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An Investigation of the Microbiological Contamination of Ultrasound Probes: Evaluation of Cleaning Methods to Reduce It

Microbiology

KEYWORDS : Nosocomial infections, Ultrasound Probes, Ultrasound Coupling Gel, Decontamination

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ABSTRACT

Nosocomial infections develop in hospitals leading to significant morbidity and mortality. Ultrasound equipment comes into direct contact with patients and practitioners during scanning procedures, enabling it to be a potential vehicle for the spread of nosocomial infections. The aim of the present study is to assess the microbiological contamination of the ultrasound probes and to formulate effective decontamination guidelines for the ultrasound probes. The swabs were taken from unclean probe of two ultrasound machines over a period of two months at the Department of Radiology and were processed in the Microbiology department. The above procedure was repeated after single and double paper wipe cleaning of the probe. The isolates were identified using standard techniques and antibiotic susceptibility testing was carried out as per CLSI guidelines. The potential for the ultrasound coupling gel to serve as a culture medium for bacterial growth was also investigated. Out of 50 swabs, 36 (72%) were culture positive and 14 (28%) were bacteriologically sterile. A total of 37 bacterial isolates were recovered from the 36 culture positive patients.Klebsiella species(93.75%) constitutes the predominant isolate followed by Acinetobacter species (6.25%). The average CFU transmitted by the unclean probes was 74.56, for the probes cleaned by single paper wipe was 6.71 and for the probes cleaned by double paper wipe was 0.76. There is a statistical significant difference (P <0.001) between unclean probes and after single and double paper wipe cleaning procedure. The potential for the ultrasound coupling gel to serve as a culture medium for bacterial growth was evaluated and found that the ultrasound coupling gel can support bacterial growth. The results of our study indicate that our minimal standard of probe decontamination consists of wiping the probe with soft paper after each procedure until it is visibly clean.

Introduction

Nosocomial infections either develop in hospitals or occur due to microorganisms which are acquired from hospitals, leading to significant patient morbidity and mortality.[1,2]The Radiology department in the hospital is a potential source of nosocomial infections as it is an integral part of the medical services for the admitted as well as for the walk-in patients. The ultrasonography suite is one of the busiest areas and the most commonly used imaging modality and a large number of sonographic examinations are performed in tertiary care hospitals. Ultrasound equipment comes into direct contact with patients and practitioners during scanning procedures, enabling it to be a potential vehicle for the spread of nosocomial infections. Many studies have shown that ultrasound (US) probes are an ideal vector for transmitting the pathological organism from one patient to another vulnerable patient, unless there are effective cleaning methods.[3-10]This is particularly relevant in interventional ultrasound procedures and endocavitary sonographical examinations.

Materials and Methods

Study design and settings

This prospective study was conducted on patients attending the Sonology Department at Tirunelveli Medical College Hospital, Tirunelveli, TamilNadu from March 2011 and August 2011.The study protocol was approved by the Institutional Scientific and Ethics Committee.

Collection of swabs from each Ultrasound probe

Two ultrasound machines were sampled over a period of two months at the Dept. of Radiology .The swabs were taken from unclean probe of each machine after each scanning procedure by using a sterile cotton swab and then these will be inoculated in Brain Heart Infusion broth. The probe was wiped with a soft, clean but non-sterile absorbent paper and the swab collection was repeated the same way. The probe was wiped for the second time wiped dry and the process was repeated the same way. The bottles of BHI broths were immediately transported to the Microbiology Department within 10 minutes of collection and these bottles were incubated for 48 hours at 37^0c.

The broth was then cultured on the following media: Sheep blood agar, MacConkey agar plates and Nutrient agar and were incubated aerobically at 37oC for 24-48 hours. The resulting growth on any of these media was reported and the isolates were identified using standard techniques.[11]

Antibiotic susceptibility testing:

Antibiotic susceptibility testing was carried out using the Kirby-Bauer disc diffusion technique on Muller-Hinton agar and commercial antibiotic discs were used for antimicrobial testing. The antibiotic discs used were: Ampicillin (10µg), Gentamicin (10 µg),Amikacin (30µg), Tobramycin (30 µg),Trimethoprim-Sulphamethoxazole (1.25/ 23.75µg), Cefotaxime (30 µg), Ceftazidime (30 µg), Ciprofloxacin (5 µg),Cefoxitin (30 µg), Oxacillin disc (1µg), Erythromycin (15µg), Clindamycin (2µg) and Vancomycin (30µg) and different combinations of these were chosen for different organisms according to the Clinical and Laboratory Standards Institute (CLSI) recommendations. The antibiotic disc impregnated culture plates were incubated at 37oC overnight. The diameter of the zone of inhibition was measured and recorded as resistant or susceptible according to the Clinical and Laboratory Standards Institute (CLSI) interpretative criteria.[12]

Evaluation of the Coupling Gel as a Medium for Bacterial Growth

The potential for the ultrasound coupling gel to function as a culture Medium that would support bacterial growth was investigated. Twenty-five Mueller-Hinton agar plates were inoculated with a reference strain of S. aureus to produce a confluent growth of this organism. Ultrasound coupling gel was then applied to half of each plate over the inoculums of S. aureus. The plates were incubated aerobically at 37^0C for 48 hrs and was inspected for growth, specifically to compare bacterial growth on both halves of each plate.[4]

Results

In the first part of our study, the ultrasound probes were exposed to the intact skin of the 50 patients. Of the 50 patients studied, 22 (44%) were out patients while 28 (56%) were inpatients. The age-sex distribution of the selected patients was depicted in Table-1.

