ORIGINAL ARTICLE

Sensitivity Pattern of Staphyloccus Aureus in Surgical site Infections after Elective Surgery

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ABSTRACT

Objective: To determine the sensitivity pattern of Staphylococcus aureus in surgical site infection after elective surgery.
Study Design: Cross sectional descriptive.
Duration of Study: January1, 2012 to May 31, 2013.
Materials and Methods: Patients with minor or major surgical site infection (SSI) were selected by the treating surgeons and swabs taken for culture and sensitivity testing on blood agar, chocolate agar and MacConkey's agar plates (incubated at 370C) aerobically. The suspected colonies were subjected to catalase test and later coagulase test to confirm as Staphylococcus aureus and tested for sensitivity against commonly used antibiotics.
Results: Staphylococcus aureus was isolated in 59.2% of positive cultures. The highest resistance of S.aureus was against Cefixime (95.1%) followed by Cefaclor (77.1%). The least resistance was against Sulbactam & Cefoperazone (8.2%) followed by Sparfloxacin (11.5%) and Amikacin (16.4 %). S. aureus was variably resistant to other commonly used drugs.
Conclusion: Staphylococcus aureus is sensitive to less commonly used drugs like combination of Sulbactan & Cefoperazone and Sparfloxacin. Resistance to commonly used drugs like Cefixime and Cefaclor exists in surgical site infection and needs appropriate measures for prevention and control.

Key Words: *Organism, Staphylococcus aureus, surgical site infection.*

Introduction

Infection is a major concern in surgical wards. Surgical site infections (SSI) are defined as infections that occur at the incision site within thirty days after surgery.[1] A major SSI is defined as a wound that either discharges significant quantities of pus spontaneously or needs a secondary procedure to drain it. The patient may have systemic signs such as tachycardia, pyrexia and a raised white count [systemic inflammatory response syndrome (SIRS)]. Minor wound infections may discharge pus or infected serous fluid but should not be associated with excessive discomfort, systemic signs or delay in return home.

Staphylococci (staph) are Gram-positive spherical bacteria that occur in microscopic clusters resembling grapes. S. aureus colonizes mainly the nasal passages, skin, oral cavity and gastrointestinal tract. S. aureus forms a fairly large yellow colony on rich medium. S. epidermidis is an inhabitant of the skin and forms a relatively small white colony.[2]

S. aureus is a major cause of hospital acquired (nosocomial) infection of surgical wounds and infections associated with indwelling medical devices. The portal in human staphylococcal infections is usually a break in the skin like a surgical wound. Foreign bodies, including sutures, are readily colonized by staphylococci, which may make infections difficult to control.[3] In pediatric intensive care units, S. aureus is the most common isolate among the Gram-positive organisms.[4] S. aureus can quickly develop resistance. Hospital strains of S. aureus are usually resistant to a variety of different antibiotics. In addition, S. aureus exhibits resistance to antiseptics and disinfectants, such as quaternary ammonium compounds, which may aid its survival in the hospital environment. Drug resistant "hospital strains' have caused S. aureus infection outbreaks resulting in deaths in surgical units and newborn nurseries.[2] These are the Beta-lactam resistant strains such as Methicillin resistant Staphylococcus aureus (MRSA) that cause high mortality and morbidity.[3] Various studies across the globe have been consistent enough to show a predictable bacterial profile in the wound infections. This makes an important observation for a clinician who intends to start empirical treatment to his patients, while laboratory culture reports are awaited.[5]The susceptibility test is used to guide the choice of the antibiotic treatment for the individual patients and empirical choice of antibiotics for surgical prophylaxis against most common causative agent

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after elective surgery and provide surveillance data to monitor resistance trend in SSI.

Inclusion Criteria: Patients of all ages showing signs of surgical site infection (SSI) after elective surgery within 30 post operative days.

