Frontiers in Health InformaticsISSN-Online: 2676-7104
www.healthinformaticsjournal.com
2024; Vol 13: Issue 3
Open Access

Surgical Strategies and Outcomes in Managing Diabetic Hand Infections – A Case Series

Shriya Reddy.A[1], Manimaran Ramachandran[2*], Kanchana Koppolu[3] and Prithvinathan V[4]
[1,4]Department of General Surgery, SreeBalaji Medical College and Hospital, Chennai, Tamil Nadu, India
[2,3]Department of Plastic Surgery, SreeBalaji Medical College and Hospital, Chennai, Tamil Nadu, India

Cite this paper as:
Shriya Reddy.A, Manimaran Ramachandran, Kanchana Koppolu and Prithvinathan V (2024). Surgical Strategies and Outcomes in Managing Diabetic Hand Infections - A Case Series. *Frontiers in Health Informatics,* 13(3), 4948-4965

Abstract
Hand infections in diabetics are less reported and underestimated therefore, there is a significant morbidity and disability among the diabetic population. Infections of the foot in diabetics are well studied and understood, but there is limited literature on hand infections. Diabetic hand infections progress rapidly, with severe destruction of the tissue. Most of these patients have poor control of diabetes. If these infections are not controlled at the earliest, it will lead to complications like tissue loss, amputations, septicemia, and loss of hand function. Good sugar control, immediate and effective surgical debridement and specific antibiotic therapy are the most important considerations when treating hand infections in diabetics. We studied patients with diabetic hand infections admitted at our tertiary care center retrospectively for the factors like the onset of infection, glycemic control, microbiology and surgical procedures.

Keywords: *Amputation, Diabetes Mellitus, Hand infections, Hba1c, Multiple Surgery.*

INTRODUCTION

Diabetes mellitus is a metabolic disorder that affects multiple systems in our body. People with diabetes are more prone to infections. Hyperglycemia reduces cell-mediated immunity by preventing chemotaxis and phagocytosis. Hyperglycemia also causes microangiopathy and peripheral neuropathy further making the healing process more difficult. Diabetic foot infections are more common than hand involvement. 9.7% of patients with diabetes mellitus developed foot infections while only 0.37 % of patients with diabetes mellitus developed hand infections [3]. A lot of importance is given to Diabetic foot infections and there is more awareness for such infections in terms of prevention and early diagnosis. Though diabetic hand involvement is less common, the severity with which it affects the hand and the amount of function lost is more than that of foot infections. Hence hand salvage is crucial for early reconstruction and restoration of functions. Treating hand infections is more challenging than foot infections as the Infections of hand in diabetics are more severe and spontaneous or followed by trivial trauma which patients don't remember most of the time [1, 2]. Therefore patients present late to the hospital. The infection may start as localized cellulitis which may rapidly progress to abscess and necrosis, sometimes distal gangrene [Figure 12 &19]. Disseminated disease with shock is the deadly complication of hand infections if not addressed promptly. Moreover, studies on hand infections have demonstrated poor glycemic control with high levels of hba1c and blood sugar levels as risk factors for hand infections [5, 7]. Tropical diabetic hand syndrome (TDHS) is a term used to describe hand infections in diabetics, especially in the tropics presents as an acute and progressive form of infection often leading to gangrene [4, 5, 8]. A wholistic approach for the management of diabetic hand infections is necessary which includes surgical debridement, appropriate antimicrobial therapy along with blood sugar control [18]. Patient education about diabetes, "Diabetic hand care "along with foot care is the need of the hour. In this study, we aimed to report the clinical presentation, pattern of hand involvement, culture characteristics, risk factors, surgical interventions and outcomes of the treatment in patients diagnosed with

diabetic hand infections.

