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Microbial Contamination and Poor Hygienic Practices among Food Handlers in a Slum of Kolkata: A Matter of Concern

Aloke Biswas[1], Aparajita Dasgpta[2], Sayan Bhattacharyya[3], Amit Banik[4], Soumit Roy[5], Pritam Ghosh[6], Atul Raj[7]

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Abstract

Purpose: Unsafe methods of food processing and food handling with relative lack of proper storage facilities possess higher risk of food-borne diseases. Current IDSP data suggested that nearly half of reported out breaks were food-borne. Proper hygienic practices are essential to preclude the microbial contamination from food establishments through sanitation barrier.

Objectives: To find out the prevalence and predictors of poor hygienic practices and microbial contamination of hands among food handlers.

Materials and Methods: A cross-sectional study was conducted among 137 randomly selected food handlers in Chetla, Kolkata from June to September 2019. Participants were interviewed using a predesigned, pretested schedule. Hygienic practices were observed using a predesigned pretested checklist. Micro biological assessments of hand swabs were also conducted. Data were analysed using SPSS version 16.0 and logistic regression was used.

Results: Microbial contamination was observed in nearly two-third (69.3%) of the participants' hand. High colony count (≥20 CFU/cm²) was noticed in 40% cases. Staphylococcus aureus was the commonest (36.5%) identified bacteria in their hand. Most of them (56.9%) had poor hygienic practices. Majority had an unsatisfactory level of knowledge (78.8%) and attitude (68.6%). Positive growth was significantly associated with Poor hygienic practice (P-value <0.01), unsatisfactory level of knowledge (P-value <0.01) and attitude (P-value <0.05).

Conclusion: High prevalence of bacteriological growth indicated failure in safe food handling practices. Further training is needed to improve their knowledge, attitude and practices regarding safe food handling. Effective and inclusive food safety policy and legislation is the need of the hour.

Keywords: Food Safety; Food Handling; Food-Borne Diseases; Drug Resistance-Microbial; Hand Hygiene.

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INTRODUCTION

Access to ample quantities of safe and salubrious food is pivotal to enduring life and promoting good health. Unsafe food carrying pathogenic bacteria, viruses or parasites accounts more than 200 diseases ranging from diarrhoea to cancers. The World Health Organization (WHO) reports that 600 million fall ill after eating contaminated

food and 4,20,000 die every year, culminating in the loss of 33 million healthy life years (DALYs), more so in developing capitals.[1] The trend of street food vending is mushrooming in India. These provide a source of economical, easily available and often salutary food in urban area. Integrated Diseases Surveillance Programme (IDSP) showed food borne outbreaks constitute nearly half of all reported outbreaks in 2015-17.[2]

Unsatisfactory personal hygiene most importantly in effective hand washing has been identified as a significant risk factor of food poisoning.[3] Hand hygiene is the most basic yet critical measure for ensuring safe food handling by food handlers.[4–8] Therefore, it is speculated that hand hygiene could play as an indicator of food handlers' adherence to safe food practices during food preparation. Food safety, nutrition and food security exist in a labyrinthine association. Unsafe food forges a vicious cycle of disease and malnutrition, particularly affecting extremes of ages and the infirm. Food borne diseases thwart socioeconomic advancement by straining health care systems, and harming national economies, tourism and trade.[1] To prevent the contamination from food settlements we have to find out the epidemiological co-relates of poor food hygiene. Testimony on the food safety and hygiene practices of food handlers is sparse in the eastern part of the country. In present study, microbiological evidence on hand hygiene was assessed among street food handlers in an urban community in Kolkata and its determinants had been found out.

MATERIALS AND METHODS

Work place based observational study with cross-sectional design was conducted from June to September 2019 at urban field practice area of the institute in Chetla, Kolkata. The food handlers of various food establishments as well as street food vendors residing in the study area and working for at least six months were included in the study. Food handlers unwilling to participate were excluded from the study.

Sampling: Using standard formula for sample size calculation, Sample size (N) = Z 2 PQ/L2 Where, P = prevalence, Q = 1-P, Z = standard normal deviate and L = absolute precision, Z (at confidence level 95%) = 1.96. Prevalence (65%) of microbiologically confirmed hand swab among food handlers was taken from Malaysia study.[9] Taking 8.5% absolute precision minimum sample size 124, with 10% non-response rate final sample size = 137 food handlers. The list of food handlers were obtained from the Occupational Health register of Urban Health Unit. By random number table, 137 food handlers were selected by simple random sampling from the list.

Study Tool: A pre-designed, pre-tested, structured schedule developed by the researchers including items on socio-demographic, respondents' knowledge, attitude and observed practices on food safety and hygiene containing both open and close ended questions was used. The schedule consisted of 59 items on demographic information (14 items), food safety knowledge (16 items), attitude (9 items), and observed checklist for practices (20 items). Food safety knowledge was assessed based on three constructs (i) personal hygiene (7 items); (ii) cross-contamination prevention and sanitation (6 items) and (iii) food borne diseases (3 items). The respondents were required to choose either "correct" (score = 2), "don't know" (score = 1) or "incorrect" (score = 0) for each item on food safety knowledge.

For items under the attitude section, 5 point Likert scale was used with the lowest point (1 point) was given to "strongly disagree" to the highest (5 points) for "strongly agree". The participants were given a score of 1 for "Good practice" and 0 for "bad practice" in observed checklist.

Data Collection

This study was approved by Institutional Ethics Committee of AIIH & PH (Certificate no. PSM/IEC/2018/4 (dated 11th October, 2018). Confidentiality was maintained through out the process. Informed written consent was obtained from all participants' prior data collection. Multiple visits were conducted in the work place of those food handlers. At first participants were interviewed with a predesigned pretested schedule. Second visit was done to collect hand swab from the participants'. Each sterile swab was dipped into a sterile test tube containing peptone water to moisten the swab tip and swabbed over the palm and fingertips of the food handler's dominant hand, collected from 12:00 p.m. - 1:00 p.m. when the food handlers were preparing food, and then transported in vaccine carrier maintaining SOP (as per WHO guideline) to the microbiology lab of the institute within 1 hour of collection.

