

Bacterial Skin and Soft Tissue Infection in Dhaka, Bangladesh

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Abstract: Specimen from 300 patients with different kinds of skin and soft tissue infections were collected and cultured on blood agar, MacConkey agar and chocolate agar. Colonies cultured in these media were identified by biochemical tests and then checked for antibiotic susceptibility. These data taken together with the patient history provided the prevalence of skin and soft tissue infections in Dhaka, Bangladesh. 32.42% of the skin and soft tissue infections were due to bacterial agents, with *Escherichia coli* (52%), *Staphylococcus aureus* (27%), *Pseudomonas* (18%), *Acinetobacter* (3%), *Candida* (1%), *Serratia* (1%) and *Proteus* (2%) being the major pathogens. Men within the age group of 40-60 years had the highest number (41.89%) of infections, with *E coli* (21.62%) being the most common pathogen. Women within the reproductive age (18-45 years) were infected by *E coli*, *S aureus* and *Pseudomonas* (16.67%) while *E coli* (23.33%) was the predominant cause of infections in post-menopausal women. 12.24% males and 28.57% female patients were diabetic. The rate of post-surgical nosocomial infection was 6.86% while 9.8% contracted nosocomial infections from non-surgical sources. The infections were recurrent in 25.49% cases. A wide-spread resistance against amoxicillins and β -lactams, azithromycin and second generation cephalosporins was found.

Keywords: Bangladesh, multi-drug resistance, nosocomial infection, Skin and soft tissue infection

I. Introduction

Pyogenic diseases refer to local inflammation, pus formation from accumulation of dead leukocytes and infectious agent. Systemically, an adequate blood supply is needed for wound healing. Pyogenic infections can occur in different forms; the purulent skin infections caused by bacterial contamination of wound or compromised skin is more of an aesthetical than clinical concern in an immune-competent individual. However, the same condition is a matter of concern for an immune-deficient patient. The infections with multi-drug resistant bacteria are also alarming since the last resort for success in such cases is often too expensive.

Some serious manifestation of pyogenic ailments manifest as pyogenic granuloma, pyogenic arthritis, pyogenic liver abscess, pyogenic spondylitis and toxic shock associated with pyogenic soft tissue infections (Vincent et al,2008). Rupture of the abscess might cause life-threatening skin infection and toxicosis. Contamination of burn wounds with pyogenic pathogens are of great concerns in burn units. In our study we chose to collect sample from pyogenic infections from superficial pyogenic diseases as well as aspirates from deep tissue infection.

A decreased or inadequate blood supply favors bacterial proliferation and damage that may prevent or delay healing. Uncontrolled edema, smoking, poor nutrition, diabetes with a poorly controlled blood glucose level, excess alcohol intake, drugs that interfere with the immune system, or immunodeficiency diseases may all challenge wound healing. Local factors inhibiting healing may include a large wound size, local presence of foreign bodies (prosthetic joints, retained thread of gauze, or suture), and an untreated deeper infection, such as osteomyelitis (Sibbald et al.,2007). Most bacteria enter the wound bed through external contamination from the environment, dressings, the hands of the patient or the health-care provider.

This study investigated the bacterial skin and soft tissue infections among the patients seeking treatment in Dhaka, Bangladesh. Patients seeking treatment for skin and soft tissue infections caused by bacteria were included in the study.

II. Materials and Methods

2.1 Study population

The study was conducted over three month-period from July 2013 to September 2013.

2.2 Study population

All samples were collected from OPD and IPD patients of having clinical symptoms of microbial infection. Samples were collected from both sexes and different age groups.

2.3 Samples size and type of specimen

Total 300 clinical isolates were tested from OPD and IPD patients. The specimen type that include in this study were wound, swab, pus.

2.4 Media preparation

Commercially available dry media were used to prepare Nutrient Agar, Muller Hinton agar and the biochemical test media (Oxoid, UK). All the media were sterilized (15lbs for 15 minutes) by using autoclave. Glass materials sterilized at 180°C for 1 hour in a hot air oven prior to use. All solution was sterilized under the same condition.

2.5 Suitable sample for test

Dried, contaminated specimen or specimen arrived in broken containers were excluded from further analysis.

2.6 Microbiological Identification

The potential pathogens were identified based on cultural characteristics, oxidase production, catalase production, citrate utilization, gas production, reaction in triple Sugar Iron medium, Gram staining, Motility Indole Urease test (Holt et al.1994).