PATENTS AND METHODS

A retrospective review of the medical records of the patients admitted for diabetic hand infections from 20th April 2023 to 20th April 2024 was done. We included all the patients who completed the treatment and were discharged to home. Hand infections in type 2 diabetes patients were only included. Patients with type 1 diabetes non-diabetics or those who were treated on OPD basis were not included. We collected all the demographic data of the patients for 1 year. The parameters such as age, sex, the onset of illness, duration of illness, duration of diabetes, glycosylated haemoglobin (HbA1c) level, random blood sugar (RBS) levels at admission, osteomyelitis, microbiology, and surgical procedures including reconstructive procedures as well as amputations were selected to understand the trends in presentation, predisposing factors, microbial agents causing the infections, management, intervention methodologies and outcomes

RESULTS

A total of 20 patients with diabetic hand infections admitted to our center in one year were included in the study [Table 2]. Out of 20 patients, 12(60 %) were male and 8 (40%) were female. The mean age of the patients was 48.6 years, the youngest being 35 years and the oldest being 65 years. Out of 20 patients 16, that is 80 percent of patients had a spontaneous onset of symptoms like swelling, redness, pain and fever. Rest 20 percent had a minor trauma. One patient had a history of IV injection, one patient had a history of needle prick, and one patient had a history of abrasion while removing the ring. Another patient has not given a clear history of trauma though he vaguely remembers blunt trauma to the forearm.[Figure1]

The average duration of the first symptom of infection to the presentation at the hospital was 10-15 days. The average duration of Type 2 diabetes was 6.4 years. Average blood sugar levels at the time of admission were 348.5mg/dl and average HbA1C was 11.03. The microbiological profile showed most of the infections were due to staphylococcus of which methicillin-resistant staphylococcus aureus was the most common etiological factor [17,19,20]. 13 patients had infection with Staphylococcus aureus out of which 12 patients (60 %) had MRSA (Methicillin Resistant Staphylococcus aureus) infection. Therefore, the most common infections in our study were due to MRSA. The other patient with S. aureus infection had MSSA (Methicillin Sensitive Staphylococcus Aureus). 3 patients had polymicrobial cultures with Pseudomonas aeruginosa, Klebsiellapneumoniae, Escherichia coli and Acinetobacter as causative organisms. 2 patients had isolated infections with gram-negative organisms namely K. pneumoniae and P. aeruginosa respectively. 2 patients had no growth in the cultures.[Figure 2] Two patients had osteomyelitis of the distal phalanx out of which one patient was treated and the finger salvaged while the other patient underwent amputation of the little finger at the proximal phalanx level.

All patients underwent surgical interventions for both initial damage control and reconstruction. The total procedures done were 48 procedures in 20 patients with an average of 2.5 procedures per patient, 5 being the maximum and 1 being the minimum number of procedures done in a single patient Table-1, shows the list of procedures performed and the number of each procedure done. Four patients out of 20 (20 percent of the patients) underwent amputation at the appropriate level involving the digits only[Figure 10 & Figure 14]. No major amputations were performed in our patients.60% underwent reconstructive procedures [Figure3,5,7&8]. The reconstructive procedures which were performed were secondary suturing [Figure 18], split skin grafting, full-thickness skin grafting[Figure 5], and flap cover [Figure 4]. Five patients were left to heal with secondary intention [Figure 21]. All patients recovered and were discharged to home. There were no systemic complications or deaths among our patients.

