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STAPHYLOCOCCUS AUREUS: AN EMERGING CHALLENGE IN ORTHOPAEDIC PATIENTS.

Orthopaedics

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ABSTRACT

Background: This is a retrospective study based on the analysis of data available in the database of swab culture sensitivity for samples received from the orthopaedics department in a year. **Aim:** To see the prevalence of organisms in positive swab culture. The pattern of organisms positive on culture and requiring a detailed evaluation of the organism is widely present in the culture **Materials & Methods:** All samples were analysed for positive cultures. Positive cultures were subjected to antibiotic sensitivity. The culture sensitivity of positive cultures was assessed for antibiotic resistance within the same organism **Results:** A Total of 702 samples were analysed, out of which 291(41.45%) were positive. out of which 104(35.73%) found positive for staphylococcus aureus, (71(68.26%) for MRSA, 33(31.73%) For MSSA. There was a presence of increased resistance to multiple antibiotics in the MRSA group, but also in the MSSA group to a large extent, which was usually considered to be a less resistant strain. **Conclusion:** The Staphylococcus aureus has emerged as the leading microbial infection in Orthopaedics. The MSSA and MSSA have antibiotic resistance to multiple antibiotics, which is a matter of concern. Emphasis on Aseptic techniques, Sanitisation, Sterilisation, and Sensitisation of Health Care providers is urgently required to achieve infection control. There should be empirical use of antibiotics in Infection prevention protocols and antibiotic sensitivity-based antibiotic use.

KEYWORDS

Staphylococcus aureus, MRSA, Orthopaedic infections, Antibiotic resistance.

INTRODUCTION

With the rising number of orthopaedic surgeries, the number of post-operative complications has also increased, among which surgical site infection is one of the most serious complications. [1] A patient can have either a closed or an open fracture due to trauma. Fractures of the lower limb are more common than compared of the upper limb, and among them, fractures around the hip are most common. These fractures need to be fixed surgically to promote early mobilisation, return to routine, and prevent any further complications. The infection rate following open reduction and internal fixation (ORIF) for fracture is between 1 and 3%, and can be as high as 50% for some high-energy and open fractures. [2,3] Despite decades of attempts to optimize antimicrobial prophylaxis, implant sterility, and other exogenous factors, the incidence of infection and resulting revision surgery has continued to rise. [4] With an estimated incidence of 780 cases per 100,000 surgeries, SSI alone incurs an annual cost of US$3.3 billion in the USA. [5,6,7] SSI results in prolonged hospitalization, reduced physical activity, diminished quality of life, and even death. Staphylococcus Aureus is the most common cause of surgical site infection. This is a spherical gram-positive bacterium that exists in clusters and causes a wide variety of clinical diseases. Methicillin was introduced in 1959 to combat staphylococcus and other bacteria with penicillin resistance, but the treatment remains challenging due to the emergence of multidrug-resistant strains such as MRSA (Methicillin-Resistant Staphylococcus Aureus), which was first detected in 1961 in the UK and spread to every continent soon.[8] Prevention of Staphylococcus aureus is a challenging task because it is found in the normal human flora, located on skin and mucous membrane, but does not cause any infection in normal skin. But it becomes a matter of concern when the skin is breached, and it enters the tissue or bloodstream, where it causes a variety of diseases, often referred to as Surgical Site Infection (SSI). [9] SSI can range from minor wound discharge to life-threatening conditions. Prevention of SSI leads to better surgical outcomes and union of fracture and return to normal routine lifestyle, which is the ultimate goal in orthopaedics following a Surgical Fixation. Although it is a global issue, there is still very limited data available regarding this in the region.

Staphylococcus aureus is established as a major cause of infection in orthopaedics worldwide. [10] Various factors responsible for the spread of the organism are operative status, type of injury, type of implant used, and local environment. Gram-negative cocci like E. Coli are the 2nd most common organism, which is also a leading pathogen in patients with open fractures. [11] A study done by **Mallick SK et al** in central India reports that from 16 isolated Staphylococcus aureus strains obtained from pus and wound swabs, 57.1% accounted for MRSA infection, and the incidence of MRSA in the orthopaedic ward was 23.4%. [12] since orthopaedic Since orthopaedic infections are devastating in terms of significant morbidity and mortality hence the study was undertaken to chart out the microbial culture pattern of orthopaedic patients at our institute.

