

ORIGINAL ARTICLE**Surgical Infection of the Hands and Upper Extremities in Adult Patients Presented to Emergency Departments at Some Khartoum State Teaching Hospitals**Anas Yousif Elgorashi Elmahi¹, Aamir Abdullahi Hamza²

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Abstract:

Background: Hand and upper extremity (HUE) is extremely important in performing day-to-day activities, ranging from simple to very complex tasks. This makes HUE vulnerable to trauma, subsequent infections and a wide spectrum of complications.

Objectives: to study the pattern of infection, the anatomical sites distribution, causative organisms, and management offered and the outcome.

Patients and methods: This was a prospective, descriptive, cross-sectional, hospital-study. It was a multicentric study, conducted at Khartoum state teaching hospitals, Sudan. During the period from August to October 2019. All patients with HUEI attending emergency department in Khartoum state hospitals, were enrolled. Non probability sampling including patient consecutively. Questionnaire were used and included the following variables: type of infection, anatomical site, management done, culture and sensitivity of the offending organism and outcome of treatment. Patients' informed consent and ethical clearance were obtained in advance. Data was analysed using SPSS version 22.0. and the P value was considered significant if < 0.05 .

Results: this study included 68 patients who satisfied the inclusion criteria. The mean age \pm SD of patients was 32 ± 14.2 years (ranged from 18 - 68). There is male preponderance 53 (77.9%) with M:F ratio of 3.5:1. Most common causes for

HUEI were trauma (47%), puncture or laceration (22%), unknown causes (10%), and postoperative infections (7.4%). Animal bites 2.9%. Spontaneous infections (1.5%), foreign body (1.5%), insect bites (1.5%) other causes (6%). Most frequent site to encounter infection was fingers (20.5%), palm (19.1%), proximal forearm (11.7%), wrist and distal forearm (7.3%), upper arm (3%). Dominant hand affection (69%). Superficial type of infection was found in (60%), and deep in (40%) of the patient. Management included; wound debridement (67.6%), incision and drainage of abscess (29.4%), with antibiotics (97%) of patients. Out of the total patients the admission rates was (56%), Complications rate (85%). Most common isolated organisms in culture were *Staph. aureus* (52%), *Pseudomonas* (21%), *E. coli* (20%), *Enterococcus faecalis* (11%), *Klebsilla* (9%), *Citrobacter* (9%). Other organisms isolated were *Staph epidermidis*, *Streptococcus*, *Proteus*, *Acintobacter*. MRSA was found in (38%) of cultures. The commonest complications encountered were; delayed wound healing (31%), cellulitis (19%), joint stiffness (16%), and deformities (12%). Necrotizing fasciitis, sepsis and others developed in (7.5%). The mean length of hospital stay was 9 ± 10.3 day.

Conclusion: Complications rate in patients with HUEI is high, a new management guide should be incorporated in the system. MRSA is also an emerging problem; infection control departments should take role concerning this.

Key words: Antibiotic resistance, causative organisms, complications, debridement, hand abscess, hand infection, MRSA.

Introduction:

The HUE is extremely important in performing daily activities, ranging from simple to very complex tasks. This makes HUE vulnerable to trauma, majority of patients with HUEI are young adults who are healthy and active but they neglect treatment for minor trauma, severe infections are seen in patients with impaired immune status or complicated traumas.

The initial evaluation for management of hand infection includes; a focused history and examination plus imaging and laboratory as needed, marking and documenting progression of the infection, starting empirical antibiotics and elevation of the hand and arm along with appropriate pain control, this will help decrease swelling and provide comfort. Deep hand infections are surgical

emergencies as the risk of compartment rises. Rapid evaluation and proper treatment of hand infections makes the difference between an excellent outcome and permanent disability. ^(1,2)

Patients and Methods:

The study was descriptive, prospective, hospital-based study, executed in Khartoum state hospitals including (Ibrahim Malik, Khartoum North, Omdurman and Shargel Neel)hospitals in the period from 25th of August to the 3rd of October. Any adult who arrived the emergency departments of these hospitals with HUEI was included. Non-probability sampling technique was used; data were collected using a pre-designed and pre tested questionnaire. The variables includes general demographic data, aetiology, co-morbidities, time interval to hospital presentation, interval from presentation to management, details of management offered, culture sensitivity and resistance of causative organisms, nature of infection (deep vs. superficial) and outcome of management. Data were analyzed using SPSS v22.0, and the P value was considered significant if less than 0.05. Consent obtained from all patients in addition to the ethical clearance.

Results:

Sixty eight patients satisfied the requirement and were included in the study. The mean age and SD was 32±14.2 years, range (18-68) years. There were 53(77.9%) males and 15(22.1%)females, with M: F ratio of 3.5:1. The majority (59%) of patients were in the age<30 years (**Table 1**).

Table (1): Age and gender distribution among patients presented with hand and upper extremity infection(n=68)

Age groups (years)	Gender distribution		Total
	Male	Female	
<30	32	5	37 (54%)
31-40	07	5	12 (18 %)
41-50	07	1	08 (12%)
51-60	05	3	08 (12%)
>60	02	1	03 (04%)
Total	53(77.9%)	15(22.1%)	68 (100%)

Manual labourers (27%) working as mechanics, factory workers, maids, carpenters, builders and factory labourers. Dominant hand was affected in 69% of cases.