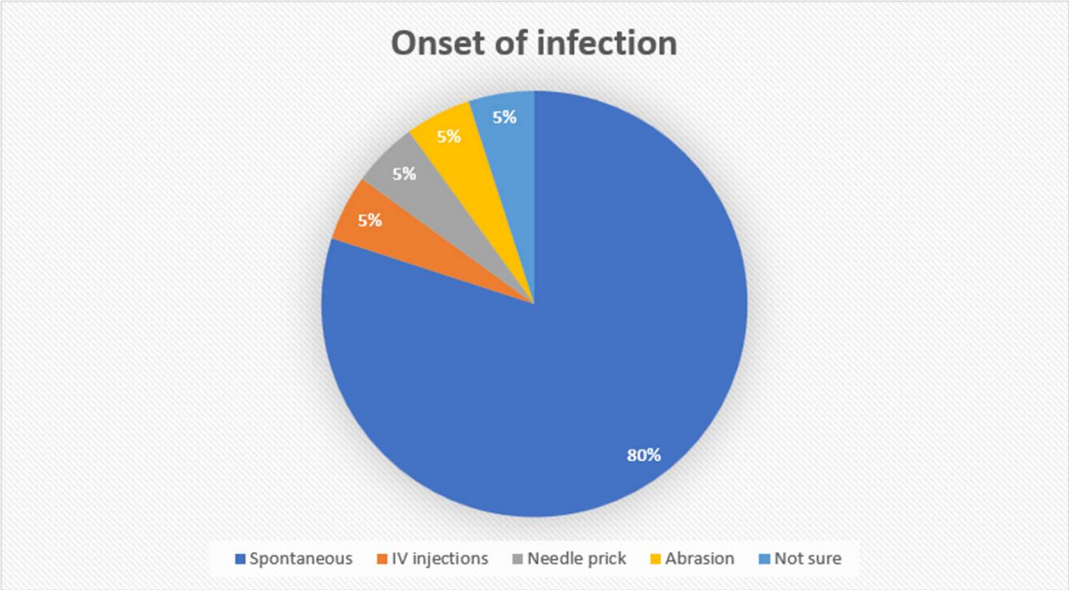

Figure1: Onset of hand infection in diabetic patients

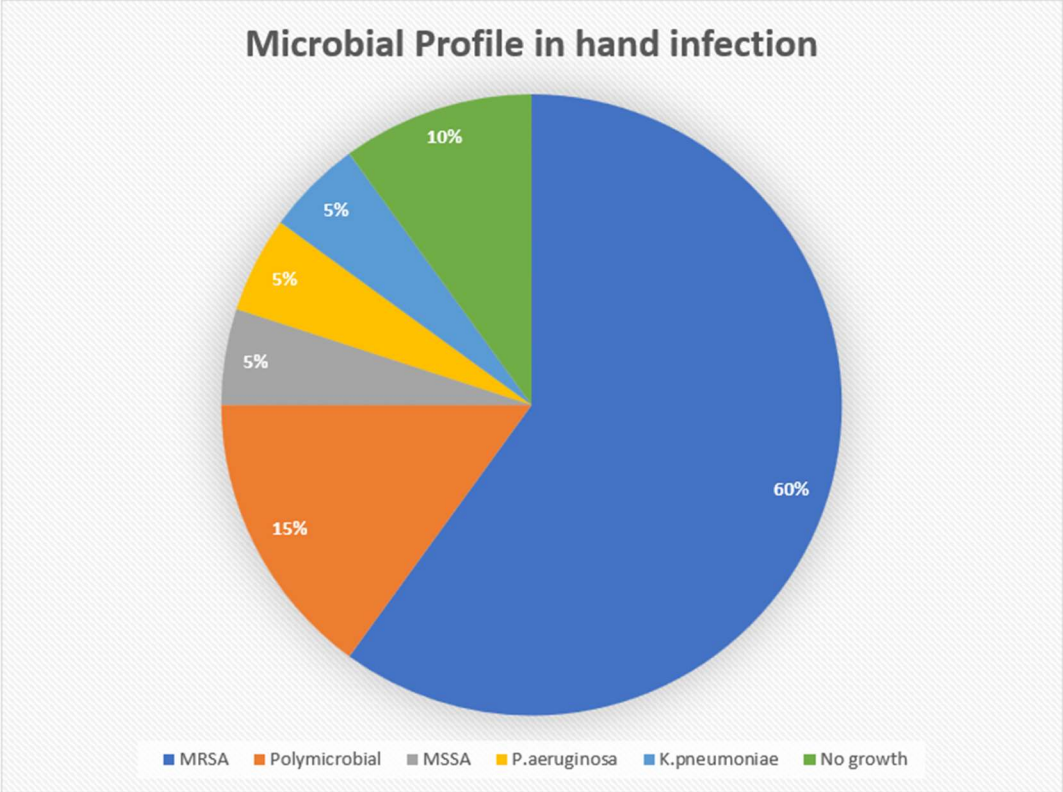

Figure 2: Microbiological profile in diabetic hand infections (MRSA: Methicillin Resistant Staphylococcus Aureus, MSSA: Methicillin Sensitive Staphylococcus Aureus)

