

TOE WEB DISEASE AND LOWER LIMB CELLULITIS AT KENYATTA NATIONAL HOSPITAL

BY

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A Dissertation Submitted to the School of Medicine in Partial Fulfilment of the Requirement for the Degree of Master of Medicine in General Surgery

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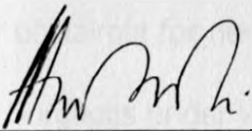
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## DECLARATION

I declare that this dissertation is my original work and has not been presented for a degree in any other university.

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## LIST OF ABBREVIATIONS

KNH	Kenyatta National Hospital
mmHg	Millimeters of Mercury
O.R	Odds Ratio
STSS	Streptococcal Toxic Shock Syndrome
CT	Computerised Tomography
MRI	Magnetic Resonance Imaging
P.I.C.T	Provider Initiated Counseling and Testing
D.O.A	Duration of Admission

## ABSTRACT

The purpose of this study was to determine the factors associated with lower limb cellulitis in patients admitted with acute cellulitis of the lower limb in Kenyatta National hospital (KNH), with particular emphasis on toe web disease.

The study was guided by the following specific objectives:

1. To determine the factors commonly associated with lower limb cellulitis in KNH.
2. To determine the physical status of ipsilateral toe webs in the patients with lower limb cellulitis.
3. To determine the relative significance of toe web intertrigo as an associated factor in lower limb cellulitis in KNH.

The research design was a prospective case control study and the study population comprised patients admitted in KNH due to lower limb cellulitis. A total of 94 patients were sampled consecutively, as per the calculated sample size, upon an assumed risk factor frequency of 25% for toe web intertrigo at 80% power. A researcher developed questionnaire was administered to all patients recruited and blood for blood sugar, total blood count and HIV taken for analysis in the KNH laboratories. Data was collected over a 9 month period from July 2008 to march 2009.

The study findings were coded and entered into Excel worksheets and then analysed using SPSS Ver. 14.0 software. Chi square test was used to test the significance of differences found between categorical variables. Odds ratios were calculated for identified risk factors. Independent t-test was used for continuous data.

Data for all the 94 recruited cases and controls was analysed. The study found that lower limb cellulitis affected the young and middle aged with a mean age of 43.3 years. There was equal representation of the sexes. The commonest site of cellulitis was the leg (76.6%). HIV was identified as a significant systemic condition predisposing to lower limb cellulitis  $p=0.017$ , O.R 0.2 (95%CI 0-0.7). Diabetes was found not to be an

independent risk factor for lower limb cellulitis  $p=0.105$  for the difference between cases and controls. The main local limb factor predisposing to lower limb cellulitis was identified as presence of a wound/ulcer/injury  $p<0.001$ , O.R 50.1 (95%CI 11.7-215.3), followed by dermatitis  $p=0.051$  O.R 4.3 (95%CI 0.9-20.7). Lymphoedema had  $p<0.001$  for the difference between cases and controls but the Odds Ratio could not be calculated since the incidence in controls was nil. Finally toe web intertrigo was found to be a significant risk factor for lower limb cellulitis  $p<0.001$  O.R 3.5 (95%CI 1.7-7.3), occurring in 86.2% of the cases and 63.8% of the controls.

From the study it was recommended that lower limb injuries should be managed promptly and appropriately to avert the risk of lower limb cellulitis. Healthcare professionals should be alert to the increased risk of cellulitis in patients with dermatitis or lymphoedema of the lower limb. Health education for the HIV positive should incorporate information on the need for examination for and management of toe web intertrigo, and also prevention of and prompt care for lower limb injuries however minor. It was further recommended that all healthcare professionals should actively examine for toe web intertrigo in all patients and manage it accordingly.



## 1.0 INTRODUCTION

### 1.1 Background of the study

Lower limb cellulitis is an infection of dermal and hypodermal tissues characterised by local erythema, warmth, swelling, pain, and fever [1,2,3]. This definition often includes erysipelas an acute staphylococcal infection that is superficial, and presents with an indurated "peau d'orange" appearance that is sharply demarcated from normal skin by a raised border [2,3]. Though it may be possible to clinically differentiate the two entities, previous studies have used a common definition of cellulitis to include erysipelas [1,3].

Lower limb cellulitis may complicate any condition leading to loss of the normal barrier conferred by intact skin providing a route of entry for pathogenic bacteria, lymphoedema of the limb, and following saphenectomy or saphenous vein graft harvesting [1]. The gram positive bacteria *staphylococcus aureus* and *streptococcus pyogenes* are the bacteria most commonly associated with lower limb cellulitis, though other bacteria have been identified such as *pasturella multocida* in cat bites [1,2,3]. Intertriginous toe webs have been found to have altered bacterial colonisation to include pathogenic bacteria [7], and even more commonly in intertriginous toe webs of patients with lower limb cellulitis [1,15]. People will often not notice when they have toe web intertrigo [10] and they may thus not complain of it when attended to either for lower limb cellulitis or for other ailments, and it may therefore go untreated predisposing patients to occurrence or recurrence of lower limb cellulitis [1,5].

A study conducted in 1998 at KNH examining the spectrum of diseases leading to admissions to the surgical wards found 15 patients were admitted with acute lower limb cellulitis in a period of one month [6]. Other studies have also indicated significant contribution of lower limb cellulitis to admissions in dermatology wards [1,3].

## 2.0 LITERATURE REVIEW

### 2.1 Introduction

Cellulitis is an infection of the dermal and hypodermal tissues characterised by local erythema, warmth, swelling, pain, and fever, [1,2,3]. It is most commonly caused by pyogenic bacteria usually following a break of the intact skin due to a wound, or dermatitis [2]. The commonest bacterial causes are skin contaminants or they may be normal flora. *staphylococcus aureus* and *Streptococcus pyogenes*, are the commonest implicated, but other gram positive and gram negative bacteria may be involved and the initiating events may provide clues as to the causative bacteria [1,2,22]. Cellulitis following cat bites is most often caused by *pasteurella multocida*, *clostridia* may cause cellulitis following penetrating wounds, and anaerobic bacteria such as *bacteroides*, and *peptostreptococcus* cause a crepitant cellulitis [2,22]. The infection spreads locally and though fever is common, bacteraemia as indicated by positive blood cultures is uncommon [2]. Most complications are local such as ulceration and lymphoedema but in rare cases cellulitis caused by *streptococcus pyogenes* may progress to streptococcal toxic shock syndrome [22,24].

Cellulitis may affect any area of the body however, the lower limb is the most commonly affected body site, the upper limb, and then the face [2,6,11]. In most of the studies conducted in more developed countries, lower limb cellulitis is commonest in the elderly who have the predisposing conditions and co-morbidities, whereas in children the commoner form is facial cellulitis caused by *haemophilus influenza* [1,2,3,22]. It is probable that in the setting of a less developed country the demographic distribution of lower limb cellulitis and its predisposing factors may be different given the different demographic structure and spectrum of co-morbidity.

### 2.2 Risk Factors

Risk factors and predisposing factors for lower limb cellulitis have been identified in several studies. Dupuy et al. [3] in a case control study found a significantly higher rate

of lower limb cellulitis in patients who had any breach of the lower limb integument, due to ulcers, bites, surgical wounds, or toe web intertrigo. In their study toe web intertrigo was found to be a significant independent risk factor. It is notable that in this study local limb factors were much more significant than systemic ones such as overweight or diabetes mellitus which had very low odds ratio, suggesting that these may be predisposing factors rather than independent risk factors. Other risk factors identified were history of previous cellulitis and lower limb oedema.

Another case control study [1] confirmed local risk factors were more significant, and in particular the presence of beta haemolytic *streptococci* and/or *staphylococcus aureus*, in toe webs of the patients, which had the strongest association with lower limb cellulitis. Other strongly associated factors were history of cellulitis, history of saphenectomy, and the presence of leg ulcers. Similarly in this study, overweight, diabetes mellitus, and history of smoking were far less significant. The study also demonstrated that persistent risk factors could account for recurrence of lower limb cellulitis. The authors postulated that presence of a break in the cutaneous barrier allows pathogenic bacteria access to the subcutaneous tissues and hence occurrence of cellulitis. They however observe that though saphenectomy, previous cellulitis, and leg oedema are independent risk factors for lower limb cellulitis, their specific roles in the infection have not been elucidated.

The role of dermatomycosis in lower limb cellulitis has also been questioned to find out whether it is just compromise of skin cover or infection with dermatophytes that predisposes to lower limb cellulitis. Roujeau et al. [9] found a higher rate of cellulitis in patients with chronic dermatomycosis of the foot though they did not investigate the bacterial colonisation of the fungally infected feet. Lestringant et al. [7] found that in patients presenting in a dermatology clinic with toe web intertrigo, those with proven dermatomycosis had a higher frequency of fissuring and maceration of the toe web skin. This suggests that the role of dermatomycosis is increasing the severity of breach of the integument thus allowing bacterial access. It is conceivable though, that both bacterial and fungal flora may be taking advantage of a primarily fissured toe web due

to a third factor, a matter that can only be cleared by a cohort study, and this may explain the increased rate of cellulitis in patients with toe web dermatomycosis [7].

Normal toe webs have been shown to have high bacterial microflora. Compared to other body areas, only the perineum had higher bacterial counts [17,18]. Swab cultures in normal subjects revealed coagulase negative (non-pathogenic) *staphylococci* in 100% of subjects sampled and coryneform bacteria in 86.7%, as the two most common bacterial isolates [17,18]. Pathogenic bacteria were also identified but at much lower frequencies of 13% [17] and 11% [18] for coagulase positive staphylococci in the two studies. In the presence of toe web intertrigo the bacterial flora was demonstrated to change to a predominance of gram negative bacilli [7,17,18]. It is notable that Lestringant et al. [7] found only 3 out of 45 patients had pathogenic bacteria, beta haemolytic *streptococci*, and since none of the patients in their study had lower limb cellulitis, it is possible that the colonisation of the intertriginous toe web with pathogenic bacteria precedes the development of cellulitis in that limb.

Change of environment also changes the bacterial microflora of toe webs as well as other body surfaces. Larson et al [16] found that patients hospitalised for at least two weeks have different microflora from normal controls in the population. Apart from the difference in species recovered from the two sets of patients, hospital patients acquired more antibiotic resistant bacteria. This study also raises the possibility that change of geographical location may change the surface normal flora composition of individuals and that individuals in varied geographical locations may have different bacterial normal flora [7,16]. For this proposed study therefore, only freshly admitted patients will be admissible in to the study both for cases and controls. These studies also show that it is imperative to conduct local studies to ascertain the local bacterial flora in intertriginous toe webs.

