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ORIGINAL ARTICLE

Pattern of Bacterial Infection in Orthopedic Department at Tertiary Care Hospital

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ABSTRACT

Aim: To identify prevalence of different type of bacteria among patient of different diseases in orthopedic department.
Methodology: It was cross-sectional study done in Department of Orthopedics, Saidu Group of Teaching Hospital Swat from 1st February 2022 to 31st January 2023. A total of 209 patients, both male and female with age between 10 years to 70 were included. The specimens including pus and/or fluids were collected from the effected site by orthopedic consultants for culture and sensitivity.
Results: Bacteria were isolated from 198(94.70%) samples while 11(5.30%) samples showed no growth of any bacteria. Among them staphylococcus aureus was isolated from 117 samples making 55.98% of total samples, pseudomonas aeruginosa was isolated from 44 samples making 21.03% of total samples, Escherichia coli was isolated from 32 samples making 15.31% of total samples. Three species of Citrobacter (1.43%) and two species of Enterobacter spp. (0.95%) were also isolated from the samples. Sixty seven samples were taken from post-operative site, 44 samples from abscess, 39 samples from osteomyelitis, 38 samples from Septic arthritis and 21 from diabetic Foot. Pseudomonas aeruginosa (49.27%) was most prevalent in postoperative infections, Staphylococcus aureus (94.87%) in osteomyelitis, Pseudomonas aeruginosa (52.38%) in diabetic foot, Staphylococcus aureus (68.18%) in soft tissue abscess also in Septic Arthritis (86.84%).
Practical Implication: The pattern of microbial infection varies in post-operative infections, septic arthritis, osteomyelitis, diabetic foot ulcer and abscess.
Conclusion: Bacterial infections in musculoskeletal system are common and on time identification with use of specific antibiotics may help in early recovery and abutting complications.
Keywords: Prevalence, Orthopedics, Post-operative site, Abscess, Osteomyelitis, Septic arthritis, Diabetic foot

INTRODUCTION

Musculoskeletal diseases are a leading cause of disability worldwide. Around 1.71 billion people worldwide suffer from musculoskeletal disorders (WHO). Diseases of the musculoskeletal system have been known for a long time. Post-traumatic osteomyelitis is one of the most common complications after bone surgery. In the discipline of orthopaedics and traumatology, the main problem in degenerative and traumatic pathologies is implanting diseases. The surgical site after surgery can be traumatic for both the patient and the surgeon. This can lead to increased antibiotic use, longer hospital stays, more intensive care, longer recovery times, and higher morbidity and mortality[1]. The most common route for bacteria to reach bone in humans is through blood[2]. However, injuries such as penetrating injuries[3], implants and postsurgical complications[4]. Presence of foreign body[5], fractures and intramedullary nailing[6] have been identified. Intravenous drug users[7] also predispose to bone infection. These diseases are a major problem for surgeons as they are often multidrug resistant[8]. Infection can be prevented by aseptic surgical techniques or by using early wound dressing, the infection can be largely resolved and conservative treatment can be expected. Identification of the causative agent is important for the final selection of antibiotics.

In orthopedics, postoperative infection is considered a serious complication that can increase medical costs, prolong hospital stay, and possibly lead to limb loss or death[9]. Implantation materials used in fracture fixation devices, which increases the risk of infection that is difficult to eliminate due to biofilm formation[10]. Various bacteriological studies have shown that both Gram positive and Gram negative bacteria play a role in surgical complications[11]. Previous data showed that the most common bacteria were Staphylococcus aureus (31.58%) followed by Klebsiella pneumonia (26.31%), Pseudomonas aeruginosa (15.79%), Escherichia coli (10.53%), Acinetobacter (10.53%) and Proteus mirabilis (5.26%)[8].

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Medical resources, diagnosis, and treatment must improve in developing countries. There are limited resources: access to medical and health resources; knowledge about disease; awareness, trainings, and awareness about health[35,36,37,38,39,40]. The aim of the study was to evaluate bacterial profile in Patients of different infectious condition in Orthopedic Department at Saidu Group of Teaching Hospital serving around 2.5 million population of district swat region north Pakistan.