Anatomic sites of infection

Digits were the most frequent site (21%) to encounter infection, the palm (19%), proximal forearm (12%), wrist and distal forearm (7%), and upper arm (3%)(**Figure 1**).

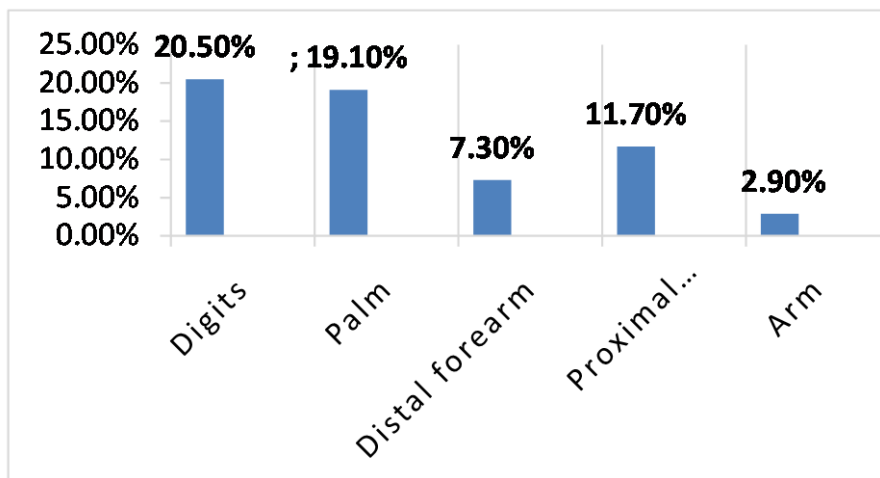


Figure (1): Anatomical distribution of HUEI in the study group.

The main aetiological factor revealed by the study was trauma 47% (RTA, Machinery and assaults), punctures and lacerations in 22%. Only 7(10.3%) patients could not identify the causes, while postoperative infections were recognized in 5(8%) patients. Animal bites was the aetiology in 3%. Spontaneous infections, foreign bodies and insect bites showed similar percentages of occurrence 1.5%, while other causes (6%) includes: burns and traditional herbal applications.

Only three co morbid factors appeared in the study group; smoking (25%), diabetes miletus (9%), and alcohol consumption (1.5 %). Management offered to the patients included wound debridement (68%), excision and drainage (29%), and giving antibiotics. Details of types of antibiotics given are shown on figure 2.Fifty three percent of the patients received antibiotics that matches culture and

sensitivity results, while 29% received antibiotics inconsistent with sensitivity results.

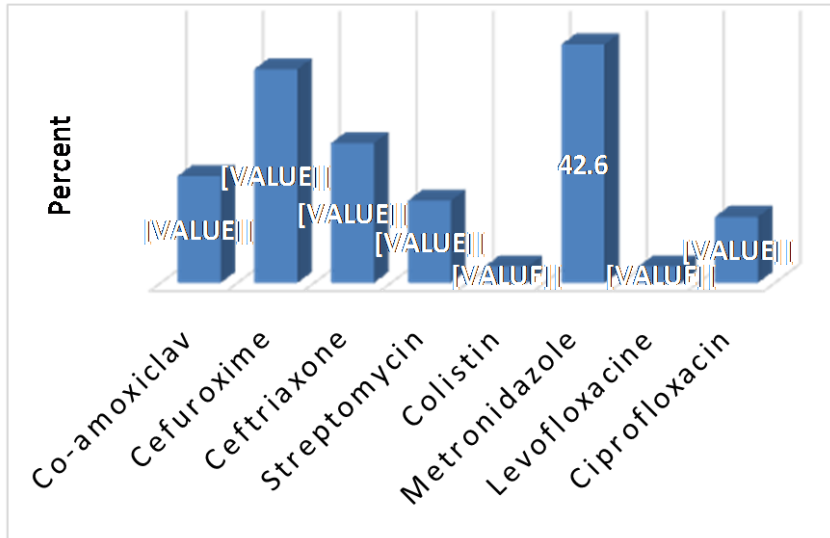


Figure (2): Antibiotics prescribed as part HUEI management In the study group

On review of outcomes, 30(44%) patients were discharged uneventfully, while 38 (56%) patients required admission to hospital. Complications occurred in 85% of patients in the sample size. Encountered complications included; delayed wound healing affecting 21(31%)of patients, cellulitis 19%, joint stiffness in 11(16%) patients, deformities in 12% patients, necrotizing fasciitis in 3%, sepsis happened in one (1.0%) case, and other complications seen was 3%.

Concerning the type of infection, superficial infections occurred in 41(60%) patients while deep infections comprised 40% (Tables 2 and3).

Table (2): Types of superficial hand infections presented in the study group.

