

**CERVICOFACIAL NECROTIZING FASCIITIS AMONG PATIENTS
ATTENDING THE MUHIMBILI NATIONAL HOSPITAL
DAR ES SALAAM, TANZANIA.**

Arnold Augustino

**M.Dent (Oral and Maxillofacial Surgery) Dissertation
Muhimbili University of Health and Allied Sciences
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By

Arnold Augustino

**A dissertation Submitted in partial Fulfillment of the Requirements for the Degree
of Master of Dentistry (Oral and Maxillofacial Surgery) of
Muhimbili University of Health and Allied Sciences**

**Muhimbili University of Health and Allied Sciences
October, 2013**

CERTIFICATION

The undersigned certify that they have read and hereby recommend for acceptance by Muhimbili University of Health and Allied Sciences a dissertation entitled **Cervicofacial Necrotizing Fasciitis among Patients Attending the Muhimbili National Hospital Dar Es Salaam, Tanzania**, in fulfillment of the requirements for the degree of Master of Dentistry (Oral and Maxillofacial Surgery) of Muhimbili University of Health and Allied Sciences.

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DECLARATION

AND

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I, **Dr Arnold Augustino**, declare that this **dissertation** is my own original work and that it has not been presented and will not be presented to any other University for a similar or any other degree award.

Signature.....

Date.....

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DEDICATIONS

This work is humbly dedicated to my beloved wife Gaudencia Mgoma and my precious son Alvin Zhirwa Arnold

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ABBREVIATIONS

NF	Necrotizing Fasciitis
MUHAS	Muhimbili University of Health and Allied Sciences
MNH	Muhimbili National Hospital
MoHSW	Ministry of Health and Social Welfare
HIV	Human Immunodeficiency Virus
AIDS	Acquired Immune Deficiency Syndrome
FBP	Full Blood Picture
ESR	Erythrocyte Sedimentation Rate
OPG	Orthopantomograph
SPSS	Statistical Package for Social Sciences
HbsAg	Hepatitis B Surface Antigen
OPD	Outpatient Department
DIC	Disseminated Intravascular Coagulopathy
I.V	Intravenous
DM	Diabetes Mellitus
CD4	Cluster of Differentiation 4

ABSTRACT

Background: Cervicofacial Necrotizing Fasciitis (NF) is a rare life threatening infection which characteristically spreads along the fascial planes to involve subcutaneous tissues, fascia, and fat and in late stages it can involve muscles and skin in the head and neck region. The disease carries high rates of morbidity and mortality, and is not frequently initially suspected due to its rarity and misleadingly innocuous presentation. Since the clinical presentations of the disease in the early stages are not specific, it may not be properly diagnosed.

Objective: The main objective of this study was to determine the occurrence, clinic pathological presentation, and management and treatment outcomes of Cervicofacial Necrotizing Fasciitis (NF) among patients attending treatment at the Muhimbili National Hospital (MNH).

Materials and methods: This Prospective descriptive cross-sectional hospital based study was carried at Muhimbili National Hospital (MNH) for one year from May 2012 to April 2013. A total of 42 patients with Cervicofacial NF were included in the study. They were interviewed for demographic information, chief complaints, nature of the symptoms, the duration of the symptoms and the treatment they got before reporting at MNH. Afterwards the patients were examined to assess the general health condition then management was given according to MNH protocol. Data obtained from these patients was analyzed using Statistical Package for Social Sciences SPSS 19.

Results: During this study period, 151 patients reported at MNH with odontogenic infections. Out of these a total of 42 (27.8%) patients met our diagnosis criteria for Cervicofacial NF. Their age ranged from 15 to 83 years (mean 43.95, SD +/-16.16). Greater proportion of participants 15 (35.7%) were in the age group 30-39 years. Considering gender, greater proportion of participants were males 31 (73.8%) followed by females 11 (27.2%) with a male to female ratio of 2.8:1.

The majority of the patients 26 (61.9%) came from municipals of Dar es Salaam city (Ilala 8, Kinondoni 9, and Temeke 9), whereas 16 (38.1%) of the patients were from upcountry. About 15 (35.7%) patients had one co-existing systemic conditions, which included anemia 5 (11.9%) patients, followed by diabetes mellitus (DM) and malnutrition 4 (9.5%) patients each and HIV positive 2 (4.8%) patients. Three patients had more than one systemic conditions namely HIV + ve and malnutrition 1(2.4%) patient, HIV + ve and anemia 1(2.4%) patient and Diabetes mellitus and anemia 1(2.4%) patient. The study had a mortality rate of 42.9% comprising of 14 (33.3%) males and 4 (9.6%) females.

Conclusion:

In this study cervicofacial NF affected all age groups above 10 years with the highest frequency in the 30-39 years age group. More males were affected compared to females. Anaemia, diabetes mellitus and malnutrition were the main co-existing systemic conditions that were found. Cervicofacial NF is a polymicrobial infection that required a combination of antibiotics, surgical measures and management of co-existing systemic conditions to control it. The rather high mortality in this group of patients was mainly attributable to late reporting for appropriate care.

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CHAPTER ONE

1.0 INTRODUCTION AND LITERATURE REVIEW

Necrotizing fasciitis (NF) is a rare but life-threatening multimicrobial soft tissue infection characterized by progressive, usually rapid, necrotizing process of the subcutaneous tissues, fats and fascial planes, with resulting skin gangrene and systemic toxicity (Balcerak 1988, Reed et al. 1992). This condition, commonly described in the extremities, abdominal wall and perineum following surgery or trauma, particularly in individuals with underlying systemic diseases such as diabetes mellitus, arteriosclerosis, chronic renal failure or malnutrition, is rarely seen in the head and neck (Reed et al. 1992). However, its occurrence in the head and neck is probably more common than the reported cases would suggest.

NF can progress in hours to days from a small innocuous wound to a fulminant necrosis of the skin with septic shock and death. In view of the rapid evolution of NF and its fatal outcome without early treatment, immediate diagnosis is essential to reduce both morbidity and mortality (Ord et al. 2009). NF of the cervicofacial region is a rare entity that has seen an increasing prevalence in the last 20 years. It is most common in patients with systemic disease associated with immunosuppression, but can also be seen in healthy adults and children. It is characterized by soft tissue destruction which is disproportionate to its clinical symptoms and signs, with rapid progression and if not treated rapidly and radically it can result into a fatal outcome (Ord et al. 2009). The cervicofacial region is involved in less than 10% and as is the case in any infection, the disease involves a precipitating event, an infectious agent and a host. The commonest precipitating event is an odontogenic infection (Whitesides et al. 2000, Wong et al. 2000).

NF of the face and neck is a very rare complication of dental infection; nevertheless Otolaryngologists and Dentists should be familiar with this condition. Dental infections are the most common etiologic factors, followed by trauma, peritonsillar and pharyngeal abscesses and osteoradionecrosis (Shraddha et al. 2008). In a review of 17 cases with NF, Panda et al. (2004) found that 12 cases had associated systemic diseases such as anaemia (58.82 %), diabetes mellitus, pulmonary disease, chronic renal failure, alcoholic addiction, HbsAg positive serology, and Arnold Chiari malformation. A clinical staging of the disease progression has been proposed based on the cutaneous signs. Stage I (early) includes clinical signs of tenderness, erythema, swelling, and colour. Stage II (intermediate) involves blistering or bullae. Stage (late) III involves crepitus, skin anaesthesia, and skin necrosis (Wang et al. 2007). In true NF, the infection is related to the fascia and subcutaneous fat while the overlying skin is spared. In its classical form, the underlying muscles are not affected, but a necrotizing myositis may occur as part of the spectrum of the condition.

The disease in the head and neck region can occur in two forms namely the craniofacial and the cervicofacial, each form behaving differently (Banerjee et al. 1996). The craniofacial form involves the scalp and eyelids, where the disease is most commonly caused by trauma (that might be minor) followed by infection (Maisie et al. 1997, Balcerak 1988). The cervicofacial form classically involves the neck, and the majority of cases follow dental or oropharyngeal infections. However, many authors have reported a form of cervicofacial disease which follows dental infection (Balcerak et al. 1988, Simon & Berege, 2006). This type has a rapidly progressive course and, if left untreated, is associated with a mortality of between 22 and 100 % (Panda, 2004).

Several factors have been found to influence survival in NF. In the series reported by Umeda and others, three clinical factors were found to affect mortality namely a delay in surgery, the development of mediastinitis, and the presence of medical comorbidities (Umeda et al. 2003).

In another series, the ultimate prognostic factors were old age, female sex (especially aged > 60 years), uncontrolled diabetes mellitus, anemia, coexistent pulmonary diseases, delayed referral (more than 6 days), and late surgical intervention (Panda et al. 2004).