2.7 Determination of antibiotic resistance

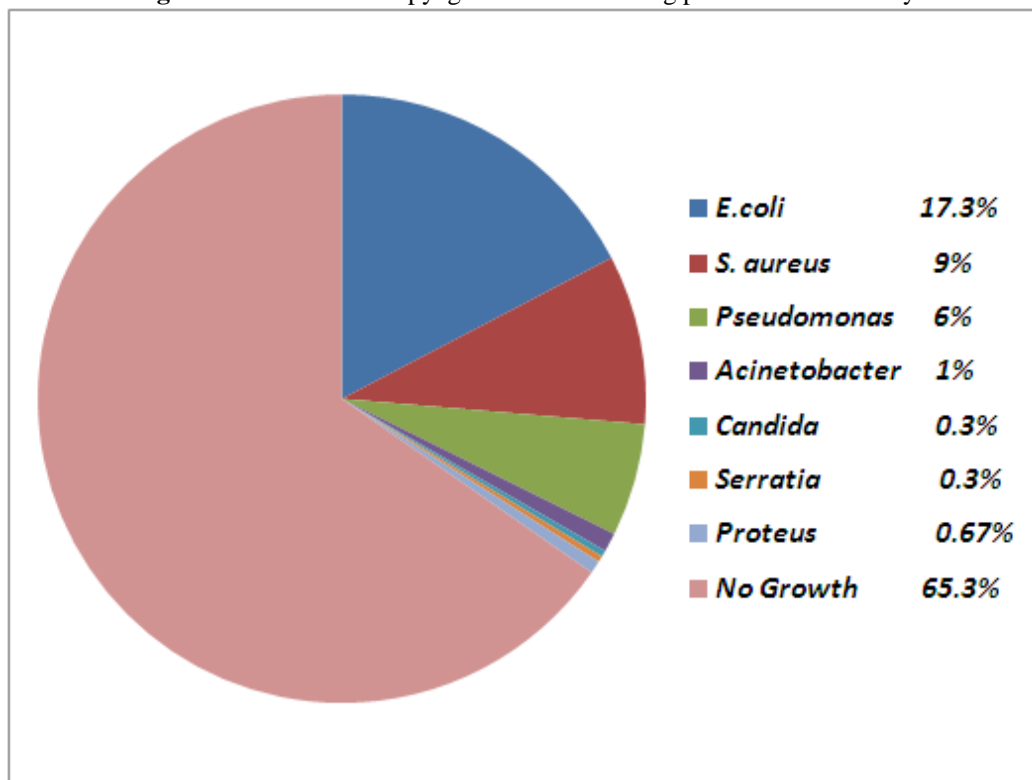
The antibiotic sensitivity tests were done on Muller-Hinton agar with commercially available discs from Oxoid,UK and the sensitivity of the isolates were determined as per NCCLS guidelines, (NCCLS, 2000).

III. Results

3.1 Patients in Dhaka show an atypical etiology of pyogenic infection

The most virulent pyogenic bacteria described in clinical literature are Streptococcus pyogenes, Klebsiella pneumonia, Staphylococcus aureus. In this study, a total of 300 patients with purulent disease were included, however 34.45% of them were found to contain pyogenic bacteria and 65.55% were suffering from non-identifiable etiology, characterized by no growth in culture media. As shown in Figure 1, the population under study has a distinct pattern of pyogens since E coli, S aureus and Pseudomonas are the dominant isolates.