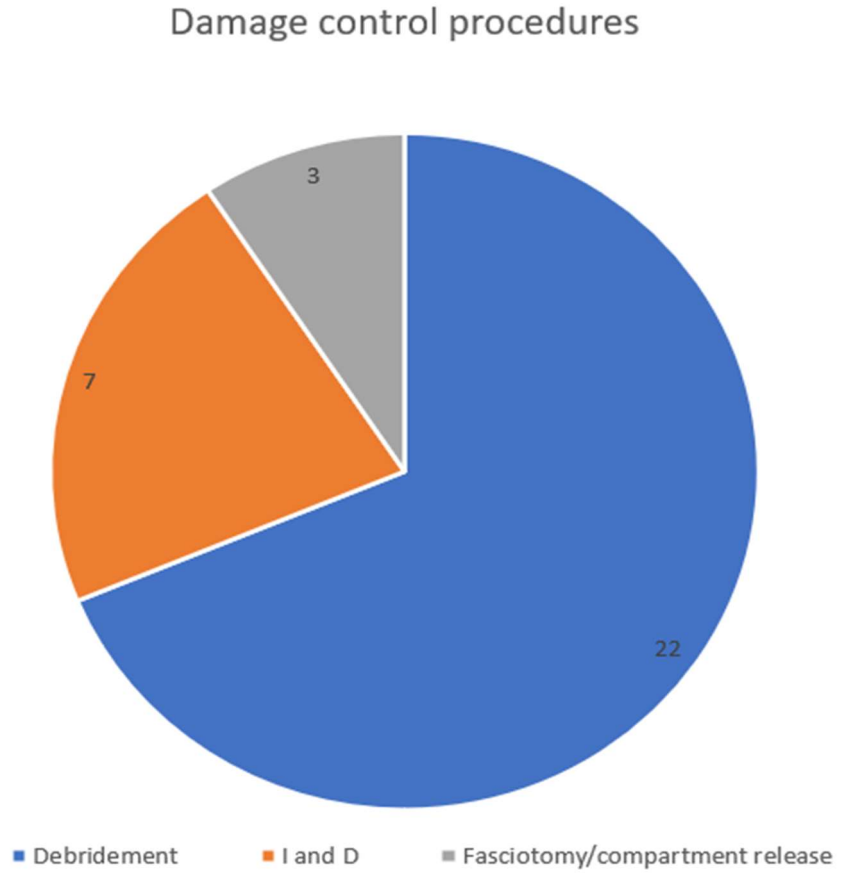

Figure 3: Initial damage control procedures in diabetic hand infections

(**I and D:** Incision and Drainage)

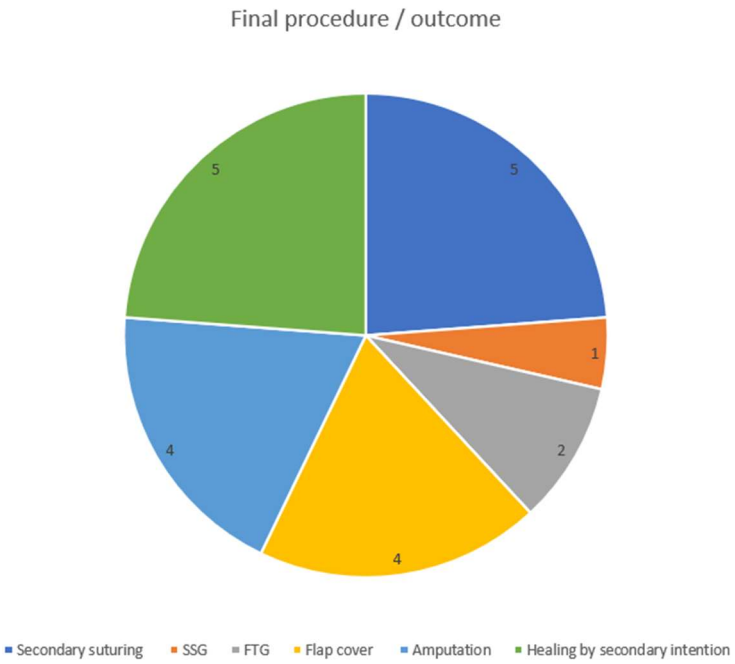

Figure 4: Final Procedure done in Diabetic hand infections

SSG: Split Skin Graft; **FTG:** Full Thickness Graft

Table 1: Surgical interventions in hand infections

S.No	Procedure	Number Performed
1	I and D	7
2	Debridement	22
3	Fasciotomy	3
4	Secondary suturing	5
5	Skin graft: split thickness	1
6	Skin graft: full-thickness	2
7	Flap cover	4
8	Amputation	4
	Total	**48**
	Healing by secondary intention	**5**

Figure 5: 42 years, female- Debridement followed by Full Thickness Grafting was done

Figure 6: 40 years, male- Post Debridement followed by abdominal flap was done

Figure 7: 40 years, male- Post Debridement followed by abdominal flap was done

Figure 8: 40 years, male-Wound debridement with abdominal flap Post flap division and inset

Figure 9: 54 years, male-Wound Debridement followed by distal amputation of little finger

Figure 10: 54 years, male-Wound Debridement followed by distal amputation of little finger

Figure 11: 54 years, male-Wound Debridement followed by distal amputation of little finger with primary closure.

