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ANTIBIOTIC SENSITIVITY AND RESISTANCE PATTERN IN ORTHOPEDIC INFECTIOUS CASES OF A TERTIARY CARE TEACHING HOSPITAL

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ABSTRACT

Aim of this study was to evaluate the antibiotic resistance and sensitivity pattern in various orthopedic infectious cases. Study conducted upon patients present with orthopedic infection and post operative surgical site infection present in orthopedic in-patient during August 2016 to October 2016. Bacterial culture investigation was carried out to identify the specific organism present. Antibiotic sensitivity profile was obtained by "Kirby-Bauer disc diffusion" method from hospital microbiology lab. Relevant data was collected from patient medical report and was analyzed to get the final outcome. A total of 16 infectious cases were confirmed and reported during the study period. Of these 16 cases, male preponderance (15) with age group 21-30 years (05). Out of 16 cases, 13 were surgical site infection, 02 osteomyelytis and only 01 septic arthritis case. Most frequently isolated organism was *Staphylococcus aureus* (07) followed by *Eschericia coli* (04) (43.75%). Maximum isolated organism shows resistance to Amoxicillin+Clavulanic acid combination. In orthopedic infectious cases, culture and sensitivity report offers a better support to choose appropriate antibiotic so as to get better outcome with minimal treatment failure.

KEYWORDS: Orthopedic infection, culture and sensitivity, antibiotics.

INTRODUCTIONS

Orthopedic infections can be devastating. Disease-carrying bacteria, viruses, and parasites that get into the body can destroy healthy tissue, multiply and spread through blood. Infection of skin and other soft tissue can lead to infection of bones (osteomyelitis) and joints (septic arthritis). Without prompt treatment, orthopedics infections can become chronic. Thus, even a small scratch on the fingertip has the potential to permanently disable your hand, or worse. Fortunately, early diagnosis, appropriate antibiotic therapy, and surgical intervention when required can cure most infections and prevent permanent problems. Orthopedic surgical site infection (SSI) is defined as microbial contamination of the surgical wound within 30 days of an operation or within 1 year after surgery if an implant is placed in patient[1] Surgical-site infections causes increased morbidity, mortality, extended hospital in-patient stays and economic burden to the hospital resources[2-5]. Many preventable causes of SSI have been identified and if proper measures are implemented, the incidence could be reduced. Patients, surgeons and nurses, as well as operative room atmosphere and instrumentation are prime areas of concern. Various methods have been established to reduce infections in implant surgery, but infection does occur. The washing of hands and maintaining basic hygiene[5], prophylactic antibiotics given at the proper time and at the correct strength[6], surgical clothing[7] and reducing the flow of staff in the operating room[8-10] all contribute to lowering the incidence of infection. This study was aimed to assess prevalence of various orthopedic and orthopedic surgical site infections to isolate the causative organism and culture & sensitivity report to enhance the antibiotic policy for management of such cases. Kirby-Bauer antibiotic testing (also called KB testing or disk diffusion antibiotic sensitivity testing) uses antibiotic-containing wafers or disks to test whether particular bacteria are susceptible to specific antibiotics. First, a pure culture of bacteria is isolated from the patient. Then, a known quantity of bacteria are grown overnight on agar (solid growth media) plates in the presence of a thin wafer that contains a known amount of a relevant antibiotic. If the bacteria are susceptible to the particular antibiotic from a wafer, an area of clear media where bacteria are not able to grow surrounds the wafer, which is known as the zone of inhibition. A larger zone of inhibition around an antibiotic-containing disk indicates that the bacteria are more sensitive to the antibiotic in the disk. Clinicians can use KB test results to choose appropriate antibiotics to combat a particular infection in a patient. Administering antibiotics that specifically target the particular bacteria that are causing the infection can avoid using broad-spectrum antibiotics, which target many types of bacteria. Thus, clinical application of KB testing results can decrease the frequency with which antibiotic-resistant bacteria evolve[11]. Automated bacterial identification and antibiotic susceptibility testing: bioMérieux is the market leader with its VITEK- 2 range. Results can be obtained as quickly as 3 to 7 hours thanks to the combination of analysis software and an original, miniaturized consumable, the VITEK- 2 card, which is available for a wide range of antibiotics.VITEK-2, identifies the vast majority of routine organisms (over 300 microorganisms)[12].

