

Ultrasound in Emergency Medicine

A REVIEW OF LAWSUITS RELATED TO POINT-OF-CARE EMERGENCY ULTRASOUND APPLICATIONS

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Abstract—Background: Previous investigators have assessed United States Case Law to evaluate the medicolegal risk surrounding point-of-care ultrasound applications. These studies have suggested that nonperformance is the primary source of an allegation of medical malpractice. **Objectives:** The objective of this study is to update the literature regarding medical malpractice cases involving ultrasound applications that could be used at the point of care, and assess the risk conveyed to advanced practice providers and by application of emerging applications of ultrasound. **Methods:** Authors reviewed the Westlaw database for medical malpractice cases involving point-of-care ultrasound applications between December 2012 and January 2021. Cases were included if there was an allegation of misconduct by an emergency provider and if an ultrasound included in the American College of Emergency Physicians investigators core, extended, emerging, or adjunct applications was discussed to any degree. Investigators independently reviewed the cases for inclusion. Authors abstracted the case information, type of ultrasound performed, and the specific allegation of misconduct. **Results:** Nineteen cases met inclusion criteria. Seven cases involved core applications of emergency ultrasound and 13 involved extended, emerging, or adjunct applications. One case was included in both categories as it included elements of both core and extended applications. The most common primary allegation was failure to perform

an ultrasound. No cases clearly alleged misinterpretation of a point-of-care ultrasound. **Conclusion:** As previous studies have suggested, nonperformance of ultrasound seems to convey the greatest medicolegal risk. Extended, emerging, or adjunct applications of ultrasound may convey a slightly higher risk. © 2022 Published by Elsevier Inc.

Keywords—ultrasound; point-of-care ultrasound; POCUS; lawsuit; malpractice; litigation

INTRODUCTION

Point-of-care ultrasound is a powerful tool for medical decision-making, diagnosis, and procedural guidance in the hands of well-trained emergency providers (EPs). Performance of this procedure is a core competency of Emergency Medicine residency and its use is increasing (1). Use of point-of-care ultrasound by advanced practice providers with appropriate training has been endorsed by national emergency medicine organizations (2). The practice of emergency medicine carries significant medicolegal risk, with 75% of emergency physicians being named in a medical malpractice action at some point during their career (3). Despite this, relatively little is known about the medicolegal risk surrounding EP-performed point-of-care ultrasound. Previous studies into causes of medical malpractice have found that total number of years in practice and number of patient interactions are factors for being named in a medical malpractice lawsuit (4).

Meetings: Department of Emergency Medicine Research Day – June 2021, University of Arkansas for Medical Sciences, Little Rock, Arkansas.

RECEIVED: 9 January 2022; FINAL SUBMISSION RECEIVED: 22 March 2022;
ACCEPTED: 23 April 2022

Required training in point-of-care ultrasound among emergency medicine residency graduates, increasing breadth and depth of point-of-care ultrasound applications, and increasing frequency of use of point-of-care ultrasound creates the potential for ultrasound to take a larger role in medical malpractice actions. Additionally, training in, and use of, point-of-care ultrasound by advanced practice providers is becoming more common and may be an element of medicolegal risk for advanced practice providers. Risk of medical malpractice may involve failing to perform an ultrasound study, inadequately performing an ultrasound study, or may arise from inaccurate or inadequate interpretation of a study. As point-of-care ultrasound becomes more common, the ability to shift liability onto consulting services by ordering consultative studies rather than performing point-of-care ultrasound may become more perilous.

Two previous studies have attempted to describe the risk of medical malpractice regarding emergency physician-performed point-of-care ultrasound. Blaivas and Pawl analyzed 659 cases filed between 1987 and 2007 (5). Stoltz et al. analyzed 120 cases filed between January 2008 and December 2012 (6). Both studies identified no cases relating to the performance or interpretation of point-of-care ultrasound. Blaivas and Pawl identified a single case alleging that the emergency physician failed to perform a point-of-care ultrasound (5). The aim of our study is to build upon the work of Blaivas and Pawl and Stoltz et al. by characterizing the malpractice litigation involving point-of-care ultrasound that has occurred from December 2012 to January 2021 (5,6). Additionally, our study aims to analyze the risk of medical malpractice for advanced practice providers surrounding the use of point-of-care ultrasound.

