

ORIGINAL ARTICLE

# Analysis of lawsuits related to point-of-care ultrasonography in neonatology and pediatric subspecialties

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**OBJECTIVE:** Point-of-care ultrasonography (POCUS) is becoming increasingly available for neonatologists and pediatric subspecialists (PSS); however, concerns over potential litigation from possible missed diagnoses or incorrect management have been documented. This study aims to define the extent and quality of lawsuits filed against neonatologists and PSS related to POCUS.

**STUDY DESIGN:** We conducted a retrospective study of all United States reported state and federal cases in the Westlaw database from January 1990 through October 2015. Cases were reviewed and included if either a neonatologist or PSS were accused of misconduct or the interpretation or failure to perform an ultrasound/echocardiogram was discussed. Descriptive statistics were used to evaluate the data.

**RESULTS:** Our search criteria returned 468 results; 2 cases were determined to be relevant to the study objective. The two cases alleged a failure to perform a diagnostic test and implicated POCUS as an option. There were no cases of neonatologists and PSS being sued for POCUS performance or interpretation.

**CONCLUSION:** This study of a major legal database suggests that POCUS use and interpretation is not a significant cause of lawsuits against neonatologists and PSS.

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## INTRODUCTION

There is significant evidence in adult medicine that point-of-care ultrasonography (POCUS), or ultrasonography (US) carried out at bedside by non-radiology and non-cardiology practitioners, can reduce procedure time, minimize complications and augment the diagnosis and management of acute disease processes.<sup>1–6</sup> Though less studied in the pediatric population, many POCUS applications have been extrapolated and more studies are showing similar potential benefits in the fields of pediatric emergency medicine (PEM), pediatric critical care medicine (PCCM) and neonatology.<sup>7–11</sup>

However, POCUS is a multifaceted skill, including image acquisition, interpretation and clinical knowledge; and proficiency requires education and hands-on training experience.<sup>12</sup> In pediatrics, only PEM has guidelines for POCUS use that were recently published by the American Academy of Pediatrics.<sup>13,14</sup> In neonatology and other pediatric subspecialties, the legal ramifications of possible missed diagnoses or incorrect management have been documented as concerns and perceived barriers to POCUS implementation.<sup>15–17</sup>

Despite the worries over potential litigation, no objective data have been published on the topic of lawsuits related to POCUS in neonatology or other pediatric subspecialties. Blaivas and Pawl<sup>18</sup> analyzed 659 legal cases from the Westlaw database regarding POCUS use by adult emergency medicine (EM) physicians from 1987 to 2007 and identified none related to performance or interpretation of POCUS. They expanded on this body of evidence

by examining cases from 2008 to 2012, by which time POCUS had been integrated into EM training and practice,<sup>12,19,20</sup> and again no reported cases of failure to interpret or misdiagnosis were identified. However, the authors found five cases that alleged a failure to perform POCUS or a failure to perform it in a timely manner; four of the cases resulted in a patient death. Thus, due to the increased use and scope of practice of POCUS in EM from 1990 to 2012, the legal risk of not using POCUS became significant to EM physicians.

POCUS's utility to expedite clinical decision-making, direct follow-up diagnostic imaging and aid in procedural guidance, along with its non-invasiveness, safety profile, portability and lack of radiation, are factors driving its increased use and training in pediatric subspecialty fields.<sup>9,14,16,21,22</sup> Though evidence is mounting regarding the benefits of POCUS applications in neonatology and other pediatric subspecialties, the concern of litigation may cause hesitation and limit the proliferation of POCUS use and training. A review of lawsuits to date on this matter would be helpful in addressing these legal concerns, as well as elaborate on the pattern of lawsuits that neonatologists and pediatric subspecialists (PSS) have encountered regarding POCUS use.

## METHODS

The purpose of this study is to define the extent and quality of lawsuits filed against neonatologists and PSS related to POCUS. We conducted a retrospective study using the Westlaw database. The Westlaw database is one of the primary online legal research resources used by United States

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lawyers and legal professionals for scholarly and professional work.<sup>23</sup> The restricted database service links to >40 000 databases of state and federal case law, state and federal statutes, public records and other information sources. We decided to review the Westlaw database instead of closed malpractice claims databases such as the Physician Insurers Association of America because such databases are known to lack contextual and circumstantial case descriptions.<sup>24,25</sup> The study was approved by the institutional review board.

We searched the Westlaw database 'ALLCASES' for published case law in the United States from January 1990 through October 2015, including both federal and state decisions. We felt that 1990, at which the literature started documenting routine POCUS use by EM physicians, would be a very conservative starting point. Search terms were 'ultrasound or sonography or echocardiography' and 'neonatologist or pediatric', with any suffix. The database automatically accounts for different word variations. This is a significantly broadened variation of the searches carried out by Blaivas and Pawl<sup>18</sup> and Stolz *et al.*<sup>19</sup> in an effort to capture all cases pertaining to pediatric practitioners and POCUS; the returned cases were expected to include many actions not actually involving POCUS or neonatologists/PSS. These search criteria would capture infants and children managed by non-pediatric specialties, such as EM physicians, if the term 'pediatric' were used in the case filing. Database assistance was provided by a third year law student (MC).

One neonatologist (SN) with many years of research and clinical experience in POCUS and one neonatology fellow (JN) trained in POCUS reviewed all records identified through the search. Cases involving US or echocardiography (ECHO) use/interpretation by cardiologists, radiologists and US/ECHO technicians were excluded. Cases were included if either a physician was accused of misconduct or the interpretation or failure to perform an ultrasound was discussed. We recorded a brief narrative of the case, the POCUS examination, the department or pediatric specialty of the accused and a broad category of the cause of action (misdiagnosis, failure to interpret, failure to perform, failure to perform in a timely manner). Descriptive statistics were used to evaluate the data.

