Infection Control & Hospital Epidemiology (2020), **41**, 469–471
doi:10.1017/ice.2020.13

Concise Communication

Barriers and facilitators to standardization of ultrasound use and probe disinfection in the ambulatory setting

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Abstract

To determine barriers and facilitators to standardization of ultrasound probe disinfection at ambulatory sites, we conducted observations and interviews of staff. Variability was noted in disinfection practices and in the use of protective equipment even for procedures with the potential for the probe to contact sterile tissues. Standardization is needed.

(Received 6 August 2019; accepted 1 January 2020; electronically published 10 February 2020)

Minimizing risks to patients and staff by preventing exposure to potentially infected blood or other body fluids is essential. The Joint Commission found that 74% of all immediate threats to life in a healthcare setting were due to improper sterilization or high-level disinfection (HLD) processes.[1] Ambulatory care sites are vulnerable to lapses in sterilization and HLD due to facility design preventing proper sterilization or HLD and lack of knowledge or training of staff.

With the expansion of ultrasound use, probes increasingly have the potential to contact blood and other sterile tissues, and there have been several reports of contaminated ultrasound equipment leading to outbreaks.[2–4] Current guidance regarding probe reprocessing comes from multiple organizations and separates probes into Spaulding categories (ie, noncritical, semicritical, and critical) depending on the intended use and risk for contact with sterile tissues, mucous membranes, or nonintact skin.[5–7] A 2017 survey of US infection preventionists (IPs) revealed variation in following these guidelines, with 22%–96% compliance depending on the procedure, which suggest that patients could be at increased risk for preventable infections.[8] In this project, we investigated ultrasound use and barriers to reprocessing probes at ambulatory sites.

Methods

Ambulatory sites known to conduct ultrasound procedures were selected, and managers at those sites were contacted. Observations and interviews were ultimately conducted at sites that agreed to be observed and had at least 1 appointment related to ultrasound scheduled within our observation period.

Observations were conducted by an IP and/or a medical student from June 15, 2018, to July 27, 2018. The medical student was trained by directly observing IPs and completing initial observations with IP oversight. Observation checklists were developed using reprocessing guidelines from the Centers of Disease Control and Prevention (CDC), the American Institute of Ultrasound in Medicine (AIUM), and the Association for the Advancement of Medical Instrumentation (AAMI) (Appendix A online). Probe use was categorized based on the tissue the probe had the potential to contact: intact skin; mucous membrane or nonintact skin; or sterile tissue, including blood or vascular tissue. If a probe was used for ultrasound "scouting" before the procedure and then for active ultrasound guidance during the procedure, then 2 uses were counted. Compliance with probe reprocessing before and after use of the probe was assessed through observation or discussion of the process and products used (Appendix B online). The observation checklist also included type of ultrasound gel, probe cover, and gloves used during the procedure. Interview questions were developed based on items from the observation checklist. Responses were transcribed and analyzed for themes using an open card sort method. Excerpts were assigned to work system elements within the Systems Engineering Initiative for Patient Safety (SEIPS) model and were coded by project staff into themes that were divided into barriers or facilitators to achieving CDC, AIUM, and AAMI standards.[9]

Results

We observed 55 patient encounters at 24 clinics that spanned 15 specialties and/or departments (Appendix C online) and included 64 probe uses: 30 carried the potential to only contact intact skin, 13 carried the potential to contact mucous membranes or nonintact skin, and 21 carried the potential to contact blood or sterile tissues (Appendix D online).

Figure 1 highlights disinfection practices. Ultrasound probes expected to only contact intact skin usually underwent low-level disinfection (LLD) before use (87%) and after use (63%). Practitioners

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Cite this article: Ai A, *et al.* (2020). Barriers and facilitators to standardization of ultrasound use and probe disinfection in the ambulatory setting. *Infection Control & Hospital Epidemiology*, 41: 469–471, https://doi.org/10.1017/ice.2020.13

Table 1. Disinfection Status of Probes With Potential to Contact Sterile Tissues, Before Use and After Use, by Procedure (N = 21)

	Disinfection Before Use				Disinfection After Use			
Ultrasound-Guided Procedure	No Disinfection, No. (%)	LLD, No. (%)	HLD, No. (%)	Sterilized, No. (%)	No Disinfection, No. (%)	LLD, No. (%)	HLD, No. (%)	Sterilized, No. (%)
Biopsy (n = 6)	4 (67)	0 (0)	2 (33)	0 (0)	0 (0)	2 (33)	4 (67)	0 (0)
Joint injection (n = 5)	4 (80)	1 (20)	0 (0)	0 (0)	2 (40)	3 (60)	0 (0)	0 (0)
Nerve block (n = 3)	0 (0)	3 (100)	0 (0)	0 (0)	0 (0)	3 (100)	0 (0)	0 (0)
Intramuscular injection (n = 3)	0 (0)	3 (100)	0 (0)	0 (0)	0 (0)	3 (100)	0 (0)	0 (0)
Peripheral IV placement (n = 2)	1 (50)	1 (50)	0 (0)	0 (0)	0 (0)	2 (100)	0 (0)	0 (0)
Radiofrequency ablation (n = 1)	0 (0)	1 (100)	0 (0)	0 (0)	0 (0)	1 (100)	0 (0)	0 (0)
Prostate brachytherapy (n = 1)	0 (0)	0 (0)	0 (0)	1 (100)	0 (0)	0 (0)	0 (0)	1 (100)
Total (n = 21)	9 (43)	9 (43)	2 (10)	1 (5)	2 (10)	14 (67)	4 (19)	1 (5)

Note. LLD, low-level disinfection; HLD, high-level disinfection.