MATERIALS AND METHODS

This is a retrospective review of the Westlaw Edge database for medical malpractice cases involving point-of-care ultrasound filed in state and federal courts in the United States. Westlaw Edge is an online legal research database, primarily used by legal professionals for scholarly and professional work, which serves as a repository of statutes, case law, and public records. Our study builds upon the previous studies by Blaivas and Pawl and Stoltz et al., which investigated medical malpractice risk involving point-of-care ultrasound with similar methodology (5,6). This study was evaluated by the Institutional Review Board at the University of Arkansas for Medical Sciences who determined that this did not meet the definition of human subject research.

We reviewed the Westlaw Edge database “ALL-CASES” for published U.S. case law between December

2012 and January 2021. We utilized a modified version of the search strategy described by Stoltz et al. in her previous work on this subject (6). Boolean search terms included “ultrasound,” “sonography,” “sonogram,” and “echocardiogram,” with any suffix. These terms were searched within 250 words of “emergency” with any suffix and within 10 words of “physician” or “doctor.” We also searched the same Boolean terms within 250 words of “emergency” with any suffix and within 10 words of “physician assistant” or “nurse practitioner.” This search strategy was first validated by limiting the time period of our search to the time frame evaluated by Stoltz et al.—January 2008 through December 2012—and ensuring that all five cases reported in that study were captured by the search terms (6). After validation of the search strategy, we then limited our timeframe to December 2012 through January 2021.

The search was conducted and records were reviewed by an Emergency Medicine ultrasound faculty member (JA) and an Emergency Medicine ultrasound fellow (BR). Cases were included if a physician, nurse practitioner, or physician assistant providing emergency care was accused of misconduct, the encounter occurred in the Emergency Department (ED), and the interpretation or failure to perform an ultrasound that falls into the American College of Emergency Physicians (ACEP) core, extended, emerging, or adjunct applications was discussed to any degree (7,8). Similar to the inclusion criteria utilized by Stoltz et al., we included applications of ultrasound that were performed by Radiology and Cardiology but could have been performed by an emergency physician, with the intention of identifying cases where an EP either did or potentially could have performed a point-of-care ultrasound (6).

Two authors (JA, BR) reviewed each case independently to assess for inclusion in the study. Each reviewer recorded a brief narrative of the case, the type of examination involved, the department that performed the study, the allegation of misconduct, and if the type of study was recognized as an ACEP core application or an extended, emerging, or adjunct application of ultrasound. Cases of disagreement were adjudicated by a third reviewer (ZL) who is an ultrasound faculty member. We agreed, a priori, that the third reviewer would conduct the adjudication by first independently reviewing contested cases prior to hearing arguments from each primary reviewer about inclusion or exclusion prior to issuing a final verdict in quasi-judicial fashion.

RESULTS

We identified 276 cases matching our search criteria, of which 19 cases met final inclusion criteria. [Figure 1](#)