The hyperglycemic state of diabetic mellitus patients impairs the leucocyte functions and thereby suppresses the host immune system, thus being unable to respond to infection (Sarna et al. 2011). A study done by Chunxu et al. 2009 pointed out that among others, age, self medication, delay to seek medical care, high admission temperature, respiratory difficulty, and underlying systemic diseases were significantly associated with life-threatening complications of odontogenic infections such as cervicofacial NF. A study done by Lee (2010) showed that cervicofacial necrotizing fasciitis had widely varying presentations, ranging from mild, localized cellulitis to deep neck infections with subcutaneous emphysema and mediastinitis. There was no association between the location of the initial infection and the spread to mediastinitis or the presence of subcutaneous emphysema.

Cervicofacial NF of odontogenic origin has been reported from few countries as rapidly progressing infections which were difficult to recognize in their early stages. (Krishnaraj et al. 2008). The body and angle region of the mandible were commonly involved (Fliss et al. 1990). Single institutions generally do not accrue sufficient cases to permit reporting of patterns of presentation and management, and the existing literature consists nearly entirely of individual case reports and several small case series (Judy 2010). The diagnosis of necrotizing fasciitis is a clinical one, and a high index of suspicion is required. The infection spreads with alarming rapidity, and an entire region may become involved within 36 hours (Wang et al. 1992). Early diagnosis is imperative for successful therapy and minimization of cosmetic deformity.

A successful management of NF requires early accurate diagnosis, aggressive surgical debridement, high doses of intravenous broad-spectrum antibiotics and adequate fluid and nutritional support. Krishnaraj et al. (2008) suggested that the necrotic tissue should be excised carefully to avoid damage of major blood vessels, at the same time not leaving behind

any dead tissue. Dissection has to be carried out until fresh bleeding occurs and then the wound is irrigated with 2% hydrogen peroxide and metronidazole solution. Dressings should be changed every six hours with gauze soaked in gentamycin solution. The offending tooth has to be extracted once the general condition of the patient is deemed fit. The wound can heal with contracture therefore some patients may require split thickness skin graft to overcome the problem.

For small submandibular NF, the patient can heal with hidden moderate scars without skin grafting (Nyako et al.2006).

The use of broad spectrum antibiotics, ceftazidime 1 g, gentamycin 80 mg, and metronidazole 500 mg each given 8 hourly has been suggested by Mustapha et al.(1997). Another study found that the causative organisms were sensitive to gentamicin, cefuroxime (zinacef),cefotaxime (claforan), ceftriaxone (rocephine), ciprofloxacin and amoxicillin clavulanate (augmentin) (Shariat et al. 2008). Nothwang et al. (1998) proposed penicillin, clindamycin, gentamicin or ampicillin-sulbactam or cefazolin plus metronidazole combinations to be considered as initial antibiotics therapy in a patient with NF. In addition to appropriate antibiotic coverage, hyperbaric oxygen therapy has been advocated and accepted as an adjunct therapy in the treatment of NF (Korhonen, 2000). Not only has hyperbaric oxygen therapy been shown to reduce mortality, but it has also been shown to improve the salvage of tissue viability (Riseman et al.1990, Korhonen et al.1998). The beneficial properties of hyperbaric oxygen include inhibition of exotoxin production, improved leucocyte function, and attainment of sufficient tissue oxygen levels that kills strict anaerobes and inhibit growth of facultative anaerobes. This treatment may enable better tissue healing, maximizing the amount of viable skin, and may decrease the number of debridements necessary. Meticulous daily wound care is essential after surgical debridements, to facilitate further removal of compromised tissue. A twice-daily regimen of wound irrigation and wet-to-dry dressing changes is recommended (Lee, 2010). Wound defects which are excessively large or which do not close by secondary intention can be managed with a reconstructive procedure. Reconstruction should be delayed until resolution of infection is well established and there is formation of granulation tissue.

Complications that have been associated with NF of the head and neck include necrosis of the chest wall fascia, mediastinitis, pleural effusion, pericardial effusion, empyema, airway obstruction, arterial erosion, jugular vein thrombophlebitis, septic shock, lung abscess, carotid artery thrombosis, and Disseminated Intravascular Coagulopathy (DIC) (Masayuki et al. 1999). Descending mediastinitis is a dreaded complication of cervical space infection the cause of which remains unknown (Langford et al. 1995, Marty-Ane et al. 1994 and 1999). Although cervicofacial NF is similar over different populations, it is important for individual communities to analyze data from their own regions so that specific recommendations on prevention and management can be targeted to the needs of the population (Chunxu et al. 2009).

The aim of this study was therefore to determine the occurrence, clinicopathological presentation, management and treatment outcome of cervicofacial necrotizing fasciitis among patients attending Muhimbili National Hospital, Dar es salaam, Tanzania.

1.1 STATEMENT OF THE PROBLEM

Hospital records at MNH show that on average more than 30 cases of cervicofacial NF are admitted in the wards annually and most of these cases end up with severe morbidity and occasionally death. This is contrary to the information which is generally available in the literature, which shows that cervicofacial NF is a rare entity.

This polymicrobial infection is usually associated with non-communicable diseases such as diabetes mellitus, malignancies, atherosclerotic vascular diseases and obesity which previously were not common in underdeveloped countries like Tanzania. These conditions are now seen with increasing frequency. The advent of acquired immunodeficiency syndrome (AIDS) might also have contributed to the current situation of cervicofacial NF of odontogenic origin.

Majority of these cases are referred from upcountry district and regional hospitals. The long process the patient undergoes before arriving at MNH results in patients presenting late with severe local destruction, severe dehydration and systemic toxicity.

The health seeking behaviour of these people is influenced by individual awareness and that of their communities, availability of trained health workers, and distance to the health facility and economic status. There is also suspicion that the long existing myth that a painful tooth should not be extracted in the presence of a swelling leads to many patients staying with infections for long time. At the primary centers they are often put on antibiotics in the belief that the swellings shall improve or disappear and allow tooth extraction to be done. To the contrary such swellings worsen and lead to eventual development of cervicofacial NF.

Most of the available literature on cervicofacial NF is largely western based where delay in seeking medical care, lack of personnel, self prescription, and nutrition is not a primary problem. Although presentation of cervicofacial NF might be considered to be similar in different populations, there is a need to investigate the presentation and prognosis of the disease in our locality so that we can have specific recommendations on prevention and management of the disease. Therefore there is a need to carry out a detailed study of the different factors associated with this condition in our country.

1.2 RATIONALE OF THE STUDY.

Currently there is little information available in the literature regarding cervicofacial NF. The epidemiology, aetiology, management and prognosis of this condition in Tanzania and in the region is still unclear. While a thorough review of international literature shows that cervicofacial NF is very rare (Scott et al. 1994, Mustafa et al.1997, Shand et al. 2001, Sarah et al. 2004, Naresh et al. 2004, Ashwani et al. 2006, Shariat et al.2008, Krishnaraj, et al. 2008, Shraddha et al. 2008 Rord et al 2009), our local experience gives a different picture.

NF has been associated with several underlying systemic conditions like diabetes mellitus and other debilitating conditions. Since the epidemiology of these conditions differs from country to country there is a great possibility of NF epidemiology also to differ from country to country and from one region to another. The result from this study shall therefore clarify the situation regarding cervicofacial NF in Tanzania.

A detailed study of demographic features of the patients, clinical features, microbiology and microbial sensitivity, association with underlying systemic conditions, management and outcome in our communities shall provide appropriate information to be used in drawing management and preventive measures. This information shall also be submitted to MoH for use in making appropriate evidence based plans in educating the society on how to avoid occurrence of this condition and other infections of odontogenic origin. The study is also part of fulfillment of the requirement of Masters of Dentistry in Oral and Maxillofacial Surgery degree programme.

1.3 OBJECTIVES

1.3.1 Broad objective

To determine the incidence, clinicopathological presentation, management and treatment outcome of cervicofacial necrotizing fasciitis among patients attending treatment at Muhimbili National Hospital, Dar es salaam, Tanzania.

1.3.2 Specific objectives.

- 1) To determine the demographic pattern of patients with cervicofacial NF attending treatment at the Oral and Maxillofacial department of MNH.
- 2) To determine the co-existence of systemic conditions in patients with cervicofacial NF attending treatment at the Oral and Maxillofacial department of MNH.
- 3) To determine the factors leading to delay in seeking treatment in patients with cervicofacial NF attending treatment at the Oral and Maxillofacial department of MNH.
- 4) To determine the etiological factors of cervicofacial NF in patients attending with cervicofacial NF at the Oral and Maxillofacial department of MNH.
- 5) To determine the bacteriological and microbial sensitivity pattern in patients with cervicofacial NF attending treatment at the Oral and Maxillofacial department of MNH.