Exclusion Criteria: Growth of bacteria other than S. aureus

Materials and Methods

Surgical site infection (both major and minor) was identified by the treating surgeons in admitted patients or among those coming for follow up after surgery [107 patients out of total 867 elective surgeries (12.3%) performed in all surgical units]. Culture and sensitivity testing was performed in all these cases after informed consent. The skin around the wound was cleaned with alcohol swab to avoid the growth of commensals. Samples were obtained from the deeper fresh part of the ulcer/wound and immediately processed and cultured in the laboratory of the department of Microbiology DHQ teaching hospital following American Society for Microbiology guidelines.[6] Blood Agar, Chocolate agar (incubated at 370C+5% CO2) and MacConkey's Agar plates (incubated at 370C) were used for isolation of pathogens. Swabs were gently rolled on the media to make the primary inoculum. Then primary inoculum was spread on the agar surface. The inoculated plates were incubated for 24 hours at 37°C aerobically. Identification of the isolates was done according to the colonial characteristics on the two media. Characteristic colonies were picked for analysis by Gram staining Jensen version6and confirmed by Biochemical tests.[7] The suspected colonies were subjected to Catalase test. All Catalase positive samples and gram positive cocci growing in clusters (red grapes) from the samples were classified as Staphylococci. All tube coagulase positive samples were confirmed as Staphylococcus aureus. It however became difficult to confirm the other isolates individually using other methods since our focus of the study was on S. aureus. Sensitivity testing was performed by Kirby Bauer disk diffusion method on Mueller Hinton Agar (MHA),[8] which included the discs with the commonly used antibiotics in the hospital (as shown in Table I)

Table I: Antibiotics used in the study

Class		Antibiotic
Tetracyclines		Doxycycline
Penicillins		Co-amoxiclav
Cephalosporins	1st generation	Cephradine
	2nd generation	Cefaclor
	3rd generation	Ceftriaxone
		Cefixime
Sulbactam	With 3rd generation cephalosporin	Sulbactam & Cefoperazone
Quinolones	2nd generation	Ciprofloxacin
	3rd generation	Sparfloxacin
		Levofloxacin
	4th generation	Moxifloxacin
Macrolides		Clarithromycin
Aminoglycosides		Gentamycin
		Amikacin
Carbepenem		Meropenum

Results

Staphylococcus aureus (n=61 – 59.2%) was the most commonly isolated pathogen. No growth was found in 4(3.7%) cases and in 36 (33.6%) cases, other bacteria were found as shown in Table II. The cases infected by S.aureus and included in the study are shown in Table III. Sensitivity patterns of S.aureus to commonly prescribed antibiotics is shown in Table IV.

Table II: Microorganisms Isolated (n = 103)

Species	Number of isolates	% age
S. aureus	61	59.2
E. coli	21	20.5
Pseudomonas spp	8	7.8
S. pyogenes	5	4.8
Enterococcus spp	4	3.9
Klebsiella	3	2.9
S. saprophyticus	1	0.9

Table III: The cases included infected by S.aureus (n=61)

Cases	Number	Percentage
Skin grafting	13	21.3
Repair of incisional hernia	11	18.0
Elective Cholecystectomy	10	16.4
Patey mastectomy	8	13.1
Removal of foreign body	7	11.6
Excision of pilonidal sinus	4	6.6
Inguinal hernioraphy	3	4.9
Repair of paraumbilical hernia	2	3.3
Inguinal herniotomy	1	1.6
Femoral hernia repair	1	1.6
Splenectomy	1	1.6

Table IV: Efficacy of different antibiotics against S.aureus (n = 61)