Microbial Analysis: He swabbed samples were put into nutrient agar culture media for growth under controlled environment. Test used for identification of *Staphylococcus* species were Catalase and slide

coagulase test using pooled human plasma. *Bacillus* cereus was identified by dry colonies, Gram staining, positive lecithinase activity in Egg Yolk agar and inability to break down mannitol.

Antibiotic susceptibility testing (AST) was conducted following the *Clinical & Laboratory Standards Institute* (CLSI) guidelines. For these purpose Mueller Hinton Agar plate and Kirby Bauer disk diffusion method were used. Antibiotics used for *Staphylococcus aureus* were methicillin, ciprofloxacin, erythromycin and tetracycline. For Gram negative bacilli susceptibility testing ciprofloxacin, erythromycin and tetracycline were used.

Data Description and Analysis

Data was analysed using Microsoft Excel 2007 and Statistical Package for the Social Sciences version 16 (SPSS for Windows, version 16.0, SPSS Inc., Chicago, USA) software. Descriptive statistics was performed to assess the background characteristics. Maximum and minimum attainable score for knowledge were 28 and 0 respectively, for attitude (based on 5 - point Likert scale) and self-reported practice score it was 45, 9 and 20, 0 respectively. Univariate and multivariate logistic regression analysis conducted to find significant association of hand swab result with its predictors, if any.[10]

Operational Definition

The scores were dichotomized into knowledge as *satisfactory* - ≥21 out of 28 (3rd quartile)/ *unsatisfactory* - (<21 out of 28), attitude as *satisfactory* - (≥33 out of 45 (3rd quartile)/ *unsatisfactory* - <33 out of 45), taking 75th percentile of attained score as the cut off and for practice as *satisfactory* - (≥11 out of 20)/*unsatisfactory* - (<11 out of 20), taking 50th percentile of attained score as the cut off.

Microbiological Hand Swab Test

Positive if any of the non-commensal bacteria found to be present on the culture media plate after inoculation of sampled swabstick into the petri dish containing growth media for defined period following standard operating procedures.

RESULTS

Background Characteristics: Mean age of study population was 38.2 years (± 12.4). Majority (71.5%) of study participants were male. Majority (94.1%) of study population belonged to Hindu. Out of total 137 participants, 85.4% of subjects were married. Mean years of schooling was 6.7 (± 0.32) years. 15.3% of study population had no formal education. Approximately two third of the study participants' per capita monthly family income were below INR 2000. Food processor consisted 35.8% and street food vend or comprised of 19% and rest (45.2%) of the participants belonged to mixed job category. Participants involved in these work for more than a decade comprised of 43.8%. (Table 1)

Knowledge, Attitude and Observed Practice

Table 1: Distributions of Background Characteristics of the Study Participants (N= 137)

Variable	Characteristics	Number (%)	Descriptive Statistics
Gender	Female	39 (28.5)	-
	Male	98 (71.5)	
Age (in years)	<40	87 (63.5)	Age in years
	≥40	50 (36.5)	Range = 17 to 67
			Mean (SD)= 38.19 (12.37)
			Median (IQR)= 38 (29, 48)
Educational level	Above primary	45 (33.0)	Years of schooling
	Primary and below	92 (77.0)	Range = 0 to 15
			Mean (SD) = 6.70 (3.84)
			Median (IQR)= 8 (4,10)
Religion	Hindu	129 (94.2)	_
	Muslim	8 (5.8)	
Marital status	Married	117 (85.4)	_
	Never married	15 (10.9)	
	Widow/widower	5 (3.6)	

table cont...

Modified BG Prasad Social class (2019)	I	0 (0)	Per Capita Income (INR)
	II	15 (10.9)	Range = 714 to 6000
	III	37 (27.0)	Mean (SD)= 2097.8 (1008.3)
	IV	69 (50.4)	Median (IQR)= 2000.0(1333.3
	V	16 (11.7)	2500.0)
Job type	Food processor	49 (35.8)	_
	Street food vendor	26 (19.0)	
	Mixed	62 (45.2)	
Job years	>10 years	77(56.2)	_
	≤10 years	60 (43.8)	

The prevalence of unsatisfactory knowledge was 78.8% among the participants. of the three constructs on food safety knowledge tested, the respondents scored highest in the construct of personal hygiene (mean score = 54.8±24.1%) but performed poorly in the construct of cross-contamination prevention and sanitation (mean score = 37.5 ± 21.7%) and food borne diseases (mean score = 33.7 ± 27.3%). With regards to food safety attitude the participants showed unsatisfactory results in 68.6% of the respondents. The observed practices assessed demonstrated that unsatisfactory observed practice was seen among 56.9% of participants. (Fig. 1)

