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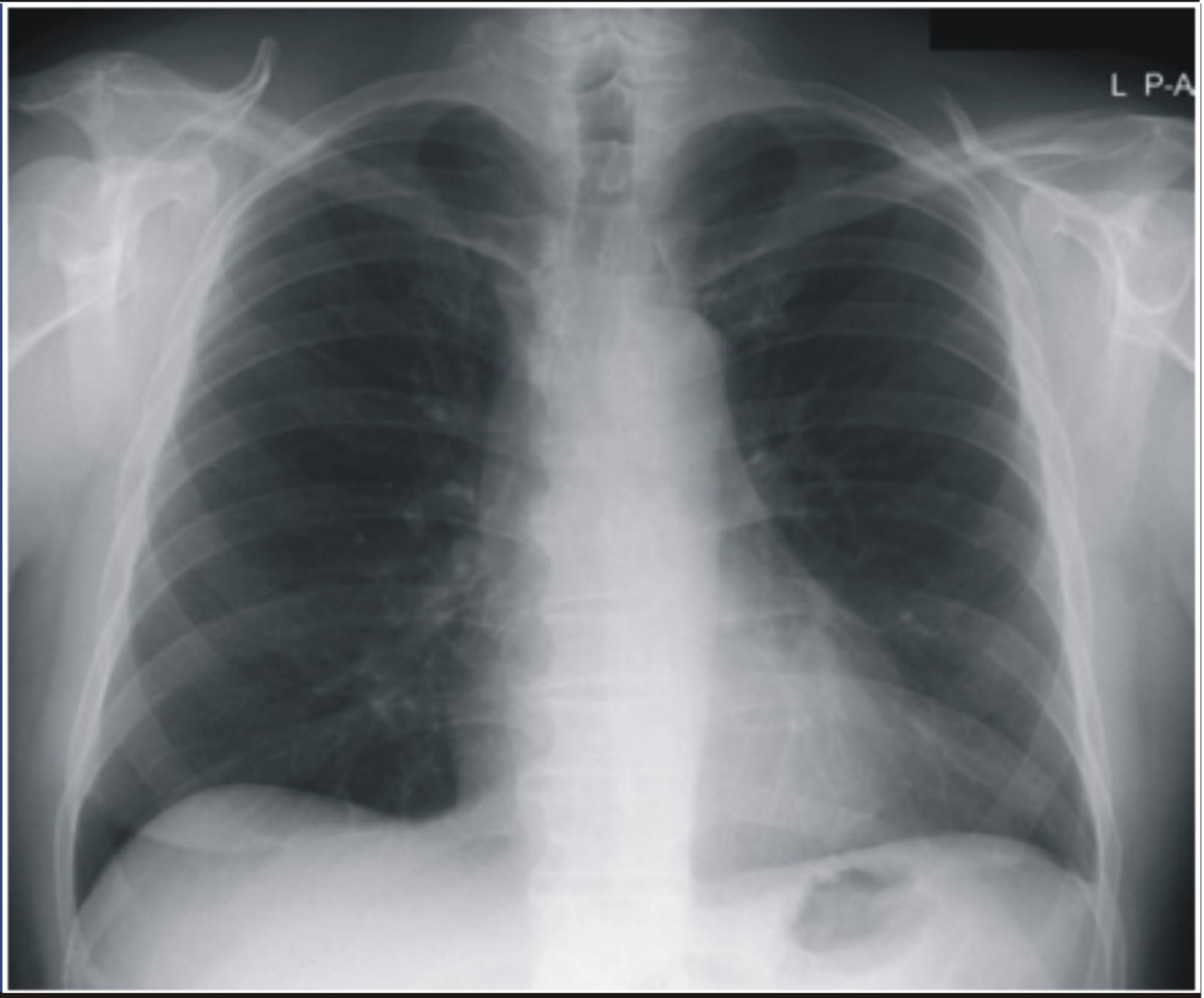

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Assessment Of Ultrasound Equipment As A Possible Source Of Nosocomial Infection

Udoh Benjamin Effiong*[1], Ulu Okoro Ulu[2], Okeke Chidi Ikechukwu[3], Agiande Emmanuel[1]

[1]Department of Radiography and Radiological Science,, University of Calabar, Calabar, Nigeria
[2]Department of Radiology, Jos University Teaching Hospital, Jos, Plateau state, Nigeria.
[3]Department of Radiography and Radiological Science,NnamdiAzikiwe University, Nnewi, Nigeria

*Corresponding author: ben123triol@yahoo.com+2348088934548
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ABSTRACT

