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Original Article

Epidemiology of Operative Hand Infections Presenting at the Emergency Care Services of Civil Hospital Karachi

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ABSTRACT

Objective: To explore demographics, causes, types, bacteriology and outcome of operative hand infections presenting to the Emergency Department of Civil Hospital, Karachi.

Study Design: Prospective longitudinal study.

Place and Duration of Study: Department of Plastic and Reconstructive Surgery, Dr. Ruth K.M. Pfau Civil Hospital, Karachi Pakistan, from Aug 2021 to Apr 2022.

Methodology: Patients presenting in Emergency Room with hand infections were studied as per the inclusion criteria. Hand surgeries were performed under general, regional or local anesthesia. Patients were followed till their discharge from the hospital.

Results: A total of 280 patients were studied with predominance of males 182(65%) and median age of 48 years. 189(67.5%) patients had injury in right hand. Among 280 patients, total hand injuries were 300 and the most affected site was dorsum 72(7%) while palm volar was the least affected site 5(1.8%). Eighteen (6.4%) patients had more than one site involved in hand injury. The most frequent infection was superficial abscess 85(30.4%) followed by felon 81(28.9%), deep abscess 68(24.3%), paronychia 34(12.1%), necrotizing fasciitis 18(6.4%), osteomyelitis 10(3.6%) and septic arthritis 3(1.1%). Out of 280 patients, 44(15.7%) did not show positive culture growth. Staphylococcus aureus was the most frequently detected pathogen 167(59.6%) whereas Group A Streptococcus was seen in a single case.

Conclusion: Our study concluded that occupational hand injuries were common because of trauma. The most frequently occurring infections in our settings was superficial abscess and the commonest causative pathogen was Staphylococcus aureus.

Keywords: Abscess, Hand injuries, Infections, Microorganisms, Occupational injuries.

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INTRODUCTION

The hand of a human is body part which is highly involved in daily activities. The extent of this involvement exposes hand at higher risk of injuries to its different structures which may limit functional outcomes and even cause long-term disability.[1] Literature reports that nearly one-fifth of emergency room visits comprises of hand injuries.[2]

A wide spectrum of hand infections is routinely noted by primary care physicians, hand surgeons and emergency rooms doctors[3]. Hand infections can be categorized as superficial and broad depending on the involvement of skin, soft tissues and structures.[4] Acute hand infections vary from patient to patient because of different aetiologies and sites but if misdiagnosed or untreated, they may become complicated.[5]

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Two-thirds of hand infection are caused by gram-positive bacteria[6]. The most commonly involved microorganisms are Staphylococcus aureus and Streptococcus species,[7] with Methicillin-resistant Staphylococcus aureus (MRSA) accounting for half of all hand infections in urban setting.[8]

Certain group of individuals are at higher risk of developing hand infections such as manual laborers, patients who have diabetes or are immunocompromised, and the elderly.[9] Appropriate clinical examination is main stride for establishing diagnosis of infectious wound and taking timely decision. Mechanism of injury, pathogens involvement, population affected and hospital outcomes of the treated patients vary due to different population characteristics', differences in geography, environment and different healthcare system. Moreover, the data related to causes of hand infections, identified pathogens and their surgical management is scanty in Pakistan. Because of lacking

this type of data in Pakistan the present study was planned with the aim to explore demographics, causes, types, bacteriology, outcome of operative hand infections presenting to the emergency services of Civil Hospital Karachi.

METHODOLOGY

The prospective longitudinal study was carried out at the Department of Plastics and Reconstructive Surgery, Dr. Ruth K.M. Pfau Civil Hospital, Karachi Pakistan, after obtaining the Institutional Review Board clearance (Ref #: IRB-2127/DUHS/Approval/2021). Open-Epi software was used for sample size estimation, with previous prevalence of hand infections being 28.9%.[10]

Inclusion Criteria: Patients of either gender aged 12 year or older, presenting with hand infections requiring surgical management were included.

Exclusion Criteria: Patients with hand abscess after incision and drainage and those developing post-operative hand abscess, who had undergone any intervention before and pregnant women were excluded.

Patients were asked to give their verbal consent for their participation in the study. Permission was taken from parents when patients were <18 years old. Non-probability, consecutive sampling was used to collect data. Patients presenting to Emergency Department with hand infections were initially assessed by the attending physician in Emergency Room who recorded their detailed history. Later hand surgery team was informed to attend the patient for further management. Patients requiring surgical management were shifted to operating room and surgical procedures were done by the consultant hand surgeon having at least 5 years of experience. The procedure was carried out under general anesthesia or regional anesthesia as appropriate. After taking all aseptic precautions, incision and drainage was performed. Then specimen was collected for detection of positive culture and forwarded to microbiology department of the hospital. Debridement was performed in case of necrosis of the tissues and dressing was done. Patients stayed in the hospital as per hospital protocol and clear instructions were given to them regarding post-operative protocols to achieve the best outcomes. Patients' demographic data, causes of injury and their clinical features such as comorbid conditions including Diabetes Mellitus, smoking status, type of infection, site affected, culture growth and detected microorganisms were documented in their medical record files and in the pre-designed study proforma.