CHAPTER TWO

2.0 MATERIAL AND METHODS

2.1 Study settings.

The study took place at the Oral and Maxillofacial OPD and in the Oral and Maxillofacial wards of Muhimbili National Hospital (MNH).

2.2 Study design

This was a prospective descriptive cross-sectional hospital based study.

2.3 Study duration

The duration of the study was from May 2012 to April 2013

2.4 Study population

All patients who attended at Oral and Maxillofacial OPD and those who were admitted in the wards due to odontogenic infection and diagnosed to have cervicofacial NF.

2.5 Inclusion and exclusion criteria

2.5.1 Inclusion criteria

All patients who attended treatment at the Oral and Maxillofacial OPD and those admitted in Oral and Maxillofacial wards diagnosed with cervicofacial necrotizing fasciitis according to the under mentioned criteria and voluntarily gave consent to participate were included in the study.

The criteria for the diagnosis of Cervicofacial NF were presence of;

- 1) Fascial necrosis
- 2) Undermining of skin
- 3) Gangrenous tissue
- 4) Primarily involvement of the face and neck

2.5.2 Exclusion criteria

All patients who attended for treatment at the Oral and Maxillofacial OPD and those admitted in the Oral and Maxillofacial wards of MNH with odontogenic infections that were not cervicofacial NF and those with cervicofacial NF but did not give consent were excluded from the study.

2.6 Sample size

Since cervicofacial NF is a rare disease, all patients with cervicofacial NF who attended MNH during the period of the study were included.

2.7 Sampling procedure

All the patients with odontogenic infections who attended for treatment at the Oral and Maxillofacial OPD were received, examined, incision and drainage done and those diagnosed with NF were admitted and were included in the study after consenting. Patients with odontogenic infections who were admitted in the wards directly from the Emergency Medicine Department (EMD) were also examined, incision and drainage done and those diagnosed with NF were included in the study after consenting.

2.8 Data collection

Participants were interviewed using a prepared questionnaire, data on demographic pattern, chief complaints, duration of chief complaints and clinical presentations of cervicofacial NF were collected.

2.8.1 Examination procedures

A thorough general, extra oral and intraoral examination was carried out with the patient seated on a dental chair using natural or artificial light at the OPD. Admitted patients were examined while lying on an examination bed using natural light and the findings on general health status of the patient, dentition involved, extent of the disease were recorded in special clinical forms.

2.8.2 Investigations

Routine and specific investigations were carried out to all the patients diagnosed with cervicofacial NF.

2.8.2.1 Routine investigation

Hematological investigations included full blood picture- (FBP), erythrocyte sedimentation rate-(ESR) and comprehensive chemistry panel (CCP). Due to the co-existence of diabetic mellitus and NF, random blood sugar were measured from all the patients on admission and for those with high blood sugar level, fasting blood sugar was measured on the following three consecutive days. All the patients were asked to consent for Human Immunodeficiency Virus (HIV) test, and for those who tested HIV positive CD4 counts were measured.

2.8.2.2 Specific investigation

In all patients with NF, pus for culture and sensitivity was collected during incision and drainage. Pus was collected aseptically using sterile cotton swab and was immediately immersed in a transport media (Stuart transport media). An investigation form was filled and then the materials were taken to the microbiology laboratory for culture and microbial sensitivity test within 30 minutes after collection. In the laboratory all pus swabs taken from the patients were inoculated into blood agar, Mac Conkey agar and chocolate agar plates.

Drug susceptibility testing was done by disc diffusion method (Kirby- Bauer's technique).

Radiological investigations such as orthopantomography was carried out to determine bone involvement and status of the dentition while chest x-ray was taken to rule out descending infection to the chest cavity.

2.8.3 Diagnostic criteria

All the patients who had infection which primarily involved the face and neck, fascial necrosis, undermining of skin and gangrenous tissue met the diagnostic criteria of cervicofacial NF.

Treatment

All the patients were treated on the day of admission. Incision and drainage and sloughectomy of the necrotic tissues were done under local anesthesia while the patient was seated on the dental chair. The wounds were irrigated with 3% hydrogen peroxide followed by normal saline then gauze containing metronidazole jelly was used to dress the area.

All the patients with NF were given a combination of broad spectrum antibiotics which included ceftriaxone 1g intravenously (I.V) once daily, metronidazole 500 mg I.V after every 8 hours, gentamycin 80 mg I.V twice in a day until the result for culture and sensitivity were obtained. The culture and sensitivity results showed the microorganisms to be sensitive to the ongoing drugs therefore the patients continued with the same drugs. I.V fluids were given to hydrate the patients but also for disintoxification. Sloughectomy of the necrotic tissues was done twice daily until fresh bleeding was seen. For anaemic patients blood transfusion was given to raise the hemoglobin level above 10 g/dl.

For the patients who came with the offending tooth, extraction was performed at the same sitting when doing the incision and drainage procedure. Few patients who had trismus and others who were very weak the extraction was delayed until the general condition of the patient improved but it did not exceed three days.

All the patients regardless of their nutrition status were given highly nutritious food to facilitate healing of their wounds.

2.9. Data handling and analysis

The data on demographic pattern, chief complaints, duration of chief complaints, clinical presentations, general health status of the patients, dentition involved, extent of the disease obtained from this study were entered in the computer. Frequency, mean, standard deviation of these data were then analysed using Statistical Package for Social Sciences programme (SPSS) software Version 19.

2.9.1 Ethical consideration

The investigator introduced himself to every patient and explained about the study before asking the patient to consent for the study. Only those who gave consent to participate were included in the study

Also the investigator asked consent for pre and post counseling for HIV test to patients with NF. Confidentiality was maintained and identification numbers were used in the questionnaires and clinical examination forms instead of patients' names. Patients diagnosed with NF were managed as per hospital and Ministry of Health and Social Welfare (MoHSW) protocol. There was no penalty if the patient refused to participate or withdrew from the study and did not affect the right of a patient for treatment. The investigator was supervised by specialists in Oral and Maxillofacial Surgery.

2.9.2 Ethical clearance

The permission to conduct this study was given by the Research and Publication Ethical Committee of the Muhimbili University of Health and Allied Sciences (MUHAS).

CHAPTER THREE

3.0 RESULTS

During this study period, about 151 patients with odontogenic infections reported at MNH. Out of these a total of 42 (27.8%) patients comprising of 31(73.8%) males and 11(26.2%) females were diagnosed to have cervicofacial NF. The majority 26 (61.9%) of the patients with cervicofacial NF came from municipals of Dar es Salaam city (Ilala 8, Kinondoni 9, and Temeke 9), whereas 16 (38.1%) of the patients were from upcountry. The age of the patients ranged from 15 to 83 years with a mean of 43.95, +/-16.16. The 30-39 years age group was most affected followed by the 60+ and 40-49 years age groups. Males were more affected than females in almost all age groups except the 10-19 years and 60+years age groups (Table 1).

Table 1: Distribution of study participants with cervicofacial NF according to age and sex.

AGE GROUP (Years)	SEX		TOTAL	%
	MALE	FEMALE		
10-19	0	1	1	2.4
20-29	3	2	5	11.9
30-39	13	2	15	35.7
40-49	7	0	7	16.7
50-59	4	1	5	11.9
60+	4	5	9	21.4
TOTAL	31	11	42	100

Majority 18 (42.9%) of the patients had primary education and 6 (14.3%) had secondary education while 16 (38.1%) study participants had no formal education (Table 2).

Table 2: Distribution of study participants with cervicofacial NF according to level of education and sex.

LEVEL OF EDUCATION	SEX		TOTAL	%
	MALE	FEMALE		
No formal education	9	7	16	38.1
Primary education	16	2	18	42.9
Secondary education	5	1	6	14.3
Higher education	1	1	2	4.8
TOTAL	31	11	42	100

Sixteen (38.1%) participants had no formal occupation, while 10 (23.8%) were peasants and 8 (19.0%) were private employees. Only 3 (7.1%) were civil servants (Table 3).

Table 3: Distribution of study participants with cervicofacial NF according to occupation and sex.

OCCUPATION OF PARTICIPANTS	SEX		TOTAL	%
	MALE	FEMALE		
No formal occupation	11	5	16	38.1
Peasant	7	3	10	23.8
Private Employee	7	1	8	19.0
Petty trader	3	1	4	9.5
Businessman	1	0	1	2.4
Civil servant	2	1	3	7.1
TOTAL	31	11	42	100

During their initial visits to the health facilities 19 (45%) patients had decayed teeth and toothache only while 23 (55%) patients had both decayed teeth and toothache associated with swelling.