Toe web intertrigo of varied aetiology is common in many populations and in most cases is subclinical and those affected may not readily present themselves for

treatment. Chan et al [13] in an epidemiologic community survey in Hong Kong found a 64% prevalence of athlete's foot in a Chinese population. Another study in Australia among school going children [12] found a low prevalence of athlete's foot in younger children, increasing with age up to 13% in the 16 to 18 age group. Attye et al. [21] found a 15% prevalence of occult dermatophyte infections of the feet in Australian swimmers. These findings suggest toe web intertrigo is highly prevalent and that there are population differences that may be due to climate differences, level of hygiene, social habits such as sitting cross-legged, or wearing closed shoes in hot environments and the use of non-absorbent socks [7,12].

Because patients presenting to clinicians for various ailments may have toe web disease that they may not complain of, it is imperative that especially in predisposed patients toe web disease be actively sought and managed appropriately [1,3,9]. Cox et al [14] observed that the diagnosis of tinea pedis was rarely made other than in dermatology departments, yet they also noted that the management of lower limb cellulitis or other conditions that predispose to it does occur in other departments. Dupuy et al [3] thus concluded that clinicians must actively examine for and manage toe web disease as a possible pre-emptive intervention against lower limb cellulitis especially in predisposed patients.

### **2.3 Clinical Presentation**

Lower limb cellulitis most commonly presents as an acutely occurring and spreading painful, red, warm swelling [2,3,22,24], and in contradistinction from erysipelas has an ill defined border [2,3]. Constitutional symptoms of malaise and fever may precede the local inflammation but may be absent in patients who receive antibiotic therapy prior to presentation in hospital [24]. Blistering and ulceration may occur [24] as well as necrosis of the subcutaneous tissues and overlying skin [2]. Clostridia or anaerobic bacteria though infrequent causes produce a crepitant cellulitis [2,22]. Marked pain, rapid progression of the infection, and deterioration of the general condition of the

patient should call for expeditious investigation for more ominous disease especially necrotising fasciitis and gas gangrene [2,22,24]

## 2.4 Investigations

The diagnosis of lower limb cellulitis is largely clinical because of the paucity of methods of immediate bacteriological diagnosis or antibiotic sensitivity assessment [2]. Diagnostic methods in current use also have relatively low bacterial yields and thus empirical therapy is currently widely practised [2,22,24]. Tissue aspirates from the site of cellulitis were observed to result in positive cultures in 31.9% of cases [11] while blood cultures were positive in 8 out of 81 specimens taken in pyrexial patients [1]. Lee et al. [20] reported a much higher recovery rate of 80% from tissue aspirates in patients without prior antibiotic experience in the course of that illness, but they had a relatively small sample size of 23 possibly explaining the high percentage. Blood culture has a higher yield in necrotising fasciitis [24]. Semel and Goldin [15] recovered the two pathogenic bacteria commonly associated with lower limb cellulitis, from 17 out of 20 patients with athlete's foot and lower limb cellulitis, by ipsilateral toe web swabs from the most abnormal toe webs, although they did not investigate further to confirm the identified bacteria was the cause of the concurrent infection.

In patients with cellulitis the recovery of pathogenic bacteria in the toe webs is significantly more frequent [1,15], and as noted above pathogenic bacteria occur more commonly in the intertriginous toe webs. Semel and Goldin [15] demonstrated that ipsilateral toe web swabs for bacterial cultures were a sensitive method of establishing the possible bacterial cause in patients with lower limb cellulitis and concurrent toe web intertrigo. Hilmarsdottir and Valsdottir found in a case study the same serotypes of bacteria in the bloodstreams by blood culture and intertriginous toe webs by concurrent swab cultures of two febrile patients with acute lower limb cellulitis [23]. Mycological cultures of macerated toe webs will reveal concurrent dermatomycosis failure to treat which is associated with recurrence of cellulitis [24].

Laboratory blood investigations include total blood count to detect neutrophil leucocytosis usually  $\geq 11 \times 10^9 / L$ , and platelet levels, the latter being below  $100 \times 10^9/L$  in streptococcal toxic shock syndrome (STSS), a potential complication of streptococcal cellulitis [24,29]. Urea and electrolyte levels are necessary to monitor renal function, and creatinine levels above  $177 \mu\text{mol/L}$  with a two fold or greater rise in hepatic transaminases are biochemical criteria for STSS [24]. Antistreptolysin O titres confirm a streptococcal cause especially where cultures were negative but the test may be negative in cases where antibiotic treatment is prompt and is only positive after the first week but may guide therapy in cases not responding to initial empirical therapy [24]. CRP levels were elevated in 97% of patients [29]. Other laboratory investigations will detect co-morbidities such as blood sugar for diabetes mellitus and D-Dimers to rule out deep venous thrombosis [1,24].

Plain radiographs and computerised tomography (CT) scans may reveal features of acute osteomyelitis where this is thought likely, though radiologic studies are unnecessary in most cases of cellulitis [2]. Plain radiographs may also reveal soft tissue gas in gas gangrene [22]. Magnetic Resonance Imaging (MRI) was found to differentiate between necrotising and non-necrotising fasciitis of the lower extremity in patients with severe lower limb cellulitis hence detecting the patients who required extensive debridement [25]. In cases where necrotising fasciitis is strongly suspected however, especially in the face of clinical deterioration or lack of improvement, surgical intervention and biopsy for confirmation of the diagnosis is indicated [2,25]. MRI is also diagnostic in Diabetic Muscle Infarction which may mimic lower limb cellulitis, and in one study can include MR-venogram to rule out deep venous thrombosis [27].

## **2.5 Management**

Supportive therapy for lower limb cellulitis includes elevation and immobilization of the limb to reduce swelling, and sterile dressings of blistered or ulcerated areas [2]. Any co-morbid conditions should obviously be managed as well as any identified predisposing conditions such as tinea pedis [24]. The decision on whether the patient requires

hospital admission and intravenous therapy or can be managed by oral antibiotics is largely clinical and lacks objective criteria [28]. Most patients presenting at hospital emergency departments however will require admission and intravenous antibiotics either because oral therapy at home has failed or the patient's condition dictates it [24,28]. After initial antibiotic therapy in hospital with good response the patient may be discharged on continuation oral therapy for a total duration of treatment of 7 to 14 days depending on the rate of response, and treatment may be longer in cases with necrosis or abscesses [2].

Antibiotic therapy for cellulitis is mostly empirical based on the established bacterial aetiology including cover for beta lactamase producing *s. aureus* and also giving consideration to specific aetiologies such as human bites, and co-morbidities such as diabetes or other forms of immunosuppression which call for antibiotic combination therapy [2,30]. Beta-lactam antibiotics and cephalosporins are widely used in treatment of cellulitis, but macrolides and fluoroquinolones have also been used [2,24,31]. Leman and Mukherjee [4] conducted a randomised control trial to test the common regime recommended in the UK NHS of combining flucloxacillin and benzathine penicillin in the management of lower limb cellulitis, against flucloxacillin alone and found using flucloxacillin alone was as effective as combining with benzathine penicillin. There are varied regimes in use for treatment of lower limb cellulitis depending on countries and even regions within the same country [2]. Corwin et al used twice daily intravenous cephazolin in a trial of home based versus hospital based antibiotic therapy and concluded that the two arms had similar results in response to therapy [28]. Lazzarini et al in an 8 year retrospective study in Italy found the commonest antibiotic in treatment of lower limb cellulitis was amoxicillin-clavulanate [29].

## **2.6 Complications**

Lower limb cellulitis rarely causes bacteremia and septic shock as might be expected of an infection, as evidenced by the low rates of recovery of bacteria from blood cultures even in febrile patients [2,22,24]. Features of septic shock may be found in



streptococcal cellulitis due to streptococcal septic shock syndrome or in necrotising fasciitis [24]. Chronic leg oedema and ulceration were found to occur in a small proportion of patients following an episode of lower limb cellulitis [14] and using lymphoscintigraphy lymph flow abnormalities have been identified post lower limb cellulitis though possibly the abnormalities may have preceded the cellulitis [32]. Localised skin necrosis, blistering, superficial ulceration and abscess formation may occur [2,24].

## **2.7 Differential Diagnosis**

Conditions causing a swollen tender limb constitute differentials for lower limb cellulitis most authors however emphasize the need to differentiate lower limb cellulitis from the more ominous necrotising fasciitis and gas gangrene whose treatment requires extensive surgical debridement [2,24,32]. Necrotising fasciitis may be distinguished from lower limb cellulitis by the presence of pain out of proportion to the visible inflammation and by the appearance of bullae and necrosis of the overlying skin and supervening toxic shock [2,24,32]. Gas gangrene is clinically crepitant, with bullae, gas in tissue planes on plain radiographs and gram stain of bulla fluid shows large gram positive bacilli [2]. Cutaneous anthrax, insect bites, acute gout and deep venous thrombosis are other significant differentials [2,24]. The deeper tissue infections pyomyositis and acute osteomyelitis may be distinguished clinically or radiologically by plain radiography, CT Scan or MRI [25,27].

### **3.0 STUDY JUSTIFICATION**

Lower limb cellulitis causes significant short-term morbidity often requiring hospitalisation for 5 to 10 days, thus incurring significant costs in treatment [3,6,14]. The disease also commonly recurs possibly due to inattention to risk factors; hence identification of associated factors will guide further study into risk factors and possibly inform their proactive management to reduce the incidence of lower limb cellulitis [3,5]. Though studies into risk factors have been conducted in other environments, those studies may not be directly applicable to the Kenyan environment because geographically diverse environments differ in disease patterns, as well as in the management of common disease entities [4]. Some patients who have recovered from lower limb cellulitis have been found to have some long-term morbidity. Cox et al. [14] found that though leg oedema and ulceration are risk factors for lower limb cellulitis some patients were observed to develop chronic leg oedema, and less frequently ulceration, after an episode of lower limb cellulitis.

#### **3.1 Hypothesis**

There are multiple factors associated with lower limb cellulitis at KNH and toe web intertrigo is a significant factor.

## **4.0 OBJECTIVES**

### **4.1 Main objective**

To determine the factors associated with lower limb cellulitis in KNH with particular emphasis on toe web disease.

### **4.2 Specific objectives**

- 4.2.1 To determine the factors commonly associated with lower limb cellulitis in KNH
- 4.2.2 To determine the physical status of ipsilateral toe webs in the patients with lower limb cellulitis.
- 4.2.3 To determine the association of toe web intertrigo with lower limb cellulitis in KNH.

## **5.0 MATERIALS AND METHODS**

### **5.1 Study Design**

This was a case control study whose data was collected prospectively

### **5.2 Study Population**

The study population comprised all patients aged 18 years and above, newly admitted due to cellulitis of the lower limb through the casualty department of Kenyatta National Hospital. Controls comprised patients admitted within 24 hours of the case admission for any other condition other than cellulitis, matched for age and gender with the respective cases. Kenyatta National Hospital is a tertiary referral hospital located in Nairobi where patients are referred from other hospitals around Nairobi and even around the country. Patients may also present primarily at the casualty department where they are assessed, treated and discharged or admitted. Ethical approval will be sought from the KNH ethical committee.