METHODOLOGY

This is a cross-sectional study conducted by the Saidu Group of Teaching Hospital Swat Orthopaedic Department from 1st February 2022 to 31st January 2023. Demographic information such as patient history, provisional and clinical diagnoses, type of performed procedures, surgery outcomes and use of antibiotics in last seven days were recorded. A total of 209 patients provided written informed consent including both male and female with age between 10-70 years with clinical sign of post-operative wound infection, abscess, diabetic foot ulcer, osteoarthritis and septic arthritis were included. Samples for culture and sensitivity were taken from the effected site to isolate causative organism in the laboratory. Patients who were diagnosed with infection of other systems (other than Musculoskeletal system), those who taken antibiotics in last seven days and patients who didn't provide informed consent excluded.

An infection is the invasion and growth of bacteria in the body that can start anywhere in the body and spread throughout the body. Post-operative infections are defined as any infection that occurs in any orthopedic surgery involving the use of implants. Soft tissue Abscess is defined as localize collection of pus within skin or subcutaneous tissue, typically caused by bacterial infection. Septic arthritis is infection of joint caused by the invasion of microorganisms, resulting in inflammation of the synovial membrane and accumulation of purulent fluid within the joint space. Osteomyelitis is a bone infection that results in inflammation, pain and destruction of bone tissue, caused by microorganisms such as bacteria or fungi. It's typically diagnosed through imaging studies and bone cultures, and treated with a

combination of antibiotics and surgical intervention while diabetic foot ulcer is chronic wound on the feet of uncontrolled diabetic patient as a result of underlying neuropathy, peripheral vascular diseases and/or trauma. Specimens including pus and/or fluids were collected from the effected site in 10ml sterile syringe for culture or culture stick. Cultures were carried out manually by qualified microbiologist in Hospital laboratory, first by transferring collected sample to sterile container. The sample was spread on a culture plate and incubated to promote bacterial growth. Then bacterial colonies are identified from the sample. The data was analyzed in SPSS-26.

RESULTS

There were 134 (64.1%) males and 75 female (35.9%) females, 55(26.32%) between 26-40 years, 63(30.14%) between 41-55 years, 60(28.71%) between 56-70 years and 31(14.83%). The bacteria were isolated from 198(94.70%) samples while 11(5.30%) samples showed no growth of any bacteria. Among them staphylococcus aureus was isolated from 117 samples making 55.98% of total samples, pseudomonas aeruginosa was isolated from 44 samples making 21.03% of total samples, Escherichia coli was isolated from 32 samples making 15.31% of total samples. Three Species of Citrobacter (1.43%) and two Species of Enterobacter spp (0.95%) were also isolated from the samples. Sixty seven samples were taken from post-operative site, 44 samples from abscess, 39 samples from osteomyelitis, 38 samples from septic arthritis and 21 from diabetic foot (Tables 1-6).

Table 1: Frequency of different types of bacteria (n=209)

Types of bacteria	No.	%
Staphylococcus aureus	117	55.98
Pseudomonas aeruginosa	44	21.03
Escherichia coli	32	15.31
Citrobacter	3	1.43
EnterobacterSpp	2	0.95
No Growth	11	5.30

Table 2: Frequency of post-operative bacterial pattern (n=65)

Bacterial isolated	No.	%
Staphylococcus aureus	16	23.88
pseudomonas aeruginosa	33	49.27
Escherichia coli	14	20.89
EnterobacterSpp	2	2.98

Table 3: Frequency of osteomyelitis bacterial pattern (n=39)

Bacterial isolated	No.	%
Staphylococcus aureus	37	94.87
Escherichia coli	2	5.13

Table 4: Frequency of diabetic foot bacterial pattern (n=21)

Diabetic foot bacterial isolated	No.	%
Staphylococcus aureus	1	4.77
pseudomonas aeruginosa	11	52.38
Escherichia coli	9	42.85