Regarding the initial health facilities that patients attended, 16 (38.1%) patients reported to health centers, followed by 13 (31.0%) patients who reported to district hospitals, 8 (19.0) patients who reported to dispensaries, and 5 (11.9%) patients reported to regional hospitals.

Twenty nine patients (69%) had no extraction of the offending teeth done at the health facilities where they first attended prior to referral to MNH. The reasons extended for not extracting the offending tooth were the presence of swellings with infection in 25 (86.2%) patients and in 4 (13.8%) patients it was the lack of oral health care services in the facility where they reported.

Eighteen 18 (42.9%) study participants had co-existing systemic conditions, which included anemia in 5 (11.9%) patients, diabetes mellitus (DM) and malnutrition in 4 (9.5%) patients each and HIV positive in 2 (4.8%) patients. The other 3(7.1 %) patients had more than one systemic conditions which included HIV +ve and malnutrition in 1 (2.4%) patient, HIV +ve and anemia in 1(2.4%) patient and diabetes mellitus and anemia in 1 (2.4%) patient. The remaining 24 (57.1%) patients had no co-existing systemic conditions (Table 4).

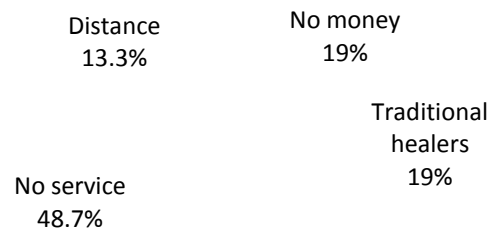
Table 4: Distribution of study participants with cervicofacial NF according to co-existing systemic condition and sex

CO-EXISTING SYSTEMIC CONDITION	SEX		TOTAL	%
	MALE	FEMALE		
Anemia	3	2	5	11.9
Diabetes Mellitus	2	2	4	09.5
Malnutrition	4	0	4	09.5
HIV +ve	1	1	2	04.8
HIV +ve and malnutrition	1	0	1	02.4
HIV +ve and anemia	1	0	1	02.4
Diabetes Mellitus and anemia	1	0	1	02.4
TOTAL	13	5	18	42.9

Thirty seven (88.1%) patients comprising of 28 (75.7%) males and 9 (24.3%) females all reported to health facilities more than a week from the onset of the disease, 4 (9.5%) patients reported between four and seven days after the onset of the disease. Only one patient reported within the first three days since the onset of disease.

The results also showed that majority 18 (48.7%) patients delayed in seeking dental treatment due to lack of oral health care services in their localities, followed by 7 (19.0%) patients who had no money to pay for treatment. Another group of 7 (19.0%) patients consulted traditional healers before seeking medical care while 5 (13.3%) said they lived far away from the health facilities (Fig 1).

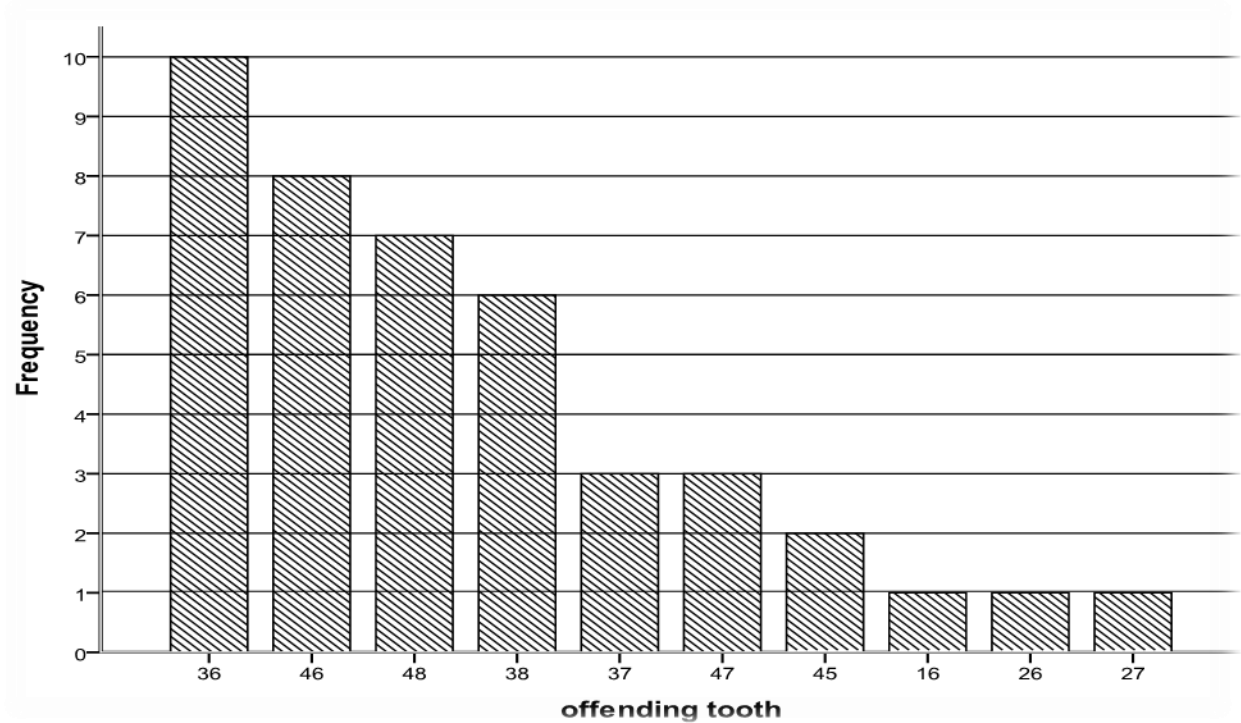
Fig 1: Frequency distribution of factors that associated with delay in seeking for treatment in patients with cervicofacial NF.



All 42 (100%) patients with cervicofacial NF in this study already had odontogenic infection on admission with either an un-extracted carious tooth in 29 (69.0%) or post extraction complications in 13 (31.0%) patients.

Mandibular molars were the most affected teeth in 37 (88.1%) patients, followed by maxillary molars in 3 (7.1%) patients and mandibular premolars in 2 (4.8%) patients (Figure 2).

Figure 2: Frequency distribution of the offending teeth in patient with cervicofacial NF



The mortality rate was 42.9% comprising of 14 (33.3%) males and 4 (9.6%) females. Among the 10 (55.6%) cervicofacial NF patients who died with co-existing systemic conditions, 4(40%) patients had severe anemia, 4(40%) patients had malnutrition and 2 (20%) were HIV positive. Among the 24 (57.1%) survivors 16 (66.7%) patients had no co-existing systemic conditions (Table 5).

Eleven (61.1%) patients died in the first week of hospital admission with majority 9 (81.8%) of them dying during the first four days. Out of the 18 patients who died, 14(77.8%) patients each reported to MNH with an unextracted offending tooth.

Table 5: Distribution of the treatment outcome of patients with cervicofacial NF according to co-existing systemic conditions.

		OUTCOME		TOTAL
		Died	Survived	
ANAEMIC	Yes	4 (9.6%)	3 (7.1%)	7 (16.7%)
	No	14 (33.3%)	21 (50.0%)	35 (83.3%)
DIABETIC	Yes	3 (7.1%)	2 (4.8%)	5(11.9%)
	No	15 (35.7%)	22 (52.4%)	37 (88.1%)
HIV +VE	Yes	2 (4.8%)	2 (4.8%)	4 (9.6%)
	No	16 (38.0%)	22 (52.4%)	38 (90.4%)
MALNOURISHED	Yes	4 (9.6%)	1 (2.3%)	5 (11.9%)
	No	14 (33.3%)	23 (54.8%)	37 (88.1%)

Despite the severity of cervicofacial NF, the majority 21 (87.5%) of the patients who survived healed without skin grafting while 3 had skin grafting done. Three patients healed with contractures.

Table 6: Distribution of patients who died by age and sex

AGE GROUP	DIED		TOTAL
	MALE	FEMALE	
10-19	0	0	0
20-29	1	0	1
30-39	8	0	8
40-49	3	0	3
50-59	2	1	3
>60	0	3	3
TOTAL	14	4	18

Growth of bacteria colonies was observed in specimens of 30 (71.4%) patients. The microorganisms that were isolated included *S.aureus* 12 (28.6%), *S.pyogenes* 9 (21.4%), *K.pneumoniae* 4 (9.5%), *P.aeruginosa* 3 (7.1%), *E.coli* 2 (4.8%), and *H.influenza* type B 2(4.8).

