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Complicated Skin and Soft Tissue Infection in a Nigerian Tertiary Hospital: A Review of Cases

Mue DD [1], ***Mue A*** [2], ***Denen Akaa P*** [1], ***Ahachi NC*** [1], ***Yongu WT*** .[1]

[1]*Department of Surgery, Benue State University, Makurdi- Nigeria.*
[2]*Department of Family Medicine, Benue State University Teaching Hospital, Makurdi- Nigeria.*

***Correspondence**: Mue Daniel Demesugh*
***Tel:** +2348035733261 **Email:** mue.daniel@yahoo.com*

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ABSTRACT

Background: The epidemiology of Complicated Skin and soft tissue infections with respect to causative strains and antibiotic susceptibility can no longer be predicted with accuracy. Community-acquired and healthcare-acquired strains are constantly shifting and this presents clinical challenge in the choice of empirical antibiotic therapy. **Objectives:** To determine epidemiological pattern and clinical presentation of complicated skin and soft tissue infections and to identify bacterial agents responsible and their antibiotic susceptibility pattern with the view to guide empirical therapy. **Materials and methods**: Retrospective data was obtained over a 5year period in NKST rehabilitation hospital Mkar, North-central Nigeria. Fifty one patients aged 2-75years met the criteria for inclusion. Aspirates were taken for microbiologic investigation. Data was analysed using SPSS version 21. **Result:** A total 51 patients with skin and soft tissue infections were studied. Thirty four (66.7%) were males and 17(33.3%) were females with a male: female ratio of 2:1. The commonest presenting complaint was pain in 51 patients (100%) followed by swelling in 50(98.0%) patients and Fever in 31(60.7 %) patients. The thigh was the commonest 24(47.1%) site involved. aspirate cultures yielded, Escherichia coli in 25(49.0%) patients, and Staphylococcus aureus in 14 (27.5%) patients. There was high level of resistance of isolates to Augmentin 14(27.5%) and ampicillin in 14(27.5%) patients and sensitivity to ciprofloxacin in 24(47.1%), perfloxacin in 10(19.6%), ofloxacin in 11(21.5%) and ceftriazone in 3(5.8%) patients. Post-operative complications encountered were multiple abscesses in 28(54.9%) and chronic osteomyelitis in 11(21.6%) patients. **Conclusion:** The commonest site of skin and soft tissue infection was the thigh and the commonest risk factor was trauma. Escherichia coli were the commonest organism isolated from aspirate followed by staphylococcus aurous. Successful management of complicated skin and soft tissue infections usually involves prompt recognition, resuscitation if required, timely surgical debridement or drainage, and appropriate antibiotic therapy. Findings from this study suggest that the empirical antibiotics of choice in our environment are floroquinolone followed by cephalosporin. The combination with metronidazole (anti- anaerobic agent) may be reasonable due to the fact that anaerobic culture is not routinely done in our environment.

Keywords: Skin and soft tissue infection, Bacterial agents, Antibiotic therapy, Debridement and drainage.

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INTRODUCTION

Complicated skin and soft tissue infections (cSSTIs) are the more extreme end of this clinical spectrum, encompassing a range of clinical presentations such as infections either involving deeper soft tissue or those requiring significant surgical intervention, such as infected ulcers, burns and major abscesses or a significant underlying disease state that complicates the response to treatment, presence of systemic signs of sepsis. cSSTIs also involve superficial infections or abscesses in an anatomical site such as the rectal area, where the risk of anaerobic or Gram-negative pathogen involvement is high.[1]

The vast majority of cSSTIs are caused by *S. aureus*[2] and β-haemolytic streptococci, usually Lancefield groups A, C and G, with group B occurring in diabetics and the elderly[3,4]. Rapidly spreading infections such as erysipelas, lymphangitis or cellulitis are usually caused by β-haemolytic streptococci. Other organism implicated in cSSTIs include, Pseudomonas *aeruginosa*, *Escherichia coli* and *Enterococcus* spp[3-5]