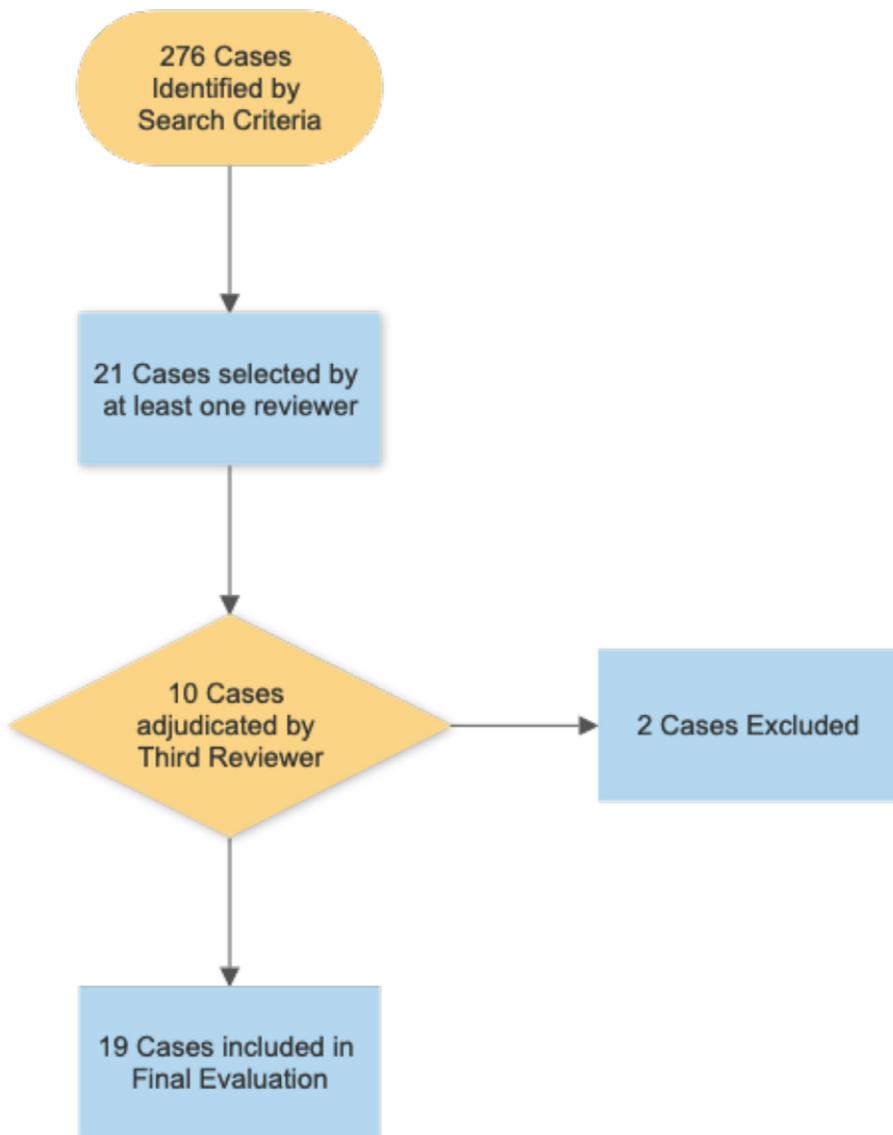


Figure 1. Case selection process.

demonstrates the case selection process. Seven cases were ultrasound applications that fell within the ACEP core applications (Table 1) (7,8). Thirteen cases involved applications of ultrasound that ACEP recognizes as extended, emerging, or adjunct (Table 2) (7,8). One case was included in both the core and extended tables as it involved a pericardial effusion, recognition of which is a core application, and a dilatated aortic root, recognition of which is an extended application. Three cases were identified in which ED-based Advanced Practice Providers were named in the action; in each, the application involved was an extended rather than a core application (Table 3).

No cases were known to have been performed as point-of-care ultrasound studies. One case involved a DVT

ultrasound of unknown provenance. The remainder of cases involved studies performed by either Cardiology or Radiology, or involved the nonperformance of studies. As Blaivas and Pawl and Stolz et al. previously concluded, our study found no cases of litigation that clearly resulted from misinterpretation of point-of-care ultrasound studies (5,6).

Failure to perform an ultrasound study was the most common primary allegation among all cases ($n = 10$). The most common examination type involved was a venous duplex examination ($n = 5$) followed by testicular ultrasound ($n = 3$), transthoracic echocardiogram ($n = 2$), obstetric ultrasound ($n = 2$), or vascular ultrasound ($n = 2$), followed by transesophageal echocardi-

Table 1. Summary of Cases Involving Emergency Physicians and Core Application of Point-of-Care Ultrasound

Case	Examination Type	Performing Department	Allegation(s)
1	DVT	Not performed	Failure to perform Failure to diagnose
2	Transthoracic echocardiography (aortic root evaluation)	Not performed	Failure to perform Failure to diagnose Failure to appropriately screen and stabilize
3	DVT	Not performed	Failure to perform Failure to diagnose
4	DVT	Not performed	Failure to perform Failure to diagnose

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Table 1. (continued)