Pure growth revealed *S.aureus* only that was seen in 12 (28.6%) of the samples and the rest yielded mixed micro organisms.

In the samples with mixed growth, *S.aureus*, and *K.pneumoniae* predominated accounting for 9 (45%) and 4 (20%) of the cases. In 10 (23.8%) of the specimens, there was no bacterial growth.

Drug susceptibility testing was done by disc diffusion method (Kirby- Bauer's technique), and ceftriaxone, gentamycin, erythromycin, ampicillin, and cloxacillin discs were used.

The isolates were highly (96.7 %) sensitive to ceftriaxone, gentamycin 86.7 % and erythromycin 83.3 %. Resistance was observed to ampicillin 86.7 % and cloxacillin 90 %.

Table 7: Bacteriological pattern in patients with cervicofacial NF

BACTERIA	GENDER		TOTAL	%
	MALE	FEMALE		
<i>S.aureus</i>	9	3	12	28.6
<i>Streptococcus</i>				
<i>Pyogenes</i>	7	2	9	21.4
<i>Klebsiella pneumoniae</i>	4	0	4	9.5
<i>Pseudomonas aeruginosa</i>	2	1	3	7.1
<i>E.coli</i>	1	1	2	4.8
<i>H.influenza type b</i>	2	0	2	4.8
No growth	6	4	10	23.8
TOTAL	31	11	42	100

CHAPTER FOUR

4.0 DISCUSSION

FINDINGS AND RELEVANCE

This study found that cervicofacial NF predominantly affected males, which is similar to what was reported in other studies from elsewhere (Sethiet al. 1994, Sakaguchi et al.1997, Ismail et al.2011, Bahuet al. 2001, Parhiscaret al. 2001, Lin et al. 2001).

The results of this study showed that the mean age of patients with cervicofacial NF was 43.49. This is almost similar to the mean age in the literature that varied from 36 to 57 years (Chen et al. 1998, Chen et al. 2000, Tom et al 1988, Anisha et al. 2010).However, these findings contradict the earlier assertions in Nigeria whereby Jacob et al. (2006) found that over half (57.1%) of the patients were children aged <15 years. Nyako et al. (2006) in his study in Ghana suggested that cervical facial necrotizing fasciitis affected all age groups.

The mandibular first and third molar teeth were the commonest teeth associated with odontogenic infections. The fact that the roots of these teeth reach below the attachment of the mylohyoid muscle allows infection from these teeth to easily reach the submandibular region. Through the fascial spaces, such infection may progress superiorly to the base of the skull, and inferiorly to the thorax and the mediastinum (Christopheret al. 2004, Hohlweg-Majert et al. 2006, Bono et al. 2008).

Clinical and radiographic examination proved that in all the patients in this study a dental problem was the primary cause of cervicofacial NF. In congruency with information in the literature (Birkanet al. 2011) the last mandibular molars were the teeth most commonly associated with this condition followed by mandibular first molars. Epidemiological studies in Tanzania have shown the lower molars to be most commonly affected by caries (Kikwilu et al. 1989, Nyandindi et al. 1994). Most of the patients started to experience toothache from dental caries, which corresponds to the fact that in majority of the patients NF was associated with the carious lower molars.

Of the 42 study participants with cervicofacial NF, 18 (42.86%) patients had co-existing systemic conditions, anaemia being the dominant finding with 7 (16.67%) patients presenting with haemoglobin levels ranging from 4.9g/dl to 10 gm/dl. Five patients had diabetes mellitus, and malnutrition was present in another five patients. Four patients were found to be HIV positive. This study showed a relatively smaller proportion of patients with co-existing systemic conditions compared to information in the literature where many published reports showed over 50% of their NF patients also had DM (Hung et al. 1996, Stock et al. 2002, Hsiao et al. 2008).

In this study the patient who spent the longest time in the hospital stayed in the ward for 104 days. On admission she was anaemic with hemoglobin of 4.9g/dl and had to be transfused 3 units of blood. She also had a fairly large wound that extended to involve the entire chest wall with loss of the right breast tissue. The patient was managed with medication, sloughectomy and skin grafting and recovered very well (Figures 3a-c). Anaemia results in poor wound healing and decreased body resistance to the disease thus increasing the total duration of hospital stay. In the literature anaemia was also found to co-exist with cervicofacial NF (Panda et al. 2004, Jaimantiet al. 2010) and it is recommended that in such patients the hemoglobin level should be maintained above 10 g/dl to promote rapid wound healing.



3a. A female patient with cervicofacial NF4th day of admission, after sloughectomy.



3b. 3rd week of admission, good granulation tissue formed.



3c. few days before skin grafting

When cervicofacial NF occurs in immunocompromised individuals it can be potentially fatal. It has been found to progress rapidly in HIV positive patients (Jacob et al. 2005, Alexandre et al. 2008, and Judy et al. 2010). In this study two out of four patients who were HIV +ve died of septicemia and multi-organ failure which could be due to suppression of the immune system.

The present study revealed that 5(11.9%) patients were malnourished, which might have been a contributory factor to the development of cervicofacial NF. In addition to the underlying malnutrition, difficult or inability to eat during the course of the disease further weakened the patients. This finding is supported by others who also found malnutrition in their patients because of the reduced oral intake(Jacob et al. 2005, Ismail et al. 2011).Dietary supplements in form of high protein diet were given to all patients.

Contrary to what was reported in several other studies that cervicofacial NF mainly occurred in the elderly and patients with co-existing systemic conditions, this study showed that the disease may occur in young and healthy individuals too. It is worthy to note therefore, that

even in the absence of underlying factors cervicofacial NF may be triggered by unattended dental carries leading to odontogenic infections or other complications following routine dental manipulations in generally healthy individuals if they don't receive proper aftercare.

In Tanzania, general health care services are available down to the village level. However, this is not the case for oral health services which are only available in referral centres, regional hospitals down to the level of municipal and district hospitals only. Therefore, an individual with a dental problem in the village is compelled to travel long distances to these centres to get the required oral health services from an expert oral health personnel.

Majority of the patients in this study group had low level of education and either did not have any formal occupation or were peasants. This meant that they were financially deprived, which might be the reason for delaying to report to health facilities at the early stages of the disease. Other factors that have been reported in the literature included limited public awareness (Jason et al. 2009), financial consequences, especially in countries where healthcare services are on a cash-and-carry basis, the cost being borne solely by the patients (Jacob et al. 2005).

The present study revealed that 19% of the patients with cervicofacial NF attended to traditional healers before reporting to any health facility. This could be due to unavailability of oral health services taking into consideration that the service is concentrated in municipal, district and regional headquarters which appear to be distant from majority of the society. Therefore, patients end up consulting traditional healers who appear to be within their reach.

There is a long existing myth among both lay people and some health personnel that a tooth should not be extracted in the presence of a swelling. This led to several of the patients who attended treatment at different health facilities including district and regional hospitals getting prescriptions for antibiotics only in the belief that the swellings would later improve or resolve to allow tooth extraction. To the contrary such swellings worsened and led to eventual progression to cervicofacial NF. Delay in seeking appropriate oral health care is therefore multifactorial and contributes to the advanced stages of disease that patients presented with.

Similar situation has been reported in New Zealand, where it was found that patients with cervicofacial NF delayed in attending treatment due to limited health knowledge; and lack of access to health care or barriers to that access (Annemarie et al. 2011).

Majority of the patients in this study had polymicrobial infection. This is consistent with the literature that pointed out that NF is a polymicrobial infection of aerobic, anaerobic, gram positive and gram negative bacteria and that up to 11 organisms had been isolated from a single case of NF (Anishaet al. 2010).

The commonest isolated organism in this study was *S. pyogenes* which is similar to what has been reported in other studies (Moshy et al. 1997, Panda et al. 2004, Jacob et al. 2005). The literature also insist that in NF, the primary pathogens are usually the aerobic partners, which produce the destructive enzymes that lead to tissue necrosis, thus creating a favorable environment for invasion by the anaerobic organisms (Jacob et al. 2005).

Due to this polymicrobial nature of cervicofacial NF, patients should initially be managed empirically by high dose of broad spectrum antibiotics. The microbial susceptibility pattern in the present study showed that the microorganisms were very sensitive to ceftriaxone, erythromycin and gentamycin, results which are consistent with other findings at MNH (Moyo et al. 2010 and 2012). These studies also showed the resistance to ampicillin and cloxacillin to be very high. The negative growth obtained from ten samples could be explained by the fact that in these patients with cervicofacial NF who presented to our academic tertiary care center had already been treated with several courses of antibiotics by general medical or dental practitioners and hence the sterile growth that was observed.