Table 5: Frequency of abscess bacterial pattern (n=44)

Abscess bacterial isolated	No.	%
Staphylococcus aureus	30	68.18
Citrobacter	3	6.81
Escherichia coli	2	4.56
No Growth	9	20.45

Table 6: Frequency of septic arthritis bacterial pattern (n=38)

Septic arthritis bacterial isolated	No.	%
Staphylococcus aureus	33	86.84
Escherichia coli	5	13.15

DISCUSSION

Musculoskeletal Diseases are the cause of chronic pain and disabilities[12]. These patients cost more due to longer hospital stays, more intensive care, additional treatments, hospitalizations and additional surgical procedures. Identification of bacterial pathogens and selection of effective antimicrobial agents are important for effective disease control. The incidence of musculoskeletal diseases, including periprosthetic joint infection (PJI), soft tissue infections, septic infections, and osteomyelitis, increases with aging, and diabetes and obesity increase[13]. In the current study, staphylococcus aureus (55.98%) was the most prevalent bacteria follow by Pseudomonas aeruginosa (21.03%), Escherichia coli (15.31%), Citrobacter (1.43%) and Enterobacter spp (0.95%), S. *Aureus (*55.98%) of total infections, a finding which was almost similar with the previous studies by Negi et al[14] (50.4%), Ranjan et al[15] (34%), Naik & Deshpande[16] *(32.2%) and* Krishna et al[17] *(31.3%).* One of the most common pathogens causing musculoskeletal infections remain staphylococcus aureus[18], few studies from India also reported S. aureus as the commonest isolate[19,20]. Staphylococcus aureus is one of the most common infections in children causing osteomyelitis[21] also infections after total hip arthroplasty[22], open trauma[23] and elective orthopaedic Surgeries[24]. Li and others[25] reported, coagulase negative staphylococci the most common pathogens. Another study conductor by Shafizad et al[26] on 200 patients with spine surgery identified staphylococcus aureus as the most common pathogen also *S. Aureus* is the predominant cause of prosthetic joint infection that results from hematogenous spread.[27] In another study of orthopaedic patients, the most common cause of surgical site infection was Staphylococcus aureus[28,29].

The second main group in our study was Pseudomonas aeruginosa (21.03%). Ranjan et al[30] reported that Pseudomonas aeruginosa was present in 29.6% of surgical sites in Haryana India and 33.3% of all the bacteria were isolated from post-operative-wound[31]. Our findings are lower than those reported by others. This can be attributed to the difference in residence and hygiene measures. This shows that the incidence of Pseudomonas aeruginosa has increased especially in postoperative infections observed by other researchers in recent years. Previous data in the literature report pseudomonas as the most common hospital acquired pathogens[32].

The third most prevalent pathogen in our study was Escherichia coli 15.31%, Escherichia coli was most commonly found in diabetic fool ulcer in which nine Escherichia coli out of 21 sample (42.85%) were isolated. 35.71% Escherichia coli was isolated from Diabetic Foot Ulcer by study conducted by Shahi[33]. The other minor group of organism isolated in our study were 3 enterobacter and 2 citrobacter out of 209 sample which is almost similar to study conducted by Gelaw and others[34]. In northwest ethopia in which 4 enterobacter and 2 citrobacter bacteria (out of 268 samples) were isolated from post-operative surgical site infection.

CONCLUSION

Bacterial infections in musculoskeletal system are common and on time identification with use of specific antibiotics may help in early recovery and abutting complications. The pattern of microbial infection varies in post-operative infections, septic arthritis, osteomyelitis, diabetic foot ulcer and abscess.

