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LETTER TO THE EDITOR

Radiologists should support non-radiologist point-of-care ultrasonography in children: a case for involvement and collaboration

Savvas Andronikou[1,2] · Hansel J Otero[1,2] · Sabine Belard[3,4] · Charlotte Carina Heuvelings[5] · Lisa C. Ruby[3] · Martin Peter Grobusch[5]

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Dear Editors,

The authors of this communication are a group of mostly paediatric radiologists and paediatricians who have been providing point-of-care ultrasound (POCUS) for some time and believe that lung US in particular has been of benefit to children around the world and a good example of collaboration leading to innovation. POCUS refers to the use of portable US applications at the bedside, performed directly by the treating physician, for either diagnostic or procedure guidance purposes. We wish to provide justification for our involvement in such activities, partly as a counterpoint to the recently published European Society of Paediatric Radiology (ESPR) position paper on non-radiologist-performed POCUS in children [1].

First, we welcome the overdue conclusions of the ESPR position paper to "support non-radiologist point-of-care US, where good training and an accreditation and governance structure exists" [1]. That the "ESPR is committed to providing high level, structured teaching courses for education, training and credentialing" is also welcome [1]. A spirit of fostering collaboration is shared by other specialists adopting POCUS [2]. However, we are up to a faulty start by suggesting that non- radiologists-performed POCUS is a "relatively new development". Thirty years ago, the Council of the American College of Emergency Physicians issued its first resolution on US, in 1990 [3]; 20 years ago, the Accreditation Council for Graduate Medical Education (ACGME) mandated that all emergency medicine residents be trained in non-radiologist POCUS, in 2001 [1]; and in 1993, the American College of Surgeons first advocated the national use of surgeon-performed US [4]. Paediatric applications followed shortly after [3, 5]. The paper by Kendall et al. [3] provides a historical summary of emergency and critical care US as well as characteristics of emergency US in detail.

Collaboration/reverse innovation

To offer credible assistance to other disciplines performing POCUS, paediatric radiology societies should accept the exponential use of US for purposes not considered traditional for radiologists — a prime example being lung and mediastinal US. Prominent paediatric radiologists have a poor track record of accepting lung US [6]. This technique has flourished primarily through non-radiologist-performed POCUS and might find further traction in managing children with coronavirus disease 2019 (COVID-19), the disease caused by the severe acute respiratory syndrome syndrome coronavirus 2 (SARS-CoV-2) [7]. An extract from the conclusion in a paper by Tomà et al. [6] in 2013 reads: "We are concerned that the main drawback with paediatric chest US comes not from its use, but from its misuse, or indeed abuse. Our concerns focus on the potential misuse of lung US as the new stethoscope". In 2020, the same authors cited a significant number of publications on useful US techniques,

✉ Savvas Andronikou
doctor.andronikou@gmail.com

1 Department of Radiology,
Children's Hospital of Philadelphia,
3401 Civic Center Blvd., Philadelphia, PA 19104, USA

2 Department of Radiology, The Perelman School of Medicine,
University of Pennsylvania,
Philadelphia, PA, USA

3 Department of Pediatric Respiratory Medicine, Immunology and Critical Care Medicine,
Charité – Universitätsmedizin,
Berlin, Germany

4 Berlin Institute of Health,
Berlin, Germany

5 Center of Tropical Medicine and Travel Medicine,
Department of Infectious Diseases,
Amsterdam University Medical Centers,
Amsterdam Infection & Immunity, Amsterdam Public Health,
University of Amsterdam, Amsterdam, The Netherlands

successful improvement and expanded practice, but they then concluded that:

> "[T]he extrapolation of this fast technique from intensive care, where it is used in close correlation with clinical data and resuscitation practices, to daily routine investigation of lung diseases, in the absence of appropriate training, has led to misunderstandings and dangerous therapeutic diagnostic drifts. What can be useful in intensive care in expert hands can cause damage in other contexts" [8].

These conclusions by ESPR leaders would not have encouraged collaboration with our clinical colleagues. This sentiment was expressed by Corsini et al. [9] in a letter to one paediatric radiologist's opinion on lung US that "the article may — as a final result — discourage the use of lung ultrasound in daily clinical practice, limiting the potential of this useful diagnostic tool". Radiologists must accept the fact that the limitations of US related to nonspecific common findings, artefacts and the less-than-perfect clinical input that we receive before performing a study are at times overcome by the adoption of POCUS. Similar to chest radiographs, lung US presents overlapping findings for different diseases. As such, lung US findings such as "alveolar-interstitial syndrome", while non-specific, are useful to differentiate several lung entities in newborns, only when appropriately paired with clinical and hemodynamic information. When radiologists accept this, they will stop seeing lung POCUS as a threatening "extrapolation of this fast technique from intensive care, where it is used in close correlation with clinical data, to daily routine investigation of lung diseases, in the absence of appropriate training" [8] and more as an opportunity. Moreover, because POCUS is often performed in low- and middle-income countries, in under-resourced environments and in mobile clinics, rural clinics and general practitioner rooms [10], it will undoubtedly result in "reverse innovation", the process whereby inexpensive "fast" applications are re-engineered as innovative radiology-led procedures.

