for the majority of ultrasound examination types, about 50 examinations are required to become a proficient user.<sup>9)</sup> But just as with every medical skill, POCUS users should be aware of the limitations as well as their capabilities and improve their skills through continuing education, reading of medical journals, and collegial discussion.

### State of affairs in Switzerland

Since 2018, the SGUM is awarding a Federal Education and Training Diploma in POCUS.<sup>10)</sup> The POCUS diploma is a multimodal and multidisciplinary degree. The SVUPP is responsible for the implementation of the pediatric POCUS component. Medical practitioners can achieve this pediatric POCUS diploma by attending a two-day basic ultrasound course, followed by a two-day POCUS course. In addition, at least one hundred supervised and one hundred non-supervised ultrasound examinations on one's own responsibility are required to get the POCUS diploma provided by the SVUPP. Supervised ultrasound examinations can be performed under surveillance of certified SVUPP tutors. For further information, visit [www.svupp.ch](http://www.svupp.ch).

Procedural		Diagnostic	
<b>Vascular access</b>	Peripheral, central	<b>Respiration</b>	Pneumothorax Pneumonia Pleural effusion
<b>Anesthesia</b>	Peripheral, regional		
<b>Lumbar puncture</b>	Location, depth		
<b>Urine Sampling</b>	Pre-catheterisation volume, suprapubic localisation	<b>Circulation</b>	Global cardiac function Cardiac tamponade Hypertrophic obstructive cardiomyopathy Fluid status (Aorta, Vena cava inferior; lungs, bladder)
<b>Abscess treatment</b>	Localisation, liquefaction stating, efficacy of incision and drainage		
<b>Foreign body removal</b>	Localisation and efficacy of removal	<b>Abdominal</b>	Appendicitis Intussusception Hydronephrosis Cholecystitis Pyloric stenosis Constipation; rectal loading
<b>Fracture manipulation</b>	Real-time reduction		
<b>Joint aspiration</b>	Optimal siting	<b>Muskuloskeletal</b>	Fracture Muscle and ligamental lesions Foreign body assessment Abscess evaluation
<b>Pleurocentesis</b>	Localisation		
<b>Paracentesis</b>	Optimal fluid pocket localisation		

**Table 1:** Procedural and diagnostic uses for POCUS in Pediatrics

Recently, ultrasound has been made part of the curriculum of Swiss medical schools. According to the learning objective catalogue, medical students of all faculties in Switzerland should reach following competence by the end of their master curriculum: «demonstrate ability to perform simple ultrasound investigations (suspected pleural effusion, abdominal mass, ascites)». <sup>11)</sup>

Future residents will complete their medical school nationwide with basic ultrasound skills, eager to put their knowledge into practice. As a leading institution in this field, the Department of Pediatric Imaging at the University Children's Hospital of Bern offers short-time ultrasound rotations, especially designed for pediatricians and pediatric surgeons. Several pediatric hospitals (e.g. Children's University Hospital of Basel) have certified SVUPP tutors where pediatric residents can log scans during their clinical shifts for their required number of supervised exams. Many pediatric practices led by SVUPP tutors provide excellent ultrasound training opportunities for pediatric registrars.

### Future Prospects

Clinician-performed ultrasonography has the potential to become a core competency of pediatric medicine in near future. Effort is needed to establish collaborations between POCUS users and traditional ultrasound experts in pediatric radiology for nationwide training opportunities and quality assurance programs. There is a need for further research, which uses patient-focused outcomes, e.g. impact of POCUS on reduction of radiation exposure and time to treatment of pediatric patients <sup>4)</sup> as well as influence on correct treatment and cost-effectiveness aspects.

### Conclusion

Due to technical progress, an enormous change is taking place in the field of ultrasound, which has led to a change in training standards and the need for new concepts. Clinician-performed ultrasound provides real-time, radiation-free, anatomical, physiological and pathological information at the point of care, that guides further patient management. Therefore, POCUS is a game changer that is challenging the traditional approach of assessing children in Pediatrics. Just as no pediatrician would like to be without his stethoscope despite its limited sensitivity and specificity if solely used, the use of focused POCUS is becoming a natural extension of the clinical examination too. Pediatricians are encouraged to familiarize with POCUS as it is a safe technology which improves patient care by better diagnostic performance and workplace efficiency.

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