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Infection Control

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Knowledge of Infection Control in Ultrasound Examination: A Cross-Sectional Survey Study among Sudanese Sonographic Specialists

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Abstract

Background: Ultrasonography is one of the imaging modalities associated with the risk of healthcare-associated infection. Therefore, ultrasound specialists must maintain infection control standards and adherence to ultrasound infection control guidelines.

Methods and Results: A cross-sectional survey was conducted through an online questionnaire to assess the knowledge of Sudanese sonographic specialists on infection control in ultrasonography. Participants who agreed to participate and complete the survey numbered 110. The result of the study demonstrate that the knowledge of infection control guidelines was average (26.93±3.79) among Sudanese sonographic specialists; the mean score of knowledge was 4.52±1.12 (moderate level), 12.51±1.96 (moderate level), 5.70±2.02 (low level), and 4.63±1.10 (average level) for ultrasound equipment, probe, gel bottles, and personal infection control precautions, respectively. Of the study participants, 70% knew that endovaginal and endocavitory probes were decontaminated by liquid chemical sterilant after each use, and 78.18% reported that the high-level disinfectant was used for cleaning and disinfecting equipment in contact with mucous membranes. In addition, 91.82% of participants agreed that sterile gel is highly recommended for intervention procedures, and 89.09% were aware of proper respiratory hygiene and coughing protocol. 41.82% of respondents were aware that personal protective equipment (PPE) is advised for cleaning and sanitizing ultrasonic equipment, and only 31.82% believed that non-sterile gel is insufficient if the transducer is in contact with non-intact skin.

Conclusion: The knowledge of infection control in ultrasound is average among Sudanese sonographic specialists, with a poor understanding of some ultrasound-gel infection control guidelines and safety aspects.(**International Journal of Biomedicine. 2022;12(4):654-660.**).

Keywords: infection control • sonographic specialist • transducer • gel bottle • disinfectant

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Abbreviations

HLD, high-level disinfectant; **LLD**, low-level disinfectant**; PPE**, personal protective equipment; **TRUS**, transrectal ultrasound; **TVUS**, transvaginal ultrasound.

Introduction

Infection control and prevention are essential for patients undergoing ultrasound procedures to provide safe and outstanding quality healthcare.[1] Contaminated transducers and ultrasonic gel or coupling agents have been associated with outbreaks of infections.[2] There are several guidelines and standards for the prevention and control of ultrasound-related infections, such as the European Society of Radiology (ESR) Ultrasound Working Group, the CDC (2008), and the Australasian Society for Ultrasound in Medicine (ASUM).[3-5]

In every ultrasound examination, the general safety precautions are followed, including washing hands before and after having direct patient contact, donning PPE when necessary, maintaining clean and disinfected equipment, maintaining a clean working environment, and properly disposing of waste.[5]

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The risk of infection from an ultrasonic transducer and the method of decontamination is divided into 3 main categories, according to the Spaulding Classification of the medical system risk and method of decontamination: non-critical when the device contacts intact skin, semi-critical when the device contacts a mucous membrane or non-intact skin, and critical when the medical device contacts a sterile body cavity.[6] For critical equipment decontaminated with high-level disinfectants (HLDs) or chemical sterilant, the ultrasound transducer is sensitive to heat, so the heat sterilization method is not used; a sterile transducer cover is recommended for semi-critical cleaning, followed by the HLD or chemical, and for non-critical cleaning, followed by the low-level disinfectants (LLDs).[5,6]

While the handling and administrative aspects of ultrasound coupling gels are associated with the development of nosocomial infections involving a variety of pathogenic microorganisms, there are various recommendations for reducing gel-related infections, including the policy for the use of sterile gel, non-sterile gel, and gel warmer.[7]

To the author's knowledge, there are no studies in Sudan dealing with the assessment of knowledge of infection control in ultrasound, and few studies in the literature evaluating the practice of sonographers and sonologists in ultrasound infection control; most of the surveys conducted deal with the knowledge of infection control in the radiology department in general. Therefore, this study aims to assess the awareness of infection control in ultrasound among Sudanese sonographic specialists.