In fact, we fully agree with Parri and colleagues [2] that it is time to acknowledge that "POCUS is not radiology but an enhancement of physical examination that can make a significant real-time difference for patients" [2], and that "just like the stethoscope, ultrasound belongs to all specialties" [2]. We would like to point out here that — given the fact that there are vast populations in low- and middle-income countries with no or only marginal access to radiology and radiologists' services [11, 12], the most pressing question is essentially not "radiologist- vs. non-radiologist POCUS" but rather "access to diagnostic US services, yes or no" [2].

Training as a tool to increase access and avoid turf wars

In the past, radiologists have also used an argument over potential abuse of the technique to avoid training non-radiologists. However, clinicians are used to dealing with uncertainty and perform even more invasive and potentially dangerous investigations when imaging is not available or is untimely. By creating a vacuum on training, the lack of engagement by radiologists has opened the door for other specialists (e.g., emergency physicians) to provide such training instead and has contributed to the independent training and accreditation avenues that exist for clinicians today. Studies such as the one by Wyrick et al. [4] document the teaching of US from one non-radiologic specialty to another, in this case surgeons claiming superior anatomical understanding for teaching US for hypertrophic pyloric stenosis to paediatric emergency medicine physicians.

The European Society of Radiology's published 2009 statement that "turf battles about the use of US continue to grow as more and more specialists are claiming US as part of their every day's work, and the position of radiologists is progressively further undermined" [13] reflects the broader radiology community's position more than 10 years ago and is not addressed in the current position paper when offering "collaboration between first-line caregivers and paediatric radiologists" and the desire to become "involved in non-radiologist point-of-care US education" [1]. In the USA, Conlon and colleagues [14] initiated a truly collaborative training and quality-assurance effort between the paediatric radiology and paediatric emergency medicine departments at a large children's hospital that did not impose accreditation by radiologists. Kaplan et al. [15] showed that in fact radiologist-performed US increased or remained stable during the introduction and growth of emergency medicine POCUS because of a complementary role, rather than substandard US at the point of care. One reasonable explanation is that clinicians use POCUS as a screening tool but defer to radiologists for full characterization of findings and more time-consuming details that escape their area of competence. These publications might have paved the way forward for our proposed collaborations with clinicians.

The advantages of non-radiologist-performed POCUS in paediatrics have been given fair representation in the ESPR position paper with regard to expedited performance at the patient-attending physician level, in improving urgent diagnosis, avoiding the loss of clinical information and overcoming staff shortages providing a 24/7 service [1]. However, the authors turned to personal experience to describe "unnecessary additional studies due to equivocal non-radiologist point-of-care US results, to repeat examinations with decreased patient compliance (especially in young children) and anxious parents, and to missed diagnoses due to the overconfidence or

limited experience of the non-radiologist point-of-care US provider" [1]. This is an unsupported statement and does not present evidence because it neither quantifies what proportion of patients have been saved the wait, trip and anxiety of a visit to the radiology department, nor provides evidence of better performance by radiologists. The comment ignores routine radiologist practices where radiologists refer from one level of expertise to another (technologist/registrar to a consultant), from one subspeciality to another (general radiologist to paediatric radiologist), from one institution to another (general hospital to a children's hospital) and from one modality to another (e.g., from US to fluoroscopy or CT/MRI). Moreover, the statement ignores that there is often no choice between a radiologist and a non-radiologist because many settings do not have a full team of subspecialists at hand 24/7.

Despite acknowledging that POCUS "can lead to cost efficiency and consequently to a decrease in overall health care costs" and that, with POCUS, "imaging can be expedited", the authors reverted to an anecdote to note that it could also lead to additional costs and potentially delay the diagnostic/treatment process and that "in comprehensive US it is obvious that a timely and accessible report is key for good patient management, this is not the case for non-radiologist point-of-care US" [1]. In fact, the main advantage of non-radiologist POCUS performed by the treating physician in the words of Kendall et al. [3] is that:

> "[I]t is done contemporaneously with patient care, and it is performed on an immediate basis (within seconds or minutes) of the clinician identifying a need. Interpretation of images is done by the treating physician and occurs simultaneously with the generation and display of images. The treating physician is seeking to immediately answer a specific question that will drive a clinical decision or be utilized to guide a difficult or high-risk procedure. In the paradigm of emergency ultrasound, the work product is improved patient care by using ultrasound technology".

