Original Article

Assessment of Common Pathogenic Micro-Organisms in Open Fractures in a Tertiary Care Hospital Hyderabad

Zamir Hussain Tunio, Khaleeque Ahmed Siddiqui, Muhammad Azeem Akhund, Khaliqur-Rahman Shaikh

ABSTRACT

Objectives: To assess the common pathogenic micro-organisms in open fractures in a tertiary care hospital Hyderabad.

Design: Prospective, observational study.

Duration: July 2007 to June 2008.

Setting: Department of Orthopaedic surgery and Traumatology in collaboration with Diagnostic & Research Laboratory Liaquat University of Medical and Health Sciences Jamshoro/Hyderabad.

Patients: Two hundred cases of open fractures were included in this study. Out of these 191(95.5%) were males and 9(4.5%) females and all age group with open fractures of appendicular skeletal system arriving within 72 hours.

Methodology: Data regarding mode & location of injury was collected on a structured proforma. Four pus swab / specimens were collected for culture & sensitivity, from depth of open fracture wounds by standard techniques using commercially available sterile stick swabs.1st sample was predebridment culture, 2nd was post debridment culture after 72 hours of 1st sample. 3rd sample on 7th day & 4th sample on12th day.

Results: Two hundred cases of open fractures were included in this study. Four samples on different occasions of 200 patients were taken in this study to assess the micro-organism. Out of these 200 patients, 46(23.0%) cases were positive and 154(77.0%) were negative in the first sample. Forty eight (24.0%) were positive and 152(76.0%) were negative in the second sample. Sixteen (8.0%) were positive and 184(92.0%) were negative in the third sample and 5 (2.5%) were positive and 195(97.5%) were negative in the fourth sample.

Conclusion: This study with its enlarged scope of pre debridment and multiple post debridment cultures effectively provides the evidence of Klebsiella, E.coli, staphylococcus aureus and Pseudomonas as the most predominant micro organisms.

Key words: Infection, open fracture, micro-organism, status of wound.

Correspondence to:

Dr. Zamir Hussain Tunio

Postgraduate Student
M.S. Orthopaedic Surgery
Liaquat University of Medical & Health Sciences, Jamshoro.

INTRODUCTION

Open fractures are high-energy injuries that require a principle-based approach, starting with detailed evaluation of patient status and injury severity. Early, systemic, wide-spectrum antibiotic therapy should cover gram-positive and gram-negative organisms[1].

Open fractures often are associated with

increased rates of infection and nonunion, multiple surgical procedures, and delayed return to preinjury activity[2]. Orthopaedic infection is even more dangerous and disabling entity. Infections in open fractures are surgical emergencies. Not controlled, they lead to malunion, non union, increase in morbidity, increase in complication rate and tremendous increase in the hospital and treatment cost & immense economic burden[3].

Over the past decade spectrum of infecting organisms has been changing. Although stahphylococcus aureus remains a major player, gram negative and mixed infection are now common[3]. The predominantly polymicrobial growth in the initial contamination has been followed by either polymicrobial or Klebsiella infection in skin, as well as, in muscle tissue samples. This shows the uncertainity in the prediction of the infective bacteria from both the skin and muscle tissue samples. The effects of medical intervention in the course of management could be a factor in it. It has also been observed that a significant percentage of late infections occur with hospital acquired organisms, suggesting that the inocculation of pathogens occurs subsequent to the initial injury[4]. As we know that all the factors starting from source of infection to eradication of infection can not be evaluated in a single study. We have conducted a very basic study to find out the incidence of infection in different types of open fractures, infection rate between the time of fracture and debridment time and the most common infection organisms in open fractures.

MATERIALS AND METHODS

This prospective study was conducted in the department of Orthopaedic surgery and Traumatology in collaboration with Diagnostic & Research Laboratory Liaquat University of Medical and Health Sciences Jamshoro /Hyderabad, during July 2007 to June 2008. The study includes 200 cases of open fractures . Inclusion criteria were that all patients after counseling for study and taking voluntary consent and diagnosed as case of open fractures of appendicular skeletal system arriving within 72 hours regardless of age and sex. Exclusion criteria included Cases of diabetes mellitus, immuno-compromised patients and open pathological fractures.