Materials and Methods

A cross-sectional survey was conducted through an online questionnaire distributed among Sudanese sonographic specialists through the Google Form Platform from March to May 2022. The sampling included 110 participants who agreed to participate and completed the survey, with different ages, genders, and education levels. Ethical approval was obtained from each study participant. The study questionnaire was adapted following the guidelines and recommendations of the European Committee for Medical Ultrasound Safety, the CDC, and the ASUM.[2-4] Demographic background information, including gender, age, years of experience, and qualifications, in addition to 39 closed-ended questions dealing with knowledge of infection control in the ultrasound examination, was divided into 4 domains (cleaning and disinfecting of ultrasound equipment, transducer, ultrasound gel, and personal hygiene). The modified version of the questionnaire was validated by academic experts in ultrasound examination (consultant sonologist) with experience of more than 15 years.

The knowledge of infection control was assessed through 4 domains, including 39 close-ended questions; in each part, items/questions were classified into "Correct," which is signed by © in the tables, and "Wrong"; the possible score ranged between zero (the less pertinent to knowledge) and 39 (the most relevant to expertise). Domain 1 deals with proper cleaning and disinfecting of the equipment and was measured by 6 items/questions. Domain 2 for knowledge of the transducer cleaning and disinfecting was measured by 17 items/statements. Domain 3 assessed the ability to properly use ultrasound gel bottles, which included 10 items/reports; Domain 4 dealt with understanding personal hygiene and was measured by 6 items/questions

Statistical analysis was performed using statistical software package SPSS version 25.0 (Armonk, NY: IBM Corp.). Baseline characteristics were summarized as frequencies and percentages for categorical variables and as mean±SD for continuous variables. Mann-Whitney U test and Kruskal-Wallis test were used, respectively, to compare differences between 2 and 3 or more independent groups. Group comparisons with respect to categorical variables are performed using chi-square test. A probability value of $P<0.05$ was considered statistically significant.

Results

A total of 110 people (37 men and 73 women) participated in the study (Table 1). More than half were aged between 30 and 39 years. The majority held M.Sc. in medical diagnostic ultrasound (80.91%), followed by those with a Ph.D. in medical diagnostic ultrasound (10.0%), then a B.Sc. (7.27%), and then a diploma (1.82%). More than half (58.18%) had experience of 1-5 years, followed by those with 6-10 years (26.36%).

Table 1.
Demographic factors (N=110).

Factor	Group	N	%
Gender	Male	37	33.64
	Female	73	66.36
Age	20-29 (yrs.)	26	23.6
	30-39 (yrs.)	60	54.5
	40 (yrs.)	24	21.8
Education	Diploma	2	1.82
	B.Sc.	8	7.27
	M.Sc.	89	80.91
	Ph.D.	11	10.0
Experience	1-5 (yrs.)	64	58.18
	6-10 (yrs.)	29	26.36
	11-15 (yrs.)	10	9.09
	16-20 (yrs.)	4	3.64
	> 20 (yrs.)	3	2.73

Concerning cleaning and disinfecting the equipment, most respondents (86.40%) chose the correct answer at the start of the examination, 72.73% before and 89.09% after each patient, and 83.64% at the end of working hours; 78.18% reported that the HLD was used for cleaning and disinfecting equipment that made contact with mucous membranes. But only 41.82% knew that wearing PPE was recommended during cleaning and disinfecting the ultrasound equipment. The mean score of knowledge was 4.52±1.12 (moderate level). Thus, it can be argued that the level of knowledge of equipment among Sudanese sonographic specialists was moderate (Table 2).

Table 2.
Domain 1. The distribution of knowledge of cleaning and disinfecting of ultrasound equipment (N=110)..

Statement			N	%
The ultrasound equipment must be clean and disinfected	At the start of the examination	**Yes©**	**95**	**86.40**
		No	15	13.64
	Before each patient	**Yes©**	**80**	**72.73**
		No	30	27.27
	After each patient	**Yes©**	**98**	**89.09**
		No	12	10.91
	At the end of working hours	**Yes©**	**92**	**83.64**
		No	18	16.36
For cleaning and disinfectant of the equipment that contacts mucous membranes, which of the following is used?		**HLD©**	**86**	**78.18**
		LLD	24	21.82
Wearing PPE is recommended during cleaning and disinfecting the ultrasound equipment		**Yes©**	**46**	**41.82**
		No	30	27.27
		I don't know	34	30.91
Mean±SD (Level) = 4.52±1.12 (Moderate)				
Keys: 0-3=Low, 3.1-4.7=Moderate, 4.8-6=High; © correct answer				