Complicated skin and soft tissue infections may be accompanied by signs and symptoms of systemic toxicity such as fever, hypothermia, tachycardia (>100 beats/min) and hypotension (systolic blood pressure <90 or 20 mmHg below baseline) [4,6] Sepsis accompanying SSTI requires prompt admission to hospital to stabilize the clinical condition of the patient and prevent progression of the disease[7]. Initial investigations should include blood cultures, full blood count and measurement of C-reactive protein, creatinine, bicarbonate and creatine phosphokinase levels[4,6]. Soft tissue cultures should be done where possible. Successful management of cSSTI involves prompt recognition, resuscitation if required, timely surgical debridement or drainage, and appropriate antibiotic therapy[1] in order to minimize the possibility of rapid spread of infection which could be fatal[4,6].

The emergence of strains with resistance to multiple agents has complicated the choice of empirical therapy; therefore, it is paramount that a local knowledge of the epidemiology and susceptibility of pathogens guides the development of antibiotic guidelines for empirical treatment[1].

The aim of this study is to determine epidemiological pattern and clinical presentation of complicated SSTIs and to identify bacterial agents responsible and their antibiotic susceptibility pattern with the view to guide empirical therapy following surgical debridement and drainage.

MATERIALS AND METHODS

This retrospective descriptive study was conducted at NKST (Nongu U Krestu u i ser U sha Tar) rehabilitation hospital Mkar, North - Central Nigeria (A faith based hospital which offers specialist orthopaedic care). It consisted of documentary review over a 5 year period from July, 2010 to June, 2015 of all patients with clinical diagnosis complicated skin and soft tissue infection who had incision , drainage and debridement upon their presentation to the hospital were included in the study. Case folders were retrieved from medical records department and data extracted and recorded on a standardized data sheet. Fifty one patients met the inclusion criteria for the study. Patients with uncomplicated skin and soft tissue infection, chronic osteomyelitis, septic arthritis and those with incomplete data were excluded from the study. The variables studied include; demographic data, clinical presentation, site affected, bacterial agent cultured, antibiotic sensitivity pattern and complications.

Aspirates were obtained from all of the affected sites using aseptic technique, and samples were sent for gram staining and microscopic culture and sensitivity (MCS). Incision, drainage and debridement was carried out on all abscesses under general anesthesia using standard technique. All loculi were broken using sinus forceps or finger fracture technique. All patients were commenced on parenteral broad spectrum empirical antibiotic therapy with 3rd generation cephalosporin and later according to sensitivity pattern where necessary. This was converted to oral when patient became apyrexic and

continued for about 3 completed weeks. Sites of incision and drainage were positioned to encourage postural drainage and daily dressing was commenced with dilute hydrogen peroxide and the cavity was packed with EUSOL soaked gauze. This was converted to alternate day dressing with honey when suppuration abated and wound was in healing phase as evidenced by the presence of healthy granulation tissue. Physiotherapy was commenced early; mobilization and frequent passive range-of-motion (PROM) exercises (in case of extremity) to the limit of pain tolerance were encouraged. The patients were followed up for about 2years in the post-operative period and all complications were recorded.

The data were analyzed using the software Statistical Package for Social Sciences for Windows version 21 (SPSS, Inc; Chicago, Illinois).

RESULTS

A total of 51 patients with skin and soft tissue infections were studied of whom 34(66.7%) were males and 17(33.3%) were females with a male: female ratio of 2:1. The age range was 2-75years with a mean age of 27.8±9.2years. Presenting symptoms in majority of patients were pain, a limp or inability to use the limb in 51 patients (100%) followed by swelling in 50(98.0%) patients and Fever in 31(60.7 %) patients.