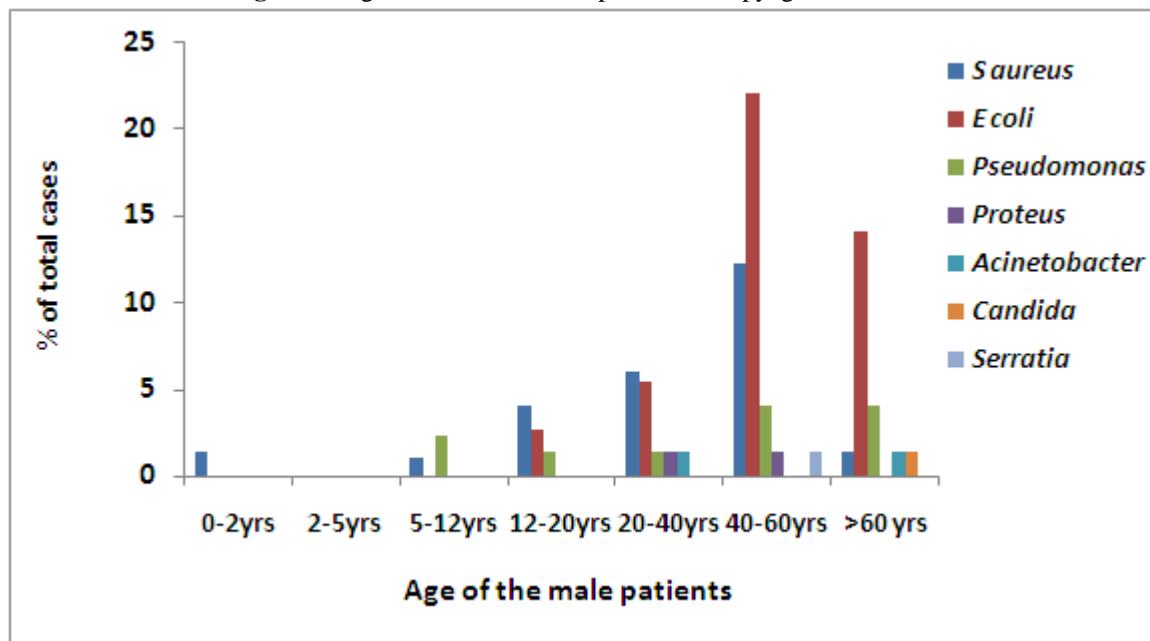
Figure 1: Distribution of pyogenic bacteria among patients in Dhaka city



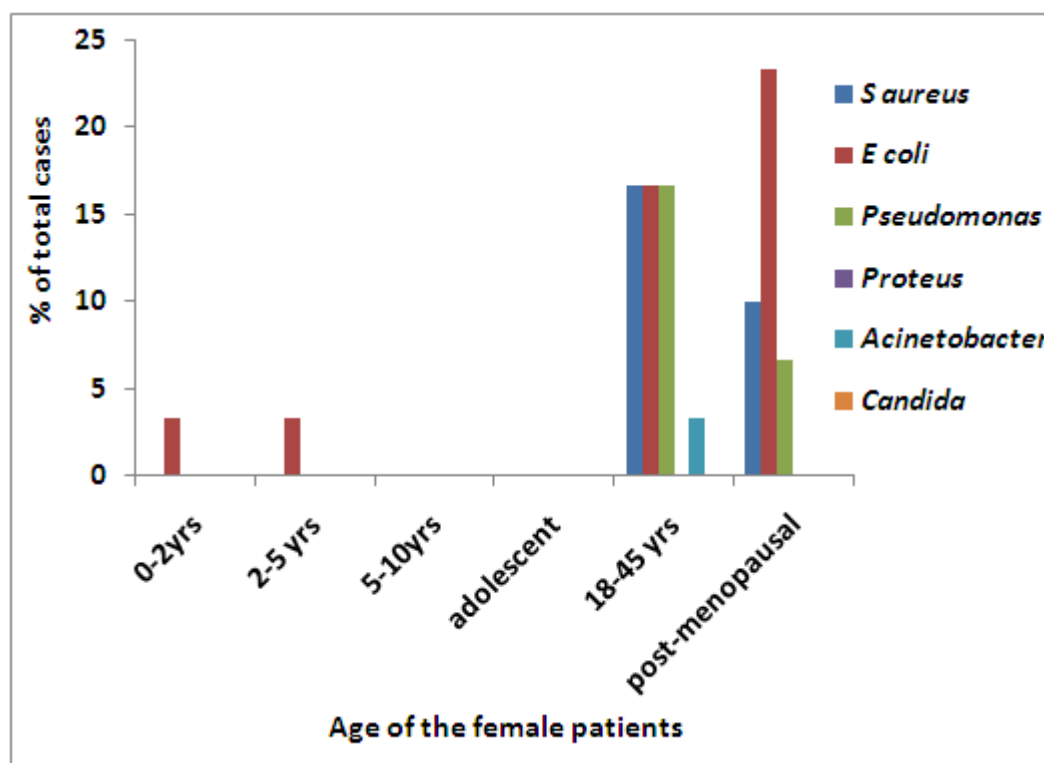
3.2 Age/sex distribution indicate male adults and post-menopausal women to be most vulnerable to pyogenic infection

Upto 5% of young adult male patients (12-20 years) showed pyogenic infection from *S aureus*, *E coli* and *Pseudomonas*. More than 20% of adult males (20-40 years) were infected with pyogenic *E coli*, 12% had infection from *S aureus* and 1.3% were infected with *Pseudomonas* or *Proteus* or *Serratia*. 12% of the older males (>60 years) were infected with *E coli* whereas the percentage of *S aureus*, *Pseudomonas*, *Candida* and *Serratia* were around 1.3% each in this age group. The results are presented in Fig. 2A.

