

The disinfection requirements in ultrasound

Transvaginal and transrectal ultrasound probes are semi-critical medical devices and as such require high-level disinfection as a minimum. As the focus tends to be on endo-cavity probes, the rest of the ultrasound station is often forgotten. This paper will review the different requirements associated with the use of ultrasound stations and will focus more specifically on the disinfection requirements of skin surface probes, probe holders, cables, monitors and keyboards.

Ultrasound stations

Ultrasound stations are used when performing specific routine check-ups as well as when diagnosing and following up on a wide variety of symptoms, diseases and conditions. Ultrasound stations are usually quite big and include several types of equipment: a computer, a screen, a keyboard and one or several ultrasound transducers. The transducers, also referred to as probes, are small devices connected to the computer by a cable. During the diagnosis, the transducer sends out high frequency sound waves through the body of the patient and listens for the returning echoes. The waves are immediately measured by the computer which can re-create a real-time picture on the screen of the station.¹

The key advantage of using an ultrasound station is that internal organs can be examined without making contact with sterile tissues. Transducers are either applied on the skin of the patient or inserted through a natural opening of the human body (e.g. vagina).

The family of transducers applied on skin is referred to as skin surface probes. It includes instruments such as transabdominal probes. These are used to monitor the main organs of the abdomen which include the gallbladder, the kidneys, the liver, the pancreas and the spleen.²

The family of transducers inserted through natural openings of the human body is called endo-cavity probes. It includes transvaginal and transrectal probes. These are respectively used to examine organs of the female reproductive and male pelvic areas.^{3,4}

Ultrasound stations can be personalised based on the transducers needed by the ultrasound department. Some will require a variety of skin surface probes for general diagnoses.

Others have a need for transabdominal and transvaginal probes for women's health or transrectal probes for men's health.

Disinfection is required at the end of each procedure. However, it is likely to differ from one probe to another.

The decontamination process and levels of disinfection associated with ultrasound stations have to be adapted depending on the transducers used.

Healthcare professionals have to pay particular attention to the conditions under which the diagnosis is taking place to understand the levels of disinfection required.

The disinfection requirements

Ultrasound stations can be divided into three categories:

1) Endo-cavity probes, 2) Skin surface probes, 3) Other equipment. The latter includes monitors, keyboards, probe holders and cables.

Endo-cavity probes

Although endo-cavity probes only enter through natural openings of the human body, they do come into contact with non-intact skin and mucous membranes. This classifies them as semi-critical and implies the use of a high-level disinfectant. Endo-cavity probes are known to be a concern in ultrasound departments due to the high-risk of transmitting Sexually Transmitted Infections (STDs) between patients. Human Papilloma Virus (HPV) is a particular concern as it can cause cervical cancer. It is estimated that 75 to 80% of females and males are affected by HPV at some point in their lives. In order to lower the risk to a minimum, it is common practice to cover endo-cavity probes with a disposable sheath. This does not change the semi-critical classification of endo-cavity probes nor the need to high-level disinfect them. Leakage rates associated with disposable sheaths do not make them a reliable prevention tool on their own.^{5,6}

Skin surface probes

As implied by their name, skin surface probes come into contact with intact skin in most cases. They are usually classified as non-critical items and undergo low or intermediate-level disinfection.

¹ 'RadiologyInfo.org' 'General Ultrasound' www.radiologyinfo.org/en/info.cfm?pg=genus

² 'U.S. National Library of Medicine' 'Medline Plus' 'Abdominal ultrasound' www.nlm.nih.gov/medlineplus/ency/article/003777.htm

³ 'U.S. National Library of Medicine' 'Medline Plus' 'Transvaginal ultrasound' www.nlm.nih.gov/medlineplus/ency/article/003779.htm

⁴ 'Emedicinehealth' 'Pelvic Ultrasound' www.emedicinehealth.com/script/main/art.asp?articlekey=129846

⁵ 'Centers for Disease Control and Prevention' 'Guideline for Disinfection and Sterilization in Healthcare Facilities, 2008'

⁶ 'The Clean Academy' 'HPV: Do you know the facts?' 'October 2013'