MATERIALS AND METHODS

All the relevant data was collected from Prospective patient medical case sheet. In patient Case sheets were thoroughly reviewed of the patients who got admitted in the department of orthopedic, Gandhi Hospital, Secunderabad which is a 1200 bedded multi super-specialty tertiary care government teaching hospital. Cases were considered for the study of those either for bone infection or presence of surgical site infection after orthopedic surgery/implant. Data was collected for a period of three months including August 2016 to October 2016. This observational case review was chiefly focused to identify the organism mainly responsible for orthopedic infection and also the antibiotic sensitivity pattern of those causative organisms which was obtained from microbiology lab by Kirby-Bauer disc diffusion method. Patient data includes patient demography, diagnosis, culture & sensitivity report to isolate the organism and to determine the antibiotic usage, length of stay, prophylactic antibiotic usage, definite antibiotic after culture & sensitivity report and recovery. Collected data were categorized and analyzed to identify the common organism to cause various orthopedic infections and also the antibiotic sensitivity pattern.

RESULTS

A total of 16 cases with confirm orthopedic infection was identified and documented during three months of observation period. Out of 16 cases, male were predominant than female & constituted 93.75% and 6.25% respectively. While coming to the age groups, patients who fall within the age group of 21-30yrs were prominent with 31.29% which is tabulated in table 1.

TABLE 1
Patient demography (gender and age wise)

Parameter	Characteristics	Frequency (N=16)	Percentage (%)
Gender	Male	15	93.75%
	Female	1	6.25%
Age (years)	1-10	2	12.50%
	11-20	4	25.00%
	21-30	5	31.29%
	31-40	3	18.71%
	>41	2	12.50%

Most frequently observed infections in the current study were SSIs (55.4%) followed by Osteomyelitis (12.5%) and septic arthritis (6.25%) which is tabulated in **table 2**.

TABLE 2
Diagnosis wise distribution

S.no	Diagnosis	Frequency (N=16)	Percentage (%)
1	SSI	13	81.25%
2	Osteomyelitis	2	12.5%
3	Septic arthritis	1	6.25%

Most frequently isolated organisms from surgical site were *S. aureus* (43.75%), *E. coli* (25%), *Klebsiella pneumonia* (12.5%), *Streptococcus pneumonia*, Citrobacter *spp.* and *Proteus mirabilis* (6.25%, each) which is tabulated in **table 3**.

TABLE 3
Isolated organism (Culture)

S.no.	Organism	Frequency (N=16)	Percentage (%)
1	S. aureus	7	43.75%
2.	E. coli	4	25%
3	Klebsiella pneumonia	2	12.5%
4	S. pneumonia	1	6.25%
5	Citrobacter spp	1	6.25%
6	Proteus mirabilis	1	6.25%

On performing antimicrobial susceptibility testing *S. aureus* showed the high frequency of resistance towards beta-lactam antibiotics. Resistance to amoxiclav (30.30%) was found to be very high. However, least resistance was observed to cefixime, cefipime, amikacin etc, same is tabulated in **table 4**.

TABLE 4
Antibiotic resistance report

S.no.	Antibiotics	Frequency (N=33)	Percentage (%)
1	Amoxyclav	10	30.30%
2	Amoxicillin	7	21.21%
3	Penicillin	3	9.09%
4	Cefazimide	3	9.09%
5	Piptaz	2	6.07%
6	Tetracycline	1	3.03%
7	Cefixime	1	3.03%
8	Cefipime	1	3.03%
9	Amikacin	1	3.03%
10	Ampicillin	1	3.03%
11	Chloramphenicol	1	3.03%
12	Cefoperazone	1	3.03%
13	Ofloxacin	1	3.03%

Isolated *S. aureus* showed high level of sensitivity towards Piptaz and Imipenem was found to be the most effective antibiotic with least resistance. Same is tabulated in **table 5**.

