TRANSMISSION OF NOSOCOMIAL INFECTIONS VIA THE ULTRASOUND PROBE AND GEL- in vivo and in vitro study.

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ABSTRACT

Transmission of diseases may occur via the ultrasound probes as they are used to scan a large number of patients every day. This may especially be a problem with those patients who are immunocompromised and those with breaks in the skin. This study was to try and ascertain if the ultrasound probe and coupling agent can act as a vector in the transmission of nosocomial infection for patients with no break in the skin and to determine a cheap ,efficient and cost-effective way of preventing transmission. The ultrasound probes were cleaned before every session and between patients with paper towel. At the end of the session the ultrasound probes from two ultrasound machines i.e. three probes were swabbed and then transferred to the Medical Microbiology Department where they were plated and cultured. The probes were inoculated with an ultrasound gel (Aquasonic, NJ) contaminated with Staphylococcus aureus and then cleaned with a dry paper towel, wet paper towel and chlorhexidine solution. The probes were swabbed and cultured. In addition plates of agar were inoculated with a confluent growth of Staphlococcus aureus and then half the plate was covered by the ultrasound gel to see if there was any inhibition of the growth. A total of 12 specimens out of 51 showed growth of Staphylococcus epidermidis.. Cleaning the probe with alcohol did not reveal any growth of Staphylococcus aureus as was the case with the chlorhexidine. The dry paper towel was not very good with 6 of the 7 swabs showing moderate growth and only 1 with minimal growth. The wet paper towel fared better 4 of the 8 swabs showing no growth and 3 showing minimal growth. The ultrasound gel did not inhibit the growth of the Staphylococcus aureus. Unlike other studies there seems to be high rate of transmission with the ultrasound probe and gel and chlorhexidine and alcohol were found to be effective cleaning agents.

INTRODUCTION

Ultrasound scanning is playing an increasingly important role in the management of patients. This is due to its low cost, lack of ionising radiation, portability and general easy access to the modality. This increase in use and its portability especially in the intensive care units and the very sick/immunocompromised patients may however lead to an increase in the possibility of cross transmission. The patient with discharging pus either primarily or post-operatively may be another source of cross infection. This may occur both via the medical personnel handling several

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patients without proper precautions. Transmission of diseases may also occur via the ultrasound probes as they are used to scan a large number of patients every day. Even though there have not been any documented cases of transmission of nosocomial infection via the probe or gel the possibility exists as other medical equipment e.g. stethoscopes, bronchoscopes as well as endoscopes have been implicated.[1,2] This may especially be problem with those patients who are immunocompromised and those with breaks in the skin. The problem of cross infection is further compounded by the rise in antibiotic resistant strains of bacteria e.g. methicillin resistant S. aureus.

OBJECTIVE

The aim of the study was to ascertain the potential risk of the ultrasound probe and coupling agent acting as a vector in the transmission of nosocomial infection for patients with no break in the skin. A cheap, efficient and cost-effective way of reducing transmission of nosocomial infection was also explored. The sterility of the ultrasound gel was investigated and also to determine if it had any bacteriostatic or bactericidal properties.

METHOD

All patients (in- and out-patients) having ultrasound examinations at the Dept. Of Radiology, University Hospital, Kuala Lumpur were included in the study. The patients were scanned on two ultrasound machines i.e. Aloka 620 and 650. The ultrasound probes were thoroughly cleaned before the every session and between patients with paper towel. The patients included both in- and out-patients. There were patients who were post-operative and no effort was made to exclude any patients. Both adults and children were scanned. At the end of either the morning or afternoon session the ultrasound probes from two ultrasound machines i.e. three probes, were swabbed using a sterile wet cotton swab and then transferred to the Medical Microbiology Department where they were inoculated onto blood agar plates and incubated aerobically at 35^{0}C for 48 hours. The bacterial colonies were then identified and enumerated.

For the second part of the study the probes were intentionally inoculated with an ultrasound gel (Aquasonic, NJ) infected with Staphylococcus aureus and Escherichia coli seperately. The infected gel was prepared by inoculating half a bottle of ultrasound gel with 10 mls. of broth culture of either Staphylococcus aureus or Escherchia coli and mixed. The broth culture contained approximately 1 power 8 colony forming units(CFU)/ml. The probes were then used to scan a sterile agar plate for several minutes in order to simulate the normal ultrasound examination .The probes were then cleaned with either a dry paper towel, wet paper towel, alcohol and chlorhexidine solution until all traces of the ultrasound gel had been removed. The surface of the probes was then swabbed with a wet cotton swab and inoculated onto blood agar plates and incubated at 35^{0}C aerobically for 48 hours.