Figure 12: 47 years, male- Gangrene of left little finger

Figure 13: 47 year male- Gangrene of left little finger post Debridement.

Figure 14: 47 year male- Gangrene of left little finger post amputation at mid PPX level

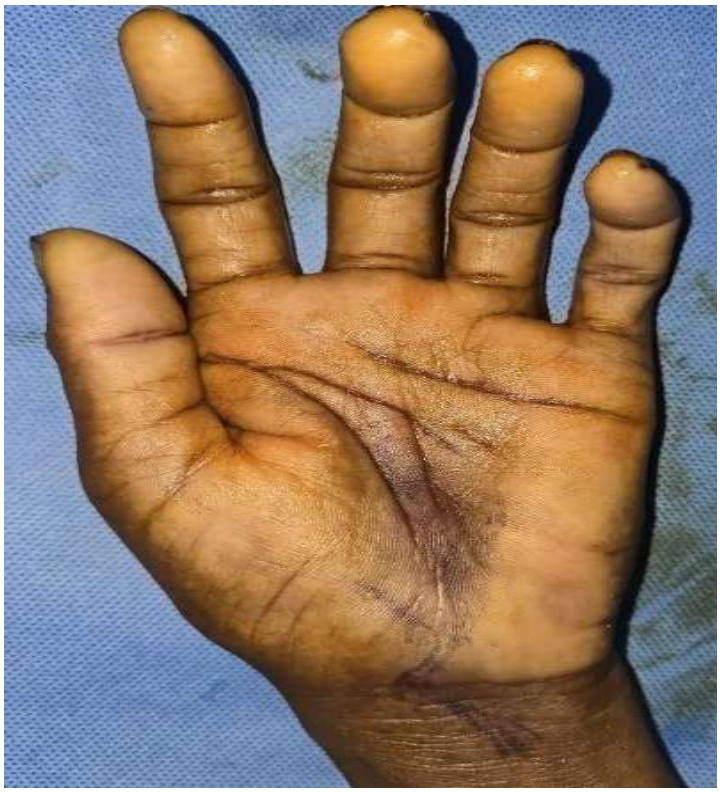

Figure 15: 45 years, male markings for carpal tunnel release

Figure 16: 45 years, male- Incision for carpal tunnel release

Figure 17: 45 years, male- I &D with carpal tunnel release

Figure 18: 45 years, male- I &D with carpal tunnel release secondary suturing

Figure 19: 10 yrs, male- Gangrene of left little finger

Figure 20: 10 yrs, male- Gangrene of left little finger post debridement

Figure 21: 10 yrs, male- Gangrene of left little finger post debridement followed by healing by secondary intention