Background: Nosocomial infections have become an increasingly recognized problem in health facilities and ultrasound equipment can be one of the sources for the spread of these infections. This research is aimed at assessing the role of ultrasound equipment as a possible source of nosocomial infections in radiodiagnostics centers in Anambra state and to identify the type of micro-organism found on the equipment.
Method: This research involved swabbing of ultrasound probes (transabdominal and transvaginal probes), ultrasound couches and ultrasound gel, of five radiodiagnosticcentres in Anambra state. A total of thirty-six swab samples were collected aseptically from the surfaces of ultrasound equipment before and after scanning and were taken to the laboratory for culture to isolate any pathogens.
Results: The results from this study demonstrated that a number of organisms were found on the ultrasound probes, couches and ultrasound gel. Organisms isolated include aerobic spore formers, *staphylococcus aurens, staphycoccocus epidermidis, coliform* and a host of other bacteria.
Conclusion: Ultrasound equipment is a possible source of nosocomial infection. Although a wide spectrum of micro-organisms are found, the most common micro-organisms found on the ultrasound equipment in this region include; *S. aureus, S. epidemidis* and *pseudomonas aeruginosa*.
Keywords: Ultrasound, Nosocomial, equipment, infection, bacteria, micro – organism.

Introduction

Nosocomial infections are infections acquired in the hospitals and other healthcare facilities which were not originally diagnosed in the patient at the time of admission. They are those infections acquired within the healthcare environment or in the course of being treated in the hospital [1]. These infections also referred to as Hospital-Acquired Infections (HAI), manifest in the patient within 48hours of admission, 3 days after discharge or 30 days after operation [2].

Nosocomial infections affect 1 in 10 patients admitted to the hospital and results in 5,000 deaths annually costing a billion pounds to the National Health Service (NHS) [3]. In the United States, it has been estimated that

9.2 out of every 100 patients acquire nosocomial infection and it affect mainly patients and healthcare personnel who become complacent in carrying out their duties, neglecting specific and laid-down hygienic practices [4]. These includes non-cleaning of health facilities before and after use, non-disinfecting of contaminated equipment, non-sterilization of heat

sensitive items in chemical sterilant, improper protection of staff and patient during hospital procedures and healthcare tasks/activities.

Nosocomial infections can be transmitted by several routes in the hospitals and healthcare centers. These include direct-contact transmission which involves a direct body surface to body surface contact and physical transfer of micro-organisms between a susceptible host and an infected person; indirect-contact transmission which involves contact of a susceptible host with contaminated intermediate inanimate object such as contaminated examination couches, probes, gloves, dressings etc; and droplet transmission which occurs when droplets are generated from the source person mainly during coughing, sneezing, talking and during the performance of certain procedures such as bronchoscopy.

Other routes of transmission includes common vehicle transmission where micro-organism are transmitted to the host by contaminated items such as food, water, medical devices and equipment; vector borne transmission where vectors such as rats, flies and other disease carrying organisms act as route of transmission.

There is a risk of cross-contamination from the ultrasound equipment to the patient whenever any part of the equipment is contaminated, be it the couch, transducer or the coupling gel. This is in line with Kibria et al.,[5], who found out that 39% of the probes used in surgical wards produced cultures, and after use, all were found to be dirty. As a result of the susceptibility of many routes to nosocomial infection, ultrasound equipment stands out as an interesting area to determine its role in cross-infection as they come into direct contact with patients and sonographers during scanning procedures.

In recent years, there is a rapid increase in the knowledge and use of ultrasound in the diagnosis of various forms of diseases in our locality and the entire world, but very few works have been carried out on the possibility of this ultrasound equipment acting as a vector or an agent of nosocomial infection in our locality. This research was carried out to determine the possibility of the ultrasound equipment found in our locality to be a source of nosocomial infection and to identify the types of micro-organisms found on the ultrasound equipment. This knowledge will be of great value in preventive policies and programs of infection control, and would help provide the hospitals and ministry of health with better and universal precautionary measures.

Material and Method

A non-experimental analytical research design was adopted for this study. A total of 46 swab samples were aseptically collected using a sterile swab stick from the surface of the ultrasound probes, couches and coupling gel. This was done before, midway and after scanning periods, from 10 different radiodiagnostic department in Nigeria.

The swabs were labeled appropriately and taken to the laboratory immediately for culture on MacConkey and chocolate agar for isolation of any pathogens. The culture media were prepared following the manufacture's instruction. The swab samples were then cultured aseptically on the MacConkey and chocolate agar designed to support the growth of most commonly encountered bacteria and fungi.

Cultures were incubated at a temperature of $37^{o}C$ for 48hours in order to grow micro-organisms. After that, the culture plates were examined macroscopically against a bright light to identify the isolated organisms based on their colonial characteristics.

Statistical analysis was carried out to determine the frequency of occurrence of these micro-organisms on the ultrasound equipment (ultrasound probes, gel and couch). Chi-square was applied to test the significance of site of collection and the type of micro-organism isolated, site of collection and growth density, site of collection and isolated organism as well as time of collection and growth density.