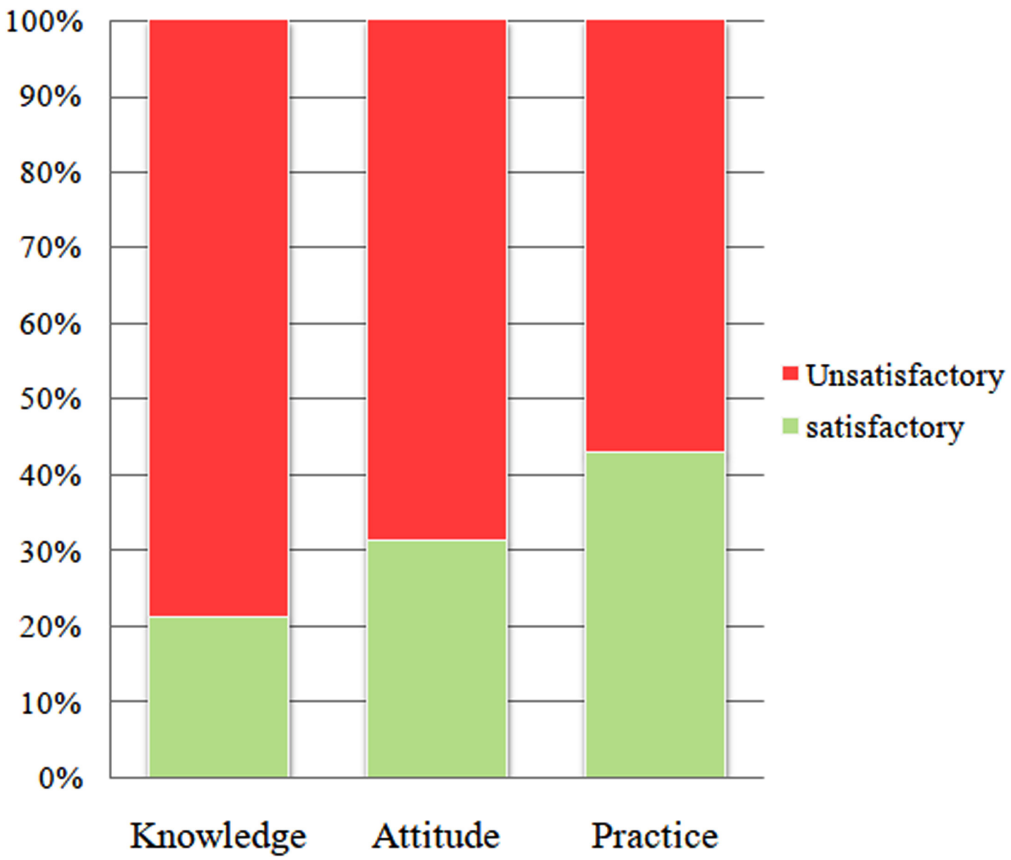

Fig. 1: Distribution of Knowledge, attitude, practice of participants (N=137)

Microbiological Findings

On bacteriological culture, most of the respondent's hand swab sample (69.3%) showed growth of at least one pathogenic bacterium. *Staphylococcus aureus* detected on most (36.5%) of the food handlers' hand followed by *Coagulase Negative Staphylococcus* (26.2%), *Bacillus cereus* (19.7%), Anaerobic spore bearer (19%), Small Gram Positive Cocci (9.5%) and 18.2% of the sample

tested positive for other pathogenic bacteria. (Fig. 2) These bacteria consisted of *Acinetobacter baumannii, Bacillus species other than Bacillus cereus, Citrobacter koseri, Enterobacter cloacae, Enterobacter aerogenes, Streptococcus bovis, Acinetobacter lwoffii, Moraxella catarrhalis, and Staphylococcus saprophyticus.*

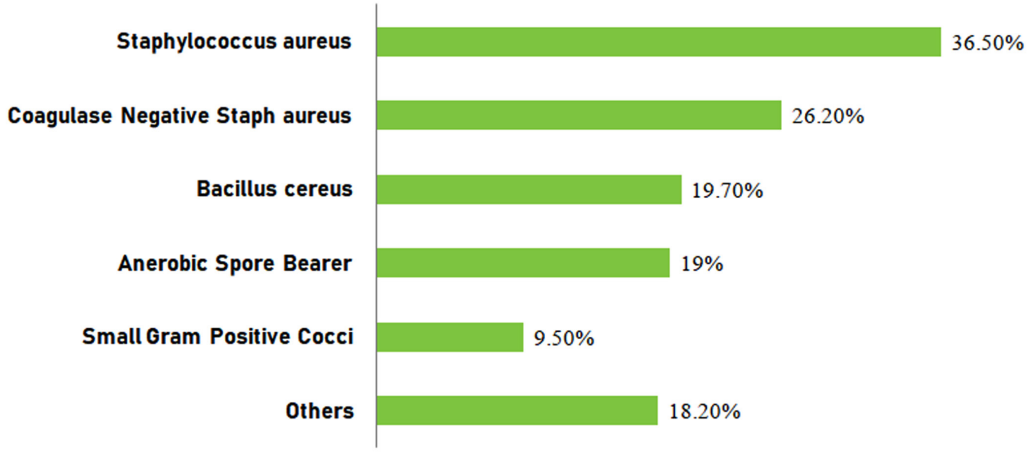

Fig. 2: Distribution of study participants according to microbiological assessment of hand swab

Bacteriological Profile

Hand hygiene assessment of the food handlers participating in this study revealed that 39.4% (n = 54) of them had an aerobic bacterial count exceeding the threshold of ≥20 CFU/cm2 based on Sneed *et al.*[11] and Tan *et al.*[12] Most alarmingly all the bacteria developed resistance to one or more of the antibiotic in Antimicrobial susceptibility testing (AST) mostly seen in Coagulase Negative Staphylococcus aureus (77.7%), followed by Staphylococcus aureus (56%) and Bacillus cereus (55.5%). (Table 2) Among 50 hand swab sample positive for Staphylococcus aureus 11 (22.0%) tested methicillin resistant (MRSA) in AST.