Table 2: Master chart of patient details and parameters

S.No	Name	Age	Sex	Onset	Dur. Of symptoms	Dur. Of diabetes	RBS on admission (mg /dl)	Hba1c	Xray	Culture	Surgical intervention
1.	Jamuna	50y	Female	Spontaneous	10 days	10 years	486	11.58	No bony Involvement	MRSA	wound debridement,Healing with secondary intention
2.	Ilangovan	65y	Male	Spontaneous	15 days	21 years	376	10.36	No bony involvement	MRSA	I & D, Wound debridement, Healing with secondary intention
3.	Madhan raj	42y	Male	Spontaneous	3 days	2 years	298	10.18	No bony involvement	MRSA	I & D, Wound debridement, Wound debridement, Secondary suturing
4.	Amudha	42y	Female	Iv injection	14 days	3 years	235	10.25	No bony involvement	Psuedomonasaeroguinosa/E.coli	Wound debridement, FTG dorsum of thumb
5.	Velu	46y	Male	Blunt trauma toforearm(doesn't remember clerly)	7 days	1.5 years (not taking medications)	453	12.5	No bony involvement	MRSA	I&D +, fasciotomy of of forearm, Wound debridement, SSG forearm
6.	Venugopal	35y	Male	Spontaneous	14 days	3 years (not taking medications)	367	9.86	Bony involvement present	Klebsiellapnuemoniae	wound debridement, Healing by secondary intention
7.	Ayisha bee	63y	Female	Spontaneous	11 days	6 years	293	10.61	No bony involvement	Psuedomonasaeroguinosa/Klebsiella	Wound debridement, FTG little finger
8.	Mary	52y	Female	Spontaneous	10 days	12 years	384	11.35	No bony Involvement	MRSA	I & D, Wound debridement, Cross finger flapfor middle finger
9.	Anandan	48y	Male	Spontaneous	7 days	15 years	396	12.26	No bony involvement	MRSA	I & D, Wound debridement, Wound debridement, Amputation of index finger, Groin flap
10.	Naveen kumar	36y	Male	Spontaneous	10 days	2.5 years	234	10.14	No bony involvement	Psuedomonasaeroguinosa	wound debridement, fasciotomy, groin flap
11.	Kousalya	62y	Female	Spontaneous	21 days	2 years	336	11.82	No bony involvement	E.coli/acenetobacter	Wound debridement, Secondary suturing
12.	Bhoopathi	48y	Male	Needle prick	10 days	4 years	468	10.72	No bony involvement	MRSA	Wound debridement, Abdominsl flap
13.	Keshavan	37y	Male	Spontaneous	7 days	3 years	385	9.56	No bony involvement	No growth	Wound debridement, Distal amputaion of index finger
14.	Lakshmidevi	45y	Female	Spontaneous	15 days	12 years	267	12.45	No bony involvement	MRSA	wound debridement, wound debridement, secondary suturing
15.	Ramesh	54y	Male	Spontaneous	10 days	2 years	239	10.68	No bony involvement	MRSA	Wound debridement, Distal amputaion of little finger
16.	Rajendran	47y	Male	Spontaneous	4 days	10 years	426	9.5	Osteomyelitis of distal phalanx	MRSA	Debridement, Amputation at mid ppx level
17.	Navaneetha Krishnan	40y	Male	Spontaneous	7 days	4 years (not taking medications)	237	8.6	No bony involvement	MSSA	debridement & healing with secondary intention
18.	Srinivasan	60y	Male	Spontaneous	4 days	7 years	472	14.43	No bony involvement	MRSA	Wound debridements Wound debridement followed by secondary suturing
19.	Vijaya	55y	Female	Ring removal, Abrasion	10 days	2 years	249	10.75	No bony involvement	No growth	I & D, healing by secondary intention
20.	Thangam	45y	Female	Spontaneous	14 weeks	6 years (not taking medications)	367	13	No bony involvement	MRSA	I & D with, carpal tunnel release, secondary suturing

DISCUSSION

Diabetic hand infections in patients with diabetes are just as serious as diabetic foot ulcers, but there have only been a small number of studies on the subject published in the literature to date. This is because diabetic patients are less likely to experience hand infections than foot infections, hand complicationsfrom diabetes mellitus are much less common than foot complications but the functional loss is more in hands as compared to the foot. Early diagnosis and surgical reconstruction at the earliest will preserve the hand functions. ulcers, but there have only been a small number of studies on the subject published in the literature to date. This is because diabetic patients are less likely to experience hand infections than foot infections, hand complications from diabetes mellitus are much less common than foot complications but the functional loss is more in the hands as compared to the foot. Early diagnosis and surgical reconstruction at the earliest will preserve the hand functions.

Age and Gender

The average age was 48.6 years in our study. The studies done in the region have shown a mean age of 50 to 60 years [1, 2]. Moreover, diabetic hand infections affect the younger age group compared to foot infections. There is a male preponderance as, 60 % of the affected patients were men [1, 2]. This is because men are more likely to be affected by occupation than women. Moreover, diabetes affects men more than women and hence chances of men being affected by hand infections are higher [10, 11]. In the tropics, women are mostly associated with household chores and they rarely seek help or delay in reaching the hospital. These are the factors because of which men are affected more than women in our study. However, some studies from Sub-Saharan and African countries have shown female preponderance due to cultural differences as women are the main workforce and labourers in the family. However, studies from the rest of the world show that males are affected more than females. [1,2,3, 4, 6, 8].

