



Isolation Of Bacteria From Compound (Gustilo Type II & Type III) Fractures Attending The Emergency Department Of Gauhati Medical College And Hospital

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ABSTRACT

Background: Open fractures pose an immediate risk of infection. In general, greater the damage to bone and soft tissues, greater the risk of infection. A primary goal in the management of open fractures is the prevention of the devastating infection of bone and soft tissues. Despite the surgeon's best efforts, some open fractures become infected. Thus, to better define the role of bacterial cultures of open fracture wounds in this part of the country, the need for a study of culture results toward infection in open fractures was felt and a study was undertaken. **Materials and methods:** A total of 230 cases of compound fractures attending the OPD and Casualty of Department of Orthopaedics, Gauhati Medical College and Hospital who met the inclusion and exclusion criteria outlined below were included in the study. A single swab for culture and sensitivity was collected at the time of admission on first inspection of the wound and then the patient was taken for emergency debridement. **Results:** Of the 230 cases, the total number of cases where organisms were isolated was 55. The highest number of organisms (49%) were isolated from type IIIB compound fractures. The most common organisms isolated in the study conducted by us, was *Acinetobacter* species (15 cases), which is a gram-negative non-fermenter, followed by *Klebsiella pneumoniae* (9 cases) which is a gram-negative bacterium of the Enterobacteriaceae family. **Discussion & conclusion:** Bacteria belonging to the gram-negative group were predominant in our study.

Key words: Infection, Compound fractures, bacterial culture

I INTRODUCTION

Open fractures are one of the most important causes of bone and soft tissue infections. In general, the greater the damage to bone and soft tissues, the greater the risk of infection¹. Since the introduction of sulfonamides and penicillin in the

1930's and 1940's, specific antimicrobial resistance has been an issue. Methicillin resistance developed in the 1960s, and amino glycoside resistance among *Pseudomonas Aeruginosa* isolates was first seen in the late 1960's and 1970's. In the last decade, multidrug resistance became frequent among nosocomial pathogens (that is *Staphylococcus*, *Enterococcus* and *Enterobacter* species). In addition, antimicrobial resistance methicillin resistance among *Staphylococci*, vancomycin resistance among *Enterococci* and third generation cephalosporin and fluroquinolone resistance among *Pseudomonas*, *Enterobacter* and *Escherichia Coli* species) has become common in isolates acquired from community^{2,3}. A primary goal in the management of open fractures is the prevention of the devastating infection of bone and soft tissues. To achieve this goal, the most widely accepted treatment protocols include emergent surgical irrigation and debridement of open fracture wounds, administration of broad-spectrum antibiotics, and stabilization of the fracture. In 60% to 70% of open fractures, wounds are contaminated with bacteria at the time of injury⁴. Several large series from multiple centres have identified the most common organisms present and have led to the acceptance of use of a first-generation cephalosporin, augmented by an aminoglycoside in Type II and higher injuries and by penicillin in farmyard injuries^{5,6,7}.

The necessity for sequential or multiple cultures of open fracture wounds and their interpretation is controversial⁸. Culture practices have included swabbing the wound at the time of presentation, before preparing for surgical debridement, during the surgical debridement, and at the conclusion of the debridement⁹. The role of these cultures in the management of open fractures is not very clear. In an effort to better define the role of bacterial cultures in open fractures in this part of the country, the need for a study on culture in open fractures was felt and a study was undertaken.



II. MATERIALS AND METHODS

- Study design: Cross sectional study.
 - Study setting: Department of Orthopaedics, Gauhati Medical College and Hospital in collaboration with the Department of Microbiology, Gauhati Medical College and Hospital.
 - Study period: The study was conducted from June 2019 to May 2020.
- A total of 230 cases of compound fractures attending the OPD and Casualty of Department of Orthopaedics, Gauhati Medical College and Hospital who met the inclusion and exclusion criteria outlined below were included in the study.

Inclusion criteria:

- Only those patients who gave informed consent were included in the study.
- Patients of all age and both sexes with open fractures of Gustilo Anderson classification type II and type III were included in the study.

Exclusion criteria:

- All patients with open fractures who had received antibiotic therapy before presenting to our hospital were excluded.
- Patients with open fracture of type I Gustilo Anderson classification.
- Patients not willing to give consent for the study.

Study period: The study was conducted from June 2019 to May 2020.

Ethical clearance: The Institutional Ethical Committee approval was obtained prior to initiation of the study.

Data collection: The patient's demographic details and other relevant information were recorded in a pre-designed proforma.