Table 2: Distribution of Study Participants According to Bacteriological Profile (N=137)

Microbial indicator	Number (%)	Min. C.F.U* count/cm²	Max. C.F.U count/cm²	Resistance to C/S test (%)
CONS†	36 (26.2)	2	110	28 (77.7)
S. aureus	50 (36.5)	6	300	28 (56.0)
B. cereus	27 (19.7)	1	30	15 (55.5)
ASB‡	26 (19.0)	1	10	5 (19.2)
Small GPC§	13 (9.5)	3	100	7 (53.8)
Others	25 (18.2)	2	200	2 (8)
Total	95 (69.3)	-	-	No (%)

*Colony Forming Unit, † Coagulase Negative Staphylococcus, ‡ Anaerobic Spore Bearer, § Gram Positive Cocci

Association with Related Factors

Univariate logistic regression analysis showed statistically significant association of positive hand swab test for pathogens within satisfactory knowledge about food borne disease (OR=1.69; P-value <0.01), knowledge about personal hygiene (OR = 1.31; P-value<0.05), knowledge about cross-contamination prevention and sanitation (OR= 1.73; P-value<0.05), attitude (OR= 6.61; P-value <0.05) and observed practice (OR = 14.80; P-value <0.01) with whereas it showed statistically insignificant association with unsatisfactory self-reported practice (OR = 2.69; P-value >0.05). (Table 3).

Multivariate logistic regression analysis retained strong association of unsatisfactory attitude (AOR = 6.47, P-value<0.05) and unsatisfactory observed practice (AOR= 14.61, P–value<0.05) with positive hand swab test for bacteria. This model explained 11-15% variance of dependent variable i.e. microbiological status (Nagel Karke R2= 0.15, Cox and Snell R2= 0.11) with goodness of fit (Hosmer-Leme show = 0.217).

Table 3: Association of positive growth with Co-variates in a Logistic Regression Model (N= 137)

Independent variable	Hand swab Growth positive (%)	OR (CI) for Growth positive hand swab; P-value	AOR (CI) for Growth positive hand swab; P-value
Sex			
Male	70.5	1.17 (0.52 – 2.67)	–
Female	61.3	1 (P-value = 0.07)	–
Age (years)			
<40	66.3	1.48 (0.70 – 3.10)	–
≥40	53.4	1 (P-value = 0.03)	–
Monthly PCI (in INR)			
>2000	56.2	2.14 (0.96 – 4.57)	–
≤2000	43.2	1	–
Job Type			
Food processor	71.4	1.37 (0.61 – 3.08)	–
Street food vendor	21.1	1.83 (0.64 – 5.24)	–
Mixed	64.5	1 (P-value = 0.40)	–
Job duration (in years)			
>10	57.9	3.65 (0.94 – 8.37)	–
≤10	32.5	1	–
Knowledge about food-borne disease			
Unsatisfactory	86.1	1.69 (1.02 – 4.73)	–
Satisfactory	36.9	1 (P-value <0.01)	–
Knowledge about personal hygiene			
Unsatisfactory	64.3	1.31*	–
Satisfactory	25.7	1 (P-value <0.05)	–
Knowledge about cross-contamination prevention and sanitation			
Unsatisfactory	73.8	1.73 (1.10 – 5.39)	–
Satisfactory	26.2	1 (P-value <0.05)	–
Attitude			
Unsatisfactory	80.9	6.61 (2.18 – 20.04)*	6.47(1.90 – 21.96)
Satisfactory	19.1	1 (P-value <0.05)	–
Observed Practice			
Unsatisfactory	76.9	14.80 (5.81–37.64)*	14.61 (5.52 – 38.70)*
Satisfactory	9.3	1 (P-value <0.01)	–

DISCUSSION

In the knowledge domain, significant association of positive hand swab growth was seen with each of the constructs i.e. personal hygiene, cross contamination prevention and food borne diseases. This showed that current study findings were consistent with several studies.[14–17] In current study the proportion (21.2%) of participants having satisfactory knowledge was low compared to findings by Bas *et al.*(43.4%), Marais *et al.* (46%), and Gomes *et al.*(56.5%) and Araujo *et al.* (62.5%) for food handlers.[13,17–19] Angelillo *et al.* suggested that food handlers who had good knowledge of proper food handling practices could aid to curb food poisoning because of their immediate contact with food, particularly ready-to-eat foods.[20] In this study the majority of food handler's food safety attitude was unsatisfactory and similar attitude was seen by Lee H K *et al.*[9] suggesting lack of concerns about keeping ready-to-eat food safe for consumption. This study found out higher prevalence of unsatisfactory food safety practices in contrast to the study findings by Kubde *et al.*[21] Another study conducted by Malhotra *et al.* Among food handlers working in North India found prevalence of entero-parasite infestation to be 41.1% and hand washing practices were observed to be poor with low use of soap.[22]

A microbial assessment to examine the hand hygiene of the food handlers was conducted to obtain a better insight into the evidence of current food safety practices. It reflects the actual practices of safe food handling and at the same time could be used to validate the self-reported practices. The findings from this study were not encouraging as very large number of food handlers were found to have microbial counts exceeding the standards (Table 3). More alarmingly, Staphylococcus aureus was detected on the hands of about one third (36.5%) of the food handlers while other studies by Okareh *et al.*, Yap M *et al.*, Loeto D *et al.* showed similar findings of 38.3 % and 30 % and 30.9% in hands-swab samples among the food handlers.[23–25] A study by Assefa *et al.* found prevalence of Staphylococcus aureus 23.5%[26] Almost one quarter (26.2%) showed Coagulase negative staphylococcus in their working hand which was almost similar to the study finding (28.4%) by Udo EE *et al*.[27] This study found Bacillus cereusin 19.7 % of hand swabs while another study by Yap M *et al.* showed the similar only in 5% of food handler hands, where as another study by Woh PY *et al.* found similar prevalence (25%).[25,27] Staphylococcus aureus ranged between 6 and 300 CFU/cm^2 on dominant hand finger tips. These microbes are frequent inhabitants of the skin and mucous membranes and 20% to 60% of normal healthy adults may be carriers of Staphylococcus aureus.[29] Its presence in fingertips during food preparation may be attributed to it being introduced into the food during cutting, chopping or mixing after cooking by contamination from other body parts of vendors. In a study done in the Johannesburg area, South Africa, by Mosupye *et al.* reported similar observations.[30] Another important co-finding of the current study showed that there is critically greater spectrum of antimicrobial resistance of the isolated bacteria indicating a double fringeds word for this industry. In the current study Staphylococcus aureus was shown to be resistant to one or more of the antibiotics in AST in nearly half (56%) of the isolates which is lower than study findings of 73.5% by Loeto *et al*.[25] The prevalence of MRSA among the isolates positive for Staphylococcus aureus in this study was 22.0% which is almost similar to the findings (22.4%) by Loeto *et al*.[25]