Although 67.27% reported that the probe should be cleaned before examination and after each patient, only 34.55% agreed that detergent wipes before the application of disinfectants are the most effective in cleaning transducers used for non-critical ultrasound examination (intact skin) (Table 3). If the probe is used externally on unbroken skin, 85.45% reported that a cleaning step is needed, then disinfection by LLD by 74.55%, and no need to be cleaned and disinfected by 11.82%. Most specialists (83.64%) reported that using HLD is recommended when the probe is in contact with blood or body fluids. Only 46.36% said that a dedicated transducer cover was mandatory for endocavitory examinations and all interventions. About 90.91% reported that the Spaulding Classification of endovascular and endovaginal ultrasound probes is critical or semi-critical. While 70% of the participants said that the decontamination of endovaginal and endocavitory probes was done by liquid chemical sterilant after each use, only 37.27% knew that the hydrogen peroxide gas plasma is

Table 3.
Domain 2. The distribution of the knowledge concerning cleaning and disinfectant of ultrasound transducer (N=110).

Statement			N	%
The probe cleaning.	Perform after each patient		31	28.18
	Perform at the end of the day		5	4.55
	Perform before examination and after each patient©		**74**	**67.27**
Which of the following is most effective in cleaning of transducer used for non-critical ultrasound examination (intact skin)?	Soap and running water		14	12.73
	Detergent wipes before application of disinfectants©		**38**	**34.55**
	Dry paper		58	52.73
If the probe is used on intact skin, it could undergo?	A cleaning step	**Yes©**	**94**	**85.45**
		No	16	14.55
	Disinfect by low level disinfectant	**Yes©**	**82**	**74.55**
		No	28	25.45
	No clean or disinfect	Yes	13	11.82
		No©	**97**	**88.18**
How to disinfect the probe contact with blood or body fluids?	**Using high-level disinfectant©**		**92**	**83.64**
	Using low-level disinfectant		5	4.55
	Using intermediate-level disinfectant		13	11.82
Which of the following is mandatory for endocavitory probes and all interventions?	High-level disinfectant		50	45.45
	Low-level disinfectant		9	8.18
	Dedicated transducer cover©		**51**	**46.36**
It is essential to allow sufficient time for the probe to dry to attain maximum effect after disinfecting.		**Yes©**	**75**	**68.18**
		No	16	14.55
		I don't know	19	17.27
The Spaulding Classification of endovascular and endovaginal ultrasound probes.		**Critical and semi-critical©**	**100**	**90.91**
		Non-critical	10	9.09
The decontamination of endovaginal and endocavitory probes done by	heat sterilization after every use	Yes	19	17.27
		No©	**91**	**82.73**
	liquid chemical sterilant after each use	**Yes©**	**77**	70.00
		No	33	30.00
	hydrogen peroxide gas plasma after each use	**Yes©**	**41**	**37.27**
		No	69	62.73
Used of transducer cover.	Intact skin	Yes	21	19.09
		No©	**89**	**80.91**
	Skin wound and ulcer	**Yes©**	**100**	**90.91**
		No	10	9.09
	Intact infected skin	**Yes©**	**95**	**86.36**
		No	15	13.64
	TVUS and TRUS	**Yes©**	**104**	**94.55**
		No	6	5.45
	Pleural effusion and ascites drainage	**Yes©**	**75**	**68.18**
		No	35	31.82
Mean±SD (Level) = 12.51±1.96 (Moderate)				
Keys: 0-8=Low, 8.1-13.5=Moderate, 13.6-17=High; © correct answer				

used for decontamination after each use; on the other hand, 82.73% reported that heat sterilization is not used for probe decontamination. The respondents displayed good knowledge concerning the usage of transducer covers. It was found by 94.55% that transducer covers must be used in TVUS and TRUS, skin wounds and ulcers by 90.91%, intact infected skin by 86.36%, pleural effusion, and ascites drainage by 68.18%, and not used in intact skin by 80.91%. To sum up, the mean score was 12.51±1.96 (moderate level). Thus, the Sudanese sonographic specialists have good knowledge concerning the safety aspect of the probe's transducer infection control (Table 3).

Only 59.09% agreed that the larger refilled bottle carries a higher risk of contamination than the single-use one; 54.55% reported that a single-use gel bottle, once it is opened, could be discarded, and 52.73% said that if gel warmers are used, only bottles for immediate use should be warmed (Table 4).

Table 4.

Domain 3. The distribution of knowledge about avoiding contamination and correct use of ultrasound gel bottles (N=110).