Figure 2: Age/Sex distribution of patients with pyogenic infection



2(A) Occurrence of Pyogenic infection among men from different age groups



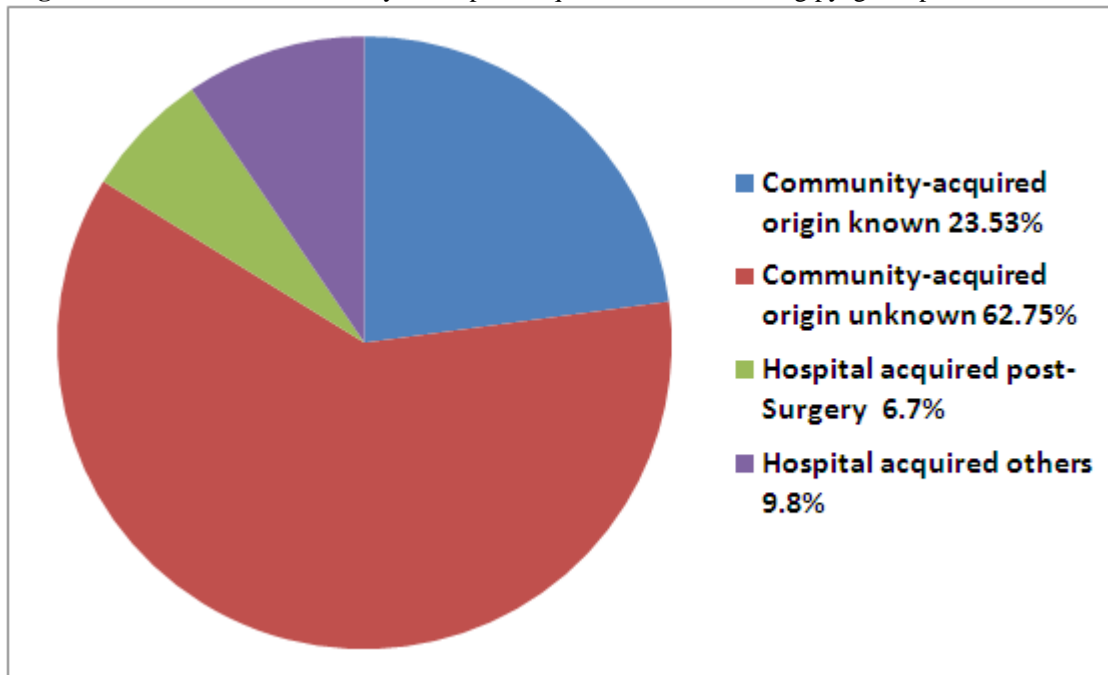
2(B) Occurrence of Pyogenic infection among women from different age groups

On the other hand, 16.67% of the female patients within the reproductive age (18-45 years) were infected with E coli, S aureus and Pseudomonas and 3.33% were infected with Candida. In case of post-menopausal female patients, 23.3%, 16.67% and 10% were infected with E coli, S aureus and Pseudomonas respectively (Fig. 2B).

3.3 Incidences of Community vs Hospital acquired infections

A careful analysis of the medical history of the patients revealed 23.53% patients contracted community acquired pyogenic infection from known sources (eg. Unhygienic practices, wound or use of suspected contaminated products) while 62.75% patients suffered from infections belonging to unknown sources, 43.75% of whom were diabetic. 6.86% patients has hospital-acquired infection after surgical procedures while 9.8% patients had hospital-acquired purulent disease after long-term hospitalization or from other reasons (Figure 3).

