ORIGINAL ARTICLE

Common bacterial pathogens in extremity fractures due to bomb blast injuries

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Abstract

Objective: To determine common bacterial pathogens in extremity fractures due to bomb blast injuries.

Study design: Descriptive study

Place and duration of study: Department of Orthopedics and Trauma, Khyber Teaching Hospital, Peshawar, KPK, Pakistan from January 2014 to December 2016.

Material and Methods: About 160-patients of both gender meeting the inclusion criteria were recruited in the study. All the patients showing clinical signs of infection i-e pus discharge or erythema and warmness of wound were subjected to culture test using sterile technique and were immediately sent to the hospital laboratory where culture was performed by a consultant microbiologist. All the patients with positive culture tests were put on appropriate antibiotics according to culture report.

Results: Out of 160-patients, 126 (78.75%) patients were males and 34(21.25%) patients were females. Mean age was 36-years with SD±3.169 (Range 10 to 58-years). Among 160-patients, 49 (30.63%) patients developed clinical signs of infection and culturewas aseptically taken from all these patients. 40-patients (n=40, 88.89%) shows positive result. The most common pathogen was staphylococcus aureus (45%) followed by Escherichia Coli (27.5%) and Pseudomonas Aeruginosa (15%).

Conclusion: Our study concludes the most common bacterial pathogens were Staphylococcus aureus (45%) followed by Escherichia Coli (27.5%) and Pseudomonas Aeruginosa (15%).

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Keywords: common bacterial pathogens, extremity factures, bomb blast injuries, Escherichia Coli, staphylococcus aureus, Pseudomonas Aeruginosa

Introduction:

Over the last decade, terrorist attacks in the form of bomb blasts have increased greatly.[1] There is real threat to lives of civilians due to increase in suicide bombings specially in public places.[2-4] These bombings result in multiple casualties because most of the times they occur in crowded places. Blast victims usually have very complex injuries of varying severity due to combined effect of explosion and shrapnel-causing penetrating trauma.[5,6] Extremity injuries have been the frequent injury pattern during bomb blast injuries.[7,8]

Wound infections in war injuries remains a serious cause of morbidity and mortality and the attending surgeon have to take care to treat these infections.[9-12] Review of literature shows controversy regarding bacteriology of wound infections in blast injuries. The most common organisms in blast wounds are Acinetobacter spp. (25.94% patients), Coagulase-negative staphylococci (21.98%), Escherichia coli (19.28%), Pseudomonas aeruginosa (16.58%) and Klebsiella spp. (15.49%).[13] While in another study done in Peshawar in 2013, incidence of infection in gun shot and blast injuries in Pakistan was 14.3% and it was more common in patients with bomb blast (26.1%) than in patients with gunshot injuries (10.6%). Most common pathogen

Table 1: *Bacterial Pathogens (n=40)*

Bacterial Pathogens	Frequency	Percentages
Staph. Aureus	18	45%
E. Coli	11	27.5%
P. Auroginosa	6	15%
Coagulase Neg. Staphylococcus	2	5%
Klesiella Species	2	5%
Acinetobacter Species	1	2.5%
Total	40	100%

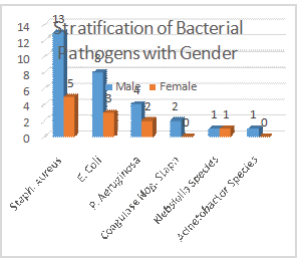

Figure 1: *Duration of symptoms in months in two groups*

Table 2: *Stratification of bacterial pathogens with age (n=40)*

Bacterial Pathogens	10-20 years	21-30 years	31-40 years	41-50 years	>50 years	Total
Staph. Aureus	3	5	6	3	1	18
E. Coli	1	4	3	2	1	11
P. Aeruginosa	0	3	2	1	0	6
Coagulase Neg. Staphylococcus	0	1	1	0	0	2
Klebsiella Species	0	1	0	1	0	2
Acinetobacter Species	0	1	0	0	0	1
Total	4	15	12	7	2	40

was staphylococcus aureus (44.2%) followed by Escherichia coli (25.7%) and Pseudomonas aeruginosa (16.9%).[14]

The purpose of this study is to know the frequency of bacterial pathogens in patients with bomb blast related orthopaedic injuries. The rationale behind this research work is that it will help to solve the controversy regarding the bacteriology of blast wounds. Locally, data is rare on this research topic.

Material and Methods:

This case study was carried out at Department of Orthopedics and Trauma Khyber Teaching Hospital, Peshawar, KPK, Pakistan from January 2014 to December 2016. A total of 160-patients having bomb blast related extremity open fractures were included in the study. Written informed consent was taken from all the patients. Thorough history and complete clinical examination was performed and antero-posterior and lateral radiograph of the involved extremities were taken. All patients were assessed according to ATLS protocol and treated accordingly. All the patients showing clinical signs of infection like pus discharge, redness and warmth during hospital stay or on follow up visits were subjected to culture test using aseptic technique, labelled and sent to hospital laboratory for culture to detect bacterial pathogens.

All the culture procedures were performed by a consultant microbiologist having minimum of 3-years of experience. All the patients were empirically put on broad spectrum antibiotics as per patient needs after culture swab was taken.