### **5.3 Sampling**

Consecutive purposive sampling of all patients presenting with lower limb cellulitis at KNH casualty department was done from July 2008 continuing until the desired sample size was achieved in April 2009. Cases were identified in the casualty, and the admitting wards daily, by trained assistants comprising level 5 medical students, and notices were also placed on the casualty notice boards to inform medical officers and senior house officers to notify the researcher if they admitted a patient with lower limb cellulitis. The researcher also followed up on a daily basis with the admitting wards to identify any eligible cases that may have been missed.

### **5.4 Case Definition**

#### **5.4.1 Inclusion Criteria**

- i. Age above 18 years
- ii. Clinical diagnosis of lower limb cellulitis by the standard features [1,2]

- iii. Admission within the last 24 hours
- iv. Informed consent

#### 5.4.2 Exclusion Criteria

- i. Failure to consent

### 5.5 Control Definition

Controls were selected from patients admitted with acute medical or surgical conditions other than cellulitis within 24 hours of the case admission, matched for age and gender with the respective case. Age matching was within a range of 5 years maintained as close as possible to the case's age. Only those controls failing to consent were excluded and replacements were sought.

### 5.6 Sample Size Determination

The sample size was determined using EPI INFO 2005 ver. 3.3.2 epidemiology software, based on the following assumptions as determined by the literature review.

- i. Risk factor frequency of 25% for toe web intertrigo
- ii. Relative risk 2.5
- iii. Two sided significance level 0.05
- iv. Power 80%
- v. Ratio of 1:1

Based on this calculation a sample size of 94 cases and controls each, was required to detect a difference between the cases and controls, thus this study sampled 94 cases and one control for each. All the data collected was found suitable for analysis.

### 5.7 Data Collection

A researcher-designed questionnaire was administered by the research assistants or the primary researcher to all consenting cases and controls immediately upon recruitment. A general physical examination followed whose findings were recorded in the questionnaire, noting any co-morbidity and any identifiable precedents to the cellulitis. All patients examined by the research assistants were reviewed by the primary

researcher within 24 hours of admission. Other diagnoses for cases or controls were recorded as established by the Senior House Officers in the respective wards.

Toe web examination was conducted on the ipsilateral limb and findings dichotomised into normal or abnormal. The specific definition of abnormality for this study was any macroscopic interruption of the toe web skin due to fissuring, ulceration, desquamation, or injury based specifically on the physical appearance of the skin. For controls the same limb as the matched case was examined and the toe web findings were recorded as described above.

Since the study hospital is a referral hospital, it was probable that some of the patients presenting would have taken antibiotics. Prior antibiotic use was recorded where proof was available such as referral letters or if the patient had any of the remaining medications taken with them and they were clearly identifiable.

## 5.8 Laboratory Analyses

All the patients recruited had their Total Blood Counts and Random Blood Sugar determined in the Kenyatta National Hospital laboratory, while counselling and testing for HIV was conducted as per the established hospital protocol. Normal values were as provided by the KNH laboratories as shown below.

Parameter	Normal Range
<b>Total WBC count</b>	4-11x10 <sup>9</sup> /L
<b>Neutrophils (%)</b>	40% - 75%
<b>Haemoglobin</b> <b>Male</b>	11.5 – 16 g/dL
<b>Female</b>	12 – 18g/dL
<b>Random Blood Sugar</b>	3.3 – 7.8 Mmol/L

## **5.9 Data Analysis Methods**

Data was analysed using a computer software SPSS ver. 14.0. Descriptive statistics were done for both continuous and categorical data. Measures of central tendency and dispersion were used for continuous data and proportions and frequencies were used for categorical data. Odds ratios were calculated. Chi-squares tests were used to determine significant differences between nominal variables and independent t-test was used for continuous data.

## **5.10 Ethical Considerations**

Approval was obtained from the joint Kenyatta National Hospital/University of Nairobi Ethical Review Committee (KNH/UON-ERC) prior to commencing the study. Informed consent was obtained from each individual prospective case and each prospective control, as per the consent form in appendix 2. In addition standard pre and post test counseling for the HIV test was offered to all the participants as per the current KNH Provider Initiated Counseling and Testing (P.I.C.T) protocol. All participants (cases or controls) found to be HIV positive during the study were referred to the KNH Comprehensive Care Centre for free staging, adherence counseling, continued supportive counseling, and where appropriate free anti-retroviral treatment services, as offered at the centre.

The prospective participants were taken through the consent process highlighting the following issues regarding the study;

1. Introduction of the researcher and nature of the study.
2. The purpose of the study.
3. The procedures of the study including full details of all the laboratory tests to be undertaken.
4. That participation was voluntary and no consequences would result from not participating in the study.
5. All benefits of the study.

6. Assuring open communication between the participants and the researcher during the period of study by offering the researcher's mobile phone contact.
7. That the participants would have full access to the results of the physical examination and their laboratory test results.
8. That standard therapeutic interventions as per accepted standards of practice would be advised where need arose.
9. Confidentiality would be maintained and all study materials would be handled with due discretion.



## 6.0 RESULTS

Data from all the 94 recruited cases and corresponding controls was analysed

### 6.1 Demographic Characteristics

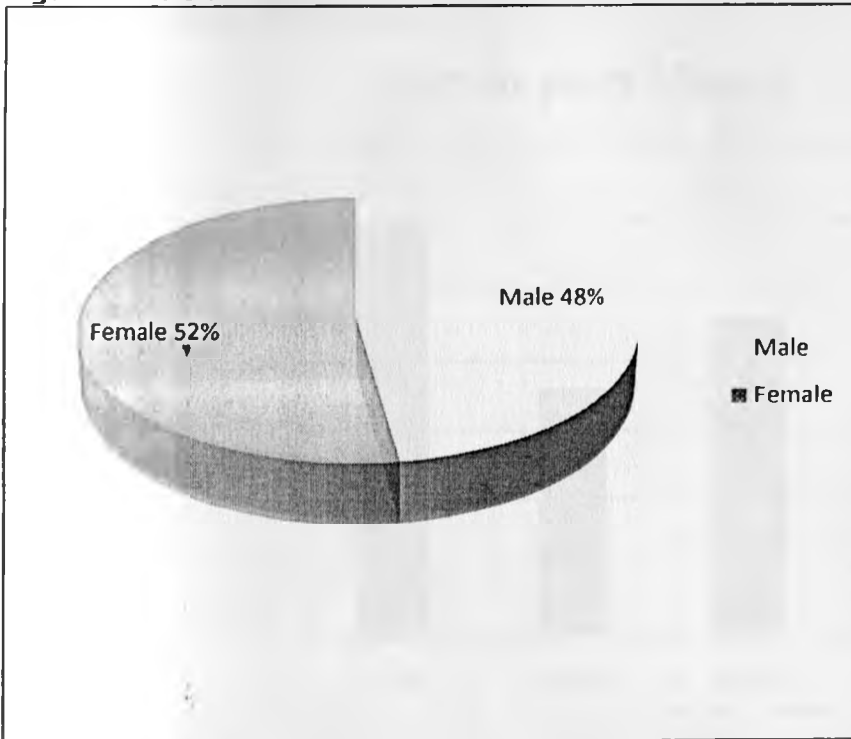
#### 6.1.1 Sex

**Table 6.1: Sex Distribution of the Cases and Controls**

Sex	Status		Total	p value
	Case	Control		
Male	45 (47.9%)	45 (47.9%)	90	0.59
Female	49 (52.1%)	49 (52.1%)	98	
<b>Total</b>	<b>94 (100%)</b>	<b>94 (100%)</b>		

p-value for sex was 0.59.

**Figure 6.1: Sex distribution of the cases**



Females were more than males. The male:female ratio was 1:1.08

## 6.1.2 Age Distribution

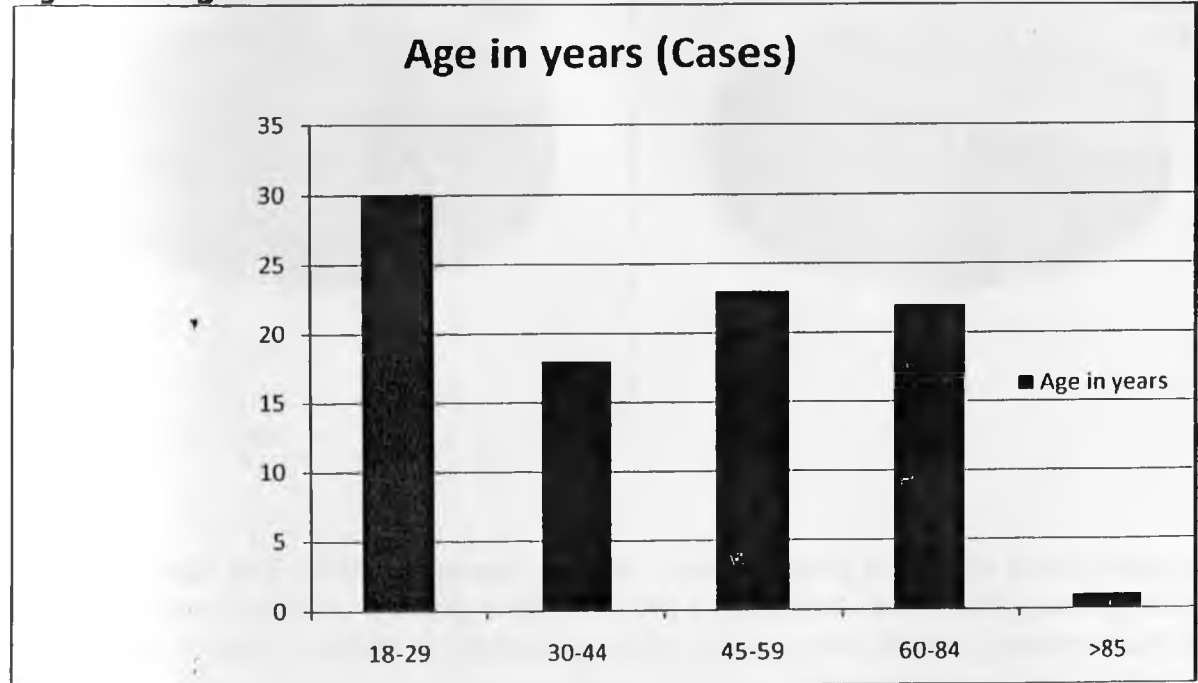
**Table 6.2 Age Summary**

Status	Case	Control	p-value
Mean Age (SD)	43.33 (19.18)	41.8 (18.84)	0.584

**Table 6.3 Age Distribution (Cases)**

Age Range	Frequency (%)
18-29	30 (31.9%)
30-44	18 (19.2)
45-59	23 (24.5%)
60-84	22 (23.4%)
>85	1 (1.1%)
<b>Total</b>	<b>94 (100%)</b>