CONCLUSION

The meagre performance in the hand hygiene assessment illustrated a deficient definite practice in food handling. The current finding suggested a call for scrutinizing the effectiveness of safe food handling practices. It was professed from this study that a good knowledge is not emblematic of satisfactory food safety practice. Current nation wide safe food handling initiative under FSSAI should improve dissemination of food safety knowledge, but most importantly intervene to make safe food handling practices among street food handlers. Evidence should be build up to unearth the predictors that impede the conversion of knowledge into food safety behavior so that an effective food safety policy can be instituted.

By exercising microbiological evaluation, this study yielded evidence for magnitude of translation of knowledge into real hygiene and safety practices. It may provide an imperative justification for planning and determination of further approaches to be taken to improve food safety in the country. Forth comingre search should implicate partnership with the government and a larger population of food handlers so that the authority can establish a more comprehensive approach to ensure food safety.

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Review Article

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Rare Fungi Causing Nail Infections

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Abstract

Nail infections are very common among the people especially in females it is one of the most over looked infections which remain untreated and can lead to destruction of the nail and deformity of the nails. Dermatophytes are the common causes of nail infections amongst people. However other filamentous fungi and even yeasts are also responsible for many cases of nail infections. These will be elaborated in this chapter.

Context: Public health importance of non-dermatophyte nail infection.

Aims: To enlist the causes and epidemiology of non-dermatophytic fungal nail infections.

Settings and Design: Review of existing information about this.

Methods and Material: Scientific literature search.

Statistical Analysis Used: Nil.

Results: Non-dermatophytes are important but neglected causes of nail infections.

Conclusions: One should be vigilant about occurrence of these infections.

Keywords: Non-Dermatophytic; Nail; Infections.

Key Messages: Clinicians, nurses and Microbiologists should be vigilant about occurrence of non-dermatophyte nail infections.

Abbreviations:

KOH: Potassium Hydroxide, **NDM:** Non-Dermatophytemolds, **OIAD:** Onychodystrophy Infectious Agent Detection, **PCR:** Polymerase Chain Reaction, **SDA:** Sabouraud's Dextrose Agar, **WSO:** White Superficial Onychomycosis

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INTRODUCTION

Nail infections are very common in the general population. In fact, they can be found in about 10% of the population. Above 70 years of age, they are found in almost 50% of the population. They are commoner in toenails as compared to fingernails.[1] Common predisposing factors for nail infections are nail surgery, shared nail clippers, immunocompromised states or Diabetes mellitus.

MATERIALS AND METHODS

Scientific literature search was carried out for delineating available information about non-dermatophyte onychomycosis.

RESULTS

Dermatophytes are very common causes of onychomycosis. However other molds and even yeast like fungi can cause nail infections in 2-15% cases. Clinically, fungal nail infections may cause nails to become discoloured, thick, fragile, or cracked. The nail may also become separated from the nail bed.

Other than dermatophytes, non dermatophyte molds like *Aspergillus niger* is also a very common cause of nail infections. In fact, there are reports of this fungus causing nail infections in immunocompromised patients also.[2]

Yeasts can also be causes of nail infections. *Candida albicans* can affect nails especially in immunocompromised hosts.[3] It is the second commonest fungus causing nail infections after dermatophytes.[4]

Non dermatophyte molds like *Scytalidium dimidiatum* (now called Neoscytalidium dimidiatum) are also common causes of nail infections. It usually causes distal subungual onychomycosis.[4] *S. dimidiatum* and its hyaline mutant, *S. dimidiatum* var. Hyalinum are common causes of nail infections. *Scytalidium* nail infection are common in nails of index finger and thumb in green tea pluckers of North East India.[4] It is characterized also by blackish discolouration of nail plate and appearance of small, opaque black patches on nails, which can be easily scraped away.[5]

Other non dermatophyte molds are also important as causative agents of onychomycosis, like *Acremonium* and *Fusarium* spp. *Fusarium* spp. colonize soil and affect the nails by direct inoculation.[6] F. *solani* is one important species causing onychomycosis, but other species like F. *dimerum* and F. *oxysporum* are also important.[7] *Fusarium* nail infection responds well to Itraconazole.[6] It also usually involves the toenails more than other nails, and presents usually as white superficial lesions. Nail *Fusariosiscan* predispose to diseeminated fusariosis also later. Among *Acremonium* spp., A. *alabamensis*, A. *falciforme*, A. *kiliense*, A. *roseogriseum*, A. *strictum*, A. *potroni*, and A. *recifei* are important for causing nail and other infections.[8]

The dematiaceous fungus *Alternaria alternata* also causes nail infections rarely. It is the rarest non-dermatophyte mold causing nail infection. It is resistant to Griseofulvin but susceptible to Itraconazole and Ketoconazole.[9]

The hyaline mold *Scopulariopsis brevicaulis* is also a rare cause of nail infection. In fact, *Scopulariopsis* spp. and *Fusarium* spp. commonly cause proximal subungual onychomycosis or infection of the proximal nail fold.[5]

WSO or White superficial onychomycosisis caused by dermatophytes but can also be caused by other molds like *Acremonium strictum* and *Ony chocola canadiensis*.[10] Fusarium and Aspergillus may cause deep version of WSO. Among *Aspergillus* species, not only A. *niger* but also A. *terreus* and A. *candidus* can cause WSO. Candida *albicans* can also cause WSO in very small children. Diffuse Candida-associated WSO of several fingernails and toenails may be found in premature infants who have been born to mothers having vaginal candidiasis.[5] This entity may also be associated with oral thrush and angular cheilitis.

