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A Retrospective Study of Post-Operative Wounds in the Surgical Wards of University of Port Harcourt Teaching Hospital: The Identification and Occurrence Rate of Organisms

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Abstract

Background: Infections acquired in hospitals are classified as nosocomial infections. Most of these infections are related to surgery, usually at the post-operative wound site. It is also termed Surgical Site Infection (SSI). *Staphylococcus aureus* is the documented most common organism that infect surgical wounds.

Objective: This study was focused on identifying the most common microorganism documented in post-operative wound sepsis in surgery wards of the University of Port Harcourt Teaching Hospital.

Materials and Methods: This retrospective research was carried out in the University of Port Harcourt Teaching Hospital with a sample size of 1050 subjects (patients), whose records span from January, 1986 to December, 1990. The study involved obtaining records of subjects with cases of contamination and isolation of organisms that frequently infect post-operative wound site.

Results: The results showed that *Staphylococcus Aureus* was the most frequently isolated organism (28.6%) followed by Proteus and *E. coli* (21.4% each), and the *Clostridium* (14.3%) and, *Pseudomonas and Klebsiella* (7.1% each).

Conclusion: The study is therefore important in identifying those at risk of post-operative wound sepsis and the probable causative organisms. This will be useful in the choice of prophylactic antibiotics for treatment of high-risk patients, thereby setting up an empirical antibiogram for use at the University of Port Harcourt Teaching Hospital, Port Harcourt.

Keywords: Post-operative; Wound-Sepsis; Surgical-Ward; University of Port Harcourt Teaching Hospital.

Introduction

The ability of the host to resist infection determines the out-come of his contamination with microorganism referred to as his immune status. The resistance of the host, if adequate, prevents him from being infected so that no symptoms or signs may be expressed despite the millions of these microorganisms harbored in the organism. The resistance of the host to the microorganism can be broken either by an increased viru00.0. Lance of the organism or diminished immune status of the host, which may lead to a successful invasion, establishment and subsequent multiplication of these organisms. When a patient gets infected after surgery and the infection is related to that surgery, (usually at the post-operative wound site) it is referred to as post-operative wound sepsis [1,2]. *Staphylococcus aureus* is commonest organism, most documented, to infect surgical wounds sites. This is because 5% of people carry the organism on all the hair-bearing areas and up to 50% of people carry it in their nostrils [3,4]. It is also a transient commensal on the skin of the hand together with *Pseudomonas, Klebsiella* and *Enterobacter* species, which are all found on the hands exposed to moisture, abrasions associated with chronic skin disease and nail bed lesions.

The possibility of colonization with multiple antibiotic-resistant hospitals bred *Staphylococcus aureus* is a recognized major risk in patient's surgical procedures [1]. Some factors operating in the post-operative period enhance the likelihood of infection in this period [5]. These could be classed as patient related factors, surgery related factors and hospital related factors which increase the likelihood of acquiring post-operative wound sepsis range from age (neonates and the elderly), immune status for the debilitated, drugs including steroids and cytotoxic drugs and other illnesses like diabetes. Surgery related factors include: the type of surgery (a minor surgery is less predisposed than a major surgery); site of surgery whether clean or not; technique of surgery especially avoiding undue tissue injury as dead tissues are potential foci of infection; decreasing surgery dead space as hematomas could accumulate in them leading to surgical wound infection. Deep general anesthesia diminishes immune status unlike local anesthesia [6]. Additional surgical manipulations like open drainage, prosthesis, inadequate bowel preparations with major re-routing of the large bowel are confounding factors of self-induced wound infections. The length of stay of surgery is also a recognized factor as surgeries lasting over 2 hours are at increased risk of developing surgical wound site infection.

In a preliminary report of a prospective study of surgical wound infection over one year period at Military Hospital, Benin City, Abayomi and Ferreira (1979) [7] provided 7.63% as an overall wound infection rate in Nigeria. He stressed the importance of surface contamination as a major factor in the pathogenesis of surgical wound infection. The incidence of 66% cultured microorganism being *Staphylococcus aureus*. 40% of cultures were mixed. Common organisms cultured in this study were resistant to penicillin, streptomycin, ampicillin, septrin and tetracycline.

It is debatable that chemoprophylaxis whilst awaiting sensitivity reports in the management of surgical wounds is ineffectual. Ferreira then proposed the need for each institution to design its own antibiotic policy and that periodic study be conducted to test the continued veracity and reliability of such scientifically designed policy.