**Figure 6.2 Age Distribution**



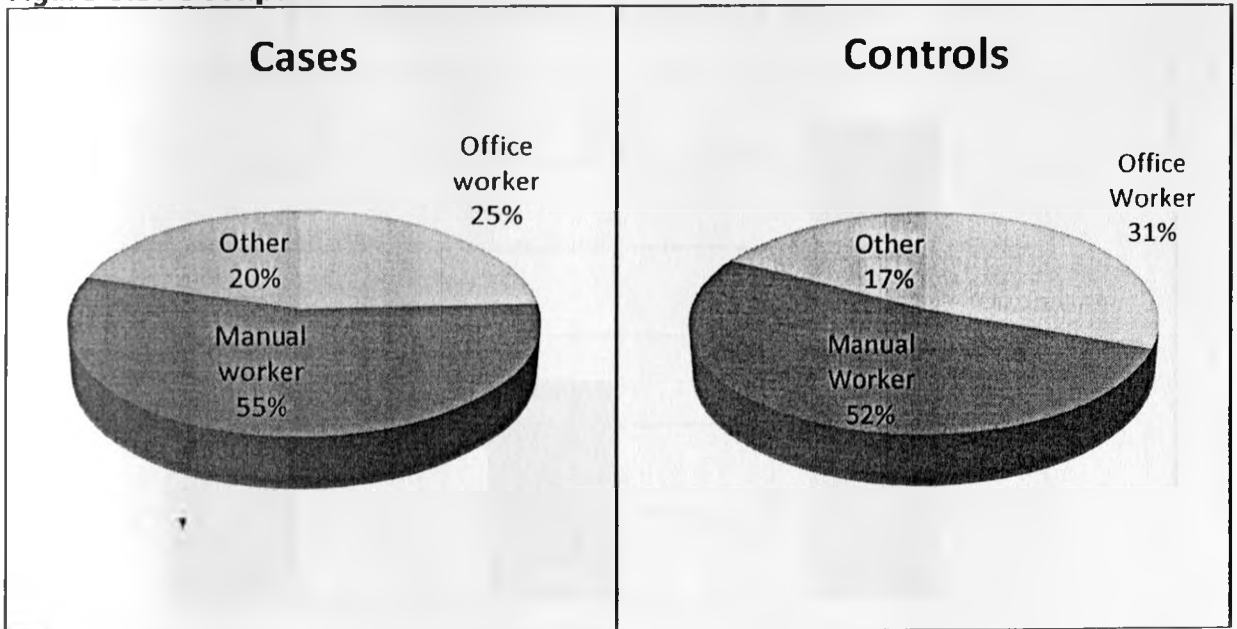
The mean age for cases was 43.3 and for controls 41.8. The p-value was 0.584. Age ranged from 18 to 88 years. About half the patients (51.1%) were below the age of 45 years, and the other half above. For cases 75.6% were below age 60 years.

### 6.1.3 Occupation

**Table 6.4: Occupation**

Category	Status		Total	p-value
	Case	Control		0.660
Office worker	23 (24.5%)	29 (30.9%)	52 (27.7%)	
Manual worker	52 (55.3%)	49 (52.1%)	101 (53.7%)	
Other	19 (20.2%)	16 (17%)	35 (18.6%)	
<b>Total</b>	<b>94 (100%)</b>	<b>94 (100%)</b>	<b>188 (100%)</b>	

**Figure 6.3: Occupation**



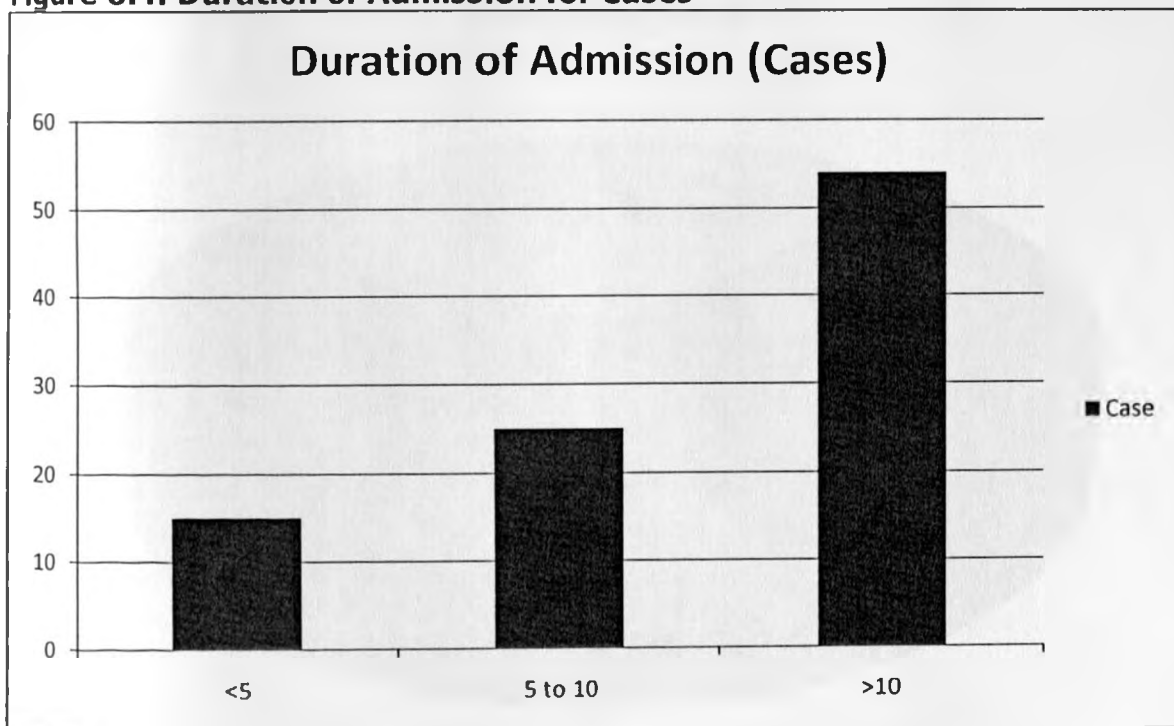
For both cases and controls manual workers predominated at 55.3% among cases and 53.7% among controls. Overall 18.6% of the participants were categorised as other which were mainly students and retired workers. The p value for occupation was 0.66.

## 6.2 Duration of Admission

**Table 6.5: Duration of Admission (DOA)**

DOA (days)	Case	Control	p-value
<5	15 (16%)	7 (7.4%)	0.151
5-10	25 (26.6%)	32 (34%)	
>10	54 (57.4%)	55 (58.5%)	
Total	94 (100%)	94 (100%)	
Mean DOA (SD)	20 (27.89)	17 (15.2)	0.433

**Figure 6.4: Duration of Admission for Cases**



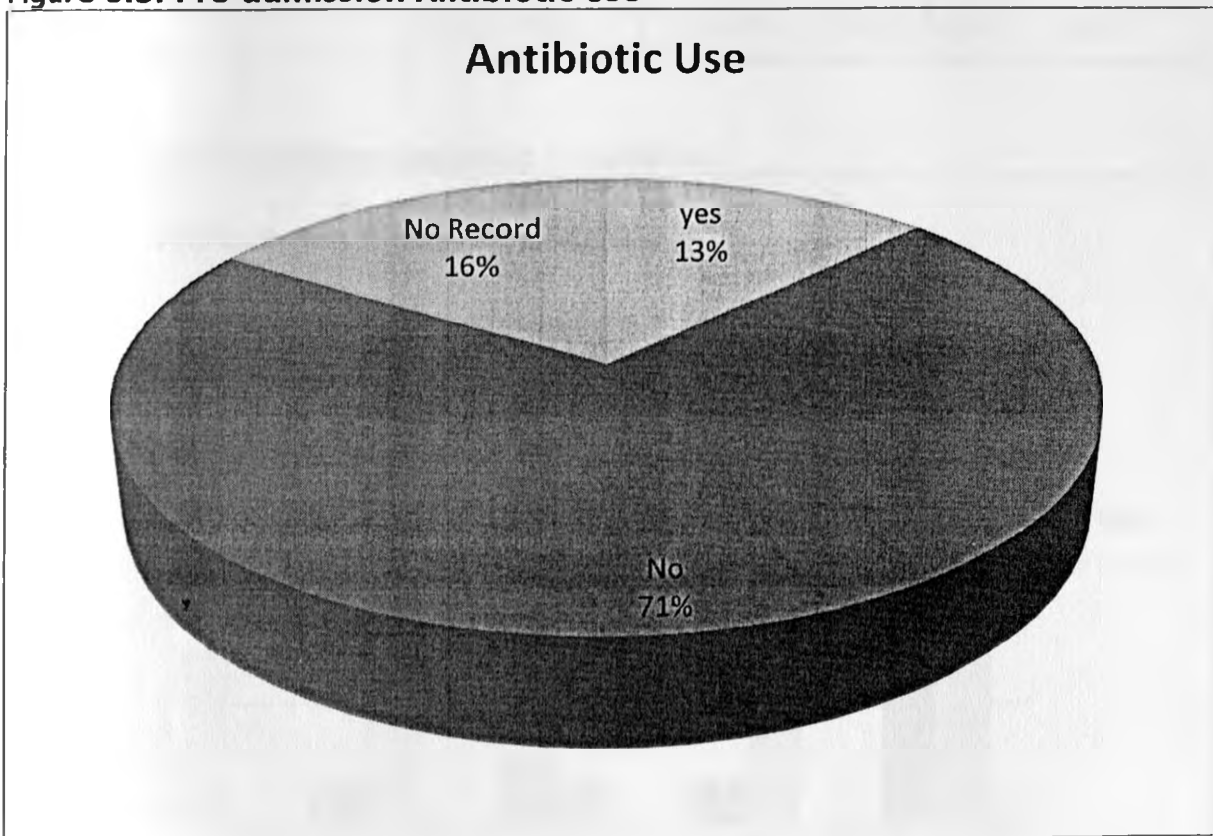
The majority of cases were admitted for more than 10 days (57.4%). The mean duration of admission for cases was 20 days while for controls it was 17 days. The p-value was 0.433.