Nail destruction or onychodystrophy is rarely seen in non-dermatophyte onychomycosis. Most molds are non-keratolytic (except for Neoscytalidium dimidiatum). They require the presence of underlying trauma or other nail disorders to penetrate nail tissue and cause infection.[11] Differential diagnosis should include trauma, psoriasis of nails and Lichen planus.[11]

Laboratory Diagnosis

Clinically one should suspect non-dermatophyte onychomycosis which occurs in specified predispositions and is usually associated with paronychia.[11] A wet mount of nail scrapings with 40% KOH solution can reveal the microscopic morphology of the fungi by dissolving keratin. Culture can be carried out on Sabourauds' Dextrose agar (SDA) and SDA with cycloheximide and Chloramphenicol. Neoscytalidium dimidiatum fails to grow on SDA with cycloheximide and Chloramphenicol, but grows on simple SDA as greyish black colonies.[4] It is also characterized by pigmented broad hyphae and thin hyaline hyphae seen together, along with broad pigmented arthroconidia. Recently molecular techniques like PCR have also been employed for diagnosis of non-

dermatophyte onychomycosis. Histopathology can also be useful for diagnosis. In fact, the 3 most commonly used methods used for diagnosis of non-dermatophyte mold (NDM) onychomycosis are culture, polymerase chain reaction (PCR) and histopathology. Histopathology can yield an in-situ vision of the nail plate and subungual keratin for presence of fungal elements, thus providing direct evidence of fungal invasion which is not visible via a simple light microscopic examination.[12] Also, interpretation of PCR results can be complicated by the possible presence of contaminant and commensal microorganisms and how to distinguish them from possible pathologic organisms. As regards PCR is concerned, people have also tried with great success, the Onychodystrophy Infectious Agent Detection (OIAD) assay, a multiplex real time PCR assay which utilizes Taq Man technology for detecting a particular genetic target. Also, one should consider lack of demonstrated viability of the detected microorganism. This is particularly problematic for non-dermatophyte molds (NDM) found in toenails, which can usually or often be regarded as mere environmental contaminants.[12]

Treatment: Triazoles like Itraconazole offer better treatment outcomes than Griseofulvin in cases of non-dermatophyte onychomycosis. Fungal nail infections characteristically do not go away on their own. The best treatment is usually prescription antifungal pills taken orally. In severe cases, a healthcare professional might remove the nail completely. It can take many months to a year for the infection to get resolved.

DISCUSSION

Non dermatophyte fungi are also very important etiological agents behind nail infectionsin all age groups, but are often neglected as causative agents of onychomycosis. Proper clinical suspicion is needed for diagnosis of these infections. Treatment may also be different from that of dermatophytes causing onychomycosis.

CONCLUSION

Non-dermatophyte nail infections are very important in predisposed subjects and need to be managed well.

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Management of Electrical Burns in a Tertiary Care Hospital Our Experience

Dharmaseelan[1], Ravi Kumar Chittoria[2], Barath Kumar Singh P.[3]

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Abstract

Electrical burns can be caused by low-voltage current (usually 220 or 360 V), high-voltage (more than 1000 V) current even by lightning. Electrical injuries and clinical manifestations can vary a lot and range from mild complaints not demanding serious medical help to life-threatening conditions. The primary cause of death in victims of lightning strike or other electrical trauma is cardiac or respiratory arrest. That is why appropriate urgent help is essential. Subsequently electrical burns, deep tissue and organ damage caused by electricity, secondary systemic disorders often demand intensive care and prompt, usually later multistage surgical treatment. In this case report, we discuss the management of electrical burn wounds in our centre.

Keywords: Adult; Electrical; Burn; Management.

INTRODUCTION

Electrical burns are potentially devastating form of multisystem injury with high morbidity and mortality. Most electrical injuries in adults occur in the work place, whereas children are exposed primarily at home. In nature, electrical injury occurs due to lightning, which also carries the highest mortality.[1] The severity of the injury depends on the intensity of the electrical current (determined by the voltage of the source and the resistance of the victim), the pathway it follows through the victim's body, and the duration of the contact with the source of the current.[1,2] Immediate death may occur either from current induced ventricular fibrillation or asystole or from respiratory arrest secondary to paralysis of the central respiratory control system or due to paralysis of the respiratory muscles. Presence of severe burns (common in high voltage electrical injury), myocardial necrosis, the level of central nervous system injury, and the secondary multiple organ failure determine the subsequent morbidity and long-term prognosis. In this case report, we discuss the management of high voltage electrical burns in our centre.

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MATERIALS AND METHODS

This study was done at tertiary care hospital after obtaining approval of departmental scientific and ethical committee. Informed consent was obtained from the patient. This is a prospective descriptive

non randomised case study about a 27 year old male sustained electrical burn injuries while he was working near the electric post for party decoration work. He sustained electrocution by contact with electrical line. He arrived to our emergency department with an electrical burn in both hands, abdomen, left thigh and both feet (fig. 1). It was

Fig. 1: At time of Admission

presumed that the current entered his Right hand and exited through his left foot. At the time of admission his Glasgow Coma Scale score was 15. Multiple second degree superficial burns involving anterior aspect of left lateral abdomen region, bilateral thighs (anterior aspect), and at left ankle region. The serum electrolytes, urea and creatinine, urine analysis, and electrocardiogram were normal, urine myoglobin negative. He was resuscitated with the standard WHO burn protocol. Patient was asymptomatic with no seizures, syncope, focal neurological deficits. Initially, serum myoglobin values rise up to 30000 IU/l after three days. The patient was hydrated adequately as per WHO protocol in electrical burns. The urine myoglobin was negative during the hospital stay. The serum myoglobin values came back to normal after one week. The electrical burn will undergo progressive skin necrosis, so the debridement was done after demarcation of necrotic patch. The dermabrasion is done using the mechanical dermabrader. The non-viable necrotic tissue was debrided without damaging the normal tissues in both horizontal and vertical planes with dermabrader. After wound debridement, derma-abrasion was done till the removal of unhealthy tissues. Then patient undergone split thickness skin graft (fig. 2). After

