Ultrasonography and Outcomes Research: One Small Step for Mankind or Another Drop in the Bucket?

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The use of ultrasonography in emergency medicine has grown dramatically throughout the past 20 years. In the late 1980s and 1990s, emergency medicine, a young specialty, eagerly adopted this novel and exciting technology and ran with it. Ultimately, it has found its place in many parts of emergency medical practice: echocardiography for effusions and cardiac arrest; trauma for evaluation of hemoperitoneum; assisting procedures, including central lines, paracentesis, and thoracocentesis; detection of abdominal aortic aneurysms; identification of gallstones; and the confirmation of early intrauterine pregnancy. These have become common ultrasonographic applications for emergency physicians.

More than any other emergency ultrasonographic application, trauma ultrasonography has become a cornerstone of emergency ultrasonographic practice. Since its initial description by Kristensen et al in 1971, ultrasonographic use in trauma management is routine at many institutions. The term FAST (focused assessment with sonography in trauma) was coined by Rozycki et al in 1995 during a period of increasing research evaluating ultrasonography’s basic test characteristics and its ability to identify patients requiring laparotomy. Research emerged showing that emergency physicians and trauma surgeons could accurately detect hemoperitoneum, use ultrasonography as well as other specialties, and learn it relatively quickly. It seemed that the sheer volume of supportive research proved that ultrasonography was unquestionably useful in trauma care.

But like many things in medicine, quantity doesn’t always equate with quality. In 1996, Pearl and Todd reviewed the available data on FAST ultrasonography and published a review in Annals. They were critical of the quality of current trauma ultrasonographic research. In addition, they outlined that, although there was emerging evidence of its test characteristics, there were no data on clinical efficacy or outcomes. The question became, does trauma ultrasonography really make a difference? This was an important call to those of us who used ultrasonography to step back and look at how this technology really helped our patients, which is true now more than ever with the advent of high-performance computed tomography that can scan an entire trauma patient within minutes and gives so much more information than ultrasonography.

In this issue of Annals, Melniker et al present the results of a very ambitious trial focusing on outcomes with the FAST examination that addresses this issue. Although previous randomized trials in trauma ultrasonography have been done, no previous work has shown that FAST actually improves important clinical outcomes in a randomized controlled trial. Melniker et al developed a loose multicenter network termed SOAP (Sonographic Outcomes Assessment Program). This study is the first and largest of the SOAP trials to date. They enrolled 262 patients who sustained thoracoabdominal trauma and randomized them into ultrasonography or no-ultrasonography groups. Their primary outcome variable was time to operating room. Secondary outcome variables were computed tomography use, length of stay, complications, and hospital charges. In the end, they reported that trauma patients receiving an ultrasonograph during resuscitation were transferred to the operating room 64% sooner than the control group. In addition, all of the secondary outcome variables, computed tomography use, length of stay, complications, and hospital charges had clinically significant odds ratios favoring the ultrasonographic group.

On the face of it, these are impressive results. What could be better than a single test that leads to significantly better outcomes and resulting lower use and cost? For those of us who embrace ultrasonography in emergency practice, here is the evidence we have been waiting for. Or is it? Obviously, results as dramatic as this need to be replicated. Several issues are present in the trial that affect the external validity of the investigators’ conclusions. The laparotomy rate in the trial is somewhat higher than that generally published (26% for the ultrasonographic group and 32% for the control group), though the inclusion of both blunt- and penetrating-injury patients may account for this. They comment that they had no nontherapeutic laparotomies, though there is no evidence that they a priori defined therapeutic laparotomy or had this variable independently or blindly reviewed to support this conclusion. Additionally, a formal cost analysis was not done as part of the...
trial, so the economic data are likely overstated. All this being said, this study is a critical first step in demonstrating, through outcomes research, the value of routine ultrasonographic use in trauma patients.

However, the underlying question that still remains is why did it take so long to do a randomized trial of ultrasonography to demonstrate improved outcomes? The answer to this question is rooted in a few issues. First, many of the conditions that emergency ultrasonography evaluates are relatively uncommon. Small single-institutional clinical trials may not have enough of the needed events in question to be adequately powered to show a benefit in clinical outcomes (ie, abdominal aortic aneurysm, ectopic pregnancies, pericardial effusions). Second, well-done multicenter trials take experience, support, and, above all, funding. Networks that can tackle difficult questions have already been established in emergency medicine. Pediatric Emergency Care Applied Network (PECARN), an EMSC-funded network for pediatric emergency care research, is an excellent example of a funded and well-managed network allowing investigators to answer important questions relatively efficiently. Multicenter Airway Research Collaboration (MARC) for asthma, National Emergency X Radiography Utilization Study (NEXUS) for cervical spine fractures, and National Emergency Airway Registry (NEAR) for airway management are other examples of emergency medicine research networks that have successfully addressed outcome questions given proper funding and administrative support.

Melniker and colleagues should be applauded for their attempt to establish a similar network for ultrasonographic research. However, continued ultrasonographic outcomes research, whether SOAP or any other ultrasonographic network, cannot continue without funding to develop and retain the infrastructure necessary to answer the question of patient outcomes. More important, poorly funded research can lead to poor design, poor data acquisition, and poor analysis, leading to methodologically flawed research, perpetuating the criticism that ultrasonographic research is inferior. Research funding from both within the emergency medicine community and the greater medical community is needed to continue building an ultrasonographic research network that helps investigators answer the question we all want answered: does this ultrasonograph really help my patient? This trial is a start in demonstrating to funding sources that ultrasonography can possibly change outcomes and safely lower use.

Certainly, ultrasonographic outcome research such as this trial is an important first step in the evolution of ultrasonographic research. Other emergency department ultrasonographic applications will require the same degree of commitment to answer the question of clinical outcomes. These answers will come only from a well-designed and supported network. Emergency physicians need to know why they should learn ultrasonography and how it will help their patients. Without continuing outcomes data from well-designed network-based trials, future ultrasonographic research will continue to be seen as another drop in the bucket.

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Dextrose extravasation causing skin necrosis. During the administration of the intravenous 50% dextrose, the patient’s blood pressure cuff was inflated under the sleeve of his hospital gown. The dextrose infiltrated into the subcutaneous tissue. One week later, a 3-cm by 4-cm ulcer was observed just proximal to the right antecubital fossa (Figure).

A known complication of hypertonic dextrose administration is tissue necrosis as a result of extravasation. Common sites of injury are the dorsum of the hand and the antecubital fossa, where there is limited soft tissue. It is recommended that, when hypertonic dextrose is administered, an intravenous catheter of at least 18 gauge be used and tested with a 10- to 20-mL bolus of 5% dextrose to avoid infiltration. In addition, make sure there is no impedance to venous flow. For example, deflate blood pressure cuffs and remove tourniquets.

REFERENCES