Statement			N	%
The larger refilled bottle carries the risk of contamination more than the single-used one.		**Yes©**	**65**	**59.09**
		No	16	14.55
		I don't know	19	17.27
		I am not sure	10	9.09
Standard non-sterile bottles are sufficient if the transducer is in contact with non-intact skin		Yes	51	46.36
		No©	**35**	**31.82**
		I am not sure	23	20.91
		I don't know	1	0.91
Avoid contact of the gel dispensing tip with the patient or other sources of contamination.		**Yes©**	**83**	**75.45**
		No	13	11.82
		I am not sure	11	10.00
		I don't know	3	2.73
Only bottles for immediate use should be warmed if a gel warmer is used		**Yes©**	**58**	**52.73**
		No	26	23.64
		I don't know	21	19.09
		I am not sure	5	4.55
Gel bottles should be stored upside down in warmers		Yes	44	40.00
		No©	**39**	**35.45**
		I don't know	18	16.36
		I am not sure	9	8.18
For a single-use gel bottle, once it opens, it ideally should be discarded and not used for a second patient		**Yes©**	**60**	**54.55**
		No	26	23.64
		I don't know	18	16.36
		I am not sure	6	5.45
The sterile gel is highly recommended?	Non-intact skin patients	**Yes©**	**49**	**44.55**
		No	57	51.82
	Intervention procedures	**Yes©**	**101**	**91.82**
		No	7	6.36
	Endocavitory examination	**Yes©**	87	**79.09**
		No	17	15.45
	Intact skin patients	Yes	54	49.09
		No©	**50**	**45.45**
Mean±SD (Level) = 5.70±2.02 (Low)				
Keys:0-6=Low,6.1-7.9=Moderate,8-10=High; © correct answer				

However, only 35.45% disagreed that gel bottles should be stored upside down in warmers. In comparison, only 31.82% disagreed that standard non-sterile bottles are sufficient if the transducer is in contact with non-intact skin. A large percentage (75.45%) agreed with avoiding contact of the gel dispensing tip with the patient or other sources of contamination, and 91.82% agreed that sterile gel is highly recommended for intervention procedures, followed by endocavitory examination (79.09%), then non-intact skin patients by only 44.55%; however, 45.45% reported that it is not recommended for intact skin patients, for a mean score of 5.70±2.02 (low level). Thus, it can be argued that the level of knowledge of infection control when using ultrasound gel was low.

Regarding hand hygiene in ultrasound, 80% reported that it should be done before and after examination, while only 31.82% reported that the proper order of PPE is "gown–mask (respirator)–eye protection–gloves." The respiratory hygiene and cough etiquette procedure were approved as follows: 86.36% and 87.27% reported that it is important to reduce the transmission of the droplet and airborne pathogens to patients and health care, and 88.18% stated they knew that it applies to all coughing and sneezing individuals;, the total score was 4.63±1.10 (average level). Thus, it can be argued that the level of knowledge of personal hygiene was intermediate (Table 5).

Table 5.

Domain 4. The distribution of knowledge of personal hygiene among the study participants (N=110)

Statement			N	%
Hand hygiene in ultrasound should be done:	Before patient		5	4.55
	After patient		17	15.45
	Before and after examination©		**88**	**80.00**
The proper order of donning PPE is:	**gown–mask (respirator)–eye protection–gloves©**		**35**	**31.82**
	mask (respirator)–eye protection–gloves–gown		28	25.45
	gloves–eye protection–gown–mask		47	42.73
Knowledge of respiratory hygiene and cough etiquette procedure		**Yes©**	**98**	**89.09**
		No	12	10.91
Respiratory hygiene and cough etiquette procedure	Reduce the transmission of the droplet and airborne pathogens to patients	**Yes©**	**95**	**86.36**
		No	15	13.64
	Reduce the transmission of the droplet and airborne pathogens to healthcare	**Yes©**	**96**	**87.27**
		No	14	12.73
	It applies to all coughing and sneezing individual	**Yes©**	**97**	**88.18**
		No	13	11.82
Mean±SD (Level) = 4.63±1.10 (Average)				
Keys: 0-3=Low, 3.1-4.7=Average, 4.8-6=High; © correct answer				
The mean score of knowledge across all four domains was 26.93±3.79 (Average)				

The study demonstrates that there was no significant difference in the score of the knowledge of infection control in ultrasound among the study participants with respect to gender, years of experience, or education level(P>0.05), despite the fact that the study found the score significantly differs among the different age groups, the younger age group's mean rank of knowledge score being more (64.58) than the other age groups (*P*=0.001) (Table 6).