Out of 50 swabs, 36 (72%) were culture positive and 14 (28%) were bacteriologically sterile. A total of 37 bacterial isolates were recovered from the 36 culture positive patients. 11(29.7%) isolates were from the outpatients and 26 (70.2%)

isolates from inpatients. All the 35 culture positive yielded one organism each while one of the outpatient yielded organisms. Of the 37 isolates, 32 (86.5%) isolates were gram negative bacilli and 5 (13.5%) isolates were gram positive cocci. Klebsiella species (93.75%) constitutes the predominant isolate among the gram negative bacilli followed by Acinetobacter species (6.25%) which is seen only in outpatients. Most of the isolates were sensitive to commonly used antibiotics.(Table -2).

The average CFU transmitted by the unclean probes was 74.56, for the probes cleaned by single paper wipe was 6.71 and for the probes cleaned by double paper wipe was 0.76. There is a statistical significant difference (P <0.001) between unclean probes and after single or double paper wipe cleaning procedure.

Discussion

Nosocomial infections are hospital-acquired infections that occur 48 hrs after the admission of the patients to the hospital.[13] They are a significant cause of morbidity and mortality in the hospitalized patient.[14]The prevalence of nosocomial infections reported from the hospitals of South-East Asia is 10%, which is the second highest regional distribution in the world.[2]Medical instruments including bronchoscopes, gastrointestinal endoscopes and stethoscopes have all been previously implicated in the transmission of nosocomial infections.[15,16] Recently, an electronic thermometer was also implicated as the vehicle of transmission in an outbreak of nosocomial infections due to a multidrug-resistant strain of Enterococcus faecium [17]Ultrasound probes can be a potential source of nosocomial infections which can act as vectors for transferring pathogenic organisms (commonly Staphylococcus aureus), which is particularly risky for immunocompromised patients.[18,19]

Although, studies of nosocomial outbreaks of infections in our environment have been reported from contaminated intravenous infusion, disinfectants, instrumentation and personnel, none has considered ultrasonography probe or coupling gel as a possible source of cross infections. Our study appears to be the first of its kind in this environment to evaluate the possibility of cross infection from ultrasonography.[20-22]

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Table-1 Demographic status

Age Group	Total Number Of Patients = 50			
	OP = 22		IP = 28	
	Male = 14	Female = 8	Male = 10	Female =18
0-10		1		
11-20	1			
21-30	1	1	2	10
31-40	5	6	2	4
41-50	1		3	1
51-60	4		2	
61-70	2		1	2
71-80				1

Table – 2:Types and Distribution of Bacterial Isolates in the Patients

Organism	In Patient n=28(%)	Out Patient n=22(%)	Total n=50(%)
Staphylococcus aureus			
i. MRSA		1(2.7)	1(2.7)
ii. MSSA	1(2.7)	1(2.7)	2(5.4)
CONS			
i. MRCONS			
ii. MSCONS	2(5.4)		2(5.4)
Klebsiella spp	23(62.1)	7(18.7)	30(81.1)
Acinetobacter spp.		2(5.4)	2(5.4)
Total	26(70.2)	11(29.7)	37(100)

MRSA-Methicillin Resistant Staphylococcus aureus
MSSA-Methicillin Sensitive Staphylococcus aureus

REFERENCE

[1]Garner JS, Jarvis WR, Emori TG, Horan TC, Hughes JM. CDC definitions for nosocomial infections, 1988. Am J Infect Control 1988; 16:128-40. | [2]Mayon-White RT, Ducel G, Kereselidze T, Tikomirov E. An international survey of the prevalence of hospital acquired infection. J Hosp Infect 1988; 11 (Suppl A): 43-8. | [3] Fowler C, McCracken D. US Probes: risk of cross infection and ways to reduce it comparison of cleaning methods. Radiology 1999; 213: 299-300. | [4] Muradali D, Gold WL, Phillips A, Wilson S. Can ultrasound probes and coupling gel be a source of nosocomial infection in patients undergoing sonography? An in vivo and in vitro study. AJR Am J Roentgenol 1995; 164:1521-4. | [5] Gaillot O, Maruéjouls C , Abachin E, Lecuru F, Arlet G,Simonet M, et al. Nosocomial outbreak of Klebsiella pneumoniae producing SHV-5 extended-spectrum betalactamase,originating from a contaminated ultrasonography coupling gel. J Clin Microbiol 1998; 36:1357-60. |