In addition 10 Muller Hentan plates were infected with a confluent growth of Staphylococcus aureus and then half of the each plate was covered by the ultrasound gel. The plates were subsequently examined to see if there was any inhibition of the growth by the gel.

Ultrasound gel from the unused bottles was also cultured to determine if these showed any evidence of infection.

RESULTS

A total of 51 swabs were collected from the ultrasound probes at the end of the sessions. Of these, 12 showed growth of Staphylococcus epidimidis (23.5%). None of the specimens showed growth of Staphylococcus aureus or Eschericia coli. Cleaning the probe with chlorhexidine and alcohol did not show any growth of either S. aureus or E. coli (Table I). However cleaning the probe with the dry towel (8

swabs) showed minimal growth of E. coli but was poor for the gel infected with S. aureus. On the other hand cleaning the probe with the wet paper towel was poor for E. coli but good for the S. aureus.

The ultrasound gel did not inhibit the growth of the confluent growth of S. aureus. In addition there was no evidence of any growth from the swabs taken from the unused bottles of ultrasound gel.

Table Ia. Gel infected with E. coli

Type of cleaning agent	Number of swabs	Results
Wet towel	7	1 No growth 2 Less than 10 colonies 4 40-50 colonies
Dry towel	8	7 No growth 1 Less than 10 colonies
Alcohol	8	No growth
Chlorhexidine	7	No growth

Table Ib. Gel infected with S. aureus

Type of cleaning agent	Number of swabs	Results
Wet towel	8	4 No growth 4 Less than 10 colonies
Dry towel	7	2 Less than 10 colonies 5 Greater than 30 colonies
Alcohol	9	No growth
Chlorhexidine	8	No growth

DISCUSSION

Nosocomial infections are on the rise and the problem has been further compounded by the presence of antibiotic resistant strains e.g. methicillin resistant S. aureus and gram negative bacilli resistant to multiple antibiotics. There have reports of numerous medical equipment being involved as transmitters of infection.[1,2] Though there have been no documented cases of the ultrasound probe and gel being a cause of transmission of nosocomial infection but in a study by Spencer & Spencer[3] they showed that ultrasound scanning in patients with post-operative wounds, 33% showed growth of skin flora including S. aureus.

Even though most of the pathogens cultured from the probe and gel are not serious pathogens in the normal patient, in those who are

immunocompromised, debilitated or with open wounds,[4] this may result in serious consequences. S. epidimidis is a under-reported cause of systemic infections involving the prosthetic valves and the urinary tract.[5] These infections may be life-threathening.

In our study there was a high rate of growth of S. epidimidis (23.5%) with the ultrasound probe and gel but no growth of S. aureus. However Muradali et al[6] showed only 1 out of the 27 swabs taken showed growth of S. epidimidis even though they used the same method of cleaning i.e. dry unsterile paper towel. The differences could probably be accounted for by the vigour of cleaning. In our study the other users of the ultrasound machines were not aware of the study being done and therefore maybe a better reflection of the actual rate of transmission. In addition the swabs in our study were done between session where between 15 to 20 patients would have been scanned rather than between each patient. There were no cases of S. aureus detected during their study. A study done by Spencer and Spencer[3] found there was a 33% incidence of bacterial growth (including S. aureus)of the gel prior to cleaning the probe with alcohol. They did not specifically look at the value of cleaning with dry paper towels. Their patient scanned had post-operative wounds.

Spencer and Spencer[3] also found that ultrasound gel infected with organisms showed viability for 72 hours. This is important because similar to our study the gel has no bactericidal or bacteriostatic properties and therefore gel left on the probes overnight may still alllow transmission of infection.

Even though the most common method that is in use for cleaning the probe is a dry paper towel, the effectiveness is suspect. Studies have found it to be effective[3, 6,7] though our study showed that its effectivenss was limited. Chlorhexidine and alcohol are excellent at cleaning of the infected probes though this advantage may be offset by the increased risk of damage to the probe. There have been some vendors who are looking at over-coming this problem. The wet paper towel was good for the S. aureus but not very effective against the E. coli and the reverse for the dry paper towel. The other methods like using plastic bags, surgical gloves or otheer antiseptic solutions ahve been advocated but not assessed.

In conclusion the ultrasound probe and gel may act as transmitters of infection and that care should be taken when scanning patient s with open wounds or those who are immunocompromised or in the intensive care units. Cleaning the probe with alcohol or chlorhexidine is very effective at eliminating cross-infection though the effects on the probe may be a problem. Better methods of reducing cross-infection may need to be explored. The ultrasound gel has no bacteriostatic or bacteriostatic properties and is inherently sterile.

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