There is zero delay from the caregiver's perspective. Corsini et al. [9] noted in a letter to *Pediatric Radiology* that in the neonatal intensive care unit, the time between the decision to perform lung US and the diagnosis was shorter for non-radiologist POCUS when compared to radiography. Lee et al. [16] showed that nearly one-third of follow-up recommendations in radiologist reports are not executed by clinicians, which might in part be because of the inherent delay between clinical decision-making and the time it takes to generate a radiologist report, or because radiologists have not examined the patient with the rest of the clinical team. As Parri and colleagues [2] noted, "historically, diagnostic radiologists have been our imaging experts with limited patient interaction". Radiologists are the ones working in a silo, away from the clinical platform.

We firmly believe that increased support across subspecialties will result in better care and challenge the suggestion that "missed diagnoses due to the over-confidence or limited experience" of the person performing the POCUS refers only to non-radiologists [1]. In fact, there are not enough paediatric radiologists in practice even in Europe, the United States or Canada, and it is unlikely that the majority of paediatric US exams are performed in children's hospitals by expert paediatric radiologists — more likely they are being performed by radiology registrars, general radiologists, junior radiologists and non-expert paediatric radiologists at general radiology practices. It is highly likely, therefore, that missed diagnoses are also being made by radiologists performing US. Eakins et al. [17] (not referring specifically to US) documented that in paediatric patients referred to a tertiary-care children's hospital for body imaging cases, major (32.6%) and minor (18.7%) disagreements occurred between the original radiologist opinion by generalist community radiologists and the second opinion of specialty radiologists at a tertiary-care paediatric hospital. Furthermore, the authors of this letter, having been involved in lung and mediastinal US practice in children and having trained both radiologists and non-radiologists, believe that limited experience with lung US is what puts patients at risk of missed diagnoses regardless of radiologist, paediatric radiologist or non-radiologist status.

Finally, having a well thought-out curriculum for each clinical specialty wishing to perform POCUS is an excellent recommendation. While the ESPR position statement lists European curricula and credentialing/certification methods for undergraduates, general radiology training and radiology subspecialisation, it should be noted that these are not requirements for licensing and performing paediatric US as a radiologist in Europe. The "need for credentialing non-radiologists who want to become involved in non-radiologist point-of-care US" [1] should be balanced by what is expected of radiologists themselves. The distance between offering to assist with curriculum development and training, and paediatric radiologists' involvement in a "credentialing board" for non-radiologist POCUS is wide, and the reason given — "because paediatric radiologists are the experts in the field" — might be offensive to other disciplines [1]. The latter statement presumes that paediatric radiologists are the best at performing all aspects of paediatric US — but in fact radiologists should concede that there are cardiologists performing high-quality echocardiograms, foetal medicine physicians performing expert-level foetal US and gynaecologists performing expert-level trans-vaginal US. This expertise has been developed independent of radiologists. Therefore, when making recommendations, the ESPR should consider that the paediatric radiology profession be held to the same standards. Do all paediatric radiologists, by definition, through the available

curricula and credentialing processes need to be expert sonographers in all fields of US? Can a paediatric radiologist be called a paediatric radiologist if he or she performs US less than 1 day a week or works solely as a neuroradiologist? Should general radiologists continue to perform US on children if they are not paediatric radiologists or certified in paediatric US specifically? Societies must consider the safety of their own memberships when making recommendations to other disciplines.

It is a poor starting point for collaboration, when offering to assist non-radiologists in their quest to perform POCUS, to suggest that "non-radiologist point-of-care US should be limited to guiding specific interventions, such as line placement and suprapubic punctures, or to those studies that are performed to promptly answer specific diagnostic yes/no questions" [1]. It is also inappropriate to state that "all radiologists will have several anecdotal cases in which non-radiologist point-of-care US missed the diagnosis thus leading to a delay in the diagnosis and potential damage to the patient" [1]. Surely, to err is human and anecdotal examples of radiologist misdiagnoses, despite their formalised training or expertise, also exist.

In summary, we firmly advocate for collegial collaboration with physicians while keeping an open mind for new ideas for non-radiologist-led POCUS applications and learning to perform these in addition to our regular high-end imaging methods. This includes non-traditional uses of US that might offend radiologists' senses at first but still need to find their place in the triage and workflow. Similar issues exist in the United States, and a paper by Coley [18] summarises these, suggesting just such a collegial approach. In (affluent) Europe — not to mention in the rest of the overwhelming larger portion of the world, lower- and middle-income countries — the ESPR should accept the interest by paediatricians to perform POCUS as complementary rather than as undermining the paediatric radiologists' position, offer to assist clinicians in attaining their goals *without preestablished conditions,* and be confident that paediatric radiologists' expertise will rise to the surface, making them invaluable. To quote the editor of *Pediatric Radiology* on non-radiologist POCUS, "Regardless of who does it and where it is done, let's do it well!" [19] — we would like to emphasise the "let's" portion — let us all.

Declarations

Conflicts of interest None

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