Christie (1981) [8] reported that the spread of infection within a community from one person to another depends on the virulence of infectivity of the organism, the incubation period of the disease, the level of susceptibility or immunity among the members of the community and on the living conditions of the people. The human nasopharynx harbors many bacterial pathogens. Studies documented show that the Nasopharynx of upto 42% of Hospital room personnel's is colonized by *Staphylococcus aureus*. Since the late 19th century facemask been worn in an attempt to control the spread of bacteria. Many types of disposable masks are now in use demonstrating different filtration capabilities for bacterial trapping. Studies have also shown that the face mask makes little difference in total operating room bacterial count but serves to redirect emitted pathogens. These functions are revealed when a member of the operating team sneezes [9]. The aim of this study was to identify the most common microorganism documented in post-operative wound sepsis in surgery wards of the University of Port Harcourt Teaching Hospital.

Materials and Methods

This study was conducted within a period of 5 years (1986 - 1990) in the University of Port Harcourt Teaching Hospital. The data of 2100 patients comprising of adult males, females and children were collected from the registers in male surgical, female surgical and children surgical wards respectively.

Information on each patient selected were carefully obtained by an in-depth study of the patients' case notes (folder), which contain the house officer's detailed clerking at patient's presentation to clinic, casualty or referral before admission to the three surgical wards above. The day to day conditions of the patients were studied. Every necessary procedure was carefully observed pre-operatively and post-operatively.

The symptoms of post-operative wound sepsis like fever, undue pains at the operative site and signs such as exquisite tenderness, hyperaemic incision edges and the discharge of pus from the stitches and incision site (which are indices of wound sepsis) were carefully recorded. The surgical procedures were divided into clean and contaminated groups (A and B) respectively. The following tables were prepared based on data obtained from patient's file or folder. A list of swabs taken was made against the organism isolated (Table 1). A table of bacteria isolated, frequency and percentage of isolation was made. A table to elucidate the organisms in the clean and contaminated operations was also made. A table of antibiogram of the organisms isolated was also prepared (Table 2). Some of the tables were reported using graphical method for concise and easy comprehension (Table 3).

Exclusion Criteria

Evidence of sepsis at the operative site prior to surgery or pus seen at laparotomy such as drainage of an appendicular mass or pelvic abscess. Oral, anal and urogenital surgeries below the level of the bladder Files with incomplete records were also excluded. The duration of acquisition of the post-operative wound infection was determined by subtracting the date of appearance of pus at the operation site from the date of surgery, one which if less than 4 days was discarded as having been gotten before surgery. Records were rejected if there was any evidence of sepsis at the operative site prior to surgery or pus seen at laparotomy such as drainage of an appendicular mass or pelvic abscess.

Table 1: Swabs taken and organisms isolated.

Mixed Growth		Isolated Growth		No Growth	
Organism (s) Isolated		Organism (s) Isolated		Organism (s) Isolated	
SWABS I	E.Col:/Proteus	SWABS VI	Staph	SWABS X	Nil
SWABS II	E.Col:/ Proteus	SWABS VII	Staph		
SWABS III	Staph / pseudomonas	SWABS VIII	Proteus		
SWABS IV	Staph/ colliforms	SWABS IX	Klbsiella		
SWABS V	Staph / colliforms				

Table2: Antibiogram of the isolated organism.

ORGANISM		Staph.	Proteus	E.coli	Colliforms	Pseudomonas	Klebsiella
DRUGS	Aug.	+	+	+	U	U	U
	Flucio.	+	+	+	U	+	U
	Gen.	+	O	+	+	+	+
	Clox.	+	U	+	U	U	U
	Tarivid	U	+	+	U	+	U
	Ceffa.	O	+	+	U	+	U
	Amp.	U	O	U	U	U	U
	Sept.	O	U	+	U	U	U
	Chlor.	+	+	O	U	O	U
	Tetra.	U	O	+	U	O	U
	Eryth.	O	U	U	U	U	U
	Clin.	+	U	U	U	U	U
	Cipro.	+	+	U	U	+	U
	Peni.	O	U	+	U	+	U
	Strep.	O	+	U	+	U	U
	Sulfo.	+	U	U	+	U	+
	Clot.	U	U	U	+	U	+
	Cefu.	O	U	U	U	U	U

Note: Aug. = Augmentin; Fluclo. = Fluclozacillin; Gen. = Genticin; Clox. = Cloxacillin; Tarivid; Ceffa. = Ceffadizime; Amp. = Ampicillin; Sept. = Septrin; Chlor. = Chloramphenicol; Tetra. = Tetracycline; Eryth. = Erythromycin; Clin. = Clindamycin; Cipro. = Ciproxin; Peni. = Penicillin; Strep. = Streptomycin; Sulfo. =Sulfonamide; Clot. = Clotoran; Cefu. = Cefuroxime.
Key: + =Sensitive; O= Resistant; U = Untested.