Results

Staphylococus aureus, aerobic spore formers and staphylococcus epidermidis were the most common microorganisms found after culture. Transabdominal probe and ultrasound gel harbours the highest percentage of S. aureus 36.3% and 27.6% respectively. The ultrasound gel and ultrasound couch has the highest percentage of aerobic spore formers 30.8% and 30.0% respectively. Our results show that *S. aureus* was the most commonly isolated organism 33.8% from the ultrasound equipment. Ohara et al., [6] also reported high contamination of ultrasound equipment (39%) with *S. aureus*. This may be due to the fact that *S. aureus* forms part of the skin's natural flora and is found in up to 40% of healthy people. More so, *S. aureus* has been known to be implicated in a range of illness from minor skin infection such as pimples, impetigo, boils (furuncle), cellulitis, scalded skin syndrome, abscesses, etc. to life threatening diseases such as pneumonia, meningitis, pelvic inflammatory disease (PID) etc. [7].

Aerobic spore formers, an environmental organism were also commonly isolated (26.2%). These isolated organisms were not highly pathogenic but could cause nosocomial infections if conditions were favorable in the susceptible patient. *S. epidermidis* (15.4%) was also commonly isolated in the swabbed samples. Abdulla et al., [8] reported that a high frequency of *S. epidermidis* (23.5%) was found in the ultrasound gel. *S. epidermidis* has been recognized as a major infectious agent associated with prosthetic joints and the urinary tract.

The most commonly contaminated ultrasound equipment in this present study is the transabdominal probe which had the highest percentage of heavy growth of organisms like S. aureus. This is in consonance with Mirza et al., [9] who noted a high level of bacterial count on a transabdominal probe due to patient's body contact. This is because transabdominal probe is the most frequently used probe for abdominal and pelvic ultrasonography and therefore harbours micro-organisms from the patient's skin, ultrasound gel and couch. Studies show that after scanning of a patient, bacteria can be transmitted from the patient's skin to the ultrasound probe and that the organisms mostly transmitted are *S. aureus* and *pseudomona aeruginosa* [10]. Spencer et al., [11] also reported that trans-abdominal probe, if cultured after routine scanning of intact skin, may become colonized with skin flora in up to 30% of cases.

Our study also shows that ultrasound gel was also contaminated with organisms like *S. aureus* followed by aerobic spores former, and *pseudomonas aeruginosa* . This shows that ultrasound gel might be a possible vehicle for the spread of nosocomial infection. This finding is in line with that of Fowler et al., [12] who detected staphylococcus contamination of ultrasound gel and noted that the gel was often not removed or the equipment cleaned prior to subsequent patient's examination. The implication of this is that it would be unhealthy and unsafe to allow direct contact of ultrasound gel on areas of the body that are prone to infections such as open wound, vaginal cavity, etc. The transvaginal probe must as a matter of necessity always be

covered with a sterile rubber latex before it is used on a woman.

Ultrasound couch was also contaminated by some organisms with aerobic spore formers having the heaviest contamination (40.0%), followed by *S. epidermidis* 30.5%, and *S.aureus* 10.0%. The reason for this contamination is because the couch is not usually cleaned before and after scanning periods with a compatible disinfectant e.g 70% alcohol or that the decontamination protocols were sometimes poor

Table 1: frequency of occurrence of isolated organisms

Organisms isolate	**Frequency of occurrence (%)**
Aerobic spore formers	17 (26.2%)
Staphylococcus aureus	22 (33.8%)
Staphylococcus epidermidis	10 (15.4%(
Coliform *Spp*	4 (3.1%)
Klebisella pneumonia	4 (3.1%)
Candia albicans	8 (6.2%)
Cladosporum*spp*	1.5%
Pseudomonas aeruginosa	8 (6.2%)
Proteus *Spp*	7 (6.0%)
Total	100%

Table 2: site of collection and percentage of isolated organism.

Isolated organisms	**Site of collection**			
	Transabdominal Probe	Transvaginal probe	Ultrasound couch	Ultrasound gel
Aerobic spore Former	10.0%	3.8%	40.0%	30.8%
Staphylococcus Aureus	36.3%	13.4%	10.0%	27.6%
Staphylococcus Epidermidis	35.1%	3.0%	30.5%	3.0%
Coliform *Spp*	5.5%	0.0%	3.0%	0.0%
Klesiella Pneumonia	4.1%	0.0%	3.0%	0.0%
Candida Albicans	3.0%	0.0%	4.1%	3.0%
Proteus *Spp*	3.0%	0.0 %	3.3%	0.0%
Pseudomonas *Aeruginosa*	3.0%	0.0%	5.5%	21.0%

Conclusion

Ultrasound equipment harbor some infectious micro organisms which can be transferred to patients undergoing ultrasound scan, making it a potential source for nosocomial infections. The most common bacteria isolated from this equipment were *staphylococcus aureus*, aerobic spore formers and *S. epidermidis*.

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