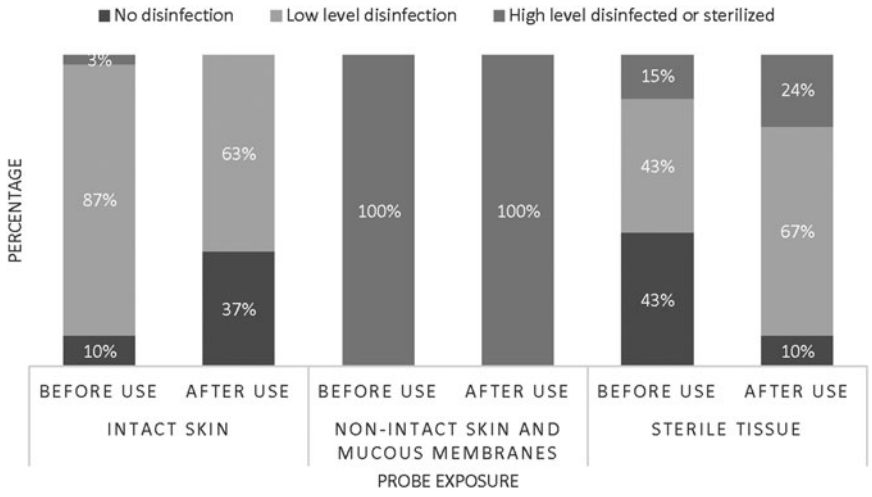

Fig. 1. Disinfection of ultrasound probes before and after use, by potentially contacted tissues: intact skin (n = 30), nonintact skin and mucous membranes (n = 13), and sterile tissues and blood (n = 21).

generally used clean ultrasound gel from a multiuse gel bottle and did not use a probe cover (97%). Probes with the potential to contact mucous membranes underwent HLD before and after use in 100% of cases (n = 13) and a clean or sterile cover was used in 92% of cases. In all cases, sterile single-use gel was used and gloves were worn.

Perhaps unexpectedly, probes with the potential to contact sterile tissue most often underwent LLD (43%) or no disinfection (43%) before use (Fig. 1 and Table 1). After use, most probes underwent LLD (67%). Due to the practice of using the same probe to scout the patient's anatomy prior to the procedure that involved a potential contact with sterile tissue or blood, 9 probes were classified as "no disinfection" before use. The equipment used with these more invasive ultrasound-guided procedures were also diverse (Appendix E online). Sterile gel (38%) and sterile covers (52%) were used somewhat more frequently than clean gel (29%) and clean covers (48%).

We conducted 29 semistructured interviews and in 70 coded excerpts (Appendix F online), and the most common themes described disagreement about whether a specific procedure required sterile technique and difficulty maintaining sterility because of the complexity of the procedure. The most common work-system elements for these themes were related to the task, person, and organization (Appendix G online). Most themes were designated as barriers to adherence to published guidelines and generally related to how complexities of procedures make adherence to strict sterility difficult (Appendix H online).

Discussion

In this quality improvement project we investigated current practice of ultrasound use to guide interventions to standardize processes and maximize patient safety. When the probe is expected to contact only intact skin, we recommend a focus on proper hand hygiene and LLD of the entire probe before and after use. High-level disinfection of transvaginal ultrasound probes and sterilization of transesophageal probes have been standardized and centralized previously at our institution.

Procedures in which the probe has the potential to contact sterile tissues or blood are more complex, partially due to the range of actual risk to the patient depending on what procedure is being performed (eg, peripheral IV placements vs brachytherapy). In addition, there is no consensus about which procedures require which level of disinfection in the guidelines. From our observations, it would be quite difficult to provide a single recommendation for disinfection that encompasses all the procedures that are feasible for our clinics. Performing HLD or sterilization universally likely would require investments in new equipment as well as

https://doi.org/10.1017/ice.2020.13 Published online by Cambridge University Press

increased time for simple procedures that could ultimately translate to higher healthcare costs and lower ultrasound utilization without proven improvements in patient safety.

We plan to perform a risk assessment and prioritize those processes that are the most efficient and cost-effective with the long-term plan of centralizing the more complex and high-risk procedures. We discovered that disinfection of probes for simple procedures like peripheral IV starts are the most difficult to classify and that it occurs in more diverse settings. Several processes can be standardized now, including sterile glove use and when to use sterile equipment, and our workgroup will establish procedure-based recommendations as a priority.

A strength of our study was in reaching a diverse set of clinics and providers, which provided insight into the complexity of the issues. Limitations include low total numbers of clinic observations, announced nature of the visit, and specificity of the results to our center, which may not applicable to other medical systems. Another broad limitation is that there is no clear consensus on how to classify ultrasound procedures because the degree of actual risk or expectation that the probe could contact sterile tissue of blood varies widely among procedures.

Ultrasound technology has great promise for improving patient care and patient safety; however, it is important that we also minimize the risk of infection from contaminated probes. Procedures involving ultrasound are increasingly common, and the complexity of HLD and sterilization in certain settings influences the entire work system and may have both intended and unintended consequences that must be anticipated and addressed.

Supplementary material. To view supplementary material for this article, please visit https://doi.org/10.1017/ice.2020.13

Acknowledgments. None.

Financial support. No financial support was provided relevant to this article.

Conflicts of interest. All authors report no conflicts of interest relevant to this article.

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