### 6.3 Pre-admission Antibiotic Use

**Table 6.6: Pre-admission Antibiotic Use**

Status	Number of cases	Percentage
Yes	12	12.8
No	67	71.2
No record	15	16
<b>Total</b>	<b>94</b>	<b>100</b>

**Figure 6.5: Pre-admission Antibiotic Use**



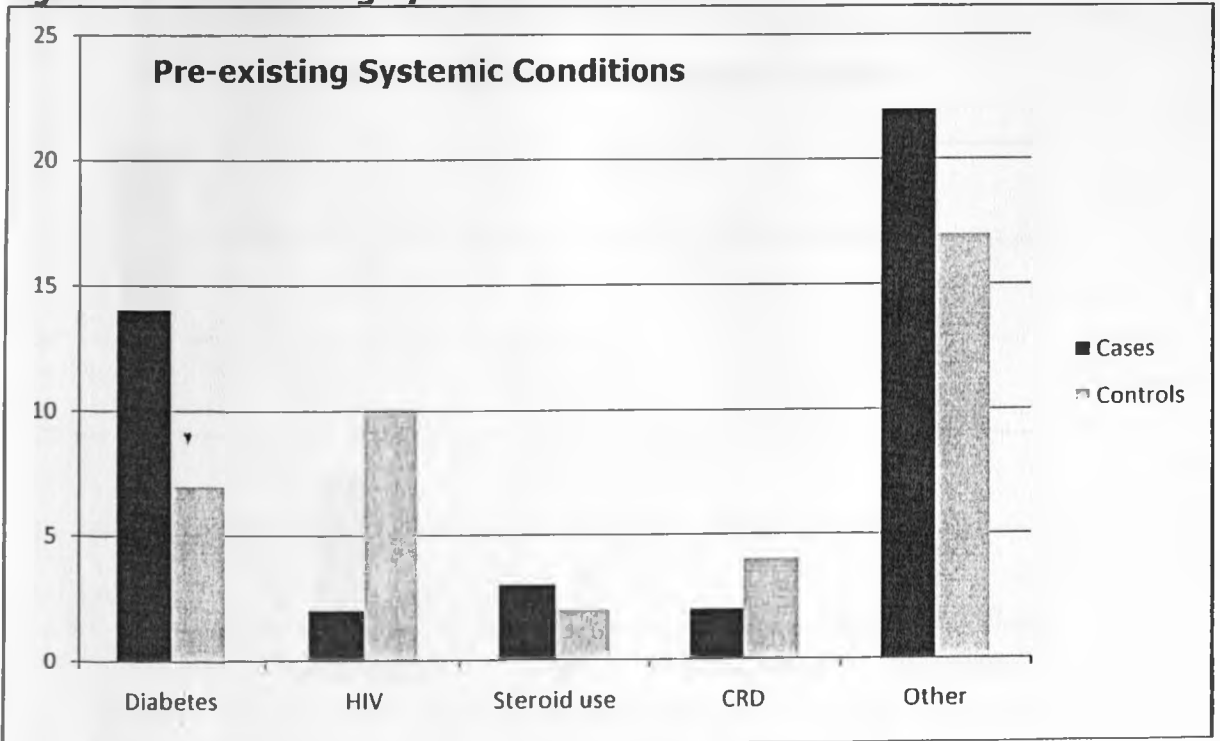
Majority of the cases (71%) had not used any antibiotics prior to presentation at KNH. 16% indicated taking medications possibly including antibiotics but no proof was available. 12.8% had taken antibiotics and had supporting documentation.

## 6.4 Pre-existing Systemic Conditions

**Table 6.7: Pre-existing Conditions**

Pre-existing condition	Status		O.R (95%CI)	p value
	Case	Control		
Diabetes	14 (14.9%)	7 (7.4%)	2.2 (0.8–5.7)	0.105
HIV	2 (2.1%)	10 (10.6%)	0.2 (0-0.7)	0.017
Steroid use (>2 weeks)	3 (3.2%)	2 (2.1%)	1.5 (0.2-9.3)	0.65
Chronic renal disease	2 (2.1%)	4 (4.3%)	0.5 (0.1-2.7)	0.407
Other	22 (23.4%)	17 (18.1%)	1.4 (0.7-2.8)	0.39

**Figure 6.6: Pre-existing Systemic Conditions**



CRD= Chronic Renal Disease

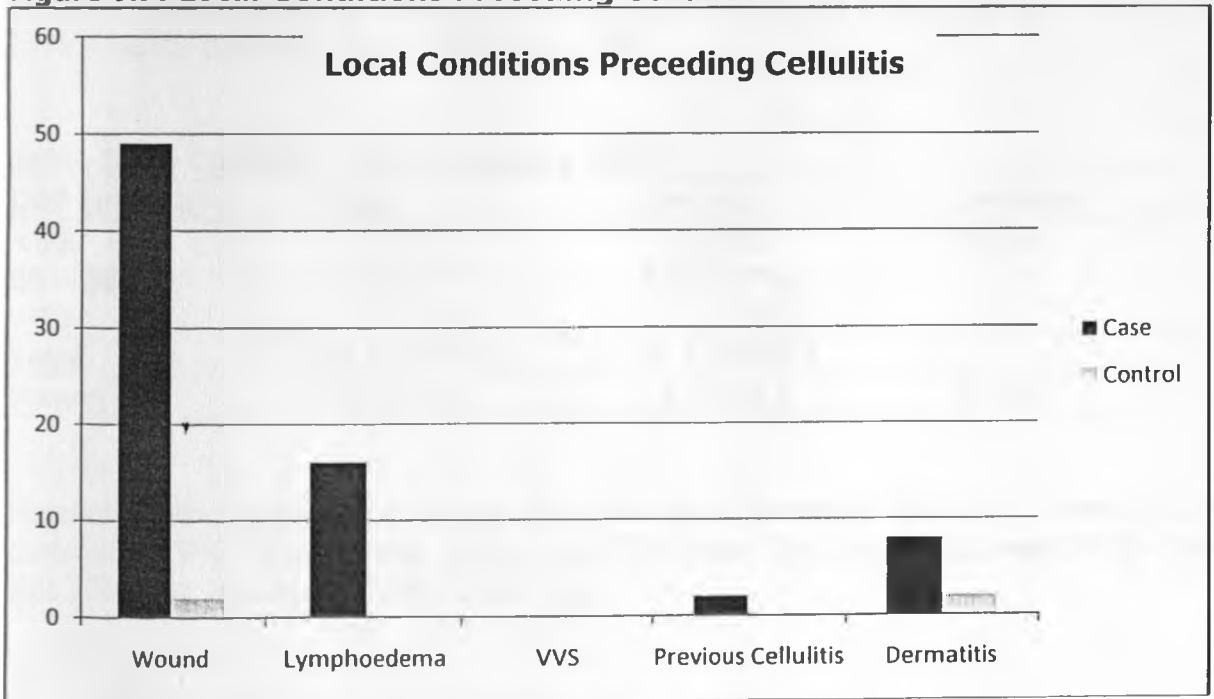
The majority of systemic conditions were in the others category for both cases (23.4%) and controls (18.1%), which were mostly hypertension and few malignancies. Diabetes was the most common systemic disease among the cases (14.9%). The p-value for HIV was 0.017.

## 6.5 Conditions on the Affected/Matched Lower Limb Preceding the Cellulitis

**Table 6.8: Local Conditions Preceding Cellulitis**

Condition	Status		O.R (95%CI)	p value
	Case	Control		
Wound/ulcer/injury	49 (52.1%)	2 (2.1%)	50.1 (11.7-215.3)	<0.001
Lymphoedema	16 (17%)	0	-	<0.001
Varicose vein surgery	0	0	-	
Previous lower limb cellulitis	2 (2.1%)	0	-	0.155
Dermatitis	8 (8.5%)	2 (2.1%)	4.3 (0.9-20.7)	0.051

**Figure 6.7: Local Conditions Preceding Cellulitis**



VVS=Varicose Vein Surgery

The majority of cases (52%) had a wound or other injury preceding cellulitis. This was followed by lymphoedema (17%) and dermatitis (8.5%). There were no patients who had undergone varicose vein surgery. P-values were <0.001 for wounds/injury and lymphoedema respectively. The p-value for dermatitis was 0.051 and for previous lower limb cellulitis 0.155.

## 6.6 Examination Findings

### 6.6.1 Blood Pressure

**Table 6.9: Systolic Blood Pressure (SBP) Distribution**

<b>SBP (mmHg)</b>	<b>Case</b>	<b>Control</b>	<b>p-value</b>
<90	0	6 (6.4%)	0.026
90 – 140	77 (81.9%)	77 (81.9%)	
>140	17 (18.1%)	11 (11.7%)	
<b>Total</b>	<b>94 (100%)</b>	<b>94 (100%)</b>	
<b>Mean (SD)</b>	<b>123 (21.56)</b>	<b>117 (20.53)</b>	<b>0.037</b>

The majority of patients both cases and controls had normal systolic blood pressure (81.9%) respectively. The mean systolic blood pressure for cases was 123 mmHg, and 117mmHg for controls. The p-value was 0.037.

**Table 6.10: Diastolic Blood Pressure (DBP)**

<b>DBP (mmHg)</b>	<b>Case</b>	<b>Control</b>	<b>p-value</b>
<60	7 (7.4%)	9 (9.6%)	0.838
60 – 90	76 (80.9%)	73 (77.7%)	
>90	11 (11.7%)	12 (12.8%)	
<b>Total</b>	<b>94 (100%)</b>	<b>94 (100%)</b>	
<b>Mean (SD)</b>	<b>77 (14.4)</b>	<b>73 (14.6)</b>	<b>0.108</b>

Majority of the cases had normal diastolic blood pressure (80.9%), similar to the controls (77.7%). The p-value was 0.838. The mean diastolic blood pressure for cases was 77mmHg, and for controls 73 mmHg.



## 6.6.2 Pulse Rate

**Table 6.11: Pulse Rate**

<b>Pulse Rate</b>	<b>Case</b>	<b>Control</b>	<b>p-value</b>
<b>Low</b>	3 (3.2%)	3 (3.2%)	1.0
<b>Normal</b>	68 (72.3%)	68 (72.3%)	
<b>High</b>	23 (24.5%)	23 (24.5%)	
<b>Total</b>	<b>94 (100%)</b>	<b>94 (100%)</b>	
<b>Mean (SD)</b>	<b>92 (20.43)</b>	<b>90 (20.56)</b>	0.594

Most of the cases and controls (72.3%) respectively had normal pulse rates.

## 6.6.3 Body Temperature

**Table 6.12: Body Temperature**

<b>Body Temperature</b>	<b>Case</b>	<b>Control</b>	<b>p-value</b>
<b>Low</b>	31 (33%)	49 (52.1%)	<0.001
<b>Normal</b>	24 (25.5%)	34 (36.2%)	
<b>High</b>	39 (41.5%)	11 (1.7%)	
<b>Total</b>	<b>94 (100%)</b>	<b>94 (100%)</b>	
<b>Mean (SD)</b>	<b>37 (0.858)</b>	<b>36.6 (1.38)</b>	0.001

Among the cases 41.5% had elevated body temperature, while 33% had normal. The p-value for body temperature was <0.001. The mean temperature for cases was 37°C and for controls 36.6°C. The p-value was 0.001.