Table 3: Frequency of antibiotics with broader efficacy

Antibiotics	Frequency	Percentage (%)
Augmentin	3/3	100
Flucloxacillin	4/4	100
Genticin	5/6	83.3
Tarivid	3/3	100
Ciproxin	3/3	100
Sulphonamide	3/3	100

Results

Table 1 showed different SWABS taken and organisms isolated. SWABS 'I' to 'V' indicated mixed growths of organisms ranging from *E. Coli* to Proteus and Staph to pseudomonas, while SWABS 'VI' to 'IX' indicated just single organisms which include Staph, Proteus and Klbsiella. *Staphylococcus aureus* was seen to be the most predominant bacteria isolated from swabs of post-operative wound sites (28.6%) as shown in the graph (Figure 1) and the most frequent organism isolated from different operative procedures. It was also the single organism isolated from clean operation wound site showing that it is acquired exogenously from contamination of wounds. 50% were found as mixed growths (Table 1) in the contaminated cases with 25% each in bowel resections and appendectomy.

The Gram negative organisms predominate in procedures involving opening of the Bowels as indicated in the (Figure 2). Proteus and E. coli

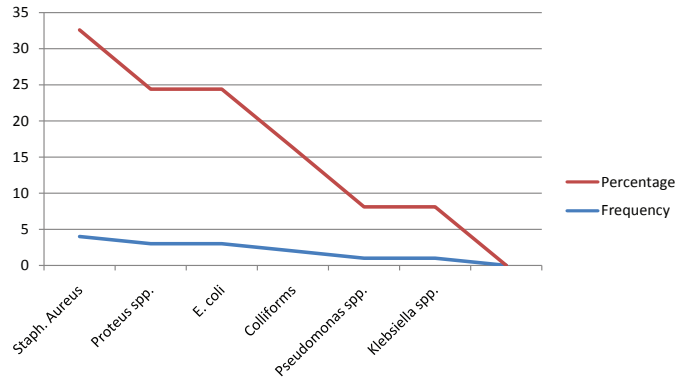

Figure 1: Graph showing types and frequency of Bacteria Isolated from Infected Wounds.

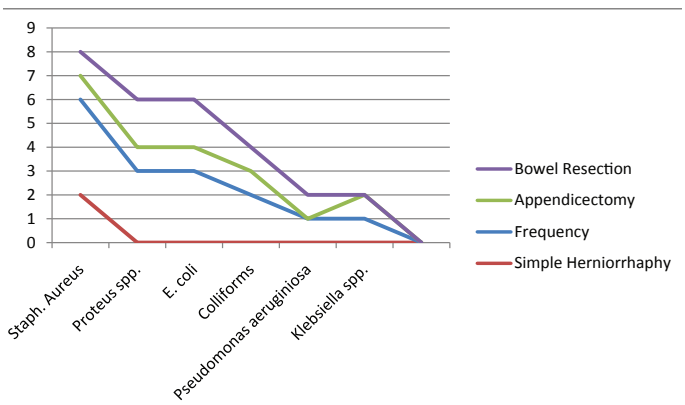

Figure 2: Graph showing organisms isolated from the different operative procedures.

were ranked second overall. Other organisms isolated were coliforms, *pseudomonas aeruginosa and klebsiella* spp. It was also observed that organisms in clean operation had a frequency of 2 with percentage of 14.3%, while organisms in contaminated operations had frequency of 12 with a percentage of 85.7%.

Discussion

Staphylococcus aureus is the most frequently encountered organism as causative agent of post-surgical wound sepsis obtained in this study, giving 28.6% of the bacteria isolated. [10] Douglas in 1972 showed 28% in his series, while John [11], in a review of Surgical wound infections, pointed out that *Staphylococcus aureus* was the most common single cause of post-surgical wound sepsis accounting for as much as 45% in a large British series and 31% in a combined American series [12]. In Nigeria, the investigation of Scott-Emuakpor (1970) and Montefire et al., (1979) [13,14] confirmed the above observations.