Onset of Symptoms

In our study, about 80 percent of the patients had spontaneous onset of symptoms. In rest of the patients the injury was trivial and most of them recollected the injury only after questioning them repeatedly. Sometimes any minor trauma to the hand would go unnoticed due to reduced sensation or pain and the patient notices as soon as the symptoms like pain, swelling redness and loss of function start in. This indicates that though the initial onset goes unnoticed, the infection rapidly progresses to the extent of forming an abscess, necrotizing fasciitis, muscle necrosis, compartment syndrome and sometimes distal gangrene of the fingers.

Duration of Symptoms

The average duration of time taken from the first sign of symptoms to the day of admission at the hospital was 10.5 days. Studies from Southern India have reported the same the time taken to seek medical care after the onset of symptoms was 11.4 [1, 2]. Mann and Peacock reported that the time taken to seek medical help was 10 days [10]. In cases of Topical Diabetic Hand Syndrome (TDHS), Abbas et al found a delay of 14 days in seeking medical help [4]. The mean time for admission was 1.38 weeks in a study conducted by Murat et al.

Duration of Diabetes

The average duration of diabetes was 6.4 years in our study. This is comparable to studies done in South India [1, 2], Where the average duration was from 6.5 to 7.1 years. 4 out of 20 patients, that is 20 % of the patients were known diabetics but were not on any medications. Every one of them had given a similar history of diagnosing the disease in the past but did not comply with the treatment medications. This clearly emphasis that patient awareness about the disease and its management is the need of the hour. Though some studies did not see any significance in the duration of diabetes Wang et al have found a direct correlation between diabetes duration and hand infections [3].

Blood Sugar Levels

Uncontrolled blood sugar levels reflecting as high RBS at admission and high Hba1C are predisposing factors for hand infections. In our study, the average RBS at admission was as high as 348.5 mg/dl and the average Hba1c was 11.3%. According to Lim et al [13] hand infections in diabetics are severe in poorly controlled diabetes. According to Ketan et al poor glycemic control leads to severe infection requiring repeated drainage and undergo eventual amputation [14,19]. Estrella et al in their study had mentioned that high levels of Hba1c are the single most risk factor in hand infections [12]. Some studies have shown that high levels of Hba1c and RBS at admission have no significance in the severity of infection [1, 2].

Microbiology

MRSA is seen in 60 % of the patients in our study. Many studies have shown MRSA and polymicrobial cultures in hand infections. According to Jalil et al [16], the MRSA prevalence was 64%. The studies done in the past by Kour et al [15] showed 55% of infections were polymicrobial while Gonzalez et al showed 46 % as polymicrobial infections [9]. In our study, 15% had polymicrobial infections and 15% had monomicrobial infections other than MRSA. Monomicrobial infections with gram-negative organisms were reported in 11% of patients by Jalil et al. [16]. 10 % had no growth in the culture in our study.

Surgical Interventions

Though all patients underwent initial damage control surgery like incision and drainage [Figure 15,16,17] , debridement [Figure 6,9,12,13,19&20] and fasciotomy, only 7 patients underwent repeated debridement. 80 percent of the patients recovered fully after a reconstructive procedure or healing by secondary intention. 20 % underwent distal finger amputations [Figure 11]. Studies have shown amputation rates as high as 35 to 39 % [3, 4, 6, 7, 14]. Though Jalil et al [16] reported a low amputation rate of 16.2 it was attributed to aggressive management and repeated debridement.

Limitations

Long-term follow-ups of the patients were not studied.

CONCLUSION

Diabetic hand infections are more aggressive infections quickly progressing to tissue necrosis and distal ischemia. Early diagnosis and management are crucial for preserving limb function. Most of the hand infections are spontaneous and occur in patients with poor control of diabetes with high HbA1c levels and high random sugar levels at admission. The two most important factors for delay in seeking help are the spontaneous onset of symptoms and lack of awareness about hand infections as compared to foot infections. MRSA is the single most causative organism in most of the cases but gram-negative organisms are no less in terms of severe infections. Protocols should be made by every institute for hand infections in diabetics with broad-spectrum antimicrobials. Covering both gram-positive and gram-negative organisms. Emphasis should be made on "Diabetic hand care "and patients educated about potential problems in the hand and seek care as soon as possible.