Clinical examination: On arrival at the hospital, the wound was examined, the description of the wound recorded, and the fracture classified according to the Gustilo Anderson classification after the relevant x-ray of the affected part.

Then a single swab for culture and sensitivity was collected on first inspection of the wound and then the patient was taken for emergency debridement.

Collection of samples: Under all aseptic precautions, wound swabs were collected from the deeper part of the wound with sterile swabs from the patients presenting with open fracture after taking a written informed consent of the patient. The samples were immediately transported to the laboratory in sample transportation box for further processing for culture.

Methods:

Aerobic culture of the wound swabs were done on blood agar and MacConkey agar plate and incubated at 37°C for 48 hours. The culture plates were examined for bacterial growth by examining the colony characteristics. Bacterial colonies were identified by conventional methods and automated method using Vitek2 wherever possible. Antibiotic sensitivity tests were carried out using automated system Vitek2 for determination of minimum inhibitory concentrations (MIC).

All wounds were subjected to copious lavage with normal saline followed by thorough debridement. After the first debridement empirical broad-spectrum antibiotics were started according to their body weight. Later on, according to the culture and sensitivity reports, the antibiotics were changed if needed.



Figure 1: Swab being taken from a compound fracture



Figure 2: Vitek2



III. RESULTS AND OBSERVATION

A total of 230 cases of compound fractures of Gustilo Anderson type II and type III were included in our study. Out of the 230 cases, 204(89%) were males and 26(11%) were females.60% of the cases presented to our hospital in less than 6 hours and 40% presented in more than 6 hours.30% of the cases who presented to our hospital in>6 hours showed positive culture compared to 19% who presented in<6 hours.On comparing the various modes of injury leading to compound fractures, it was found that road traffic accident was the most common (64%). Of the total 230 cases of compound fractures in our study, the highest was type IIIB compound fractures.

Organisms were isolated in 55 of the 230 cases. The highest number of organisms (49%) was isolated from type IIIB compound fractures.The most common organisms isolated was Acinetobacter species (15 cases), which is a gram-negative non-fermenter, followed by Klebsiella pneumoniae (9 cases) which is a gram-negative bacterium of the Enterobacteriaceae family. Bacteria belonging to the gram-negative group were predominant in our study. The remaining group of organisms were gram-positive mainly Staphylococcus aureus (5 cases) which were sensitive to methicillin; followed by Coagulase negative Staphylococcus (5 cases).

Table 1: Culture positivity based on time post injury

Time of presentation since injury	Culture positive
>6 hrs	28
<6 hrs	27

Table 2: Organisms Isolated

ORGANISMS ISOLATED	NUMBER
Acinetobacter(ACIN)	15
Klebsiella Pneumoniae(KPN)	9
Pseudomonas Aeruginosa(PAG)	8
Staphylococcus Aureus(SAU)	5
Escherichia Coli (ECOLI)	4
Coagulase Negative Staphylococcus Species (CONS)	2
Enterococcus Faecalis(EFAE)	2
KlebsiellaOxytoca(KOX)	2
Pantoea(PAN)	2
Proteus Mirabilis (PMB)	2
StenotrophomonasMaltophilia(SMAL)	2
Staphylococcus Sciuri(SSC)	2
AeromonasHydrophila/ Caviae(AHYD)	1
BurkholderiaCepacia(BCAP)	1



Enterobacter Cloacae(ECLO)	1
Serratia Marcescens (SMAR)	1
Staphylococcus Xylosus(SXY)	1