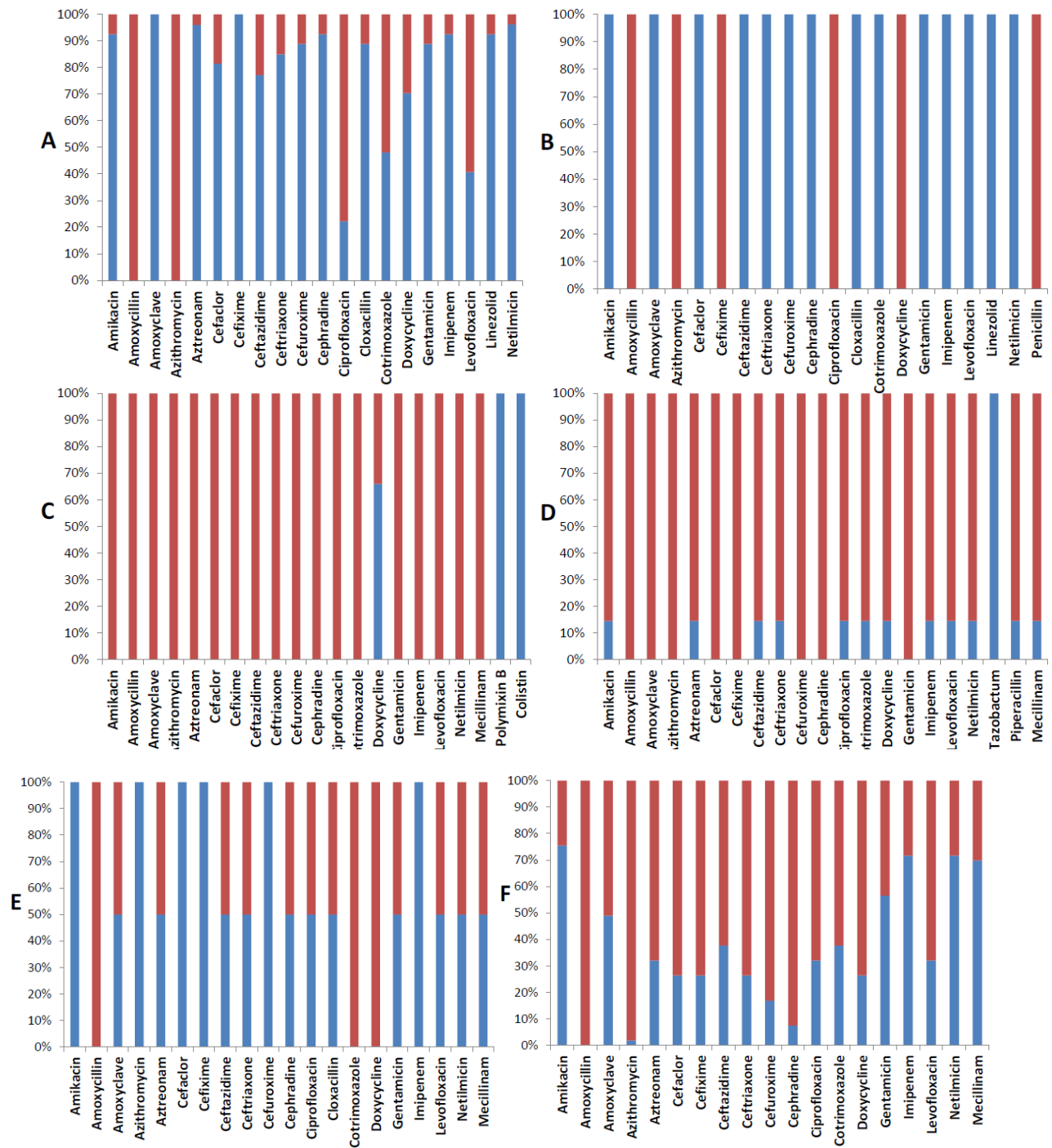
Figure 3: Incidences of community vs hospital acquired infections among pyogenic patients in Dhaka



3.4 The development of multi-drug resistance in pyogenic bacteria in Dhaka are alarming

S aureus were resistant against amoxicillin (100%), azithromycin (100%), ciprofloxacin (78%), levofloxacin (60%) and cotrimoxazole (50%). The Acinetobacter isolates were resistant against β -lactams, azithromycin, cephalosporins, ciprofloxacin, gentamicin and imipenem. The Proteus isolates were resistant against amoxicillin, cotrimoxazole and doxycyclin. The Pseudomonas isolates were resistant against most known antibiotics, exhibiting sensitivity only to tazobactam. The E coli isolates were resistant against β -lactams, azithromycin, cephalosporins, quinolones, cotrimoxazole and doxycyclin (Figure 4).