Data was analyzed Statistical Package for the Social Sciences (SPSS) version 23. Categorical variables were presented as frequencies and percentages, and continuous variables were summarized as median with inter-quartile range after assessment of normality using Shapiro-Wilk test. Patients' characteristics were compared among those who had or did not have culture growth by applying Chi-square or Fisher-exact test. The *p*-value of less than or equal to 0.05 was considered statistically significant.

RESULTS

Two hundred and eighty patients were enrolled into the study. A total of 300 injuries were seen. None of the patient died during the hospital stay. Majority of the patients required single surgical procedure 228(81.4%), where 44(15.7%) and 8(2.9%) underwent two and three surgical procedures respectively.

The age range of patients was 17-77 years, with median age being 48 years. Majority of them were males 182(65%) and presented with right handed injury 189(67.5%), whereas dominant hand was involved in 212(75.7%) injured cases. Table-I displays their socio-demographic features, presence of comorbid and injury mechanism.

The Figure displays the frequency of affected sites. Out of 33(11.8%) web space injuries, 12(36.3%) 10(30.3%), 8(24.2%), 3(8.8%) had injuries in first, second, third and fourth web space respectively whereas 1(3%) had web space collar button abscess.

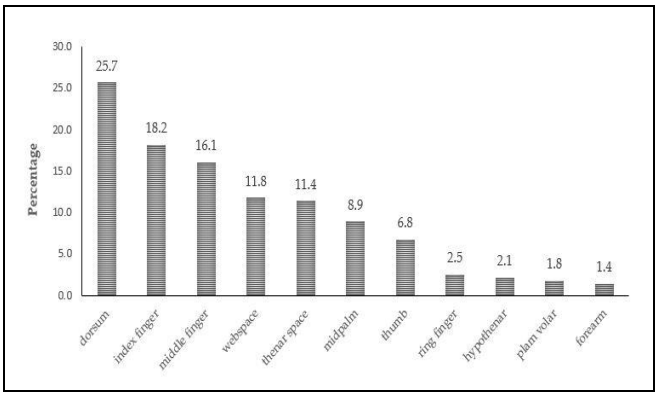

Figure: Sites of Hand Injury (n=280)

Table-II shows frequency for number of sites, culture growth and causative pathogens. Out of 167 (59.6%) cases of Staphylococcus aureus, nearly half were methicillin-susceptible Staphylococcus aureus

(MSSA) (n=91, 54.5%) whereas remaining methicillin-resistant Staphylococcus aureus (MRSA).

Table-III shows comparison of participants' characteristics among those with and without culture growth. Frequency of positive culture was significantly higher in males than females (p=0.004) Patients presenting with infection of paronychia had significantly higher culture detection rate than those who did not present with this infection (p=0.019).

Table-I: Descriptive Statistics for Socio-Demographic Characteristics of Patients (n=280)

Variables	n(%)
Age categories	
Less than or equal to 20 years	10(3.6)
21-29 years	42(15)
30-39 years	36(12.9)
40-49 years	80(28.6)
50-59 years	68(24.3)
60 years and above	44(15.7)
Occupation	
Daily wage laborer	86(30.7)
Housewife	64(22.9)
Officer worker	28(10)
Motor mechanic	23(8.2)
Driver	15(5.4)
factory worker	15(5.4)
Fisherman	14(5)
OT technician	13(4.6)
Tailor	8(2.9)
Housemaid	6(2.1)
Electrician	6(2.1)
Barber	2(0.7)
Comorbid Conditions	
Chronic kidney disease	7(2.5)
Diabetes	29(10.4)
COPD	31(11.1)
Smoking status	
Currently smoking	27(9.6)
Ex-smoker	3(1.1)
Never	250(89.3)
Mechanism of Injury	
Trauma	132(47.1)
Boil	39(13.9)
Idiopathic	35(12.5)
Foreign bite	26(9.3)
Insect bite	18(6.4)
Animal bite	13(4.6)
Burn	12(4.3)
Human bite	5(1.8)

DISCUSSION

In the present study median age of patients of 48 years with the most frequent age group of 40-49 years (28.6%). A study conducted in Karachi with the intent to uncover pattern and etiology of hand injuries, reported a younger mean age of 24.86±6.41 years[11].