MATERIALS & METHODS

This is a single-centre study conducted at a tertiary medical Centre providing health services to a population of approximately. 2.5-3 million are located in the Southern Himalayas in North India. A total of 702 samples were analysed for microbial profile and drug sensitivity.

Samples were sent for culture and antibiotic sensitivity evaluation, and results were collected over one year from the first of April 2024 to the 31st of March 2025.

A total of 702 samples were received from the Department of Orthopaedics for swab culture and sensitivity.

Study Design: This was a prospective cohort study conducted over a period of one year (2023-24).

Inclusion Criteria

The patients of all age groups with open as well as closed fractures, Septic arthritis, Osteomyelitis, Arthroplasty, Spine Surgery, trauma with Implant or without Implant in OPD or ward during pre-operative, post-operative period, or on the OT table were included.

Exclusion Criteria

Polytrauma Patients with abdominal, chest, or head injury or a combination with orthopaedic injury, samples collected from non-orthopaedic sites like urine, blood, etc, repeat samples positive for the

same organism or negative after antibiotic sensitivity-based antibiotic therapy, all these were excluded from the study.

METHODS:

Samples were collected from patients and were subjected to microbial cultures and then microscopic examination for identification of the organism, and then microorganism-specific antibiotic sensitivity. Microscopic examination revealed the underlying microorganism, which was further subjected to antibiotic sensitivity testing. The data obtained was assessed and analysed for multidrug resistance, esp. within the Staphylococcus aureus microbe category. Results were collected over a period of 1 year from 01/04/2023 to 31/03/24.

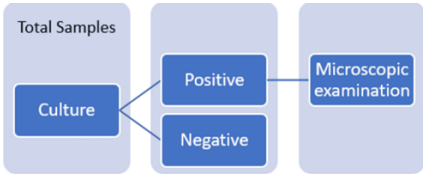

Figure 1: First stage: Culture and Microscopic examination

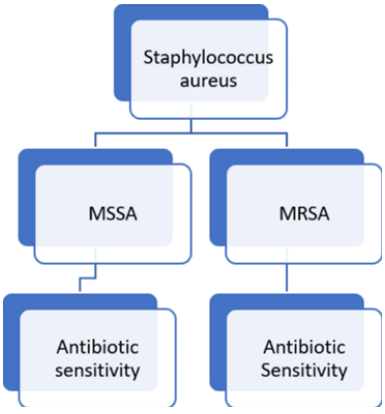

Figure 2: Second stage: Antibiotic Sensitivity

RESULTS

A Total of 702 samples were processed over the period of one year, out of which 291(41.45%) were positive and 411(58.54%) were found sterile. A total of 104 samples were tested positive for Staph. aureus, which is one in every seven samples processed and one in every three positive Samples. Out of 104 samples, positive for Staph. Aureus, 71(68.26%) were tested positive for MRSA, and 33(31.73%) were tested positive for MSSA, which were further subjected to antibiotic sensitivity as shown in **table no-1, 2 & 3.**

Table 1: Distribution Of Organism

Organism	Incidence
MRSA	71
MSSA	33
E. coli	28
Enterobacter aerogenes	19
Pseudomonas	18
Pseudomonas	16
Acinetobacter baumannii	12
Kliebsiella pneumonia	10
Enterobacter	9
Enterococcus	4
Proteus	3
Others	67

Table 2: MRSA 71 Cases

Antibiotic	Sensitive in
Linezolid	32 (45%)
Vancomycin	18 (25.3%)
Clindamycin	16 (22.5%)
Erythromycin	14 (19.7%)
Cotrimoxazole	06 (8.4%)
Tetracycline	05 (7.0%)
Cefpodoxime	02 (2.8%)
Ampicillin	02 (2.8%)
Levofloxacin	02 (2.8%)

Table 3: MSSA 33 Cases

Antibiotic	Sensitive in
Cefoxitin	19 (57.5%)
Linezolid	17 (51.5%)
Erythromycin	12 (36.3%)
Clindamycin	12 (36.3%)
Cotrimoxazole	09 (27.2%)
Tetracycline	06 (18.1%)
Vancomycin	05 (15.1%)
Cefpodoxime	02 (6%)
Chloramphenicol	02 (6%)
Doxycycline	02 (6%)
Minocycline	01 (3%)
Doripenem	01 (3%)
Ampicillin+ Sulbactam	01 (3%)

DISCUSSION

This study, conducted at a single centre, provides insights into the prevalence of pathogens and their sensitivity among orthopaedic patients over one year.