Majority (74.5%) of patients had surgery under general anaesthesia, 8(15.7%) under local anaesthesia and 1(2.0%) patient had spinal anaesthesia. Pathology was preceded by trauma in 24(47.1) patients [vehicular accident 10(19.6%), motorcycle accident 4(7.8%), fall from height 4(7.8%), and gunshot injury 2(3.9%)] while 27(52.9) patient developed symptoms spontaneously. Thirteen (25.5%) patients had medical comorbid illnesses; six (11.8%) were diabetics, 3(5.9%) patients were hypertensive, 1(2.0%) patient had retroviral disease, 1 (2.0%) patient had sickle cell disease, 2 (3.9%) patients had hemiplegic stroke.

The thigh was the commonest 24(47.1%) site involved (figure 1); followed by the leg (calf region) 8(15.7%), foot 4(7.8%), shoulder/arm 2(3.9%), forearm 1(2.0%),

Figure 1: Clinical photograph showing swelling stretched shiny skin and hyperaemia suggesting Pyomyositis involving the right thigh which constitute the commonest anatomical site of complicated skin and soft tissue infection which constitute the second most common anatomical site of complicated skin and soft tissue infection.

Figure 2: Ruptured abscess cavity with resultant infected ulcer with slough, necrotic floor and discharge of purulent material over the anterior aspect of the right leg.

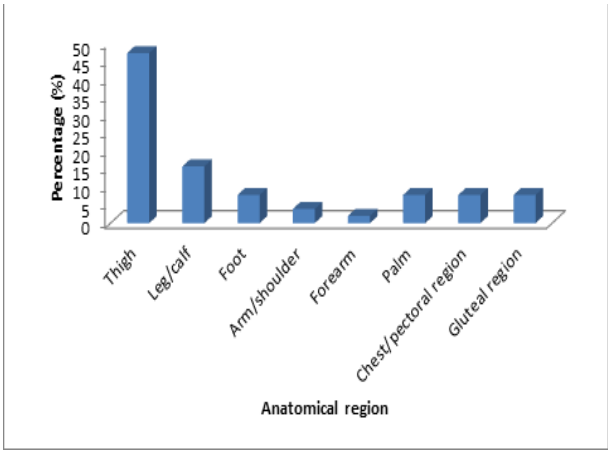

Figure 3: Bar chart showing anatomical region of complicated skin and soft tissue infection.

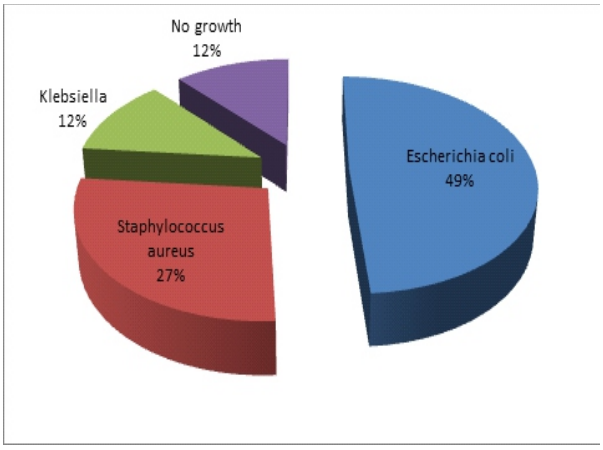

Figure 4: Pie chart showing frequency distribution of organisms cultured from aspirate culture.

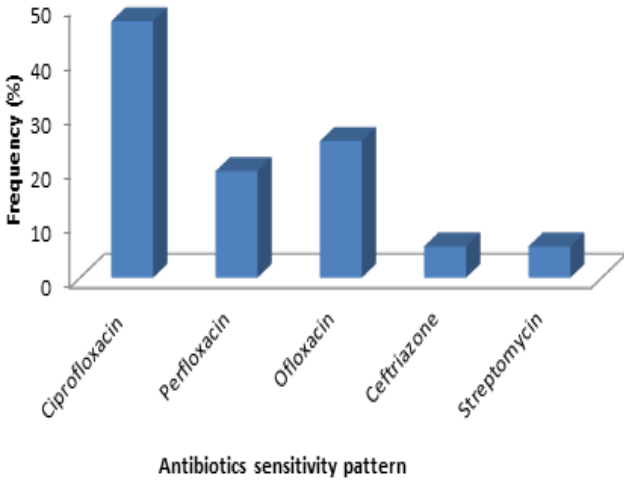

Figure 5: Bar chart showing frequency distribution of antibiotics sensitivity pattern to isolates.