Table-II: Number of Sites, Culture Growth and Causative Pathogens (n=280)

Variables	n(%)
Number of site involved	
Single site	262(93.6)
More than one site	18(6.4)
Positive culture growth	
Yes	236(84.3)
No	44(15.7)
Number of positive culture	
No culture growth	44(15.7)
Single culture growth	220(78.6)
More than one culture growth	16(5.7)
Type of infection	
Superficial abscess	85(30.4)
Felon	81(28.9)
Deep abscess	68(24.3)
Paronychia	34(12.1)
Necrotizing fasciitis	18(6.4)
Osteomyelitis	10(3.6)
Septic arthritis	3(1.1)
Causative pathogens	
Staphylococcus aureus	167(59.6)
Streptococcus pyogenes	17(6.1)
Polymicrobial	16(5.7)
Staph epidermidis	14(5)
Klebsiella	13(4.6)
Staphylococcus pyogenes	7(2.5)
Pseudomonas aeruginosa	7(2.5)
Acinetobacter	3(1.1)
Coagulase -ve staphylococci	2(0.7)
Streptococcus epidermidis	2(0.7)
Streptococcus pneumoniae	2(0.7)
Group A Streptococcus	1(0.4)

Another study conducted in Karachi demonstrated that majority of the patients were age range of 21-30 years (32%)[12]. However, an average age of 32±9.8 years was observed in a similar investigation performed in Peshawar[13]. An Indian study found that among patients of hand injury, the mostly presented age group was 16-35 years (43.3%)[14].

Despite the fact that world has been drastically changed and great efforts have been put in for improvement of occupational safety and health during the previous century, still 317 million occupation injuries occur annually around the globe[15,16]. In the present study, most of the affected group was laborers including craftsmen, mason, plumber since the nature of their work makes them highly vulnerable to hand injuries. Another Pakistani study also reported that most of the patients with hand injured were unskilled

Table-III: Comparison Of Participants' Characteristics Among Those With And Without Culture Growth (N=280)

Variables	Categories	Positive Culture Growth		*p*-value
		Yes n(%)	No n(%)	
Age (years)	<=20	9(90)	1(10)	0.582
	21-29	32(76.2)	10(23.8)	
	30-39	32(88.9)	4(11.1)	
	40-49	66(82.5)	14(17.5)	
	50-59	58(85.3)	10(14.7)	
	60 and above	39(88.6)	5(11.4)	
Gender	Male	145(79.7)	37(20.3)	*0.004
	Female	91(92.9)	7(7.1)	
Occupation	Driver	13(86.7)	2(13.3)	*†0.048
	Officer worker	23(82.1)	5(17.9)	
	Fisherman	9(64.3)	5(35.7)	
	Factory worker	9(60)	6(40)	
	daily wage labor	73(84.9)	13(15.1)	
	OT technician	12(92.3)	1(7.7)	
	Housemaid	5(83.3)	1(16.7)	
	Electrician	5(83.3)	1(16.7)	
	housewife	60(93.8)	4(6.3)	
	Tailor	27(81.8)	6(18.2)	
Chronic kidney disease	-	7(100)	0(0)	†0.604
Diabetes	-	28(96.6)	1(3.4)	†0.06
COPD	-	30(96.8)	1(3.2)	†0.062
Smoking status	currently smoking	26(96.3)	1(3.7)	†0.174
	Ex-smoker	3(100)	0(0)	
	Never	207(82.8)	43(17.2)	
Injury mechanism	Trauma	107(81.1)	25(18.9)	†0.392
	Boil	37(94.9)	2(5.1)	
	Animal bite	12(92.3)	1(7.7)	
	human bite	5(100)	0(0)	
	Insect bite	16(88.9)	2(11.1)	
	foreign bite	22(84.6)	4(15.4)	
	Burn	9(75)	3(25)	
	Idiopathic	28(80)	7(20)	
Dominant hand involved	-	181(85.4)	31(14.6)	0.375
Injury type	Superficial	167(81.9)	37(18.1)	0.068
	Deep	69(90.8)	7(9.2)	
Number of site(s) involved	Single site	218(83.2)	44(16.8)	
	More than one site	18(100)	0(0)	
Felon	-	68(84)	13(16)	0.922
Superficial abscess	-	73(85.9)	12(14.1)	0.628
Deep abscess	-	62(91.2)	6(8.8)	0.073
Paronychia	-	24(70.6)	10(29.4)	*0.019
Necrotizing fasciitis	-	17(94.4)	1(5.6)	0.221
Osteomyelitis	-	8(80)	2(20)	†0.66
Septicarthritis	-	3(100)	0(0)	†1.000