All the data was entered into SPSS version 20.

Results:

A total of 160-patients of all ages and either gender were included in the study. Mean age was 36-years with SD±3.169 (Range 10 to 58-years). More than half (50%) of the patients were in age range 21-40. 126 (78.75%) patients were males and 34(21.25%) patients were females. Among 160-patients, 49(30.63%) patients developed clinical signs of infection and culture was aseptically taken from all these patients. Most common sites of infection were tibial fractures (n=18 36.73%). Positive culture report were obtained in 40 (81.63%) patients while 9 (18.37%) patients had negative culture test. Staphylococcus aureus was found in 18(45%) patients, Escherichia Coli in 11(27.5%), Pseudomonas aeruginosa in 6(15%) patients, Coagulase Negative staphylococci in 2(5%), Klebsiella species in 2(5%) and Acinetobacter species in 1(2.5%), (as shown in table no I). No MRSA was cultured in our study. Stratification of bac-

terial pathogens with age and gender is given in able no. II and Figure no. 1

Discussion:

In our study, more than 75% of patients were males. Similar trend (males=89.6%) was seen by Filyet al.[15] This is due to the fact that most of the bomb blasts occur in crowded and congested places like mosques and bazars where male community dominates due to our religious and cultural norms. Also most of the male community go outside homes for jobs and to earn their living. More than 50% percent of the patients were in age range of 20-40 years due the same reason.

About 30.63% (n=49) of bomb blast victims develop infections. In study done by Murray et al[16] infection rate in combat injuries was 49% while Yun HC et al.[17] reported infection rate to be greater than 25% during recent conflicts in Iraq and Afghanistan. Studies of US casualties described rate of 2% to 15% in extremity injuries.[18-21] Other studies shows infection in 33-35% of patients in combat-related wounds, however these wounds were not exclusively restrictedto extremities.[22-24] This difference in infection rate may be due to the fact that in our study patients were exclusively affected by bomb blast while in these studies, injuries were also caused by gunshots and other weapons used in wars.

We obtained positive culture report in 81.63% of the patients and negative result in 18.37% of patients. In a study done in Ukrainian Military Hospital in 2017, positive cultures were obtained in 78.10 % while negative cultures were seen in 21.90 % of cases.[25] The reason of negative culture may be improper sampling technique, improper site selection and improper laboratory technique. Most common sites of infection were tibial fractures (n=18, 36.73%). This is due to the fact that tibia is the most common of the extremity bones fractured during bomb blasts injuries,[26] there is sparse soft tissue coverage of tibia, inadequate blood supply and most of the time fracture is open, and so commonly infected with skin flora.

Of the positive cases, Staphylococcus aureus was found in 18(45%) patients, Escherichia Coli in 11(27.5%), Pseudomonas Aeruginosa in 6(15%) patients, Coagulase Negative Staphylococci in 2(5%), Klebseilla Species in 2(5%) and Acinetobacter Species in 1(2.5%). Review of literature shows controversy regarding bacteriology of wound infections in blast injuries. The most common organisms in blast wounds are Acinetobacter spp. (25.94% patients), Coagulase-negative staphylococci (21.98%), Escherichia coli (19.28%), Pseudomonas aeruginosa (16.58%) and Klebsiella spp. (15.49%).[13]

Similar results were observed in study conducted by Petersen K et al. in Iraq in which a total of 132-unique organisms that were isolated from 56-patients. Acinetobacter spp. were the most common isolate overall (33%, n = 44) and represented 36% of all wound isolates and 41% of all bloodstream isolates. Escherichia coli and Pseudomonas spp. accounted for 14% each, followed by coagulase-negative staphylococcal (CoNS) infection (9%), Klebsiella spp., and Enterobacter spp. (both 6%), and Proteus spp. (5%). All other organisms (35%) represented a mixture of Streptococcus spp. and miscellaneous gram-negatives. Overall, 19% of organisms were gram-positive and 81% were gram-negative.[8] The reason that Staph. aureus was common in our study may due to fact that most of our patients had tibial fractures which is more likely to be affected by skin pathogens. In one study done in Peshawar in 2013, incidence of infection in gun shot and blast injuries in Pakistan was 14.3% and it was more common in patients with bomb blast (26.1%) than in patients with gunshot injuries (10.6%). The reason is that bomb blast injury are more destructive injuries with organ involvement and so have high rates of infections. Most common pathogen was staphylococcus aureus (44.2%) followed by Escherichia coli (25.7%) and Pseudomonas aeruginosa (16.9%).[14] No MRSA was reported in our case.

Conclusion:

Our study concludes the most common bacterial pathogens were staphylococcus aureus (45%) follow by Escherichia Coli (27.5%) and Pseudomonas Aeruginosa (15%). Future studies

with longer follow up and taking into account the culture reports and treatment of infectious complications of bomb blast injuries are recommended.

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Role and contribution of authors:

Dr Afsar Khan, conception and design, analysis/ interpretation of data and drafting of article

Dr Muhammad Zahid Shah, collection and assembly of data and statistical expertise.

Dr Zeeshan Faisal, collection of data, references and helped in discussion writing

Dr Saad Dildar Khattak, Final approval of the article.

Dr Muhammad Latif, critically review the article and made final changes

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