The significant role of surgical debridement in the management of these patients cannot be overlooked. In all patients it was done meticulously and consistently simultaneous with the use of antibiotics until the wounds were clean.

SHORTCOMINGS

This was a hospital based study conducted in the maxillofacial department of the Muhimbili National Hospital. Among the shortcomings of a hospital based study is the possibility that not all the people suffering from cervicofacial NF reported for treatment. Some patients, for different reasons, might have failed to honour the referrals that were made at lower centres and some might not have reported to any health facility at all. Nevertheless, it is assumed that, considering the severity of the condition, the majority reported to this centre.

CHAPTER FIVE

5.0 CONCLUSION

In this study cervicofacial NF affected all age groups above 10 years with the highest frequency in the 30-39 years age group. More males were affected compared to females. Anaemia, diabetes mellitus and malnutrition were the main co-existing systemic conditions that were found. Cervicofacial NF is a polymicrobial infection that required a combination of antibiotics, surgical measures and management of co-existing systemic conditions to control it. The rather high mortality in this group of patients was mainly attributable to late reporting for appropriate care.

5.1 RECOMMENDATIONS

Education to the community to raise awareness on the importance of regular dental checkups is an important measure. Society should be educated that in case of dental diseases (caries or periodontal problem) patients must report for health care early.

Oral health care personnel should be educated on the necessity for carefully handling cases that report with different stages of infection.

Early institution of appropriate measures whenever diagnosis of cervicofacial NF is reached is of outmost importance. Such measures should include broad spectrum antibiotic therapy, local surgical debridement and management of the underlying systemic conditions.

Further long term multicenter studies on cervicofacial NF in Tanzania are necessary.

REFERENCES

1. Agbor AM, Naidoo S, Mbia AM. The role of traditional healers in tooth extractions in Lekie Division, Cameroon. *J EthnobiolEthnomed*. 2011; 30:7-15.
2. Anisha M, Rajnikanth K. Cervical Necrotizing Fasciitis caused by dental infection: a review and case report. *National Journal of Maxillofacial Surgery*.2010; 2:135-138.
3. Bahu SJ, Shibuya TY, Meleca RJ, Mathog RH, Yoo GH, Stachler RJ, Et al. Craniocervical Necrotizing Fasciitis: An 11-Year Experience. *Otolaryngol Head Neck Surg* 2001; 125:245-52.
4. Birkan T,Büilent P,Barış, Firdevs. Early cervical necrotizing fasciitis of dental origin. *Int J Dent Case Reports* 2011; 1: 30-35.
5. Bono G, Argo A, Zerbo S, Triolo V, Procaccianti P. Cervical necrotizing fasciitis and descending necrotizing mediastinitis in a patient affected by neglected peritonsillar abscess: a case of medical negligence. *J Forensic Leg Med*. 2008; 15:391-394.
6. Bush JK, Givner LB, Whitaker SH, Anderson DC, Alan K. Necrotizing Fasciitis of The Parapharyngeal Space With Carotid Artery Occlusion And Acute Hemiplegia. *Percy Pediatrics* 1984; 73: 343-347.
7. Chen MK, Wen YS, Chang CC, Huang MT, Hsiao HC. Predisposing Factors Of Life-Threatening Deep Neck Infection: Logistic Regression Analysis Of 214 Cases. *J Otolaryngol* 1998; 27:141-4.
8. Chen MK, Wen YS, Chang CC, Lee HS, Huang MT, Hsiao HC. Deep Neck Infections In Diabetic Patients. *Am J Otolaryngol* 2000; 21:169-73.
9. Christopher C, Thomas K, Gerald B, George K.B Necrotizing Fasciitis of the Face: A Rare but Dangerous Complication of Dental Infection *J Can Dent Assoc* 2004; 70:611–5.
10. Cora DC , Tulsyan N, Cudjoe EA, Daniel J, Ernest A, Onime et al. Necrotizing Fasciitis of the Head and Neck: A Report of Two Patients and Review. *Head & Neck* 2002; 24(5): 497–501.

11. Hohlweg-Majert B, Weyer N, Metzger MC, Schon R. Cervicofacial necrotizing fasciitis. *Diabetes Res ClinPract.* 2006; 72:206-208.
12. Hsiao CT, Weng HH, Yuan YD, Chen CT, Chen IC. Predictors of mortality in patients with necrotizing fasciitis. *J Emerg Med.* 2008; 26:170–175.
13. Hung CC, Chang SC, Lin SF, Fang CT, Chen YC, Hsieh WC. Clinical manifestations, microbiology and prognosis of 42 patients with necrotizing fasciitis. *J Formos Med Assoc* 1996; 95:917-22.
14. Ismail I, Imran S, Ferhat B, Halil B. Life-Threatening Necrotizing Fasciitis of the Neck: A Case Report. *Journal of Current Surgery* 2011; 1: 35-37.
15. Ismail Iynena, Imran Sana, FerhatBozkusa, HalilBeklena. Life-Threatening Necrotizing Fasciitis of the Neck: A Case Report. *Indian J Otolaryngol Head Neck Surg.* 2011; 63: 390–392.
16. Jacob N, Bello BS. Necrotizing Fasciitis: A Comparative Analysis of 56 Cases, Sokoto, Nigeria. *Journal of the National Medical Association* 2005; 97: 1692-97.
17. Jaimanti B, Ramandeep SV, Ajay J, Mayuresh V. Cervical necrotizing fasciitis: Our experience with 11 cases and our technique for surgical debridement. *Ear, Nose and Throat Journal* 2010; 2:63-67.
18. Jason P, Boris F, Tang WM, A review of necrotising fasciitis in the extremities. *Hong Kong Med J* 2009; 15:44-52.
19. Jensen SL, Amato JE, Hartstein ME, Breer WA. Bilateral Periorbital Necrotizing Fasciitis. *Arch Dermatol* 2004; 140: 664-666.
20. Judy WL, Sara BI, Morris GT. Techniques for early diagnosis and management of cervicofacial necrotising fasciitis *J Laryngol Otol.* 2010; 124: 759–764.
21. Lin C, Yeh FL, Lin JT, Ma H, Hwang CH, Shen BH, et al. Necrotizing Fasciitis Of The Head And Neck: An Analysis Of 47 Cases. *Plast Reconstr Surg* 2001; 107:1684-93.
22. Mitchell A, Williams A and Dzendrowskyj P. Necrotising fasciitis: an 8.5-year retrospective case review in a New Zealand intensive care unit. *Journal of Critical Care and Resuscitation* 2011; 13:232-237.

23. Moshy J, Nguvumali HI, Matee MI. Antimicrobial susceptibility pattern of bacteria isolated from pyogenic oro facial lesions in Dar es Salaam. *Afr J Health Sci.* 1997; 4:23-5.
24. Moyo SJ, Aboud S, Kasubi M, Lyamuya EF, Maselle SY. Antimicrobial resistance among producers and non-producers of extended spectrum beta-lactamases in urinary isolates at a tertiary Hospital in Tanzania. *BMC* 2010; 24; 3:348.
25. Moyo SJ, Steinbakk M, Aboud S, Mkopi N, Kasubi M, Blomberg B et al. Penicillin resistance and serotype distribution of *Streptococcus pneumoniae* in nasopharyngeal carrier children under 5 years of age in Dar es Salaam, Tanzania. *J Med Microbiol.* 2012; 61:952-9.
26. Mustafa HA; Mohamed EZ. Necrotizing Fasciitis of the Head and Neck: Report of Three Cases. *Annals of Saudi Medicine* 1997; 17:641-645.
27. Nakamura S, Inui M, Nakase M, Kamei T, Higuchi Y, Goto A, et al. Clostridial Deep Neck Infection Developed After Extraction Of A Tooth: A Case Report And Review Of The Literature In Japan. *Oral Dis* 2002; 8:224–226.
28. Nothwang J, Ulrich C. Necrotising fasciitis-cryptogenic infection following posttraumatic immunopathy. *Arch Orthop Trauma* 1998.118:167-171.
29. Nyako E.A and Nartey N.O. Necrotising Fasciitis of the Submandibular Region. *Ghana Med J.* 2006; 40: 65–68.
30. Nyandindi U, Palin-Palokas T, Milén A, Robison V, Kombe N. Oral health knowledge, attitudes, behaviour and skills of children entering school in urban and rural areas in Tanzania. *Public Health.* 1994; 108:35-41.
31. Obiechinaa AE, Arotibaa JT, Fasolab AO. Necrotizing Fasciitis of Odontogenic Origin in Ibadan, Nigeria. *British Journal of Oral and Maxillofacial Surgery* 2001; 39: 122–126.
32. Ord R, Coletti D. Cervico-Facial Necrotizing Fasciitis. *Oral Dis* 2009; 15: 133–141.
33. Panda NK, Simhadri S, Sridhara SR. Cervicofacial Necrotizing Fasciitis: Can We Expect A Favourable Outcome? *Journal Of Laryngology & Otology* 2004; 118:771–777.