## RESULTS

Our search criteria returned 468 results. After review, two cases were determined to be relevant to the study objective. The other results were cases that mentioned US/sonography/ECHO in the case filing but the allegations did not relate to POCUS use or interpretation. Four of the excluded cases involved the misinterpretation of US findings but the US examination and interpretation were carried out by cardiology, radiology, obstetrics or sonography technicians—one involved the misdiagnosis of an abdominal mass, one concerned ovarian torsion, one concerned testicular torsion and another regarded failure to diagnose intraventricular hemorrhage.

The first case (2013 WL 3879886) regarded an infant born in 2006. The case was brought to trial in 2011 and the jury returned a verdict in favor of the defendant neonatologist. The case involved a left arm peripherally inserted central catheter placed in the neonatal Intensive Care Unit that was deemed to be in proper position by radiograph per the medical team but was later determined to be in the artery instead of the vein after the insertion arm showed signs of vascular compromise. The catheter was promptly removed but the patient eventually required an amputation below the elbow of the affected arm. The prosecution alleged that the medical team failed to do further testing to confirm correct line placement, such as ECHO, US or arterial blood gas test.

The second case (2015 WL 2373231) was filed in 2013 regarding allegations of wrongful death, and it was brought to trial in September 2015. The case involved an 11-year-old boy found by his father with a screwdriver puncture wound to the neck at a construction site. Computed tomography (CT) of the head, neck and chest were carried out in the emergency department and all were negative. The boy exhibited no signs of abdominal trauma or abdominal bleeding, and no CT of the abdomen was carried out. Soon after transfer to the pediatric Intensive Care Unit, ECHO showed 5% ejection fraction owing to unknown etiology.

Extracorporeal membrane oxygenation (ECMO) was attempted but the surgeons experienced a difficulty inserting the cannulas and the patient expired. Autopsy found blood in the retro-peritoneal space as well as perforations in the aorta and iliac arteries, where the ECMO cannulas met resistance during insertion. At trial, the defense theory was that the blood found had to have come from the failed ECMO procedure. The plaintiffs' theory was that there was blunt force abdominal trauma that caused internal bleeding that would have been discovered had the pediatric trauma surgeon ordered an abdominal CT or performed a focused assessment with sonography for trauma (FAST) of the abdomen. The jury returned a verdict in favor of the defendant.

## DISCUSSION

The concern regarding liability and litigation over possible missed or incorrect diagnoses has been recognized as a barrier to POCUS training and implementation in neonatology and other pediatric subspecialties.<sup>15–17</sup> This perceived legal liability regarding the use of US is likely extrapolated from the quality and quantity of litigation faced by obstetricians and radiologists, where misinterpretation and misdiagnosis allegations make up a significant portion of malpractice claims;<sup>25–27</sup> however, there is little evidence that pediatric practitioners share similar legal environments.

Our study describes the publicly available lawsuits pertaining to POCUS by neonatologists and PSS. No cases alleging misdiagnosis or failure to interpret were found. We could not identify any legal precedent for neonatologists and PSS regarding the use and interpretation of POCUS. The two cases that related to POCUS mentioned POCUS only as a possible diagnostic modality. The first case alleged a failure to perform ECHO or US for confirmatory line position in the neonatal Intensive Care Unit, reflecting a trend toward US becoming the 'gold standard' for line placement and/or verification in pediatrics.<sup>9,17,28</sup> The second case alleged a failure to perform a FAST examination for a child in the emergency department. Though it is unknown if a FAST exam would have detected retroperitoneal blood adequately or changed the patient's clinical course, the case suggests an increased recognition of POCUS as a bedside tool available to pediatric practitioners in acute and emergency care settings.

The American Academy of Pediatrics has acknowledged POCUS use and training in PEM and recently published the first guidelines for POCUS implementation by PEM physicians in July 2015.<sup>13,14</sup> The utility and potential benefits of POCUS appear to be increasingly appreciated in neonatology and PCCM as well;<sup>17,28</sup> however, other than a recently published expert consensus statement on targeted neonatal echocardiography,<sup>29</sup> there are currently no guidelines for POCUS training or competency standards for POCUS use in these subspecialties. In the absence of pediatric-subspecialty-specific recommendations, it may be reasonable to adopt statements from related fields as guides and adjust them to suit departmental and institutional applications and needs.

This study has several limitations. Not all pertinent cases on Westlaw may have been captured by our search criteria, as perhaps the search terms used were not present within the case; however, a very broad search criteria was purposefully used in an effort to capture all cases, with the expectation that many of the returned cases would not be pertinent to neonatologists/PSS and POCUS. Cases settled out of court, many with unpublished or unreported decisions, or cases otherwise not publicly available (for example, private negotiations, arbitrations, sealed records and so on) are not captured in the Westlaw database. Nonetheless, Westlaw is one of the major databases used by legal professionals in the United States and would capture any case regarding POCUS use that has the potential to set legal precedent. Finally, it should

be appreciated that this retrospective review of lawsuits is not necessarily predictive of future liability.

In summary, this study of a major legal database suggests that POCUS use and interpretation is not a significant source of lawsuits against neonatologists and PSS. Further, as POCUS use becomes more pervasive and accessible in acute and critical care settings, the legal trend may support more POCUS use and encourage training and proficiency.

## CONFLICT OF INTEREST

The authors declare no conflict of interest.

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