TABLE 5
Antibiotic sensitivity report:

S.no.	Antibiotics	Frequency (N=61)	Percentage (%)
1	Piptaz	10	16.39%
2	Imipenem	9	14.75%
3	Tetracyclines	7	11.57%
4	Ceftriaxome	5	8.19%
5	Amikacin	5	8.19%
6	Gentamycin	3	4.91%
7	Amoxyclav	3	4.91%
8	Cefixime	3	4.91%
9	Meropenem	2	3.27%
10	Linezolid	2	3.27%
11	Vancomycin	2	3.27%
12	Penicilin	2	3.27%
13	Daptomycin	2	3.27%
14	Cefoperasone	1	1.63%
15	Cefipime	1	1.63%
16	Co- trimaxzole	1	1.63%
17	Erythromycin	1	1.63%
18	Ofloxacin	1	1.63%
19	Sulbactum	1	1.63%

DISCUSSION

Successful management of patients with bacterial infection depends on early identification of bacterial pathogens and selection of an effective antibiotic against the organism. Antibiotics are one of the pillars of modern medical care and plays a major role as both as the prophylaxis and treatment of infectious diseases. The issues of their availability, selection, and proper use are of critical importance to the global community[13]. Although aerobic wound infections have been known to cause devastating post-operative complications, most an-aerobicidal agents are very effective in neutralizing this setback. It is in the treatment of aerobic bacterial infections where variable antimicrobial responses exist. With the influx of voluminous number of antibiotics, the clinician often finds themselves overwhelmed by the variety of options. Determination of the etiologic agent is vital in the final choice of antibiotics. Especially in a situation where empirical treatment need has to be initiated without identifying the causative organism or sensitivity results. Clinical expertise with working knowledge of the most likely causative organism and the prevailing antibiotic sensitivity/resistance pattern will be of great help[14]. The high prevalence of *S. aureus* infection may be because of its endogenous source. Infection with this organism may also be due to contamination from the environment e.g. contamination of surgical instruments. With the disruption of natural skin barrier S. aureus, which is a common bacterium on surfaces, easily find their way into surgical sites[15]. Incidence of SSI in the present study was 81.25%, which is much higher than the reported worldwide incidence of 2.6% to 41.9%. Second, our study was similar to the previous findings, which demonstrate that SSI was more common in younger patients. This could be because the majority of our patients were operated-on due to trauma and it has been reported that pre-operative soft-tissue damage is a major risk factor for developing SSI. The other independent risk factors for patients developing SSI were having an emergency operation and having prolonged surgery. There are apparent unintended differences in the quality of care that exist between patients undergoing joint arthroplasty or spinal surgery and those undergoing trauma surgeries. There could be a couple of reasons for these differences. During total joint replacement, scoliosis and other spine surgery; senior personnel are available, while routine trauma surgery is performed by junior staff. Last, because of the gravity of infection in a patient with arthroplasty, surgeons tend to extend extra care while operating and arthroplasty surgeons go the extra mile to limit SSI on the basis of research and monitoring the quality of care[13]. These data reveal high level resistance to β-lactam among all available antibiotic groups. These observations are alarming since virtually all the patients are prescribed second or third-generation cephalosporins as prophylaxis before surgery. Ceftriaxone and cefotaxime were the most effective drugs against *S. aureus* and resistance to these drugs is also soon expected. This finding is of great concern because if the situation remains same we will leave with no/very little therapeutic option in future[16]. In this study most of the cases, the culture-organism was identified by gram stain and standard biochemical reactions by which the antibiotic profile was obtained by Kirby-Bauer disc diffusion [11] method for better outcome and preference of antibiotic to be chosen but the more specific and sensitive method for determining the antibiotic profile is Minimum Inhibitory Concentration (MIC) by VITEK-2 system [12]. We have also observed a case of drug hypersensitivity i.e. Vancomycin induced erythematous rashes [17, 18] and was reported accordingly for proper management. Continuous dialogue between the microbiology department and the surgeons is strongly advised in keeping with preventing and controlling surgical wound infections at minimal cost. This will encourage rational use of antimicrobial agents and help in curbing the menace of resistance to these agents[19].

CONCLUSION

In orthopedic infectious cases, culture and sensitivity report offers a better support to choose appropriate antibiotic so as to get better outcome with minimal treatment failure. This will definitely help to administer various antibiotics and resistance of higher antibiotic can be maintained by preferable choices. The more specific and sensitive method to be used for identifying organism and antibiotic profile can be determined by Minimum Inhibitory Concentration (MIC) by VITEK-2 system but as it is time consuming process and be short of facilities.

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CONFLICT OF INTEREST
Conflict of interest declared none.

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