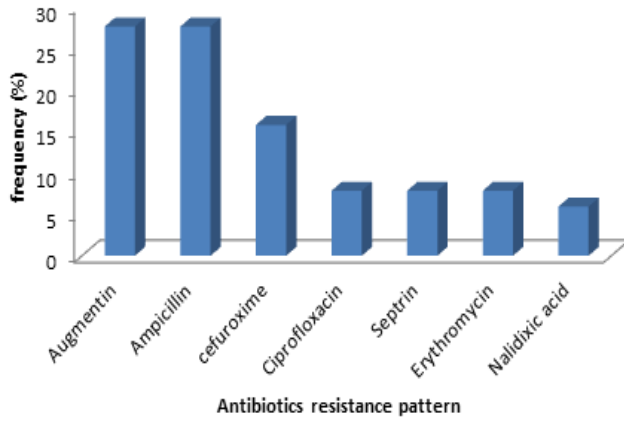

Figure 6: Bar chart showing frequency distribution of antibiotics resistance pattern to isolates.

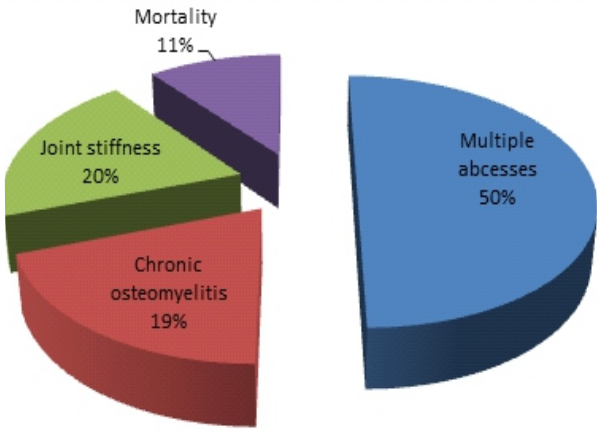

Figure 7: Pie chart showing complications of complicated skin and soft tissue infection.

palm 4(7.8%), pectoral region 4(7.8%), gluteal region 4(4.8%). Majority, 36(70.6%), of the skin and soft tissue infection occurred in the lower extremity, followed by the trunk 8(15.7%) and upper extremity 7(13.7%) as shown in figure 3.

Result of aspirate cultures yielded in, *Escherichia coli* in 25(49.0%) patients, *Staphylococcus aureus in 14(27.5%) patients,* klebsiella in 6(11.8%) patients and no growth was obtained in 6(11.8%) patients as illustrated in figure 4. Organisms were sensitive to ciprofloxacin in 24(47.1%) cases followed by perfloxacin in 10(19.6%) cases, ofloxacin in 11(21.5%) cases, ceftriazone in 3(5.8%) cases and streptomycin in 3 (5.8%) cases as shown in figure 5. Resistance to antibiotic therapy was seen with Augmentin in 14(27.5%) cases, ampicillin in 14(27.5%) cases, cefuroxime in 8(15.7%) cases, ciprofloxacin in 4 (7.8%)patients, septrin in 4(7.8%) patients, erythromycin in 4(7.8%) patients and nalidixic acid in 3(5.9%) patients as depicted in figure 6.

Post-operative complications encountered were multiple abscesses in 28(54.9%) patients, chronic osteomyelitis in 11(21.6%) patients, knee stiffness in 11(21.6%) patients and mortalities were recorded in 6 (11.8%) patients as shown in figure 7.