Conflict of interest: Nil

REFERENCES

1. Edwards C, Counsell C, Boulton C, Moran G. Early infection after hip fracture surgery, risk factors, costs and outcome. J Bone joint Surg 2008; 90-B: 770–7.
2. Glover SC, Padfield C, McKendrick MW, Geddes AM, Dwyer NJP. Acute osteomyelitis in a district general hospital. Lancet 1982; 1: 609-11.
3. Gale W, Scott R. Puncture wound of the foot? Persistent pain? Think of Pseudomonas aeroginosa osteomyelitis. Injury: Br J Acci Surg 1991; 22 (5): 427-8.
4. Khan G, Hussain A, Rehman M. Infection of the sternum and costal cartilages following median sternotomy: Report of 4 cases. JPMI 1997; 11(2): 224-9.

5. Lobati F, Herndon B, Bamberger D. Osteomyelitis: aetiology, diagnosis, treatment and outcome in a public versus a private institution. Infection 2001; 29 (6): 333-6.
6. Court-brown CM, Keating JF, McQueen MM. Infection after Intramedullary nailing of the tibia. J Bone Joint Surgery 1992; 74 B: 770-4.
7. Kak V, Chanderasekar PH. Bone and Joint infections in injection drug users. Infect Dis Clin North Am 2002; 16 (3): 681-95.
8. Sharan H, Misra AP, Mishra R. Determinants of surgical site infection in rural Kanpur, India. J Evol Med Dent Sci 2012, 1:921-8.
9. Edwards C, Counsell A, Boulton C, Moran CG. Early infection after hip fracture surgery. J Bone and Joint Surg Br 2008; 90-B(6): 770–77.
10. Trampuz A, Zimmerli W. Diagnosis and treatment of infections associated with fracture fixation devices. Injury 2006;37(suppl 2): S59–6.
11. Hanifah YA. Post-operative surgical wound infection. Med J Malaysia 1990, 45:293-7.
12. Hackett DJ, Rothenberg AC, Chen AF, Gutowski C, Jaekel D, Tomek IM, et al. The economic significance of orthopaedic infections. JAAOS 2015; 23(suppl):S1-7.
13. Patel A, Calfee RP, Plante M, Fischer SA, Arcand N, Born C: Methicillin-resistant Staphylococcus aureus in orthopaedic surgery. J Bone Joint Surg Br 2008;90(11):1401–6.
14. Negi V, Pal S, Juyal D, Sharma MK, Sharma N. Bacteriological profile of surgical site infections and their antibiogram: a study from resource constrained rural setting of Uttarakhand state, India. J Clin Diagn Res 2015;9:17–20.
15. Ranjan KP, Ranjan N, Gandhi S. Surgical site infections with special reference to methicillin resistant Staphylococcus aureus: experience from a tertiary care referral hospital in North India. Int J Res Med Sci 2013;1:108–11.
16. Naik G, Deshpande SR. A study on surgical site infections caused by Staphylococcus aureus with a special search for methicillin-resistant isolates. J Clin Diagn Res 2011;5:502–8.
17. Krishna S, Divya P, Shafiyabi S. Postoperative surgical wound infections with special reference to methicillin resistant Staphylococcus aureus: an experience from VIMS hospital, Ballari. J Biosci Tech 2015;6:697–702.
18. Post V, Wahl P, Uçkay I, Ochsner P, Zimmerli W, Corvec S, et al. Phenotypic and genotypic characterisation of Staphylococcus aureus causing musculoskeletal infections. Int J Med Microbiol 2014;304(5-6):565-76.
19. Lilani SP, Jangale N, Chowdhary A, Daver GB: Surgical site infection in clean and clean-contaminated cases. Indian J Med Microbiol 2005, 23:249-52.
20. Mundhada AS, Tenpe S: A study of organisms causing surgical site infections and their antimicrobial susceptibility in a tertiary care government hospital. Indian J Pathol Microbiol 2015, 58:195-200.
21. Dormans JP, Drummond DS. Pediatric hematogenous osteomyelitis: new trends in presentation, diagnosis, and treatment. J Am Acad Orthop Surg 1994.2: 333-41,