The lower incidence in this study can be explained from the fact that most cases seen presented late, especially as emergencies hence more of bowel commensal predominate unlike the much higher incidence of effective clean operations done in advanced countries [15,16]. 50% of the *Staphylococcus aureus* isolated were from clean surgeries (herniorraphies). The other 50% were from contaminated wounds where it presented as mixed growth in appendectomy and bowel resections respectively. In 1975, Kocher and Anke [17] in their work on problems of hospital infections in operating theatres and surgical intensive care units, found Gram negative organisms (*Escherichia Coli, Proteus, Pseudomonas aeruginosa and enterococci*) to be among the most frequent causes of hospital infection, with *Staph. aureus*, the classical well known hospital organism taking the 5th position among the organisms cultured. In the study of wound infection in the orthopaedic – Traumatology Department of Jos University Teaching Hospital, Proteus and E. coli both ranked 2nd each with 21.4% [18]. The other organisms isolated in this study are Coliforms (14.3%), *Pseudomonas aerginosa* (7.1%) and *Klebsiella* (7.1%). These results vary from hospital to hospital as pointed [19,20] studied the predictive value of bacterial contamination at operation in post-operative wound sepsis. He noticed that enteric organisms have a high relative risk of infection and high frequency of isolation in the study. These findings above showed that the presence of enteric organisms in the wound at operation was associated with a high risk of subsequent wound sepsis [1,21-23] reported similar findings. Kelly and Warren [23] also calculated the relative risk of subsequent wound infection after the isolation of specific organisms or groups enabled the relative pathogenicity of the organisms to be determined. This is particularly useful in determining the virulent organisms in situations where bacterial mixed cultures occur especially in wounds of abdominal operations.

Furthermore, the frequency of isolation of *Staphylococcus aureus* in clean wounds (50%) is significantly striking. Also, the isolation of enteric organisms in contaminated operations is similarly associated with a low risk of infection. These findings indicate the significance of the size of a bacterial inoculum and the importance of host resistance. Small number of bacteria which occur in clean wounds can effectively be dealt with by the host. In these circumstances, the organisms must have occurred in small quantities and were removed by the host's immune system.

The present study's results confirm the present rarity of hemolytic streptococcal infection which was a nightmare of post-surgical wound infection before the antibiotic era. Despite the high number of gastrointestinal operations in this study group, it is striking that anaerobes were not isolated. This is in variance with the findings of Hoffman and Gierhake (1969) [24]. Considerable technical difficulties are associated with anaerobic cultivation especially of the fastidious anaerobes.

Moreso, of the 10 swabs, one yielded no growth, 9 swabs were positive with 56% mixed growth. The most commonly cultured organism (staph. aureus) which is 28.6% was resistant to the most popularly prescribed prophylactic antibiotics whilst awaiting bacteriological reports in Nigeria, Penicillin and Streptomycin [25]. A similar result was obtained by Abayomi (1979) [8] in the preliminary report on surgical wound infection in a General Hospital. *Staphylococcus aureus* also shows resistant to septrin, erythromycin, ceftadizime and cefuroxime. 100% sensitivity was gotten for the organisms treated with Augmentin, Flucloxacillin, Ciproxin and Sulfonamide. Genticin was the only drug used against all the isolated organisms and was efficient for all except for proteus that showed resistance. Common and cheap antibiotics like ampicillin, septrin, and eruthromycin were rarely used for sensitivity while very expensive drugs like ciproxin, ceftadizine, augmentin were commonly used.

This study agrees with the findings of Pataky (1975) [26] who reported that chemoprophylaxis in the prevention of wound infection is not a problem of post-operative wound infection. However, the concept of prophylactic topical antibiotic, which has been experimented [27,28] was adequately noted.

Conclusion

This study has shown that the commonest offending organism is *Staphylococcus aureus* (28.6%), followed by proteus and *E.coli* and others. 85.7% of organisms isolated were from contaminated operations and

14.3% from clean operations. For the clean operations, only *Staphylococcus aureus* was isolated, suggesting exogenous contamination. Gram negative organisms were gotten mostly from bowel resections. The organisms isolated were resistant to penicillin and streptomycin which are the most commonly prescribed prophylactic antibiotics in Nigeria practice in the 1990s. Showing the changing pattern of bacterial resistance with changing times. Also, Augmentin, Flucloxacillin, Genticin, Tarivid, Ciproxin and Sulphonamide showed broad spectrum efficacy in this study.

The findings in this study has also presented the identification of the pathogens and the categories of operations that must be the target of appropriate prophylaxis at the time of operation or in the very early post-operative period.

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