Based on this data, the selection of empirical antibiotics used in orthopaedics can be refined. Furthermore, the sources of infection and precautionary measures to prevent these infections can also be developed from this study. In this research, Staphylococcus aureus is identified as the primary pathogen involved in orthopaedic infections and is recognized as a major cause of infections in orthopaedics worldwide. Various factors contributing to the spread of infection include the operative status, type of injury, type of implant used, and the local environment. This study also demonstrates that Gram-negative cocci, such as E. coli, are the second most common organisms isolated.

Table 4: Comparison Of MSSA And MRSA

Parameters	MSSA	MRSA
Frequency	33(32%)	71(68%)
Mode of Infection	Community Acquired	Hospital-Acquired (majorly)
Virulence	Low	High
Effective response to antibiotic treatment	Sensitive and susceptible to antibiotic treatment. So easy to treat.	Resistant to many antibiotic treatments so difficult to treat
Preferred treatment	Cephalexin, Nafcillin	Vancomycin, Clindamycin, Linezolid
Mortality	Low	High

According to this study, the incidence of MRSA is predominantly higher than that of MSSA. The MRSA is not only resistant to methicillin but also resistant to other antibiotics also leading to further antibiotic testing to reveal an antibiotic effective against the cultured MRSA.

The injudicious use of antibiotics has drastically increased antibiotic resistance in organisms. This puts stress on reserve antibiotics like linezolid, etc. They have become more troublesome to control, and they have increased the risk and rate of complications of Antibiotic and Orthopaedics disease in patients, exposing them to prolonged hospital stays and multiple surgeries, leading to morbidity and mortality. All this in turn required furthermore research and development of newer antibiotics, which demand extensive research, manpower, and finances. The development of newer antibiotics also doesn't guarantee the efficacy of antibiotics for long.

There should be more attention toward sterilization and aseptic techniques. The antibiotic use should be very judicious and limited to prevent resistance, even in antibiotics in infection control protocols. The antibiotics must be used after antibiotic sensitivity in an adequate amount, dosing schedule, route, and duration of the antibiotic course.

Study Limitation:

This is the data of a single department of an institute with a duration of only one year. But the development of antibiotic sensitivity is very rapid. The development of antibiotic resistance is directly proportional to how extensively the antibiotic is used. This antibiotic resistance is reversible if the antibiotic use is discontinued for a particular duration. it is advisable to continuously monitor the antibiotic sensitivity of

different organisms in different hospital settings, with involvement of multiple departments using antibiotics.

CONCLUSIONS

Pus samples collected from orthopaedic patients indicate that Staphylococcus aureus is the most common causative agent of infections. Among these, the prevalence of methicillin-resistant Staphylococcus aureus (MRSA) is higher than that of methicillin-sensitive Staphylococcus aureus (MSSA). MRSA is primarily recognized as a hospital-acquired infection, leading to the conclusion that most infections spread within hospital settings and are therefore preventable. There is an urgent need to develop protocols to prevent the spread of Staphylococcus aureus, which is responsible for approximately 25% of cases and is a leading cause of infection. Implementing these measures will not only reduce the disease burden but also improve outcomes for orthopaedic surgeries. Once identified, patients should be treated with specific antibiotics based on sensitivity data to prevent the development of resistance.

This study provides insight into the problem of antibiotic resistance, paving the path for antibiotic stewardship programs.

The key takeaway is that antibiotics play a crucial role in controlling infections; however, we cannot rely solely on them. It is essential to emphasize the importance of infection prevention through sterilization, sanitation, and staff training.

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