DISCUSSION

Presenting symptoms in majority of patients were pain, a limp or inability to use the limb in 51 patients (100%) followed by swelling in 50(98.0%) patients and Fever in 31(60.7 %) patients. Previous study by Stevens et al[8] suggested that patients who presented with signs or symptoms of systemic toxicity should undergo further evaluation to determine the need for inpatient care. Hospitalization should be considered in patients with the following laboratory findings: left shift in complete blood count with differential, elevated serum creatinine level, reduced serum bicarbonate level, elevated creatine kinase level, or C-reactive protein level greater than 13 mg per L (123.81 nmol per L).[8]

According to this study, identifiable risk factors included trauma in 24(47.1) patients such as vehicular accident 10(19.6%), motorcycle accident 4(7.8%), fall from height 4(7.8%), and gunshot injury 2(3.9%) and medical comorbid illnesses such as diabetics in 6 (11.8%) patients, hypertension in patient 3(5.9%) patients , retroviral disease in 1 (2.0%) patient, sickle cell disease in1 (2.0%) patient and hemiplegic stroke in 2 (3.9%) patients. This is similar to previous reports by Stevens et al[8] and Salgado et al[9] who in addition to above, included other risk factors such as intravenous drug use, previous SSTI, surgeries that disrupt the lymph tracts such as saphenous vein harvesting or axillary lymph node dissections, animal or human bites[8,9]. Multidisciplinary care should be sought where necessary and a high index of suspicion must be maintained in identifying underlying risk factor which must be treated and patient optimised where possible so as to enhance clinical outcome of the patient.

Result of aspirate cultures yielded *Escherichia coli* in 25(49.0%) patients. This is in keeping with previous studies by Makanjuola et al[10] who reported a predominance of *Escherichia coli* in 32.5% patients followed by *staphylococcus aureus* in 28.8% patients and they observed an increasing role of Gram-negative organisms in hospital infections as opposed to the predominance of *Staphylococcus aureus* in the past[11-13]. These findings were corroborated by shahane et al[14] who

reported *Escherichia coli* as predominantly implicated in the aetiology of complicated skin and soft tissue infections. They also observed that Gram-negative and anaerobic bacteria are more commonly in association with surgical site infections of the abdominal wall and infections of the soft tissue in the anal and perineal region[14].

Staphylococcus aureus was the most commonly isolated Gram-positive organism and second predominant bacteria in 14(27.5%) patients in this study. This is similar to previous report by Enweani et al[15] but at variance with studies by Oni et al[16] who reported Staphylococcus aureus as the most prevalent organism[15,16] . Despite the notable recent shift in aetiology of complicated skin and soft tissue infection, this organism has remained an important nosocomial pathogen accounting for a remarkable proportion of complicated skin and soft tissue infection. These findings suggest that the epidemiology of Complicated Skin and soft tissue infections with respect to causative agents and antibiotic susceptibility can no longer be predicted with accuracy. Community-acquired and healthcare-acquired strains are constantly shifting and this presents challenges in the choice of empirical antibiotic therapy following surgical debridement and drainage.

Klebsiella species was obtained in 6(11.8%) patients. Previous literature by Stevens et al[8] has reported that SSTIs in the presence of comorbid infections, such as diabetes, neutropenia, or cirrhosis, are more likely to be severe and caused by uncommon organisms such as *Pseudomonas species*, *Klebsiella species*, yeast, fungi[21] . Giacometti et al[22] reported mixed organisms in over 50% of their study population[22]. Polymicrobial infections involving both Gram-positive and Gram-negative organisms occur particularly where tissue vascular perfusion is compromised, such as diabetic foot infection or infection of ischaemic or venous ulcers. Among persons with diabetes, the incidence of methicillin resistant staphylococcus aureus (MRSA) infections is increasing most rapidly in those with chronic foot ulcers who have previously received antibiotic therapy. These ulcers also are more prone to polymicrobial infection[23,24] Physicians should maintain a high index of suspicion for underlying osteomyelitis in patients with diabetic foot ulcers[24].