Data Collection Procedure:

The data was collected on a structured proforma based on inclusion criteria. Information regarding the patient: history, status of general condition, status of wound, culture and sensitivity. Four culture samples were collected which include

1st culture sample : Predebridment culture.

2nd culture sample: 1st Post debridment culture, after 72 hours of 1st sample.

3rd Culture sample: 2nd Post debridment culture, on 7th day.

4th Culture sampe: 3rd Post debridment culture, on 12th day.

Four pus swab / specimens were collected on four different ocassions from depth of open fracture wounds by standard techniques using commercially available sterile stick swabs. Two bottles were used for culture one for aerobes and another for anaerobes. The atmosphere of the aerobes bottle contained 5% carbon dioxide while bottle for anaerobes contained cysteine (a reducing agent) and 5% carbondioxide in nitrogen. Needle biopsy was not done. Precautions were taken for proper collection of swab and it was ensured that swab did not touch adjacent margin of skin of patient's wound. Specimens were immediately transported to the department of pathology and all the specimens were inoculated onto blood and Macconkey's agar within two hours of collection. The isolates were identified by colonial

morphology, Gram's stain motility test by hanging drop method.Fermentation tests of various sugar like glucose, Lactose,sucrose & maltose.TSI agar Simmon citrate, Indole, IMVIC,Urease production. Oxidase utilization, oxidase fermentation test. Catalase and Coagulase test & conventional biochemical tests[5].

STATISTICALANALYSIS

The data was entered and analyzed in statistical program SPSS version 16.0. Qualitative data (frequency and percentage) such as gender, status of wound, mode of injury, location of injury, common micro-organisms, most appropriate and effective antibiotics are presented as n (%) and Pearson's chi-squre test was applied to compare the proportions among the categorical variables. All the data was calculated on 95% confidence interval. P value $\leq$ 0.05 was considered as statistically significant level.

RESULTS

Two hundred cases of open fractures were included in this study. Out of these 191(95.5%) were males and 9(4.5%) females and age ranged from 2 80 years (Fig: 1).

Culture of micro-organisms was carried in the research & diagnostic laboratory of the Liaquat University of Medical & Health sciences. Four samples on different occasions of 200 patients were taken in this study to assess the micro-organism. Out of these 200 patients, 46 (23.0%) cases were positive and 154 (77.0%) were negative in the first sample. Forty eight (24.0%) were positive and 152 (76.0%) were negative in the second sample. Sixteen (8.0%) were positive and 184 (92.0%) were negative in the third sample and 5 (2.5%) were positive and 195 (97.5%) were negative in the fourth (Fig: 2). From these 46 cases found positive in their first sampling, 16 (34.78%) cases remained positive in the second samples, 4 (8.69%) were positive in the third and we got no positive case in the fourth sample.

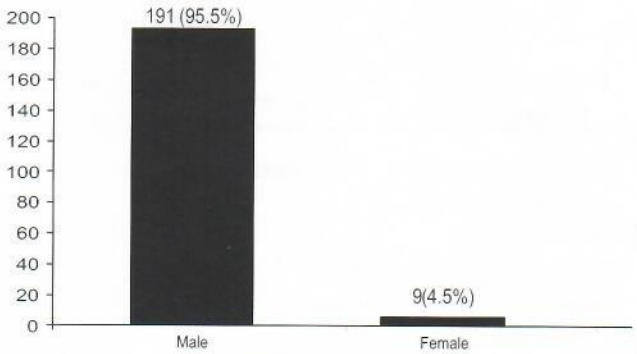

Figure No. 1
GENDER DISTRIBUTION
(n = 200)

Out of 200 cases 48 (24.0%) were found positive in the second sample. Of these 48 positive cases, 16 (33.33%) cases had previously grown organism in the first sample, 32 (66.66%) were the new positive cases. Eleven (22.91%) cases were found positive in the third sample, 3 (6.25%) cases were positive in the fourth sample. Change of virulence of micro-organism was seen in 11(22.91%) cases (Table No. 1).