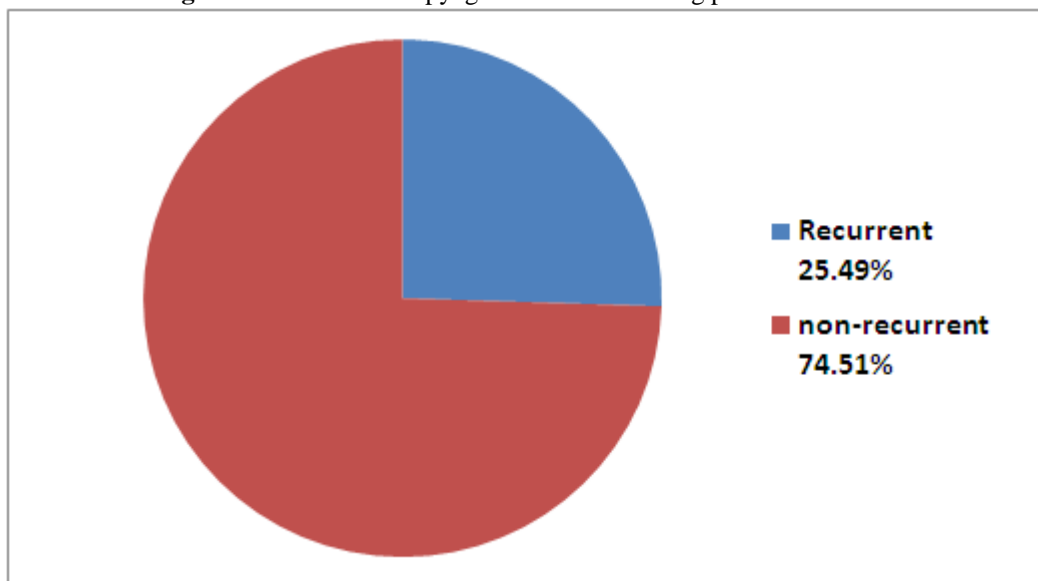
Figure 4: Antibiotic sensitivity pattern among common pyogenic bacteris isolated from patients in Dhaka. Antibiogram from (A) Staphylococcus aureus, (B) Proteus, (C) Acinetobacter, (D) Pseudomonas, (E) Serratia, (F) E coli. ■ % of resistant isolates, ■ % of sensitive isolates



3.5 High Incidence of recurrence among patients

Incidence of pyogenic infection in the same organ with same signs and symptoms within a period of 2 months is considered recurrence. Analysis of the medical history of the patients revealed 25% of them had suffered from same signs and symptoms in the same organ previously. We could not associate the source or underlying causes with the recurrence (Figure 5).

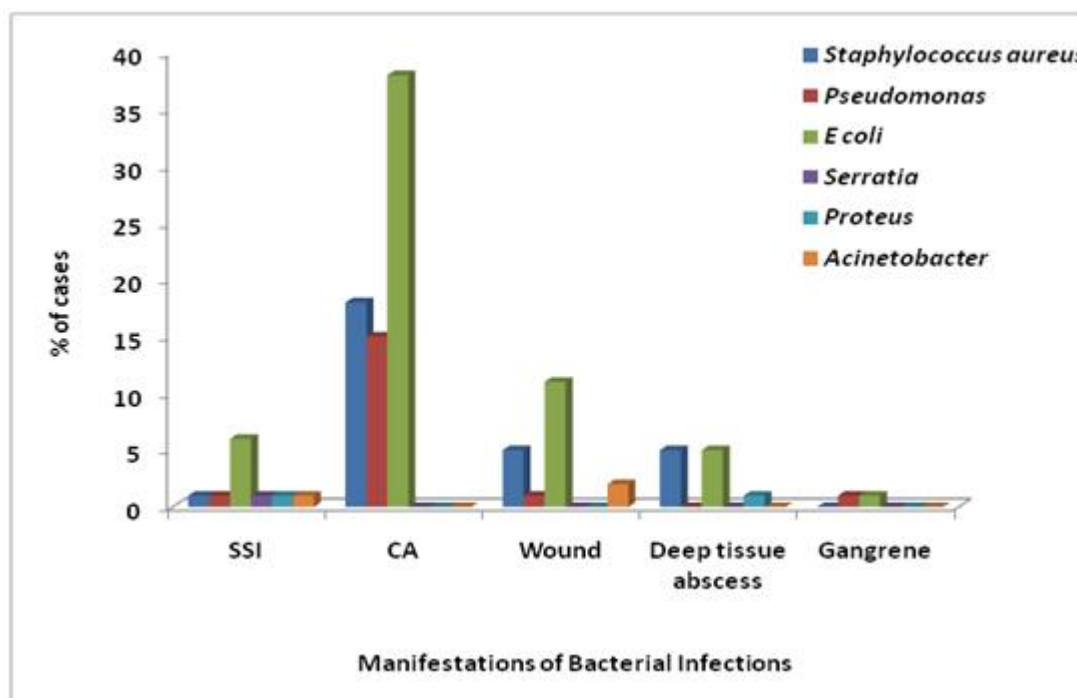
Figure 5: Recurrence of pyogenic infection among patients in Dhaka