Pattern of superficial hand infection	Frequency	Percent
Cellulitis	21	30.9
Paronychia	03	04.4
Pulp space infections	08	11.8
Subcutaneous abscess	08	11.8
Web space abscess	01	01.5
Total	41	60.3

Table (3): Types of deep hand infections presented in the study group.

Types of deep hand infection	Frequency	Percent
Synovial space infection	05	7.4
deep fascial space infection	07	10.3
Thenar space abscess	05	7.4
Mid-palmar space abscess	06	8.8
Hypothenar space abscess	02	2.9
Septic arthritis	01	01.5
Osteomyelitis + deep fascial space infection	01	01.5
Total	27	39.7

Staph. aureus was the most commonly isolated organism appearing in 29 (52%) cultures. Among these, 11(38%) were multi-drug resistant. *Staph epidermidis* appeared in 02(3.5%). The second most common organism isolated was *Pseudomonas aeruginosa* in 21% of cultures, followed by *E.coli*, grown in 19.5%. Other isolates were; *Enterococcus faecalis* (formerly classified as *Streptococcus*) 10.7%, *Klebsilla* 9%, *Citrobacter* 9.0% *Streptococcus* 3.5%, %, *Proteus* 5.35% and *Acintobacter* in 2%.

Discussion:

In this study, we report characteristics of hand and upper extremity infection in 68 patients who presented to the ER in some Khartoum state hospitals. The average age of patients in this study group was 32±14.2 years which is very close to other studies previously published over several decades.⁽¹⁻⁴⁾ Hand infections primarily

occur following minor trauma, but this was not the case in our study. Major trauma in the form of RTAs, machinery injury and assaults, were the most common (47.5%). Other studies have reported that 60% of the infections were due to trauma, 25–30% human bites, 10–15% drug abuse, and 5–10% animal bites. ⁽¹⁻³⁾ Manual labourers (builders, carpenters, factory workers) accounted for 26.5% of our patients. This appears to be similar to other studies ⁽²⁻⁹⁾, also dominant hand was involved in 69%, this is close enough to Schnall SB, et al. study in 1994 and George R. Matcuk in 2014. ^(3,4) The Digits were the most frequent site to encounter infection. A significant increase in admission rate after initial treatment in patients with diabetes was noticed, P value 0.05, while smoking and alcoholism did not affect admission rates.

Smoking was found to significantly delay wound healing rates, P value 0.023, that is consistent with studies conducted on HUEI. ^(5,6) In regards to management offered to HUEI patients, different surgical units and hospitals had different protocols. This rings the bell on lack of a standardized treatment protocol to be adopted by Khartoum state hospitals.

Management spectrum offered to patients in the study group varied, but initial offered therapy was similar. It included; debridement with antibiotics 68%, drainage with antibiotics 29%, and simple incision and drainage without antibiotics 3%. It was noticed that some simple, cost effective modalities of treatment such as; relook surgery if necessary, elevation or splinting, regular dressings, hand baths and hand therapy were practiced deficiently if not at all by some mentioned hospitals included in the study.

Concerning hospital admission rates, it was found that 56% of patients were admitted from the ER while 44% were discharged uneventfully. Previous studies reported that most infections of the hand were subcutaneous as opposed to more severe infections such as osteomyelitis, our results were consistent with these studies as shown in (Tables 2 and 3). ^(3,7-9) Complications rates were observed to be very high with 85%. The commonest complication was delayed wound healing, which was found strongly correlating with smoking, P value 0.023. Next comes cellulitis, followed by joint stiffness.

Staph. aureus was the most commonly isolated organism 52 %. 11 cultures showed MRSA making a percent of 38%, which was among the highest reported in literature worldwide ^(1, 4, 6-10). The second most prevalent organism to be isolated in the study was *Pseudomonas* (21%) of positive cultures. Surprisingly,

E. coli was commonly encountered, it grew in 20% of the cultures.

Other isolates included: *Enterococcus faecalis* (formerly classified as *Streptococcus faecalis*), *Klebsiella*, *Citrobacter*, *streptococcus*, *proteus* and *Acinetobacter*, consistent with similar studies. ^(4, 11-13)

Eight different antibiotics were used for management in the study population. Namely: Co-amoxiclav, Cefuroxime, Ceftriaxone, Streptomycin, Colistin, Metronidazole, Levofloxacin and Ciprofloxacin. Each one of the hospitals included in the study had its own practiced local antibiotic protocol.

Upon more analysis of the use of antibiotics it was found that there was a mismatching between antibiotics given and the results of culture and sensitivity. Comparatively, 53% of patients were given antibiotics correctly matching sensitivity results, while 29% had received treatment inconsistent with sensitivity results. Factors affected the length of hospital stay included diabetes and trauma as cause for HUEI with p value of 0.05% and 0.01% respectively.

Conclusion:

Complications rate of hand and upper extremities infection in Khartoum states was noted to be very high. Moreover, antibiotic resistance including MRSA showed threatening figures. On the other hand, most treating doctors in the study area were junior doctors with little working experience. Simple intervention might be introduced to improve outcomes, such as local antibiotic protocols, training and public awareness. Limitations of the study were the relatively small sample size, and shorter duration of follow up, nevertheless it shed light on some points.

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