Antibiotic	Sensitive	Intermediate	Resistant
Amikacin	40 (65.6 %)	11 (18%)	10 (16.4)
Doxycycline	21(34.4 %)	10 (16.4 %)	30(49.2)
Co-amoxiclav	29 (47.5%)	5 (8.1%)	27 (44.4%)
Moxifloxacin	44(72 %)	5 (8.2%)	12(19.8 %)
Cefixime	3 (4.9%)	……	58 (95.1%)
Cephradine	18 (29.5%)	6 (9.8%)	37(60.7%)
Clarithromycin	20(32.8%)	12 (19.7%)	29 (47.5%)
Meropenem	36 (59%)	10 (16,4%)	15(24,6%)
Sparfloxacin	48(78.7%)	6 (9.8%)	7 (11.5%)
Cefaclor	14 (22.9%)	-------	47 (77.1%)
Levofloxacin	29(47.5%)	12 (19.7%)	20(32.8%)
Ciprofloxacin	30(49.2%)	7 (11.5	24 (39.3%)
Gentamycin	20 (32.8%)	21 (34.4%)	20 (32.8%)
Ceftriaxone	11(18%)	11(18%)	41 (64%)
Sulbactam & Cefoperazone	52 (85.2%)	4 (6.6%)	5 (8.2%)

Discussion

Postoperative wound infections are one of the most common forms of nosocomial infections that can complicate the surgical procedure.[9] Surveillance for SSI is an essential part in its control and prevention. Bacterial culture of infected wounds after elective surgery showed Staphylococcus aureus as the commonest pathogen (as shown in Table II).

These results are similar to some previous studies in literature.[10, 11] Moreover C Y Lee, CP Chen and FL Huang found S.aureus as the commonest pathogen among patients in pediatric intensive care unit during 6 years.[4] P Singh found Staphylococcus aureus the commonest isolate (57.25 %) after analysis of 1379 pus samples of infected wounds.[12] But some other studies show a predominance of Gram negative bacteria like Pseudomonas, Klebsella, E. coli etc.[13] In our study, we focused only on elective surgery (as shown in Table III), where all surgeries were clean or with minimal contamination with almost no opening of bowel lumen or spillage. The source of contamination was probably from patient's skin, nasal secretions, theatre environment or infected medical devices etc. Moreover distribution of pathogens involved in infection process is usually dependent on the study population and local antimicrobial use pattern which results in the emergence of pathogens that have the potential to resist currently used antibiotics.[13,14] The highest resistance of S.aureus is against Cefixime (95.1%) followed by Cefaclor (77.1%). Similar results are shown in some previous studies in Uganda,[15] Pakistan,[16] and Nepal.[17] The least resistance is against less commonly used drugs locally like Sulbactam & Cefoperazone combination (8.2%) followed by Sparfloxacin (11.5%) and Amikacin (16.4 %). Muhammad Imran, Muhammad Faheem, Viqar Aslam et al found Sulbactam & Cefoperazone combination as the most effective drug against S. aureus in a study of burn wounds in Peshawar.[18] Among other drugs, Doxycycline and Gentamycin had 49.2% and 32.8 % resistance respectively. In a study of SSI in Karachi, Safia Bibi, Ghulam Asghar Channa, Taranum Ruba Siddiqui et al, found Tetracycline having 45.5 % and Gentamycin having 27% resistance.[13] Higher rates of resistance (around 50%) of these organisms in SSI was observed against many drugs like Cefixime, Ceftriaxone, Cephradine , Cefaclor, Clarithromycin and Doxycycline. The increased resistance against these drugs might be the result of their increased use because these antibiotics are extensively used locally as empirical treatment for various infections in the hospital and community. Literature suggests that antibiotic use is proportional to antibiotic resistance.[14] A proper infection control team including the surgeons and microbiologists may be established to continuously monitor the pattern of different pathogens and their source. It is also important to establish guidelines for antibiotic use so as to control the emerging antibiotic resistance problems in hospitals.

Conclusion

Staphylococcus aureus is sensitive to less commonly used drugs like combination of Sulbactam & Cefoperazone and Sparfloxacin. Resistance to commonly used drugs like Cefixime and Cefaclor exists in surgical site infection and needs appropriate measures for prevention and control.

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