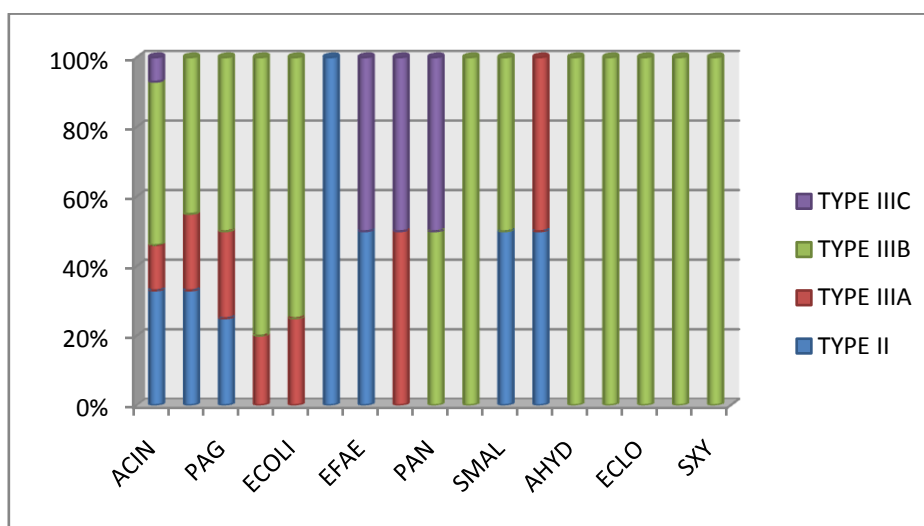


Figure 3: Organisms isolated from different type of fractures

IV. DISCUSSION

Compound fractures present a management challenge to the orthopaedic surgeons. Apart from all the other difficulties, failure to isolate the organism contaminated in the wound, makes the situation more complicated. Even after isolation of the primary organism, the macrophages and the debris present in the wound, makes an excellent media for the growth of secondary organisms and thus adding to the problems of management.

In our study, patients between the age group of 3-85 years were encountered. The mean age of our study population was 34.6 years. Our findings are in concert with findings of other related studies. Matos et al¹⁰, Yokoyama K et al¹¹ found the mean age to be 32.9 years and 31.9 years respectively. The total number of cases were 230 out of which 204 (89 %) were Males and 26 (11 %) were Females. Male preponderance was also seen in studies conducted by other authors. In the study done by Yokoyama K et al¹¹ who treated 42 open tibial fracture, 35 were Male (83%) while 7 (17%) were female. Kale et al¹² found 88.3% of their total study population to be Male whereas 11.7% of the study population was Female. In our study, it was found that 28 cases (30%) who presented to our hospital in more than 6 hours showed positive culture, compared to 27 cases (19%) who presented in less than 6 hours. It can be inferred that cases

who present late, show more contaminants in the wound, thereby increasing the chances of infection later on. Of the total 230 cases of open fracture in our study, the maximum number of cases were type IIIB amounting to 101 cases (44%), followed by type II, 77 cases (33%). The results in our study are comparable to other studies.

In the study conducted by Yokoyama K et al¹¹, 52% of the cases were type IIIB compound fractures. In the study by Dellinger et al⁸, type IIIB compound fractures constituted 29% of the cases. In the study conducted by Kale et al¹², 48% of cases were type III (A, B, C) compound fractures.

In our study, swab was obtained from the patients presenting with compound fractures of Gustilo Anderson type II and III, to the Department of Orthopaedics of Gauhati Medical College and Hospital. MRSA was not isolated from any of cases studied by us. Majority of the organisms isolated in our study were gram negative organisms. The most common organism isolated in our study was Acinetobacter species. In other studies, also predominance of gram-negative organisms is more, which is concordant with the findings of our study. Kale et al¹², in their study isolated Acinetobacter species in 14.06% of the wounds swabbed and Enterobacter species in another 14.06%. Giesecke et al¹³ in their study isolated Pseudomonas in 28% of the wounds. Johnson et al⁹ in their study of 35 cases of open tibial fractures isolated Acinetobacter



from 13 cases, Enterobacter from 6 cases, Pseudomonas from 5 cases and Klebsiella from 3 cases. **Robinson et al**¹⁴ in their study of 89 cases of compound fractures, were able to isolate positive culture in 83% of all fractures. In 39.3% of cultures, various species of aerobic Gram-negative rods (most commonly Pseudomonas aeruginosa) were retrieved, followed by Staphylococcus epidermidis (34.5%) and Staphylococcus aureus (26.1%). In the study done by **Jackson Lee**¹⁵, Staphylococcus epidermidis was isolated in the initial wound maximum number of times. **Murray CK et al**¹⁶ in their study on 49 compound fractures, reported isolation of MRSA in 2 cases from initial wound swab. MRSA was not isolated in any other study conducted by authors upon initial procurement of swab culture on presentation. However, MRSA was isolated upon development of infection later on, during follow up.

V. CONCLUSION

Various types of organisms can be isolated from compound fractures with predominance of gram negative organisms in the cases presenting to our institute. The gram-negative organisms have been known as a major cause of nosocomial infections worldwide and have shown a broad spectrum of resistance toward commonly used antimicrobial agents due to the expression of various resistance determinants like Metallo- β -lactamases (MBL) and extended spectrum beta lactamases (ESBL). It is of utmost importance to determine antibiotic susceptibility pattern of gram negative organisms and incorporate them in standard antibiotic regimen of tertiary care centres.

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