CONFLICT OF INTEREST

There is no conflict of interest

ACKNOWLEDGEMENTS

We are grateful to all those who helped in drafting this article whose names might not be mentioned here.

We thank our patient for co-operating with us and sincerely following the treatment protocol.

REFERENCES

1. Ramkumar, S. (2021). Diabetic hand infections: Factors at presentation influencing amputation and number of surgical procedures. *Indian Journal of Plastic Surgery, 54*(3), 289-296.
2. Raveendran, S. (2016). The clinical and microbiological profile of the diabetic hand: A retrospective study from South India. *Indian Journal of Endocrinology and Metabolism, 20*(5), 619–624.
3. Wang, C. (2010). A clinical analysis of diabetic patients with hand ulcer in a diabetic foot centre. *Diabetic Medicine, 27*(7), 848–851.
4. Abbas, Z. G. (2002). Tropical diabetic hand syndrome—Dar es Salaam, Tanzania, 1998–2002. *MMWR Morbidity and Mortality Weekly Report, 51*, 969–970.
5. Gill, G. V. (1998). Serious hand sepsis and diabetes mellitus: Specific tropical syndrome with western counterparts. *Diabetic Medicine, 15*(10), 858–862.
6. Pinzur, M. S. (1997). Hand infections in the diabetic patient. *Journal of Hand Surgery [Br], 22*(1), 133–134.
7. Gürbüz, K. (2019). Is the preoperative glycatedhemoglobin (HbA1c) level predictive of the severity of diabetic hand infection according to surgical and clinical outcomes? *Experimental and Clinical Endocrinology & Diabetes, 129*(10), 713-721.
8. Bahar Moni, A. S. (2019). Diabetic hand infection: An emerging challenge. *Journal of Hand Surgery Asian Pacific, 24*(3), 317–322.
9. Gonzalez, M. H. (1999). Upper extremity infections in patients with diabetes mellitus. *Journal of Hand Surgery (American Volume), 24*(4), 682–686.
10. Mann, R. J. (1977). Hand infections in patients with diabetes mellitus. *Journal of Trauma, 17*(5), 376–380.
11. Orillaza, N. (2015). Hand infections in diabetics: Risk factors. *BMC Proceedings, 9*(Suppl 3), A101.
12. Estrella, E. P. (2019). Risk factors for hand wound infections in people with diabetes: A case-control study. *Wound Management & Prevention, 65*(8), 38-43.

13. Lim, S. H. (2022). Upper limb infections: A comparison between diabetic and non-diabetic patients. *Journal of Orthopaedic Surgery, 30*(1).
14. Ketan, S. (2018). Quantifying the effect of diabetes on surgical hand and forearm infection. *The Journal of Hand Surgery, 43*(2), 105-114.
15. Kour, A. K. (1996). Hand infections in patient with diabetes. *Clinical Orthopaedics and Related Research, 331*, 238-244.
16. Amir, J. (2011). Hand infections in diabetic patients. *Journal of Hand Surgery, 16*(3), 307-312.
17. Akintewe, T. A., Akanji, A. O., &Odunsan, O. (1983). Hand and foot ulcers in Nigerian diabetics - a comparative study. *Tropical and Geographical Medicine, 35*(4), 353-355. PMID: 6670119.
18. Bajaj, S., & Bajaj, A. K. (1999). Tropical diabetic hand syndrome—Indian experience. *The Journal of the Association of Physicians of India, 47*(11), 1118–1119.
19. Wilson, P. C., & Rinker, B. (2009). The incidence of methicillin-resistant Staphylococcus aureus in community-acquired hand infections. *Annals of Plastic Surgery, 62*(5), 513-516. https://doi.org/10.1097/SAP.0b013e31818a6665
20. Sattler, C. A., Mason, E. O., Jr., & Kaplan, S. L. (2002). Prospective comparison of risk factors and demographic and clinical characteristics of community-acquired, methicillin-resistant versus methicillin-susceptible Staphylococcus aureus infection in children. *Pediatric Infectious Disease Journal, 21*, 910–917.