22. Garvin KL, Hanssen AD. Infection after total hip arthroplasty. Past, present, and future. J Bone Joint Surg Am 1995.77: 1576-88.
23. Lee J. Efficacy of cultures in the management of open fractures. Clin Orthop 1997.339: 71-5,
24. Mandell GL, Bennett JE, Dolin R. Infectious diseases. 4th ed. New York: Churchill Livingstone 1995; 1041.
25. Li GQ, Guo FF, Ou Y, Dong GW, Zhou W. Epidemiology and outcomes of surgical site infections following orthopedic surgery. Am J Infect Control 2013;41:1268–71.
26. Shafizad M, Shafiee S, Ebrahimzadeh K, Ehteshami S, Haddadi K, Abedi M. Effect of topical vancomycin on prevention of surgical site infection in spinal surgery. Ther Clin Risk Manag 2019;29:1–12.
27. Deacon JM, Pagliaro AJ, Zelicof SB, Horowitz HW. Prophylactic use of antibiotics for procedures after total joint replacement, J Bone Joint Surg Am 1996; 78: 1755-70.
28. Molinari RW, Khera OA, Molinari WJ 3rd. Prophylactic intraoperative powdered vancomycin and postoperative deep spinal wound infection: 1,512 consecutive surgical cases over a 6-year period. Eur Spine J 2012;21:476–82.
29. Pal S, Sayana A, Joshi A, Juyal D. Staphylococcus aureus: a predominant cause of surgical site infections in a rural healthcare setup of Uttarakhand. J Family Med Prim Care 2019;8:3600.
30. Ranjan KP, Ranjan N, Bansal SK, Arora DR. Prevalence of Pseudomonas aeruginosa in post-operative wound infection in a referral hospital in Haryana, India. Journal of laboratory physicians. 2010;2(02):074-7.
31. Oguntibeju OO, Rau N. Occurrence of Pseudomonas aeruginosa in post-operative wound infection. Pak J Med Sci 2004;20:187-92.
32. Ostermann PAW, Henry SL, Seligson D. The role of local antibiotic therapy in the management of compound fractures. Clin Orthop Related Res 1993; 295: 102-11.
33. Shahi SK, Singh VK, Kumar A. Detection of Escherichia coli and associated β-lactamases genes from diabetic foot ulcers by multiplex PCR and molecular modeling and docking of SHV-1, TEM-1, and OXA-1 β-lactamases with clindamycin and piperacillin-tazobactam. PloS one 2013;8(7):e682
34. Gelaw A, Gebre-Selassie S, Tiruneh M, Mathios E, Yifru S. Isolation of bacterial pathogens from patients with postoperative surgical site infections and possible sources of infections at the University of Gondar Hospital, Northwest Ethiopia. J Environ Occupa Health 2014;3(2):1.
35. Jabeen M, Shahjahan M, Farid G. Information Dissemination during COVID-19 Pandemic among Postgraduate Allied Health Sciences Students in Pakistan. Pakistan Journal of Medical & Health Sciences. 2022;16(11):366-.
36. Shahjahan M, Jabeen M, Farid G. Information Providing in COVID-19 by Health Professionals in Pakistan. Pakistan Journal of Medical & Health Sciences. 2022 Dec 12;16(10):641-.
37. Farid G, Zaheer S, Khalid A, Arshad A, Kamran M. Evaluating Medical College Lib Guides: A Usability Case Study. Pakistan Journal of Medical & Health Sciences. 2022 Aug 26;16(07):461-
38. Farid G , Niazi Ak, Muneeb M, Iftikhar S. Attitude towards Utilization of e-Resources of Medical Images among Health Care Professionals. Pakistan Journal of Medical and Health Science. 2021 Sep 15 (9);261-263
39. Farid G, Iqbal S, Iftikhar S. Accessibility, Usage, and Behavioral Intention of Print Books and eBooks by Medical Students. Library Philosophy and Practice. 2021:1-25.
40. Farid G, Abiodullah M, Ramzan M. A comparative study of information seeking behaviors of medical faculty working in government and private run medical colleges. International Journal of Information Management Science. 2013;2(1):17-24.