Case	Case Summary	Examination Type	Performing Department	Allegation(s)
5	A man presented with shortness of breath, chest tightness, and right leg pain exacerbated by walking. He was discharged after a negative evaluation for cardiac ischemia, however, he collapsed after returning home due to a pulmonary embolism. Alleged failure to appropriately screen for VTE. (2017 WL 5473587)	DVT	Not performed	Failure to perform Failure to diagnose
6	A man with a history of paraplegia presented with a swollen upper leg. Blood work and ultrasound were performed, and the patient was diagnosed with a DVT and was started on anticoagulation. Due to persistent symptoms he re-presented and was discovered to have a femur fracture and no DVT. Alleged failure to diagnose fracture and misinterpretation of ultrasound. (2018 WL 4040237, 2019 WL 1098968)	DVT	Unclear	Failure to diagnose Misinterpretation of ultrasound
7	A woman at approximately 13–14 weeks gestation presented with severe abdominal pain. She was hypotensive and an ultrasound showed fluid in the cul-de-sac. She was resuscitated with intravenous fluids and admitted to the ICU under the care of an OB/GYN, however, she subsequently died from hemorrhage due to an ectopic pregnancy. Alleged failure to diagnose ectopic pregnancy, to resuscitate with blood products, and delay in operative intervention. (2016 WL 1683951)	OB ultrasound	Radiology	Failure to diagnose

CT = computed tomography; DVT = deep vein thrombosis; PCP = primary care physician; VTE = venous thromboembolism; ICU = intensive care unit; OB = obstetrics; GYN = gynecology.

Table 2. Summary of Cases Involving Emergency Physicians and Extended, Emerging, or Adjunct Applications of Point-of-Care Ultrasound

Case	Case Summary	Examination Type	Performing Department	Allegation
1	A middle-aged woman presented with bilateral cold feet. A DVT ultrasound showed no DVT and the patient was discharged. She subsequently re-presented with bilateral critical arterial insufficiency requiring bilateral below-knee amputations. (749 S.E.2d 762, 13 FCDR 3134)	Vascular (arterial doppler)	Not performed	Failure to perform Failure to diagnose
2	A man presented with right-sided abdominal and flank pain associated with nausea and vomiting. A CT scan of the abdomen was negative and he was discharged. He subsequently re-presented at another ED 1.5 days later and was discovered to have testicular torsion and underwent orchiectomy. (2018 WL 1192242)	Testicular	Not performed	Failure to perform Failure to diagnose
3	A teen-aged boy presented with sudden-onset testicular pain that woke him from sleep. An ultrasound was performed that was interpreted as negative for testicular torsion. Three days later he re-presented with increased swelling and was transferred to another facility, where he was diagnosed with testicular torsion and underwent orchiectomy. (2017 WL 3974356)	Testicular	Radiology	Failure to diagnose Misinterpretation of ultrasound
4	A man with a history of hypertension and a paternal history of sudden death due to a thoracic aortic aneurysm presented with a “lump” in his throat, increasing pressure near the base of his skull, fatigue, and neck and chest pain. He underwent a CT scan of the brain, an ECG, blood work, and an x-ray study of the chest and neck and was discharged. Twenty days after his ED visit he died from dissection of a 4.5-cm ascending aortic aneurysm. Alleged that the patient should have undergone either a CT scan of the chest or a transesophageal echocardiogram. (2017 WL 541912)	Transesophageal echocardiography	Not performed	Failure to perform
5	A man presented with sudden-onset chest pain that began during exertion, associated with tingling in the fingers and left side of face, blurry vision, sweating, nausea, and vomiting. Initial evaluation revealed elevated troponin. During his evaluation he developed perseveration, underwent a CT scan of the brain, and was admitted. The admitting resident discovered a new murmur and consulted Cardiology and ordered an echocardiogram, which was performed the next day. The echocardiogram was read the day after it was performed and revealed a 6-cm aortic root and aortic insufficiency. A carotid Doppler was performed and discovered a carotid dissection, and subsequently, the patient underwent a CT scan that showed a type A aortic dissection and 8-cm thoracic aortic aneurysm. The patient was taken to the OR for repair and had a postoperative course complicated by cardiac arrest, embolic stroke, and renal, liver, and intestinal failure. (2014 WL 4355685)	Transthoracic echocardiography (aortic root evaluation)	Cardiology	Failure to perform in a timely manner Failure to diagnose