Out of 200 cases, 16 (8.0%) were found positive in the third sample, out of them, 4 (25%) were from the first sample and 12 (75%) were also positive in second sample. Seven (43.75%) cases were found positive from the new (32 cases) of the second samples. Five new cases grown micro organism in the third sample and they were negative in first & second sample. Virulence of micro-organism were change in 6 (37.5%) cases.

Five (2.5%) cases were positive out of 200 cases in the fourth sample. No patient from the positive culture of the first sample showed growth. Out of these five cases, 4 (80.0%) cases were from second sample (they were also positive in third sample) and one case from the third sample. Change of virulence of micro-organism was determined in 2(50.0%) cases. Virulence of micro-organism were change in 17(8.5%) cases and 19 growths (Table 2)

Table No. 1
CHANGE OF VIRULENCE
n = 17

First sample	Second sample	Third sample	Fourth sample
Streptoccocus SPP	Klebsiella	NA	NA
Pseudomonas	Klebsiella	NA	NA
Pseudomonas	Proteus	NA	NA
NA	Shigella SPP	Citrobacter SPP	NA
NA	Serretia SPP	Ecoli	NA
NA	NA	Serretia SPP	Klebsiella
NA	Klebsiella	Enterobacter	NA
NA	Citrobacter SPP	Klebsiella	Proteus
Klebsiella	Pseudomonas	NA	NA
Klebsiella	Ecoli	Pseudomonas	NA
Klebsiella	Mixed Flora	NA	NA
Enterobacter	Pseudomonas	NA	NA
Enterobacter	Ecoli	Ecoli	NA
Ecoli	Proteus	NA	NA
Ecoli	Proteus	NA	NA
Ecoli	Ecoli	Pseudomonas	NA
Ecoli	Mixed Flora	Mixed Flora	NA

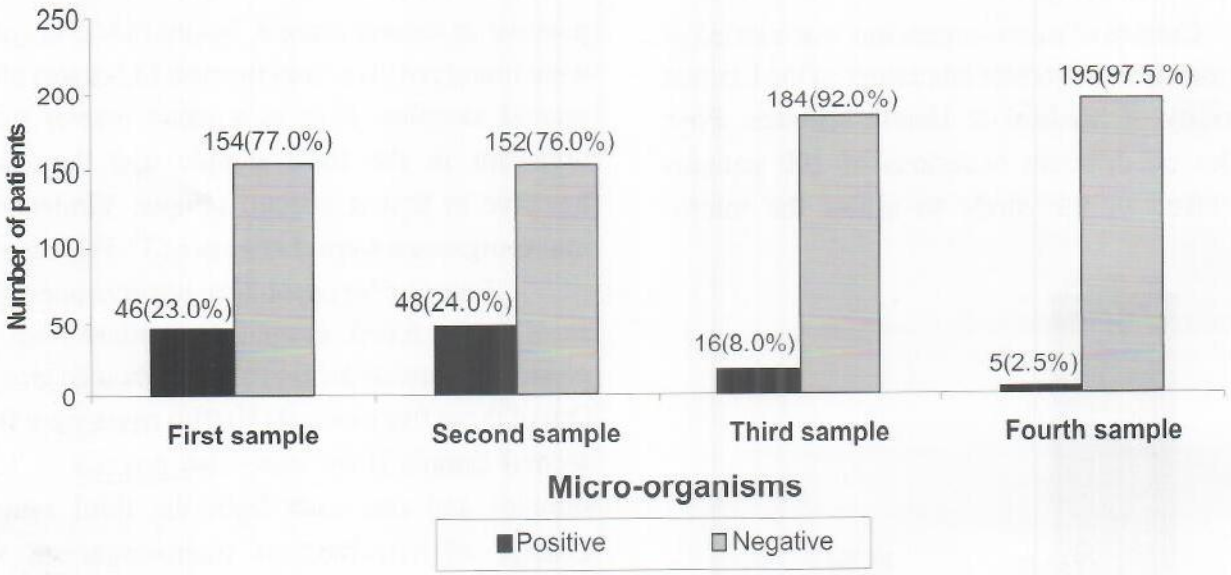

Figure No. 2
POSITIVE AND NEGATIVE SAMPLES OF MICRO-ORGANISMS
(n = 200)