34. Parhiscar A, Har-El G. Deep Neck Abscess: A Retrospective Review of 210 Cases. *Ann OtoRhinoLaryngol* 2001; 110:1051-4.
35. Sakaguchi M, Sato S, Ishiyama T, Katsuno S, Taguchi K. Characterization And Management Of Deep Neck Infections. *Int J Oral Max Surg* 1997; 26:131-4.
36. Sakamoto H, Aoki T, Kise Y, Daisuke W, Jiro S. Descending Necrotizing Mediastinitis Due to Odontogenic Infections. *Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology* 2000; 89: 412–419.
37. Scott PM, Dhillon RS, McDonald PJ. Cervical Necrotizing Fasciitis and Tonsillitis. *The Journal of Laryngology and Otology* 1994; 108: 435-437
38. Sethi A, Sabherwal A, Puri R, Jain P. Cervicofacial Necrotizing Fasciitis: An Unusual Complication Of Chronic Suppurative Otitis Media. *The Journal Of Laryngology & Otology* 2006; 18:1-3
39. Sethi DS, Stanley RE. Deep Neck Abscesses--Changing Trends. *J LaryngolOtol* 1994; 108:138-43.
40. Shand JM, Breidahl A, Hing NR, Johnstone BR, Wiesenfeld D. Ascending Necrotising Fasciitis As A Result Of Odontogenic Infection: A Report Of Two Cases. *Australian Dental Journal* 2001; 46:134-138.
41. Shariat M, Mohammad Z, Hamzaini AH, Ping CH. Necrotizing Fasciitis - The Flesh Eating Bacterial Disease of the Neck. *Shiraz E Medical Journal* 2008; 9: 105-112.
42. Shraddha Jain, Prakash S Nagpure, Roohie Singh, and Deepika Garg. Minor Trauma Triggering Cervicofacial Necrotizing Fasciitis from Odontogenic Abscess. *Journal of Emergencies, Trauma and Shock* 2008; 1: 114-118.
43. Simon ENM, Berege G. Facial paralysis as a result of severe cervico-facial Necrotising fasciitis a case report. *TanzaniaDental Journal* 2006; 2:75-78.
44. Stock CR, Winstead W, Marinez SA. Oodontogenic necrotizing fasciitis in Ile-Ifc, Nigeria. *Brj Oral Maxillofac Surg* 2002; 40:64- 7
45. Subhashraj K, Jayakumar N, Ravindran C. Cervical Necrotizing Fasciitis: An Unusual Sequel of Odontogenic Infection. *Med Oral Patol Oral Cir Bucal.* 2008; 13:788-91.

46. Suehara AB, Gonçalves AJ, Alcadipani FA, Kavabata NK, Menezes MB. Deep neck infection: analysis of 80 cases, *Braz J Otorhinolaryngol.* 2008; 74(2):253-9.
47. Suharwardy J. Periorbital Necrotising Fasciitis. *British journal Of Ophthalmology* 1994; 78: 233-234.
48. Tom MB, Rice DH. Presentation and Management of Neck Abscess: A Retrospective Analysis. *Laryngoscope* 1988; 98:877-80.
49. Zhanga C, Tanga Y, Zhenga M, Jing Y, Guiquan Z, Hao Z et al. Maxillofacial Space Infection Experience in West China: A Retrospective Study of 212 cases. *International Journal of Infectious Diseases* 2010; 14: 414–417.

APPENDICES

Appendix I: Informed Consent Form (English Version)

ID-NO.

Consent to Participate in a Study

Greetings! My name is Dr Arnold Augustino; I am working on this research with the objective of determining the occurrence, clinicopathological presentation, management and treatment outcomes of cervicofacial necrotizing fasciitis among patients attending treatment at Muhimbili National Hospital, Dar es salaam, Tanzania.

Purpose of the study

The study is conducted in partial fulfillment of the requirements for the degree of Master of Dentistry in Oral Surgery of MUHAS. This study is aiming at determining the occurrence, clinicopathological presentation, management and treatment outcomes of cervicofacial NF among patients attending treatment at Muhimbili National Hospital, Dar es salaam, Tanzania. You are being asked to participate in this study because you have this particular condition. Kindly please be honest and true for the betterment of the results that could lead to better intervention and recommendations for future.

What Participation Involves

If you agree to join the study, you will first be interviewed in order to answer a series of questions in the questionnaire prepared for the study. Secondly I shall examine you and the findings will be recorded down. Thirdly your blood will be taken for several investigations including HIV, CD4 counts, and blood sugar level.

Confidentiality

I assure you that all the information collected from you will be kept confidential. Your name will not be written on any questionnaire or in any report/documents that might let someone

identify you. Your name will not be linked with the research information in any way. All information collected on the forms will be entered into computer with only the study identification number. Confidentiality will be observed and unauthorized persons will have no access to the data collected.

Risks

We do not expect that any harm will happen to you because of participating in this study. Some questions could potentially make you feel uncomfortable. You may refuse to answer any particular question and may stop the interview at anytime.

Right to Withdraw and Alternatives

Taking part in this study is completely voluntary. You can stop participating in this study at any time, even if you have already given your consent. Refusal to participate or withdrawal from the study will not involve penalty.

Benefits

The information you provide shall help to determine the occurrence, clinic pathological, presentation, and treatment of cervicofacial NF.

Who to Contact

If you ever have questions about this study, you should contact the Principal Investigator, Dr Arnold Augustino of Muhimbili University of Health and Allied Sciences, P. O. Box 65014, Dar es Salaam. (Tel 0715952271)

If you ever have questions about your rights as a participant, you may call Prof. M. Aboud Chairperson of the Senate Research and Publications Committee, P. O. Box 65001, Telephone: 255-22-2152489 Dar es Salaam and Dr. E. Simon who is the Supervisor (Tel 0784718235)

Do you agree?

Participant agrees Participant does NOT agree

I have read the contents in this form. My questions have been answered. I agree to participate in this study.

Signature of participant

Signature of Research Assistant

Date of signed consent

Appendix II: Consent Form (Swahili Version)**CHUO KIKUU CHA SAYANSI ZA AFYA MUHIMBILI**

**KURUGENZI YA TAFITI NA UCHAPISHAJI
FOMU YA IDHINI**

NAMBA YA UTAMBULISHO.

IDHINI YA KUHUSISWA KWENYE UTAFITI

Hujambo! Jinalangu ni Dr Arnold Augustino; ninafanyia kazi utafiti huu kwa madhumuni ya kutafuta utokeaji/uibukaji, dalili, na matokeo ya tiba ya cervicofacial necrotizing fasciitis katika wagonjwa wanaohudhuria tiba Hospitali ya Taifa ya Muhimbili, Dar es salaam, Tanzania.

Dhumuni ya Utafiti

Utafiti huu unafanyika katika kutimiza sehemu ya matakwa ya shahada ya uzamili ya upasuaji kinywa na meno ya Chuo Kikuucha Afya na Sayansi ya Tiba Muhimbili MUHAS. Dhumuni ya utafiti huu ni kuvumbua uibukaji, dalili, na matokeo ya tiba ya cervicofacial necrotizing fasciitis katika wagonjwa wanaohudhuria Hospitali ya Taifa ya Muhimbili, Dar es salaam, Tanzania.

Unaombwa kushirikishwa kwenye utafiti huu kwasababu unasumbuliwa na tatizo hili. Tafadhali kuwa muwazi na mkweli, ili kufanikisha matokeo sahihi ya utafiti ambayo yatatusaidia katika mapendekezo ya kuboresha huduma kwa wagonjwa kwa sikuzijazo.

Jinsi ya kushiriki

Ukikubali kushiriki katika utafiti huu, utatakiwa kujibu maswali yaliyo katika dodoso kuhusu utafiti huu. Pili, nitafanya uchunguzi wa ndani na nje ya kinywa chako na kunakili nilichokiona. Tatu nitachukua damu yako kwa ajili ya vipimo mbalimbali ikiwamo maambukizi ya virusi vya ukimwi, CD4 na kisukari

Usiri

Nakuhakikisha kuwa taarifa zote utakazotoa zitakuwa siri. Jina lako halitaandikwa popote au kutumika kwa njia yoyote itakayopelekea wewe kujilikana. Taarifa zote zitakusanywa na kuingizwa kwenye kompyuta, ambapo kutakuwa na usiri kuhakikisha yeyote asiyehusika hawezikuzipata.