Table 2. (continued)

Case	Case Summary	Examination Type	Performing Department	Allegation
6	A teenaged boy with a history of a complex renal cyst first diagnosed at age 7 years presented to the ED with new hematuria. A renal ultrasound ordered in the ED showed a “stable cyst.” Two months later the patient died from a pulmonary embolism that was thought to be a complication of high-grade papillary renal cell carcinoma. Alleged misinterpretation of the ultrasound. (2017 WL 354286)	Renal	Radiology	Failure to diagnose
7	A man presented with epigastric, back, neck, and shoulder pain associated with nausea and vomiting and was admitted for observation. Cardiology was consulted and recommended an echocardiogram, however, he decompensated prior to this and was taken emergently to the cath lab where he was discovered to have a pericardial effusion due to dissection of a thoracic aneurysm. The patient subsequently died. Allegation involved claim that patient was not stabilized for admission and should have received some form of chest imaging. (2015 WL 437431)	Transthoracic echocardiography (aortic root assessment)	Not performed	Failure to perform Failure to diagnose Failure to appropriately screen and stabilize
8	A woman at approximately 6 weeks gestation presented with sharp right-sided abdominal pain and vaginal bleeding. Lab work and an ultrasound were performed and the patient was diagnosed with a miscarriage and discharged. On follow-up with her OB/GYN, she was discovered to have an ectopic pregnancy requiring salpingectomy. (2018 WL 3640384)	OB ultrasound (Identification of ectopic pregnancy)	Radiology	Failure to diagnose
9	An infant boy presented with right lower quadrant abdominal pain. Ultimately diagnosed with right testicular torsion requiring orchiectomy. (175 A.D.3d 578, 106 N.Y.S.3d 382, 2019 N.Y. Slip Op. 06186)	Testicular	Not performed	Failure to perform Failure to diagnose Delay in diagnosis
10	A woman presented with abdominal pain and was diagnosed with a pelvic mass or ovarian cyst and acute appendicitis based on CT scan and pelvic ultrasound. She was taken for appendectomy and received intraoperative gynecology consultation due to concern for a pelvic mass. She was discharged with a plan for follow-up with a gynecologic oncologist. Four days after discharge she re-presented and was diagnosed with ovarian torsion at another hospital and underwent salpingo-oophorectomy. (180 A.D.3d 1088, 119 N.Y.S.3d 559, 2020 N.Y. Slip Op. 01374)	Pelvic ultrasound (identification of ovarian torsion, assessment of adnexal masses)	Radiology	Failure to diagnose Misinterpretation of ultrasound Improper treatment

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Table 2. (continued)

Case	Case Summary	Examination Type	Performing Department	Allegation
11	A man presented with epigastric pain. An abdominal ultrasound was performed and showed heterogenous appearance of the liver. He was discharged with a proton-pump inhibitor and antiemetics. Approximately 1 month later he died from hemorrhagic pancreatitis. Alleged failure to diagnose pancreatitis and counsel patient against continued alcohol use. (2018 WL 3335986)	Right upper quadrant ultrasound (assessment of pancreas)	Radiology	Failure to diagnose
12	A man with a history of a femoral-popliteal bypass presented to the ED with right foot pain. Ultrasound studies of his lower leg arteries and veins showed dampening of the distal arterial wave forms but did not include imaging of the patient's bypass graft. He was discharged, however, 6 days later his symptoms worsened and prompted him to present at another facility, where he underwent an amputation due to ischemia. (2020 WL 6710208)	Vascular (arterial doppler)	Radiology	Failure to diagnose
13	A man presented with eye pain that started while working on his motorcycle. He was diagnosed with a corneal abrasion and UV conjunctivitis and discharged with instructions to return to the ED for a 24-h re-evaluation. He did not return to the ED, however, several days later presented to the Ophthalmology Clinic due to worsening pain and was discovered on ultrasound to have an intraocular foreign body. He ultimately underwent enucleation of the afflicted eye. (2020 WL 4803735)	Ocular (assessment for intraocular foreign body)	Not performed	Failure to perform Failure to diagnose

DVT = deep vein thrombosis; CT = computed tomography; ED = emergency department; ECG = electrocardiogram; OR = operating room; OB/GYN = Obstetrics and Gynecology; UV = ultraviolet.