Table 6.
Correlation between mean rank of knowledge of the study participant with demographic data.

Factor	Group	Total	
		Mean rank	χ^2 test /*P*-value
Gender	Male	47.79	χ^2 = 0.619/0.43
	Female	52.63	
Age	20-29 (yrs.)	64.58	χ^2 = 14.69/0.001
	30-39 (yrs.)	52.19	
	≥40 (yrs.)	31.71	
Education	Diploma	12.3	χ^2 = 3.91/0.27
	B.Sc.	55. 3	
	M.Sc.	51.04	
	Ph.D.	55.44	
Experience	1-5 (yrs.)	49.18	χ^2 = 0.95/0.92
	6-10 (yrs.)	51.96	
	11-15 (yrs.).	57.11	
	16-20 (yrs.)	58.62	
	>20 (yrs.)	48.17	

Discussion

It is the responsibility of every ultrasound practitioner to guarantee that cross-contamination risks have been minimized. Any equipment adopted in the environment must be safe for all patients.[2] The study found that the knowledge of infection control in ultrasound among Sudanese sonographic specialists was average. Concerning adherence to the proper method for cleaning sonographic equipment, the participants scored good knowledge; the mean score was 4.52±1.12 (moderate level). All understand that the equipment should be cleaned before and after patients, and at the end of examinations. An HLD cleans the equipment that contacts mucous or body fluids. In contrast, only 41.82% of the participants knew that wearing PPE is recommended during cleaning and disinfecting the ultrasound equipment. The participants were knowledgeable about cleaning and disinfecting ultrasound transducers. Most of them knew that when the transducer is used on intact skin, it needs a cleaning followed by an LLD; on the other hand, most of them stated that they do not require cleaning of the transducer used on intact skin, which was considered incorrect. Participants are aware that an HLD is needed when the probe comes into contact with blood or body fluids, but their knowledge was low concerning the use of a probe cover during all interventions and endocavitory examinations. In comparison to this study, Nyhsen et al.[8] assessed the practical aspect concerning the probe cleaning and decontamination in the ESR and demonstrated that a US probe cover was always used in 89% of endocavitory examinations and in 77% of the interventional procedures, which reflects more knowledge of and practice with probe cover usage than does this study.

The lens of the probe is susceptible; any abrasion or fragility of the surface of the probe reduces the performance; dry paper is one cause of abrasion in the contact surface of the probe. In this study, more than half of the participants stated that dry paper is used to clean an ultrasound probe. It is crucial to clean the transducer that is used on intact skin with a detergent wipe, followed by the LLD, which was recommended. Reprocessing of medical devices, including ultrasound transducers, is based on the Spaulding Classification system, which classifies medical devices, according to their intended use and level of disinfectant need, as critical, semi-critical, and non-critical.[1] A lack of knowledge of this classification leads to the incorrect application of appropriate methods of sterilization and disinfection, which could result in the transmission of infection from one patient to another. It was shown that 90.91% know that the Spaulding Classification of endovascular and endovaginal ultrasound probes is critical or semi-critical. These results reflect that the Sudanese sonographic specialists have adequate knowledge concerning Spaulding's classification of medical devices, thus leading to the proper use of methods of cleaning and sterilization.

Transducers used during percutaneous procedures or on non-intact skin should be protected by a single-use, sterile probe cover that matches the level of sterility utilized during the process. They should then go through LLD in between usage. If the probe cover breaks, the transducer could be tainted with blood or body fluids.[9] The respondents reflected good knowledge concerning the conditions in which the transducer covers must be used, such as TVUS and TRUS, wounds and ulcers, intact infected skin, pleural effusion, and ascites drainage.

Contaminated ultrasound gel is a source of disease transmission due to numerous processes and bacteria. According to Weist et al.,[10] improper use of the gel during routine ultrasonic scanning can lead to nosocomial skin infections caused by *Staphylococcus aureus*. According to another study, the transducer and gel's bacterial contamination rate was 42.8%.[11] Concerning infection control safety associated with gel use, the non-sterile gel should only be applied during low-risk, general inspections on healthy skin. A single-use gel bottle or sachet should be used when applying a non-sterile gel to a patient under any transmission-based precautions. A heating gel is not advised due to the possibility of bacterial contamination and growth in a warm environment. Dry heat is the ideal approach when a warm gel is required. Reusable gel bottle lids should be secured after each use, and single-use gel bottles should be discarded.[12-14] In this study, the sonographic specialists reflected poor knowledge of this safety aspect.