However, based on the circumstances under which the diagnosis takes place, the classification of the probe might have to be upgraded to semi-critical. A patient suffering from injuries or wounds might leave a certain amount of body fluids on the device. In other cases, skin-surface probes are needed during needle biopsies. This implies the use of a skin-surface probe to guide the needle to the internal part of the body where tissues have to be removed. The probability of the probe coming into contact with blood, mucous membranes or other body fluids is high in these cases.^{7,8}

A study recently conducted in Australia found more contamination on a selected sample of transabdominal probes than on transvaginal probes.⁹

When using skin surface probes, high-level disinfection should always be considered, especially if body fluids are present during the diagnosis.

Other equipment

Monitors, keyboards, probe holders and cables all classify as non-critical items. However, some studies have demonstrated that this equipment can have more contamination than ultrasound probes. This can be explained by:

- Poor decontamination practices: Probes are usually disinfected between each diagnosis. However, monitors, keyboards, probe holders and cables rarely touch the patient and can be neglected.¹⁰

- Practitioner contact: Although patients do not necessarily come into contact with this equipment, practitioners do. Cross-contamination can occur from equipment to patient.¹⁰

- Ultrasound gel: Without the use of gel, ultrasound waves can have difficulties travelling through the air and dry skin. Ultrasound gel is used as a conductor to enable wave transmissions through the body of the patient. Unfortunately, in addition to wave transmissions, several studies have identified gel as a strong vector of bacterial transmission. Contamination can either happen during production and/or packaging of the gel, filling of re-usable bottles and poor decontamination practice. For instance, putting back a probe into its holder before cleaning it, might result in gel running down the probe and contaminating the holder and cable.¹¹

Probe holders, cables, keyboards and monitors can carry more contamination than ultrasound probes and need to be frequently disinfected. The establishment of a clear disinfection procedure is required for the complete ultrasound station.

Several studies and guidelines have been published in the last few years. The below table summarises the requirements associated with the different parts of the ultrasound station.

Endo-cavity probes	Skin-surface probes		Other equipment
	Applied on intact skin	Applied on or near broken skin	
Remove and dispose of the sheath, remove any residue of gel, clean and high-level disinfect the probe. This procedure has to be done between each patient.	Remove any residue of gel, clean and disinfect the probe with the use of a low or intermediate-level disinfectant. This procedure has to be done between each patient.	Remove any residue of gel, clean and high-level disinfect the probe. This procedure has to be done between each patient.	The keyboard should be low-level disinfected after each examination. The probe holder and the gel container should be low-level disinfected at the beginning and end of each day. All other areas of the station should be low-level disinfected at least once a week.

Table 1: Recommendations based on the guidance of the National Services of Scotland, a study published in the British Journal of Infection Control and a study directed by the Australasian Society for Ultrasound in Medicine in 2015.^{9,10,12}

⁷ 'Emergency department ultrasound probe infection control: challenges and solution' 'Hamid Shokoohi, Paige Armstrong, Ryan Tansek' January 2015

⁸ 'NHS' 'Biopsy' www.nhs.uk/conditions/Biopsy/Pages/Introduction.aspx

⁹ 'Australasian Society for Ultrasound in Medicine' 'Potential risks associated with an ultrasound examination: a microbial perspective' 2015

¹⁰ 'An investigation of the microbiological contamination of ultrasound equipment' 'Sykes A, Appleby M, Perry J, and Gould K' 'British Journal of Infection Control' Aug 2006, Vol.7 No.4

¹¹ 'Is Ultrasound Gel Harboring Any Bacterial Growth?' 'Hanadi Abdulqader Jasim, Hassan Ala Faried and Mohammed Basim Majeed' 'Global Advanced Research Journal of Microbiology' January 2016

¹² 'NHSScotland Guidance for Decontamination of Semi-Critical Ultrasound Probes; Semi-invasive and Non-invasive Ultrasound Probes' 'National Services Scotland' March 2016

The Tristel products for ultrasound

Tristel offers a wide range of infection control, contamination control and hygiene products that have been used for the disinfection of instruments and surfaces for more than 20 years.