Table 3. Summary of Cases Involving Advanced Practice Providers

Case	Case Summary	Examination Type	Performing Department	Allegation	ACEP Core Application?
1	A middle-aged woman presented with bilateral cold feet. A DVT ultrasound showed no DVT and the patient was discharged. She subsequently re-presented with bilateral critical arterial insufficiency requiring bilateral below knee amputations. (749 S.E.2d 762, 13 FCDR 3134)	Vascular (arterial doppler)	Not performed	Failure to perform Failure to diagnose	No
2	A woman at approximately 6 weeks gestation presented with sharp right-sided abdominal pain and vaginal bleeding. Lab work and an ultrasound were performed and the patient was diagnosed with a miscarriage and discharged. On follow-up with her OB/GYN she was discovered to have an ectopic pregnancy requiring salpingectomy. (2018 WL 3640384)	OB ultrasound (Identification of ectopic pregnancy)	Radiology	Failure to diagnose	No
3	A man presented with eye pain that started while working on his motorcycle. He was diagnosed with a corneal abrasion and UV conjunctivitis and discharged with instructions to return to the ED for a 24-h re- evaluation. He did not return to the ED, however, several days later presented to the Ophthalmology Clinic due to worsening pain and was discovered on ultrasound to have an intraocular foreign body. He ultimately underwent enucleation of the afflicted eye. (2020 WL 4803735)	Ocular (assessment for intraocular foreign body)	Not performed	Failure to perform Failure to diagnose	No

DVT = deep vein thrombosis; OB/GYN = Obstetrics and Gynecology; UV = ultraviolet; ED = emergency department.

graphy, renal, pelvic, ocular, and right upper quadrant ultrasounds (each $n = 1$).

DISCUSSION

Medical malpractice litigation has a significant impact on Emergency Medicine providers and their practice patterns (9). Lifetime risk of being named in a malpractice action is significant, with 75% of EPs being named at some point in their career (3). Despite this, 65–70% of claims are dropped, withdrawn, or dismissed, and only approximately 7% proceed to a verdict, with 85–92% returning in favor of the defendant (3,10). The average defense expense varies by resolution, with an average of \$25,996 for cases dropped, withdrawn, or dismissed, and an average of \$41,033 overall (3).

The medicolegal climate has a significant impact on clinician behavior and cost to the entire health care system. The cost of the indemnity and defense expense is typically born by the insurer but financed by clinicians and health care organizations within the same risk pool in the form of the cost of insurance premiums. Data suggest that states with higher rates of physician malpractice claims are associated with higher admission rates and increased health care costs (9). Additionally, perception of malpractice risk, even when unfounded, has been associated with greater health care spending (11). Point-of-care ultrasound adds significant value in a multitude of ways, including reducing the cost of an episode of care and increasing ED efficiency (12–19).

Understanding the overall impact of point-of-care ultrasound and determining the optimal use of this powerful modality requires insight into the risks, including the medicolegal risks, of this modality. Historically, some providers have expressed reluctance to perform point-of-care ultrasound out of fear that this may result in the assumption of greater medicolegal risk. For this reason, some have advocated that obtaining consultative imaging from other services such as radiology and cardiology is a more legally sound practice insomuch that it shifts liability onto another service.

Studies that have investigated the malpractice risk conveyed by point-of-care ultrasound have found that nonperformance seems to convey the greatest medicolegal risk, with all cases alleging that ultrasound should have been, but was not, performed (5,6). Our findings reinforce this conclusion, with the majority of cases alleging that ultrasound was not performed when it should have been. This suggests that performance of ultrasound may convey a protective effect insomuch that this would stymie an allegation of nonperformance. No cases in our study clearly related to an inappropriately performed or inaccurately interpreted point-of-care ultrasound. There does seem to be an increasing number of medical malpractice allegations

that involve ultrasound. Whether this reflects an overall increase in number of medical malpractice lawsuits, increasing trend toward utilization of imaging, or suggests an evolving standard of care surrounding ultrasound is beyond the scope of this investigation. The inclusion of multiple cases wherein a consulting service performed or misinterpreted the study suggests that the practice of using consultative imaging in lieu of point-of-care ultrasound may not mitigate the medicolegal risk for the EP.