*COPD=Chronic obstructive pulmonary disease, †Fisher's exact test was reported, *Significant p Value*

workers (71.5%)[11]. Our findings are consistent with a similar Nepali study delineating that a greater proportion of hand injuries occurred due to fodder cutter machines (30.6%), factory machines (20.8%) and threshing machines (7.3%) indicating that these were work-related injuries[17]. Around quarter of the patients in our study were housewives. A simple explanation would be that activities at home such as cleaning, cutting, cooking, increase the risk of hand injury. Other mechanisms of getting injured within the home include fall from stairs, bed, sofa, slipping in washrooms and door slamming[18].

Worldwide, around 90% of people are right-handed[19] and so the similar pattern was revealed in the present study with nearly two-third of the patients were right handed. However, proportion of dominant hand injury was three-fourth of the whole studied sample. A higher proportion of 57.5% for dominant hand injuries was conveyed in a study evaluating pattern of occupational hand injuries in Pakistan[20]. An Indian study analyzing the spectrum of hand injuries and their management also found that 53.6% patient had injury in their dominant hand[21].

Knowing the injury mechanism is helpful to uncover how likelihood of occurrence of a serious injury. Contradictory evidences have been documented regarding role of injury mechanism in deciding trauma status and consequent care[22]. In the present study, nearly half of the injuries occurred due to trauma followed by burn and boil injuries. One international study reported in among 70.2% patients had injuries due to home accidents and fall incidents1. Ali *et al*. found in his collected sample, majority of the injuries occurred due to road traffic accidents[11]. Shrihari and coworkers observed that around half of the injuries both in dominant (43%) and non-dominant hand (47.3%) were occurred at workplace[21]. Ahmad *et al*. reported that majority of the injuries were occupational injuries followed by home injuries and road traffic accidents[12]. The top three reasons in the cited literature are road traffic accidents, home injuries and occupational related injuries which is in agreement with our study. However, animal bite, human bites, foreign bite and idiopathic injuries were not reported in these studies. One of the possible reasons of not reporting bites as cause of injury in study ascertaining causes of hand injuries that animal and human bites may not be very deep and patients try to manage that at home while they prefer to visit hospital when feeling unbearable pain or doubted that if they developed any infection. Micheel and his coworkers conducted a study in Germany to ascertain the epidemiological features in simple hand infection where he reported the bite injuries (19%) including cat and dog bites, as cause of hand infections[6].

In the present study we identified no growth was observed in nearly one-fifth of the patients (15.7%). Micheel *et al*. observed no growth in about quarter of the studied sample (27%)[6]. Arsalan-Werner and his coworkers determined the risk factors of reoperation in primary hand infections and they found that microorganisms were not isolated in 52% of the primary hand infections[23]. Further in our study we found that very few people had more than one culture growth whereas in another study 46% had more than one microorganism growth[24]. Micheel *et al*.[6] reported that more than one positive culture was detected in 29% of total tested specimens. The distribution of culture growth varies in the reported literature due different population and environmental features. In the current study, the most frequently detected organisms were Staphylococcus aureus with 54.5% MSSA and remaining were MRSA. Fuchsjäger *et al*.[24] reported MRSA only in single case and none of the patient had MSSA. Various international studies detected Staphylococcus aureus in 73%25, 53%24 and 33%6 of patients. Staphylococcus epidermidis was detected in 9% of the tested specimen in a study of Micheel6 and in our study this specimen was positive in 5% of the total infected cases. On the other hand, Streptococcus pyogenes was positive in 6.1% of cases in the current study. Surprisingly, cultures such as Shep pneumonic, Pseudomonas aeruginosa, Klebsiella, Acinetobacter, Group A Streptococcus, Streptococcus pneumonia that were identified as causative microorganism in the present study were not detected in other reports.[24] The probable reason for variation of causative pathogens is that pathogens distribution varies based on different geographic, season and environment, different hygiene levels and population characteristic.

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CONCLUSION

This study analyzed that occupational injuries were common because of trauma. The most frequently occurring infections in our settings was superficial abscess and the commonest causative pathogen was Staphylococcus aureus.

Conflict of Interest: None.

Authors Contribution

Following authors have made substantial contributions to the manuscript as under:

UZ, BZ: Data acquisition, data analysis, data interpretation, critical review, approval of the final version to be published.

FAK, WS: Study design, data interpretation, drafting the manuscript, critical review, approval of the final version to be published.

ZZ, SK: Conception, data acquisition, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity

of any part of the work are appropriately investigated and resolved.

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