No growth was obtained in 6(11.8%) patients. This may be attributed to the fact that anaerobic culture was not done therefore no anaerobe was isolated. This limitation may account for the samples which did not yield any bacterial growth despite being sent based on clinical signs of surgical infection[10]. Some patients were on empirical antibiotic therapy prior to microbiological evaluation which may have accounted for no growth of bacteria. These findings are corroborated by Makanjuola et al[10]. Trampuz *et al*[24] and Mue *et al*[25] in their previous studies suggested that antibiotics taken within two weeks may affect the accuracy of intraoperative tissue culture.

Antibiotic susceptibility testing revealed a high level of resistance of isolates to usual first line antibiotics like Augmentin in 14(27.5%) patients, ampicillin in 14(27.5%) patients, and cefuroxime in 8 (15.7%) patients. Makanjuola *et al*[10] also reported widespread resistance to Amoxycillin, Cloxacillin and Cotrimoxazole which are the antibiotics that are most widely used in this environment. Multidrug resistant organisms have been widely reported in the hospital environment and in the aetiology of complicated skin and soft tissue infection[19-22].

High susceptibility was observed to ciprofloxacin in 24(47.1%) cases followed by perfloxacin in 10(19.6%) cases, ofloxacin in 11(21.5%) cases and ceftriazone in 3(5.8%) cases. This is similar to previous studies by Makanjuola et al[10] who reported a higher susceptibility to Fluoroquinolones and third generation Cephalosporins. This is however at variance with findings from other environments[14]. The degree of susceptibility may be affected by production of Extended Spectrum Beta Lactamases (ESBL). ESBL producing organisms now abound and can spread easily in the hospital environment[26]. fluoroquinolones with enhanced anti-Gram-positive activity such as moxifloxacin are better suited for polymicrobial infection[26].

Newer antibiotics such as vancomycin, linezolid, daptomycin, and tigecycline. are finding a place in the treatment of cSSTI caused by more resistant strains[27].

Vancomycin has long been the gold standard however; Linezolid was demonstrated to be more effective than vancomycin for cSSSIs in one large pivotal trial[27]. Daptomycin is a rapidly bactericidal drug that has been shown to be equivalent to vancomycin in cSSSIs. Tigecycline, a glycylcycline antibiotic that has broad spectrum activity, covers Gram-positives, Gram-negatives, including MRSA and VRE, but lacks coverage for *Pseudomonas specie* [27,28] . These newer antibiotic agents are currently in use but pose a limitation since they are not readily available in our environment.

Findings from this study suggest that the empirical antibiotic of choice in our environment may be Floroquinolone and cephlosporins. The Combination with metronidazole (an antianaerobic agent) may be reasonable due to the fact anaerobic culture is not routinely done in our environment, therefore, no anaerobe isolated. This limitation may have accounted for the samples which did not yield any bacterial growth despite clinical signs of surgical infection[10].

Post-operative complications encountered were multiple abscesses in 28(54.9%) patients, chronic osteomyelitis in 11(21.6%) patients, knee stiffness in 11(21.6%) patients and mortalities were recorded in 6 (11.8%) patients. Complicated and potentially life-threatening SSTIs are characterized by fever, widespread or a rapidly spreading area of involvement, firm and hard feel of subcutaneous tissues, pain disproportionate to examination, skin sloughing, cutaneous bleeding with or without bullae, and skin crepitus.[28] Furthermore, patients with necrotizing infections may be lethargic or disorientated.[21]Rapidly progressive and life-threatening infections may warrant urgent surgical referral.[21,29,30]

CONCLUSION

The commonest site of skin and soft tissue infection was the thigh and the commonest risk factor was trauma. *Escherichia coli* were the commonest organism isolated from aspirate followed by *staphylococcus aurous*. Successful management of complicated skin and soft tissue infections usually involves prompt recognition, resuscitation if required, timely surgical debridement or drainage, and appropriate antibiotic therapy. Findings from this study suggest that the empirical antibiotic of choice is Floroquinolone followed by cephalosporin. The Combination with metronidazole (anti- anaerobic agent) may be reasonable due to the fact that anaerobic culture is not routinely done in our environment.

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