Limitations

Our study has multiple limitations. It is retrospective in nature and there were relatively few cases identified. Our methodology assessed only for allegations of malpractice that resulted in court filings, and does not include allegations settled by arbitration, mediation, private negotiations, or actions sealed by court order. Although this methodology has been previously utilized, it likely under-reports the true medicolegal risk of point-of-care ultrasound.

Litigation surrounding an accusation of medical malpractice experiences a significant lag between the episode of care and time a suit is filed. Although many jurisdictions have statutes of limitation for initiating an action for medical malpractice, jurisdictions may have varying discovery rules regarding when the clock starts on the statute of limitations. As a result, although our search involved legal action between December 2012 and January 2021, these lawsuits may represent care provided in a broad timeframe. For this reason, our study sheds light on the malpractice environment surrounding ultrasound in general, however, it should not be interpreted as necessarily reflecting the contemporary medical malpractice climate. However, these findings represent the emerging case law of the largest legal database utilized by legal professionals, suggesting that this case law is likely to be an element of future legal research surrounding point-of-care ultrasound.

The information available in the Westlaw Edge database is limited and provides a varying degree of detail. There may have been actions involving ultrasound that were not captured by our search strategy. There are lawsuits included in our review that may have been only tangentially related to point-of-care ultrasound. Additionally, little to no information was available regarding the medical decision-making process or the barriers to, or support for, point-of-care ultrasound, including physician skill or access to point-of-care ultrasound. For these reasons we have made the assumption that the emergency physician potentially could have performed the given ultrasound examination to broadly paint the potential risk.

Due to the limited information available for all cases and our desire to extract the qualitative information avail-

able in the cases with minimal subjective inferences, we have not commented on why ultrasound was not used or how it may have been used. Our methods assessed only for allegations of misconduct rather than verdicts against a defendant. This was intentional, to paint the broadest possible picture of the medicolegal environment surrounding point-of-care ultrasound so that EPs may have a better-informed practice. We did not comment on the validity, or lack thereof, of the allegations within the cases identified, but are mindful of the assumption of innocence of the accused and that the burden of proof rests on the plaintiff.

CONCLUSION

Our study suggests that the use of core applications of point-of-care ultrasound conveys minimal medicolegal risk at this time and may convey a protective effect. Extended, emerging, and adjunct applications of ultrasound may convey an increase in medicolegal risk relative to the core applications of ultrasound. As EPs have been enthusiastic adopters of point-of-care ultrasound, understanding the incremental change in risk as additional applications of ultrasound are adopted is critical for EPs to make informed decisions about what applications best fit their personal risk tolerance. However, it is important to note the dominant source of risk identified in our data suggests that not performing an ultrasound is the primary source of risk.

Despite the results of multiple studies into risk regarding ultrasound, there remains relatively little information regarding the impact that actual or perceived medicolegal risk has on clinician hesitance or acceptance of point-of-care ultrasound. This topic may prove valuable for understanding the barriers to the use of point-of-care ultrasound, and may be beneficial for reducing costs and increasing efficiency throughout the health care system by furthering implementation of point-of-care ultrasound.

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ARTICLE SUMMARY

1. Why is this topic important?

This article updates physicians and advanced practice providers about the medicolegal risk involved in the use or nonuse of ultrasound applications that could be performed at the point-of-care. Knowledge of potential medicolegal risk is important for providers to understand when assessing the risk tolerance of their personal practice.

2. What does this study attempt to show?

This study attempts to convey the medicolegal risk of performance or nonperformance of ultrasound applications that could be performed at the point-of-care and are potentially within the skillset of an emergency physician.

3. What are the key findings?

Applications of ultrasound that fall into the core applications of emergency ultrasound convey lower risk than extended, emerging, or adjunct applications. The most common primary allegation was failure to perform a study. No cases clearly alleged misinterpretation of a point-of-care ultrasound.

4. How is patient care impacted?

Based on this information, it seems that performance of point-of-care ultrasound may convey a medicolegal protective effect.