Tatizo

Hatutaraji utapatwa na tatizo lolote kwa kushiriki katika utafiti huu. Baadhi ya maswali yanaweza yakakuchukiza, siyolazima kujibu swali la namna hiyo.

Haki ya kujitowa na mbadala

Kushirika katika utafiti huu ni uamuzi wako binafsi, kwa hivyo unaweza kujitoa wakati wowote. Kukataa kuendelea na utafiti au kujitoa hakutakupelekea kuadhibiwa.

Faida

Taarifa utakayotoa kuvumbua uibukaji, dalili, na matokeo ya tiba ya cervicofacial necrotizing fasciitis.

Kwa mawasiliano zaidi

Kwa maswali au mawasiliano zaidi wasiliana na mtafiti mkuu, Dr Arnold Augustino wa chuo kikuu cha tiba na Sayansi shirikishi Muhimbili P. O. Box 65014, Dar es Salaam. (Namba ya simu 0715952271)

Kama una maoni kuhusu haki yako kama mshiriki, unaweza kuwasiliana na Prof. M. Aboud, Mwenyekiti wa kamati ya Seneti ya utafiti na uchapishaji, S.L.P 65001, Simu 255 22 2152489 Dar es Salaamna Dr. E. Simon ambaye ni msimamizi wa utafiti huu (namba ya simu 0784718235)

Sahihi:.....

Je unakubali?

Mshiriki anakubali..... Mshiriki hakubali.....

Mimi Nimesoma yaliyomo kwenye fomu hii. Maswali yangu yamejibiwa. Ninakubali kushirika katika utafiti huu.

Sahihi ya mshiriki

Sahihi ya mtafiti:

Tarehe ya kusaini fomu ya ridhaa

Appendix III: Questionnaire (English Version)

1. Reg NO:

2. Age:

3. Gender:

1. Male

2. Female

4. Occupation

1. No employment

2. Peasant

3. Petty trader

4. Business

5. Civil servant

6. Private employee

5. Education:

1. Not went to school

2. Primary education

3. Secondary

4. Higher education

5. Colleague and above

6. Address

1. Ilala

2. Kinondoni

3. Temeke

4. Up country (specify region)

7. Distance to health facility

1. Less than 5 km
2. 5 km to 10 km
3. More than 10 km

8. Chief complaints

1. Pain
2. Swelling
3. Pain and Swelling
4. Difficult in breathing.
5. Pain, swelling, difficult in breathing
6. Pain, swelling, difficult in breathing, difficult in swallowing.

9. How did this problem start?

1. Tooth decay followed by tooth ache
2. Mobile tooth followed by tooth ache
3. Tooth decay followed by tooth ache, mobility of the tooth and swelling.

10. What did you do when you got this problem?

1. Didn't do anything (didn't look for treatment)
2. I went to the nearest health facility where I was given medication
3. I went to the nearest health facility where my tooth was extracted
4. I went to the nearest health facility where nothing was done
5. I did self medication at home (bought antibiotics and pain killer)
6. I went to see the traditional healer who gave me local medicine.

11. How many days did you stay at home with this problem before deciding to report to a health facility?

1. 1-3 days
2. 4-6 days
3. 7-9 days.
4. More than 9 days.

12. Which health facility did you visit first?

1. Dispensary
2. Health centre
3. District hospital
4. Regional hospital
5. Referral hospital

13. Was the offending tooth/teeth extracted?

1. Yes
2. No (go to question 14)

14. How long did you stay with the offending tooth before being extracted?

1. within one week
2. within two weeks
3. within three weeks
4. within four weeks
5. More than a month

15. Why was the offending tooth not extracted?

1. Difficult in opening the mouth (Trismus)
2. Was told to wait until the swelling disappeared
3. There was no trained health personnel to do the extraction.

Appendix IV: Questionnaire (Swahili Version)

1. Namba ya Usajili:

2. Umri:

3. Jinsia:

1. Mme

2. Mke

4. Kazi

1. Sina kazi

2. Mkulima

3. Biashara ndogondogo

4. Biashara

5. Mwajiriwa wa Serekalini

6. Nimejajiri

5. Elimu:

1. Sijaendashule

2. Msingi

3. Sekondari

4. Elimu ya juu

6. Anwani

1. Ilala

2. Kinondoni

3. Temeke

4. Mikoani

7. Umbali kutoka kituo cha afya

1. Chini ya km 5

2. Km 5 mpaka km 10

3. Zaidi ya km 10

8. Sababu iliyokuleta Hospitali

1. Maumivu

2. Uvimbe

3. Maumivu and Uvimbe

4. Kushindwa kupumua vizuri.

9. Je tatizo hililianzaje?

1. Maumivu ya jino kutokana na kuoza kwa jino
2. Maumivu ya jino kutokana na kulegea kwa jino
3. Kuoza kwa jino kukifuatiwa na maumivu ya jino, kulegea kwa jino na uvimbe.

10. Je ulifanyaje ulipopatwa na tatizo hili?

1. Sikufanya chochote (sikutafuta matibabu)
2. Nilienda kituo cha afya kilicho karibu na nilipewa dawa
3. Nilienda kituo cha afya kilichokaribu ambapo jino liling'olewa
4. Nilienda kituo cha afya kilichokaribu ambapo hakufanyikac hochote
5. Nilijitibia nyumbani (nilijinunulia dawa)
6. Nilienda kwa mganga wa kienyeji na alinipatia dawa za kienyeji

11. Ulikaa nyumbani kwa siku ngapi na tatizo hii kabla ya kuamua kwenda kituo cha afya cha karibu?

1. Siku 1-3
2. Siku 4-6
3. Siku.7-9
4. Zaidi ya siku 9

12. Je, ulihudhuria kituo kipi cha afya Kwa mara ya kwanza?

1. Zahanati
2. Kituo cha Afya
3. Hospitali ya wilaya
4. Hospitali ya mkoa
5. Hospitali ya rufaa

13. Je, jino lilokuwa linauma liling'olewa?

1. Ndiyo

2. Hapana (nenda swali la 14)

14. Je, ilikuchukua muda gani kwenda kung'lewa jino lililokusumbua tangu lianze kuuma kwa mara ya kwanza ?

1. Ndani ya wiki moja

2. Ndani ya wiki mbili

3. Ndani ya wiki tatu

4. Ndani ya wiki nne

5. Zaidi ya mwezi moja

15. kwanini jino linalokusumbua halikung'olewa?

1. Mdomo ulikuwa haufunguki.

2. Niliambiwa nisubiri mpaka uvimbe upunguwe

3. Ukosefu wa daktari wa meno

Appendix V: Assessment Form.

1. Diabetes mellitus

1. Yes.

2. No

2. HIV/AIDS

1. Yes

2. No

3. Severe malnutrition.

1. Yes

2. No

4. Dehydrated

1. Yes

2. No

5. Spreading of infection to anatomical sites

1. Submandibular triangle

2. Submental triangle

3. Posterior triangle of the neck

4. Parotid area

5. Anterior chest wall

6. Posterior chest wall

6. Bacteriological findings

1. Aerobic

2. Anaerobic

3. Mixed infections

4. No growth

7. Metronidazole I.V given

1. Yes

2. No

8. Ceftriaxone I.V given

1. Yes

2. No

9. Gentamycin I.V given

1. Yes

2. No

10. Incision and drainage done

1. Yes

2. No

11. Blood transfusion for anaemia given

1. Yes

2. No

12. Sloughectomy done

1. Yes

2. No

13. Duration of hospital stay

1. Less than a month

2. One month

3. Two months

4. Three months.

5. More than three months

14. Healed without skin grafting

1. Yes

2. No

15. Healed with contracture

1. Yes

2. No

16. Healed with skin grafting

1. Yes

2. No

17. Died

1. Yes

2. No

DENTITION STATUS ASSESSMENT.

Tooth No	18	17	16	15	14	13	12	11		21	22	23	24	25	26	27	28
Carious status																	
Offending tooth																	
Periodontal disease																	
Tooth No	48	47	46	45	44	43	42	41		31	32	33	34	35	36	37	38
Carious status																	
Offending tooth																	
Periodontal disease.																	

Key:

Carious status

0 = no carious

1 = carious present

Offending tooth

0 = Not the offending tooth

1 = the offending tooth

Periodontal Disease

O = not present

1 = present