Fig. 2: Dermabrader Assisted Tangenital Excision and Skin Grafting

wound debridement we have used regenerative therapies like Low level laser therapy, Autologous platelet rich plasma, collagen scaffold dressing. Post procedure patient need closed dressing system like NPWT (negative pressure wound therapy) for improving wound healing and for preventing infection. Patient undergone multiple sessions of wound debridement with other regenerative techniques autologous platelet rich plasma (fig. 3), low level laser therapy (LLLT), collagen scaffolding (fig. 4) and Negative pressure wound therapy (fig. 5). The raw area over the palmar aspect of hand was grafted with split thickness skin graft (fig. 6). Once the burn wounds healed well, we have started scar management with Low Level laser therapy (fig.

Fig. 3: Autologous Platelet Rich Plasma Injection

Fig. 4: Collagen application

Fig. 5: Regulated oxygen Negative Pressure Wound Therapy

7), silicone gel (fig. 8), aloe vera gel (fig. 9), Onion extract application (fig. 10) over the healed burn

Fig. 6: Remnant raw area over entry site treated with skin graft

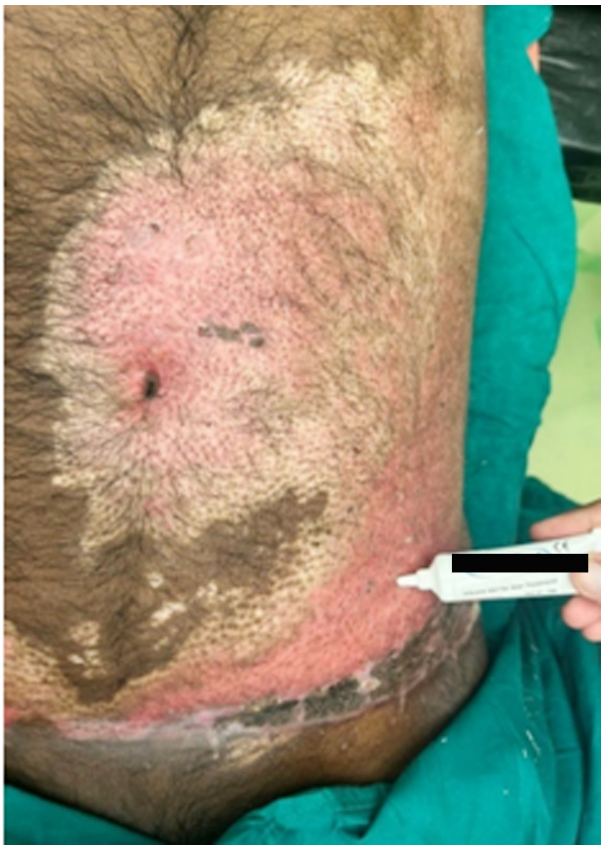

Fig. 7: Lysil gel application

Fig. 8: Low level laser therapy for healed donor site and burnt site

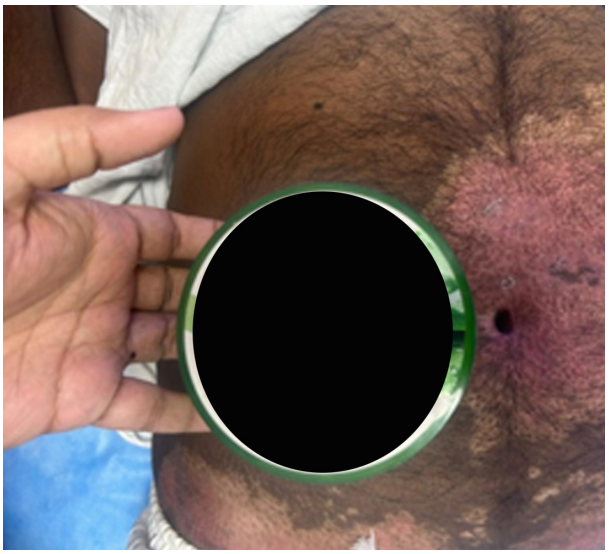

Fig. 9: Aloevera gel application

wounds to prevent the abnormal scarring. Pressure garment therapy was applied over the healed burn wounds (fig. 11).

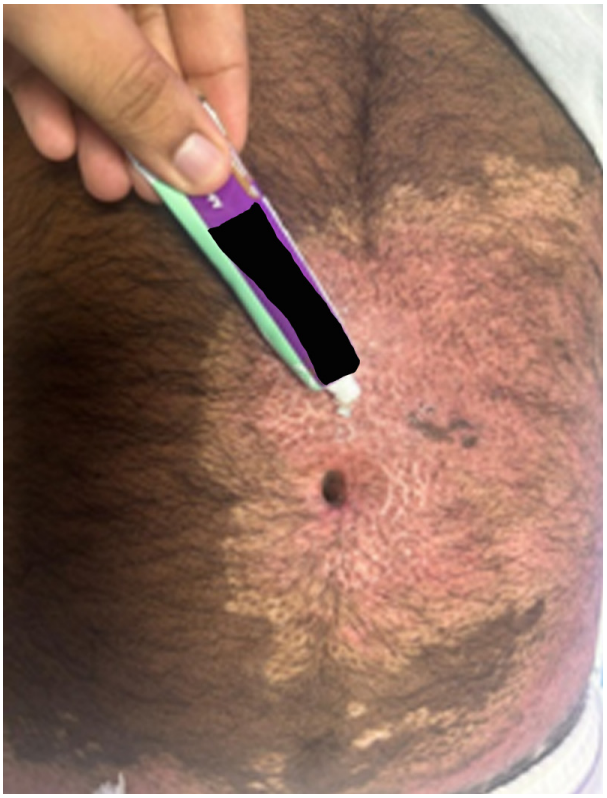

Fig. 10: Onion Extract Application

RESULTS

Patient was compliance with all the above techniques we have used for regeneration of the burn wounds. No complications were noted post

Fig. 11: Pressure Garment Application

procedure. There was no complication associated with the skin graft applied. The skin graft was healthy without any necrosis after 2 weeks (fig. 12). Patient discharged successfully.