In ultrasound, Tristel Solo for Ultrasound, Tristel Duo for Ultrasound and Tristel Trio Wipes System offer the user three complete solutions to cover all the requirements and different levels of disinfection associated with ultrasound stations.

Tristel Solo for Ultrasound are disinfectant wipes for non-invasive medical devices designed specifically for the disinfection of skin surface probes and ultrasound stations. Tristel Solo for Ultrasound disinfectant wipes are based on a quaternary ammonium compound in the form of didecyl dimethyl ammonium chloride. To aid cleaning and soil removal, Tristel Solo for Ultrasound also contain two non-ionic surfactants and one chelating agent. The wipes are effective in two minutes against microorganisms of concern such as *Pseudomonas aeruginosa*, *Candida albicans*, Methicillin-resistant *Staphylococcus aureus* (MRSA), Vancomycin-resistant *Enterococci* (VRE) and Carbapenem-resistant Enterobacteriaceae (CRE).



Picture 1: Tristel Solo for Ultrasound disinfectant wipes.

For the high-level disinfection of endo-cavity probes or skin surface probes applied on or near broken skin, the use of Tristel Duo for Ultrasound or Tristel Trio Wipes System is recommended.

Based on Tristel's proprietary chlorine dioxide chemistry, Tristel Duo for Ultrasound is a sporicidal disinfectant foam effective in 30 seconds against a wide range of microorganisms (e.g. >5.32 log reduction against HPV under dirty conditions). This quick and effective solution offers numerous advantages such as a simple disinfection on-site and increased turnaround between patients' diagnoses.



Picture 2: Tristel Duo for Ultrasound Wall Mounted Disinfectant Foam.

The Tristel Trio Wipes System is a three-part decontamination system which includes:

- A cleaning wipe impregnated with an enzymatic detergent used to remove soil and organic matter from the device.
- A sporicidal wipe impregnated with a citric acid solution activated with a foam composed of sodium chlorite. When activated with the foam, the wipe produces a sporicidal, mycobactericidal, virucidal, fungicidal and bactericidal chlorine dioxide (ClO₂) chemistry, effective in 30 seconds.
- A sterile rinse wipe impregnated with deionised water used to remove any chemistry left on the device.

The Tristel Sporicidal Wipe is effective against many organisms. These include *Bacillus subtilis*, *Mycobacterium terrae* (TB), *Enterococcus hirae*, *Staphylococcus aureus*, Vancomycin-resistant *Enterococci* (VRE), *Candida albicans*, Adenovirus, Polyomavirus SV40 (HPV), HIV, Hepatitis B and Hepatitis C.



Picture 3: Tristel Trio Wipes System.

The Tristel Trio Wipes System also provides manual or automated traceability and is recommended for the decontamination of heat-sensitive, non-lumened medical devices. These include transvaginal ultrasound probes, transrectal ultrasound probes, and other instruments such as nasendoscopes, TOEs or TEEs, laryngoscope blades, intubation endoscopes, manometry catheters and some ophthalmic instruments. When using the Tristel Trio Wipes System, the decontamination process can be completed in the consultation room in a matter of minutes, offering flexibility to the user.

Tristel's proprietary chlorine dioxide has helped many hospitals around the world to prevent outbreaks and improve disinfection procedures.

It is based on two components: Organic acids (citric acid), and sodium chlorite (salt). In general, chlorine dioxide is known for its use in water, food and agriculture disinfection. Chlorine dioxide is also a cell destroyer. In England, the Revised Healthcare Cleaning Manual of the NHS states that chlorine dioxide is more effective than chlorine. The required concentration of chlorine dioxide to achieve sporicidal efficacy is lower than that of chlorine. Its efficacy against spores and other pathogens is proven, and it is safer and quicker to use compared to hypochlorite products.¹³

Tristel Solo for Ultrasound, Tristel Duo for Ultrasound and Tristel Trio Wipes System offer the user three complete solutions, making it easier to comply with the different requirements for the disinfection of ultrasound stations.



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For Tristel patent information please visit: <http://www.our-patents.info/tristel>

¹³ 'The Revised Healthcare Cleaning Manual, NHS, Pages 159-160, Dual function hypochlorite cleaner/disinfectants