It is strongly recommended to use sterile gel for all semi-critical and critical US procedures, such as transducer contact with mucous membranes, contact with any body fluids (all major and minor US-guided interventional procedures), and when scanning infected or broken skin and wounds.[2] The results of this study clarified that the Sudanese sonographic specialists have good knowledge about sterile gel use, except for non-intact skin. One study done in Europe to assess the practice of infection control and decontamination of the US probe among the ESR stated that 30% of the study participants used sterile gel during endocavitory ultrasound and 77% used sterile gel during the interventional ultrasound.[8]

Hand hygiene is the easiest and most effective way to prevent infection because about 50% of health-related infections are in the hands of healthcare providers. WHO

2005 provides hand hygiene in medical care at 5 moments: before touching the patient, before cleaning or disinfecting procedures, after the risk of contact with body fluids, after touching the patient, and after touching the patient's surroundings.[15,16] Practicing respiratory hygiene and cough etiquette also reduces the risk of infection. It is important to use PPE to prevent exposure of healthcare workers and patients to infectious pathogens.[17] Most study participants were familiar with hand hygiene being performed before and after each patient and that respiratory hygiene and cough etiquette procedures apply to all coughing individuals and reduce the risk of infection to the patients and healthcare providers; unfortunately, only 31.82% knew that the right order of donning PPE is "gown–mask (respirator)–eye protection–gloves." This reflects poor knowledge concerning donning and doffing of PPE. The result of this study is consistent with Ashoor et al.,[18] who found poor knowledge among healthcare providers concerning donning of PPE; only 13.8% described the correct sequences.

No previous study concerning knowledge and awareness of infection control in ultrasound among Sudanese sonographic specialists was found. Kartaginer et al.[19] assessed the practiced infection control in ultrasound, which is hand washing, glove use, transducer cleaning, disinfection and sterilization, wearing additional protective clothing when necessary, and examination room maintenance. They found that 70% of sonographers washed their hands before examination and 83% afterward; 4% did not sheath the endocavitory probe before the procedure, and 77% wiped the transducer with a cleaning solution after patients. A survey found that some ultrasound specialists did not adhere to the most recent recommendations on how to properly disinfect transducers, wires, or ultrasound machine keyboards, and there is a lack of training from manufacturers concerning equipment cleaning and disinfecting; these discrepancies may be the cause of compliance problems and show that ultrasound practitioners need to implement a consistent approach to infection control.[20]

There were no significant differences in the degree of knowledge of infection control in ultrasound according to gender, years of experience, and education certificates among the study participants; while significant differences in knowledge scores were found among the different age groups with the younger age group having a higher score of knowledge than other age groups. This may be because the sample in this study is less than expected, despite the participants holding a Ph.D. in diagnostic ultrasound, reflecting a mean rank of the score more than a diploma, B.Sc., and M.Sc. in diagnostic ultrasound.

Conclusion

The study concluded that the knowledge of infection control among Sudanese sonographic specialists was average. In general, the Sudanese sonographic specialist has a good understanding of infection control considerations concerning the equipment and transducer cleaning and disinfecting, but poor knowledge concerning using a dedicated transducer cover during the endovaginal ultrasound. The awareness of the safety procedure of ultrasound gel is low except for avoiding contact of the gel dispensing tip with the patient or other sources of contamination and using sterile gel during the intervention and endocavitory examination. There were no appreciable differences in the level of knowledge of infection control in ultrasound among the study participants based on gender, years of experience, or educational certificates; those with a Ph.D. in diagnostic ultrasound had a higher mean rank of the score than those with a diploma, B.Sc., or M.Sc. in diagnostic ultrasound. Further training in infection control in ultrasound following the CDC and ESR recommendations is needed, mainly for infection control safety considerations of ultrasound gel and transducers.

Limitation

There is no previous study assessing the degree of knowledge of sonographic specialists concerning infection control safety during an ultrasound examination, and few studies in the literature reflect practicing infection control in ultrasound. Secondly, since this survey was online, there were some communication barriers. The number of samples in this study is lower than expected due to some network barriers in peripheral areas of Sudan. The study recommended further studies with a larger sample through an interview.

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Competing Interests

The authors declare that they have no competing interests.

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