Fig. 12: At Discharge

DISCUSSION

Electrical injuries occur when a conductor or electrical source sends high-energy current through

the body. Current flow, arc flash, or burning clothing cause injuries. The former two cause thermal burns by converting electricity to heat. Internal tissues or organs may be much more badly damaged than the skin, therefore the outward appearance of an electrical burn may not correctly reflect the harm. Electrical injuries in children are mostly home, while in adults they are mostly occupational. Electricity injures men more than women. Hands are the main source, then head. Feet are normally ground level. Current is directly proportional to voltage and inversely proportional to resistance, according to Ohm's Law. All three contribute to electricity burn pathophysiology. Low-frequency alternating current (AC) used in homes causes extensive injuries because it causes local muscle contraction (flexor muscles greater than extensor muscles) at the site of contact with the electrical source, often preventing the victim from releasing the offending object. DC contracts one strong muscle, typically throwing its victim away from the energy source. High skin resistance causes diffuse burns. Lower skin resistance causes deeper, organ involving burns. Electricity flows through highly resistant skin tissue and subsequently through less resistant tissues, whether skin is dry or moist. When internal tissues and organs are badly destroyed, skin burns may appear moderate.[3]

Patients with electrical burns that look like thermal burns should be examined head-to-toe, including the source of electrical injury, the voltage and current type (AC or DC) of the energy source, the duration of electrical exposure, and how the injury was caused, and treated according to trauma patient treatment protocols with priority to ABCDEs with a primary and secondary survey. Patients exposed to high voltage should have continuous cardiac monitoring during examination. If the patient has altered mental status or head trauma from a fall or blast, CT imaging may be considered.

After resuscitation, superficial and profound burn patients are cleansed, gently gauze debrided, and covered with topical antibacterial agents and dressings before surgery. Tangential wound excision involves thinly removing eschar to access healthy tissue. Punctate wound bed haemorrhage indicates viable tissue and excision.[4] Tangential excision can be used on any skin eschar to retain viable tissue and reduce tissue removal. Early burn excision and grafting are necessary for successful burn therapy due to infection control. Tangential excision can be performed alone or with various methods to obtain an allograft depth. Split-thickness skin grafting continues to be the most common permanent burn wound closure procedure because it restores epidermal function, reduces hypothermia, protein and fluid losses, and infection.[4]

Negative Pressure Wound Therapy (NPWT) removes exudates and infections and contracts the wound margin. NPWT is safe and effective for post-debridement wounds. NPWT began, and wound size was measured at dressing change. Platelets regulate inflammation, angiogenesis, cell migration, and proliferation by releasing growth factors and anti-inflammatory cytokines, which may speed wound healing.[5,6]

Autologous platelet rich plasma (APRP) contains growth factors that cause intracellular cell proliferation and wound healing when injected or sprayed. Aloe vera's anti-inflammatory, immunological, antibacterial, antiviral, and histamine lowering properties speed burn wound healing.[9] The recent review study found that Aloe vera is universally considered the best wound dressing. Silicone gel raises hypertrophic burn scars' skin surface temperature by 1.7°C, which can promote collagenase activity and scarring.[7] Silicone based scar treatment solutions may increase skin surface temperature. Static electric fields may be involved in scar involution and collagen realignment due to the negative static electric field produced by Silicone gel and skin friction. If MMP-1 activity is uneven between ECM syntheses during wound healing, excessive extracellular matrix accumulation may cause a hypertrophic scar or keloid. Both pathologies may involve excessive type I collagen buildup, decreased MMP-1 activity, and high TIMP-1 expression. Several studies show that onion extract suppresses fibroblast development. Fibroblast inhibition and antiproliferation are associated with onion extract. MMP upregulation by onion extracts modifies ECM.[10,11] Low Level Laser Therapy (LLLT) can cause photochemical reactions in tissue and cells, known as biological stimulation or photobiological regulation. Previous study has shown that LLLT alters mitochondrial photo receptors, accelerates the electron transport chain of generated energy, increases mitochondrial respiration, and increases ATP production. Thus, LLLT can alter cellular redox status and activate signalling pathways that drive transcription factors implicated in proliferation, tissue repair, and regeneration.[12] Compression reduces hypertrophic scars in 60–85% of patients. Scars did not form in incisional wounds compressed in the opposite direction to wound tension. These findings imply that mechanical scar forces may

reduce fibroblast differentiation to myofibroblasts, limiting scar contraction and collagen deposition. The current study's reduced scar contraction may have been due to reducing scar strain, which reduces myofibroblast differentiation and collagen deposition.[13-15]

CONCLUSION

The application of regenerative medicine therapies in the treatment of complex reconstruction in electrical burns has significantly aided in improving reconstructive outcomes. There construction ladder is continuing to evolve and may become the standard of care for effective management of composite tissue wounds. This has to be applied to the multiple number of cases for the assessment of the hybrid reconstructive ladder.

Conflicts of Interest: None

Authors' Contributions: All authors made contributions to the research, is putatively expected to be useful article.

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