Table No. 2

FREQUENCY OF MICRO ORGANISMS
n= 115

Organism	1st culture	2nd culture	3rd culture	4th culture	Total	Frequency Order
Klebsiella	11	9	4	2	26	1
Pseudomonas	4	8	3	0	15	3
Staph.Aureus	9	6	0	0	15	3
Proteus	1	6	1	1	9	5
Serretia SPP	2	1	1	0	4	7
Escherichia Coli	7	7	2	0	16	2
Citrobacter SPP	3	4	1	1	8	6
Enterobacter	5	1	1	1	8	6
Mixed Flora	1	5	3	1	10	4
Streptoccocus SPP	2	1	0	0	3	8
Morgnella Morganii	1	0	0	0	1	9

INFERENCE

In this study the commonest organisms in relation to mode of injury and location of injury were same. Klebsiella sp.was the most common organism followed by Escherichia.coli. The 3rd commonest were the Pseudomonas & Staph. aureus and the 4th had Mixed Flora.

DISCUSSION

Infection is the main complication following open fractures and may result in limb loss, sepsis, and death. Infection is difficult to establish in bone unless conditions favour the localization and proliferation of bacteria [6] but once it has established in bones and joints it is difficult to eradicate unless surgery is performed[7,8]. Most open fractures are contaminated with bacteria by the time the patient reaches hospital. In clean cases usually a single organism is involved but open cases are usually contaminated by multiple organisms[9], and despite of improvements in open fracture management, late infection continues to occur in 2 to 25% of all open fractures[5].

This study covered the male to female ratio 21.2:1. The male preponderance is evident 95.5% against 4.5% females. However the male to female percentage given by M. Shoaib Khan [10] in 2008 showed 64.42% males and 35.58% females out of 104 subjects, A D'Souza [5] were reported 87.96% males and 12.04% females and Hyder Ali [11] found 83.3% males and 16.7% females. A greater male to female ratio in sindh province as compared to above studies is perhaps due to greater gender

inequity; more males work out doors, operate machines, drive vehicles, construct buildings & work in fields & are consequently more exposed to industrial and agricultural hazards than females.

Pre-debridment culture was taken in all 200 cases. Of these, 46 were microbial positive. The most common organism found was Klebsiella (gram negative bacillus) 11, followed by S.aureus 09, Escherichia.coli 07, Enterobacter 05, Pseudomonas 04, Sterptococcus & Serretia 02 each, Proteus, Mixed flora and Morgnella 01each . Predebridmnet culture was found to have high sensitivity in detecting infection. Other studies also suggest that if infection is present at first presentation then the chance of detecting the offending organism was almost 84% [12].

1st Post debridement culture was taken after seventy two hours of first sample. Out of 200 patients 48(24.0%) were found positive, again Klebsiella 09 was the most common organism followed by Pseudomonas 08, Escherichia.coli 07, Staph.aureus and Proteus 06 each, Mixed flora 05, citrobacter 04, Serretia, Enterobacter & shigella Spp 01 each in this study.However study of A D'Souza also reported Pseudomonas as the second most common organism in the post debridment culture. If a culture is positive and the wound is infected, then the organism isolated has the highest probability of being the cause [5].

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Third sample (2nd post debridment culture) was taken from two hundred cases on the day 7th. Of these 16 were positive. The most common micro organism was Klebsiella 04 followed by Pseudomonas 03, Mixed flora 03, Escherichia.coli 02 & Proteus, Serretia, Citrobacter and Enterobacter 01 each. Fourth sample (3rd post debridment culture) was taken on day twelvth. Out of 200 cases, 05 were positive, the most common positive micro organism was Klebsiella 02, followed by Proteus 01, Enterobacter 01 and Mixed flora 01.

CONCLUSION

This study with its enlarged scope of pre debridment and multiple post debridment cultures effectively provides the evidence of Klebsiella, E.coli, staphylococcus aureus and Pseudomonas as the most predominant micro organisms

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