Different types of manifestation

The skin and soft tissue infections were manifested as boils, carbuncles, furuncles, purulent infection in the wound, deep tissue abscess and gangrenous ailment (Figure 6).

Figure 6: Different manifestations of skin and soft tissue infection by etiology. SSI-skin and soft tissue infection, CA-Community-acquired superficial infection, wound- inflammation in a wound, deep tissue abscess and gangrene



IV. Discussion

E coli is a multi-disease organism causing complications ranging from enteric to cerebral diseases. In recent times extra-intestinal infections have been reported by colicin-insensitive E coli, which showed increased virulence in skin and soft tissue infection (Petkovsek et al.2013). Skin and soft tissue infection is caused by multi-drug resistant or ESBL E coli (Flamm et al. 2013;Farrell et al.,2013), which are often fatal in post-surgical infections (Wong et al.,2012;Janny et al.,2013). In our study E coli was found to be the most common cause (47% of total culturable isolates) of pyogenic infections from surface and deep tissue, infecting adult males

(22% of adult male patients) and females (23.3% of the postmenopausal females and 16.6% of young females). 17.86% of the E coli isolates were multi-drug resistant; nearly all isolates were resistant to amoxicillin, azithromycin and cephadrine.

Panton-Valentin Leukocidin (P-V-L) producing S aureus are associated with pyogenic infections (Ellington et al.,2010;Robinson et al.,2005). Methicillin-resistant Staphylococcus aureus infection was first reported in Europe and was disseminated all over the world, leading to S aureus skin infections which are difficult to treat. 12% of the adult males, 16.6% of the young females and 10% of the post-menopausal women were infected with S aureus in the study population. The isolates were resistant to amoxycillin, azithromycin and ciprofloxacin.

Skin and soft tissue infections by Pseudomonas spp. especially P aeruginosa is rare but serious because this bacteria gains antibiotic resistance very rapidly (Wu et al.,2011). 6% of the isolates in this study were Pseudomonas, occurring at relatively high rates (16.6%) among young females compared to males and older females (4% and 6% respectively). Nearly all Pseudomonas isolates were resistant against the common therapeutic antibiotics (eg. first, second and third generation unconjugated β -lactams and cephalosporins, macrolides, first generation fluoroquinolones and doxycyclin). Tazobactam, a conjugate between ureidopenicillin piperacillin and a β -lactamase inhibitor, could kill the Pseudomonas isolates in this study. Tazobactam was developed by the pharmaceutical company Wyeth to inhibit community-acquired Pseudomonas, therefore it is still active (Yang et al., 1999).

Acinetobacter occurred in 6% of the isolates; the rate of infection in adult and older male was 1.35% and 3.33% in young females. Doxycyclin, polymyxin and colistin could inhibit the Acinetobacter isolates; the rest of the therapeutic antibiotics had no effect.

Serratia occurred primarily in older males. Proteus spp. was also isolated from older males but it is premature to deduce due to the small number of isolates.

Surgical site infection with S aureus, E coli, Proteus, Pseudomonas and Serratia are reported from almost every corner of the world (Hindler et al., 2013;Ducel et al.,2002). Non-surgical skin and soft tissue infections acquired from hospitals are relatively rare.

Diabetes mellitus type 2 is common among middle-aged urban population in Dhaka city and association between pyogenic infections in diabetic patients is a well-known complication (Saquib et al., 2013).

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