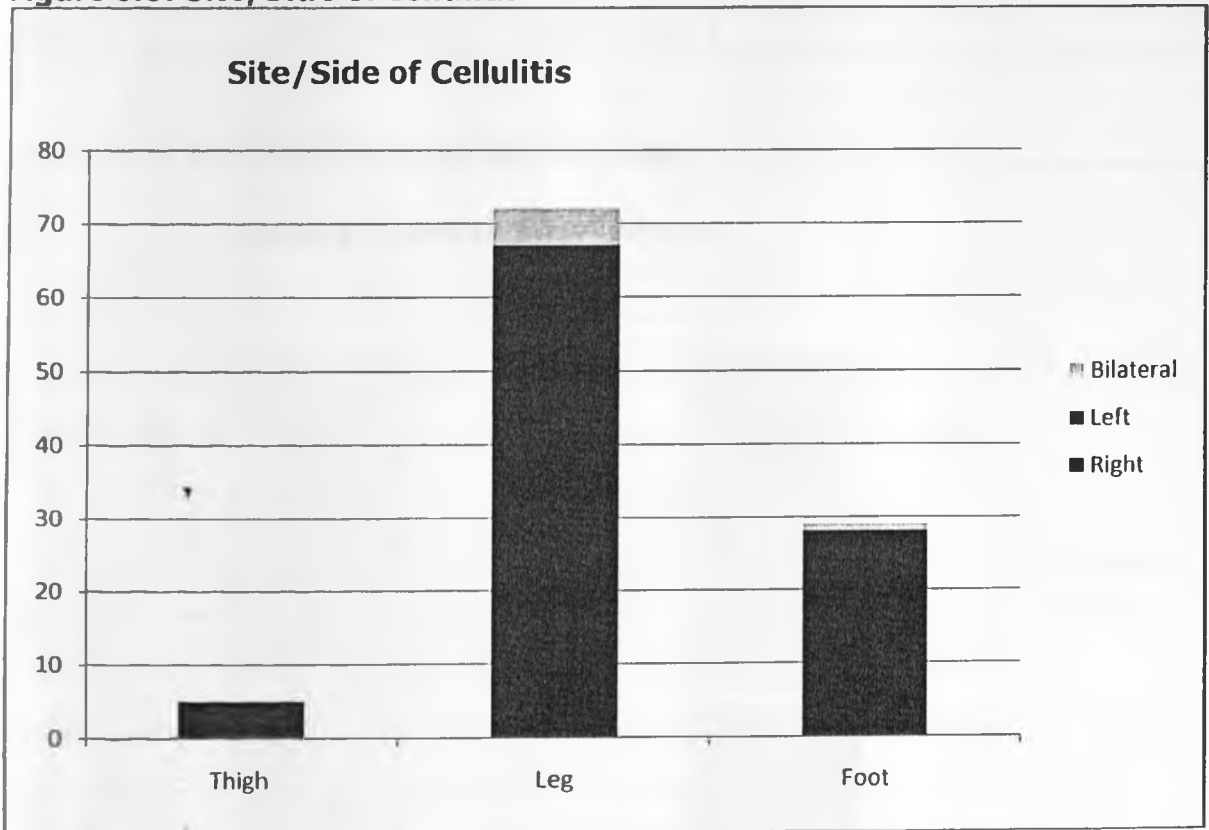
## 6.7 Site(s) of Cellulitis

**Table 6.13 Site/Side of Cellulitis**

Site	Thigh			Leg			Foot		
Side	Right	Left	Bilat	Right	Left	Bilat	Right	Left	Bilat
	3 (3.2%)	2 (2.1%)	0	35 (37.2%)	32 (34%)	5 (5.3%)	19 (20.2%)	9 (9.6%)	1(1.1%)
<b>Total</b>	<b>5 (5.3%)</b>			<b>72 (76.6%)</b>			<b>29 (30.9%)</b>		

Bilat=Bilateral

**Figure 6.8: Site/Side of cellulitis**



The leg was the commonest site of cellulitis (76.6%) followed by the foot (30.9%). The disease involved both the right and left sides equally at a total of 45.7% for each.

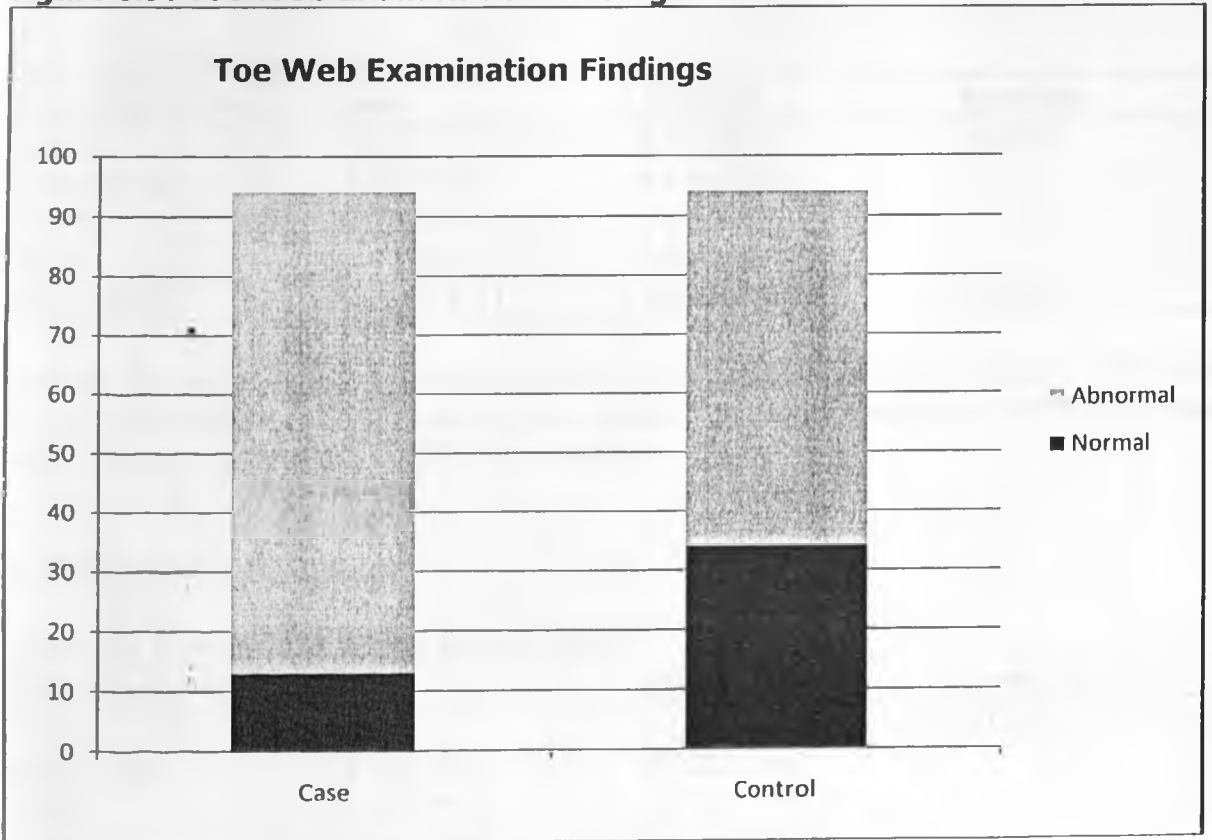
## 6.8 Toe Web Examination Findings

This summary categorises a case or control normal if no abnormality was noted in any of the toe webs. If one or more toe webs had abnormal skin, this case or control was categorised 'abnormal' and if all toe webs were normal, the assigned category was 'normal'.

**Table 6.14 Toe Web Examination Findings**

Exam findings	Case	Control	O.R (95%CI)	p-value
Normal	13 (13.8%)	34 (36.2%)	3.5 (1.7-7.3)	<0.001
Abnormal	81 (86.2%)	60 (63.8%)		
<b>Total</b>	<b>94 (100%)</b>	<b>94 (100%)</b>		

**Figure 6.9: Toe Web Examination Findings**



Abnormal toe webs predominated among the cases (86.2%). The p-value was <0.001.

## 6.9 Haemogram Results

### 6.9.1 Total White Blood Cell Count

**Table 6.15: Total White Blood Cell Count (TWBC)**

<b>TWBC (<math>\times 10^9/L</math>)</b>	<b>Case</b>	<b>Control</b>	<b>p-value</b>
<4	1 (1.1%)	6 (6.4%)	<0.001
4 - 11	19 (20.2%)	54 (57.4%)	
>11	74 (78.7%)	34 (36.2%)	
<b>Total</b>	<b>94 (100%)</b>	<b>94 (100%)</b>	
<b>Mean (SD)</b>	<b>15 (6.27)</b>	<b>9.78 (4.95)</b>	<0.001

Majority of the cases had high white cell count (78.7%). The mean total white cell count for cases was  $15 \times 10^9/L$  and for cases  $9.78 \times 10^9/L$ . The p-value was <0.001

### 6.9.2 Neutrophils (%)

**Table 6.16: Neutrophils (%)**

<b>Neutrophils (%)</b>	<b>Case</b>	<b>Control</b>	<b>p-value</b>
<40%	2 (2.1)	5 (5.3%)	<0.001
40%-75%	22 (23.4%)	61 (64.9%)	
>75%	70 (74.5%)	28 (29.8%)	
<b>Total</b>	<b>94 (100%)</b>	<b>94 (100%)</b>	
<b>Mean (SD)</b>	<b>77.5 (13.4)</b>	<b>65.4 (15.7)</b>	<0.001

Majority of the cases had a neutrophil differential count of >75% (74.5%). The p-value for the differential neutrophil count was <0.001. The mean neutrophil differential count was 77.5% for cases and 64.5% for controls.

## 6.10 Random Blood Sugar

**Table 6.17: Random Blood Sugar (RBS)**

<b>RBS (Mmol/L)</b>	<b>Case</b>	<b>Control</b>	<b>p-value</b>
<3.3	0	1 (1.1%)	0.013
3.3 – 7.8	65 (69.1%)	80 (85.1%)	
>7.8	29 (30.9%)	13 (13.8%)	
<b>Total</b>	<b>94 (100%)</b>	<b>94 (100%)</b>	

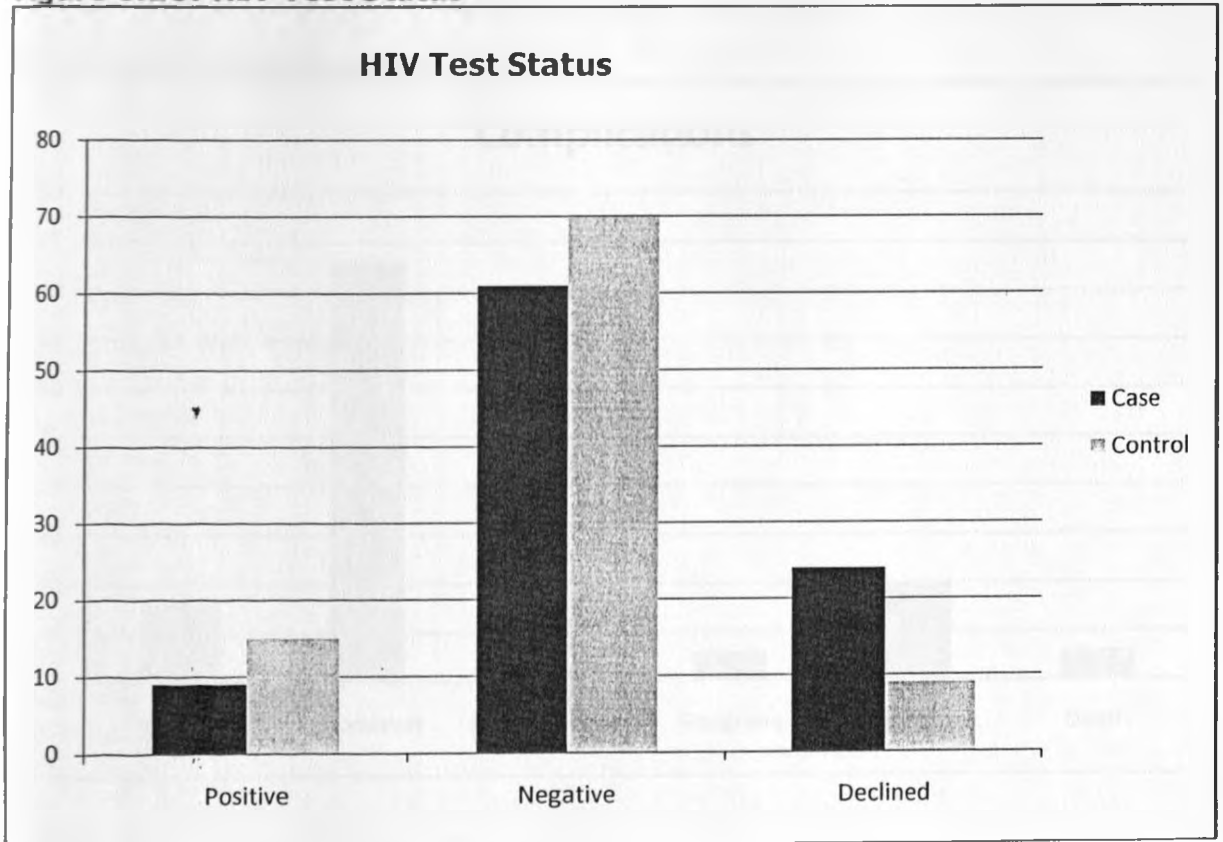
Majority of the cases (69.1%) and controls (85.1%) had normal blood sugar. Among the cases 30.9% had elevated RBS, while for controls 13.8% had elevated RBS. P-value was 0.013

### 6.11 HIV Test

**Table 6.18: HIV Test Status**

Status	Case	Control	O.R (95%CI)	p value
Positive	9 (9.6%)	15 (16%)	0.7 (0.3-1.7)	0.011
Negative	61 (64.9%)	70 (74.5%)		
Declined	24 (25.5%)	9 (9.6%)		
<b>Total</b>	<b>94 (100%)</b>	<b>94 (100%)</b>		

**Figure 6.10: HIV Test Status**



There were 9 HIV positive patients among the cases (9.6%) and 15 among the controls (16%). HIV negative patients were 64.9% among cases and 74.5% of the controls.

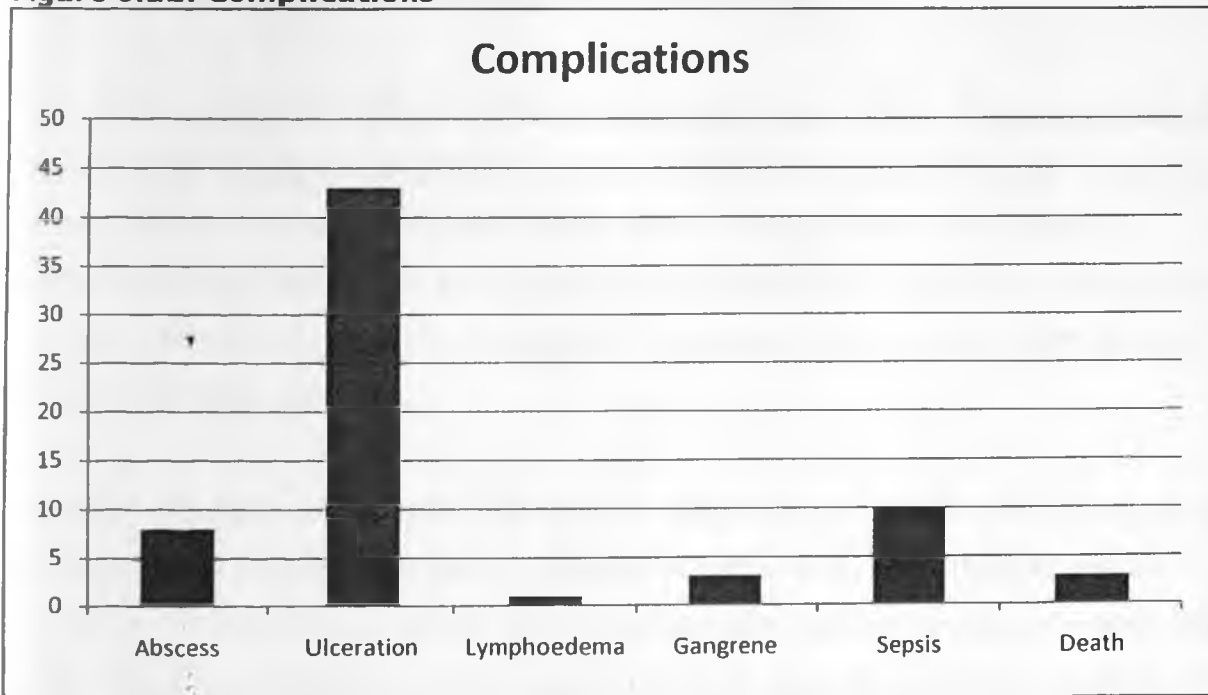
More of the cases declined the HIV test (25.5%), than the Controls (9.6%). The p-value for HIV was 0.011.

## 6.12 Complications

**Table 6.19: Complications**

Complication	Frequency	Percentage (n=94)
Abscess	8	8.5
Ulceration	43	45.7
Lymphoedema	1	1.1
Gangrene	3	3.2
Sepsis	10	10.6
Death	3	3.2
Other	0	0

**Figure 6.11: Complications**



Overall 54.2% of the cases developed complications. The most frequent complication was ulceration 45.7%, followed by sepsis 10.6%, then abscess 8.5%. Three patients (3.2%) died and a similar number developed gangrene.

## **7.0 DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS**

A total of 94 cases of cellulitis were recruited into this study with a corresponding number of matched controls.

### **7.1 Patient Characteristics**

The study found that the majority of patients with cellulitis were young, with 50% below the age 45, the mean age was 43.3 years. Three quarters of the patients were below the age 60 years. This depicts that cellulitis affects a younger population as seen in KNH compared to the UK where a mean age of 57.7 was found [26], and also compared to a mean age of 59 in a European multi-centre study [9]. In Canada however Dong et al. found a mean age of 46 years [30], similar to this study in KNH. Though some studies have found a preponderance of males presenting with cellulitis [29,30], this study found a male to female ratio of 1:1.08. Equal male to female distribution was also found by Rojeau et al. in France [9].

Most of the cases and controls in this study were manual workers. This may reflect the fact that KNH is a public hospital serving the middle class and lower social strata who would mostly be in skilled and semi-skilled manual employment. This is further evidenced by the similarity in the occupation distributions for cases and controls given the study criteria did not match occupation. Occupation had  $p=0.660$  which did not attain statistical significance.

The mean duration of admission was 20 days which was in contrast with Corwin et al. [28] who had a mean admission of 7.4 days, though Corwin et al. defined specific criteria for discharge from hospital which may partially account for the difference. Other studies have found a duration of admission of 5 to 10 days [3,6,14]. The duration of hospital stay therefore was longer in this study suggesting probably severer disease was managed or there may be significant differences in discharge criteria for lower limb cellulitis between other centres and KNH.

Only 13% of the cases in the study had used antibiotics prior to admission. In Corwin's study [28] 70% of the patients had taken oral antibiotics prior to presentation in hospital. This was equivalent to the proportion of patients who categorically stated they had not had any prior therapy in this KNH study. Lazzarini in Italy found 43% of patients admitted with cellulitis had prior oral antibiotic use [29]. This fact may be explained by differences in health seeking behaviour, or in the healthcare organisation of different countries. In Western countries patients will mostly see a general practitioner at the onset of symptoms who prescribes oral antibiotics and only being referred to hospital if subsequent progress is unsatisfactory. In KNH however it is highly likely that the 71% of patients who were antibiotic naive were presenting their symptoms of cellulitis at KNH as their first visit to any healthcare facility for that particular illness.

## **7.2 Risk Factors**

The study investigated risk factors for cellulitis of the lower limb at three levels. One was pre-existing systemic disease, local limb disease and specific examination of toe webs for abnormalities of the integument. Of the prior known systemic diseases only HIV had a statistically significant association with lower limb cellulitis ( $p= 0.017$ ). The Odds Ratio was however low at 0.2 (95%CI 0-0.7). Roberto found 67 cases of cellulitis in 2221 HIV positive patients over a ten year period [34]. Roberto et al. studied cellulitis anywhere in the body and in fact found majority involved the limbs though they did not analyse further to separate the upper and lower limbs. Though achieving statistical significance in the current study, a prior identified positive HIV status was known in only 2.1% of the cases. After testing 9.6% of all the cases were HIV positive even though 25.5% declined. The odds Ratio after testing remained low at 0.7 (95%CI 0.3-1.7). HIV infection therefore emerged in this study as a risk factor for lower limb cellulitis with a low odds ratio.



It is notable that the study did not find a statistically significant difference for diabetes between the cases and controls ( $p=0.105$ ). The odds ratio was 2.2 (95%CI 0.8-5.7). Similar findings were made by Bjornsdottir et al. O.R 0.95 (95%CI 0.46-2.00) [1], and by Dupuy et al. [3] O.R 1.7 (95%CI 0.8-3.5). The study thus confirms that diabetes mellitus is not an independent risk factor for cellulitis of the lower limb.

Of the local conditions on the affected lower limbs, wounds/ulcers/injuries, as well as dermatitis, lymphoedema and previous lower limb cellulitis were found to have statistically significant differences between the cases and controls (table 6.8). No cases of varicose vein surgery were found in the study. Odds ratios were calculated for wound/ulcer/injury and dermatitis but for the other conditions it was not statistically possible since no incidences of the same were identified among the controls. Wound/ulcer/injury had the highest odds ratio at 50.1 (95%CI 11.7-215.3) in the current study. Lymphoedema was noted in a previous study to have the highest Odds Ratio of 71.2 (95%CI 5.6-908) [1].

The study had a higher odds ratio for leg wound/ulcer/injury than other studies, Bjornsdottir et al. [1] O.R 7.02 (95%CI 3.37-14.63) and Dupuy et al. [3] O.R 20.6 (95%CI 6.7-63) for leg ulcer. Notably there was a big age difference between the subjects in all three studies. The current study had a mean age of 43.3 years, Dupuy et al. 56.5 years and Bjornsdottir et al. 66.5 years. In the latter study therefore the study population was much older and therefore less given to activities predisposing to injury. The age difference thus explains the progressive prominence of local limb ulcer as a risk factor for lower limb cellulitis with decreasing age of the study subjects from 66.5 years (OR 7.02) through 56.5 years (OR 20.6) to the current 43.3 years (OR 50.1).

Dermatitis emerged as the second most prominent risk factor for lower limb cellulitis in the study, with an O.R 4.3 (95%CI 0.9-20.7). Previous studies had similar findings with O.R 3.6 (95%CI 2.03-7.90) [2], and O.R 4.00 (95%CI 2.03-7.90) for dry skin and O.R 1.83 (95%CI 0.86-3.88) for stasis dermatitis respectively [1]. The toe web examination

In the study identified 86% of the cases with abnormal toe web integument and 63.8% of the controls ( $p < 0.001$ ). The finding of 63.8% of controls having at least one abnormal toe web implies the presence of significant subclinical toe web disease in the community. Similarly Chan et al. [13], found 64% prevalence of athlete's foot in a Chinese population. Mycological analyses were not done in the current study.

Toe web intertrigo attained statistical significance ( $p < 0.001$ ) and the O.R 3.5 (95%CI 1.7-7.3). Other studies had comparable findings O.R 5.35 (95%CI 2.73-10.48) [1], and O.R 6.6 (95%CI 4.2-10.5) [2]. In one previous study [1], bacterial and mycological cultures of abnormal toe webs of the patients with lower limb cellulitis were carried out and the statistical analysis done per category of culture result. It emerged from that study that the abnormal toe web colonised by *Staph aureus* or Beta Haemolytic *Streptococci* carried a higher risk of lower limb cellulitis O.R 28.07 (95%CI 8.71-90.24). This kind of analysis was not done in the current study.

### **7.3 Location and complications**

The commonest site of cellulitis was the leg (76.6%). The leg has been found to be the commonest site of cellulitis of the whole body, 66% [29] and 48% [30]. This study shows that even on the lower limb specifically, the leg is the commonest site of cellulitis. The most frequent complication in the study was ulceration (45.7%). This included only ulcers in which the full depth of the skin was denuded. Sepsis occurred in 10.6% of the patients. Some authors have concluded that sepsis from lower limb cellulitis is rare [2,22,24]. Cox found that 6% of patients had developed chronic lymphoedema following an episode of cellulitis after more than 6 months follow up [14]. Cox also found 2% of patients developed chronic leg ulcers on long-term follow up. The current study documents early complications of lower limb cellulitis the commonest being ulceration, sepsis, and abscess formation.

## 8.0 Conclusions

From this study the following conclusions can be made

- 8.1 Lower limb cellulitis affects the young and middle aged more than the elderly at KNH.
- 8.2 HIV positive status is associated with lower limb cellulitis.
- 8.3 Local wound/ulcer/injury is the most significant factor predisposing to lower limb cellulitis as seen at KNH.
- 8.4 Lower limb lymphoedema and dermatitis are significant factors predisposing to lower limb cellulitis.
- 8.5 Patients with lower limb cellulitis have a high incidence of toe web abnormality.
- 8.6 Toe web intertrigo is significantly associated with lower limb cellulitis at KNH.
- 8.7 Ulceration is the most common early complication of lower limb cellulitis at KNH.

## 9.0 Recommendations

- 9.1 Lower limb injuries should be managed promptly and appropriately to avoid progression to cellulitis.
- 9.2 Healthcare professionals should be sensitive to the increased risk of cellulitis in patients with lower limb oedema and dermatitis on the lower limb.
- 9.3 Health education for the HIV positive should include information on appropriate care to avoid injuries to the lower limb, proper care of any lower limb injuries and vigilance against, and management of toe web intertrigo.
- 9.4 Healthcare professionals should actively seek and manage toe web intertrigo in all patients.

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# APPENDIX

## Appendix I. Data Collection Sheet

### TOE WEB DISEASE AND LOWER LIMB CELLULITIS IN KENYATTA NATIONAL HOSPITAL

#### INSTRUCTIONS

1. Please fill in the required information in full or tick the appropriate box.
2. For controls match the limb specific enquiries with the corresponding case.
3. Label the questionnaire clearly as case or control on the top right hand corner.

#### Part A.

##### History and Demographic Data

1. Date of Admission \_\_\_\_\_

2. Date of Discharge \_\_\_\_\_

3. Inpatient Number \_\_\_\_\_

4. Gender      Male                                       Female

5. Age (yrs) \_\_\_\_\_

6. Occupation      Office worker                                       Manual worker

E.g. administrative, clerical,  
sales, teacher, shopkeeper

E.g. mason, carpenter,  
metal worker, mechanic,

7. Pre-admission antibiotic use for this episode of cellulitis

yes       no       no record

8. Pre-existing systemic conditions

YES                                      NO

Diabetes

HIV

Steroid use (>2 weeks)

Chronic renal disease

Other(specify).....



9. Conditions on the affected/matched lower limb preceding the cellulitis.

A. Any wound/ulcer/injury

Yes  (specify)..... No

B Lymphoedema

Yes  No

C Varicose vein surgery

Yes  No

D. Previous lower limb cellulitis

Yes  No

E. Dermatitis

Yes  No

### Part B.

Examination Findings

1. Bp .....Pulse.....Temp.....

2. Site(s) of cellulitis Right/Left/Bilateral (tick)

Foot  Leg  Thigh

3. Toe Web Examination

(N=Normal A=abnormal)

1<sup>st</sup> ..... 2<sup>nd</sup> ..... 3<sup>rd</sup> ..... 4<sup>th</sup> .....

4. TBC results

WBC: Total( $\times 10^9/L$ ).....

Neutrophils(%).....Eosinophils(%).....

Lymphocytes(%).....Monocytes(%).....

Platelets ( $\times 10^9/L$ ).....

Hemoglobin(g/dl).....

5. Random blood sugar (Mmol/L).....

6. HIV test

Positive  Negative  Declined

7. Complications

1. Abscess \_\_\_\_\_

2. Ulceration \_\_\_\_\_

3. Lymphoedema \_\_\_\_\_

4. Gangrene \_\_\_\_\_

5. Septicaemia \_\_\_\_\_

6. Death \_\_\_\_\_

8. None \_\_\_\_\_

9. Other (specify).....

## **Appendix II. Consent Explanation**

My name is Dr Mathenge Nduhiu, a postgraduate doctor in the department of Surgery of the University of Nairobi. My telephone contacts are 0734871144/0722843203. I request your participation in a study I am conducting titled;

### **"TOE WEB DISEASE AND LOWER LIMB CELLULITIS AT KENYATTA NATIONAL HOSPITAL"**

Please note the following regarding this study.

1. The study is about lower limb cellulitis and its associated factors in patients admitted with the disease in KNH.
2. Results of this study will benefit doctors and patients by identifying factors which may be modified to prevent the occurrence or recurrence of this condition.
3. The study will involve a physical examination, followed by taking a 4ml sample of blood for blood sugar and white cell count determination. The needle prick in a vein on the forearm is briefly painful just like any other prick, but drawing the sample is painless. Only sterile needles and syringes will be used and appropriate cleaning with an alcohol swab will be done prior to taking the sample.
4. Specific counselling before a HIV test will also be carried out and this test will only be done with your express informed consent. Knowledge of your HIV status, if you do not already know will benefit you since further counselling and treatment is currently available in KNH at no additional cost to you.
5. Your participation in this study is purely voluntary and you have the right to decline participation or withdraw from the study at any time without any consequences whatsoever.
6. Your participation in this study will not place your health at risk and will not jeopardize the care you are receiving at KNH.

### Appendix III. Consent Form (cases and controls)

English

#### Consent Form

I (name) .....hereby declare that I have voluntarily and unreservedly consented to participate in this study of lower limb cellulitis at KNH, without inducement, coercion, or undue influence of any nature whatsoever. I have fully understood that I will undergo a physical examination by the researching doctor and/or his assistant and that a blood specimen will be taken for tests relevant to the study as explained. That I have consented that my test results be shared with the other doctors treating me, and that the study, its procedures and test results will be treated with utmost confidentiality without exception, and that my identity as a participant will not be revealed to anyone without my express consent. I further understand that my participation or failure to participate in this study does not constitute any unusual health risk and will not in any way negatively impact any aspect of my care or stay at KNH. I reserve the right to cease participation in the study.

As explained to me by.....

Signed (participant) .....Date.....

Witness (name).....

Signature of witness.....Date.....

**Idhini ya utafiti**

Mimi, (jina lako)..... nimeidhinisha kwa hiari yangu mwenyewe pasina ushawishi au kulazimishwa kwa aina yoyote, kuhusika kwenye utafiti huu juu ya ugonjwa wangu hapa KNH. Nimeelewa nakukubali uchunguzi nitakaofanyiwa, nakukubali pia vipimo vyote vya maabara vinavyohusishwa kwenye utafiti huu. Nimeelewa na kukubali kwamba majibu ya utafiti nitakaofanyiwa yatajulishwa kwa madaktari watakaonitibu nikiwa hapa KNH, na kwamba hakuna mwengine yeyote atakayejulishwa juu ya majibu hayo au kuhusika kwangu ila niidhinisha mwenyewe. Zaidi nimekubali nikielewa kwamba kuhusika au kutohusika kwangu kwenye utafiti huu hakuhatarishi afya yangu kwa namna yoyote wala matibabu nitakayo pata hapa KNH, na kwamba niko huru kukomesha uhusika wangu wakati wowote.

Haya yote nimejulishwa na.....

Ni Mimi (sahihi).....Tarehe.....

Shahidi (jina).....

Sahihi ya shahidi.....Tarehe.....

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