CLINICAL AND MICROBIOLOGICAL STUDY OF PYODERMA IN CHILDREN WITH SPECIAL REFERENCE TO COMMUNITY-ACQUIRED METHICILLIN-RESISTANT STAPHYLOCOCCUS AUREUS.

Submitted by

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M. D

in

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Under the guidance of

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2012

DECLARATION BY THE CANDIDATE

I hereby declare that this dissertation entitled "**CLINICAL AND MICROBIOLOGICAL STUDY OF PYODERMA IN CHILDREN WITH SPECIAL REFERENCE TO COMMUNITY-ACQUIRED METHICILLIN-RESISTANT STAPHYLOCOCCUS AUREUS**" is a bonafide and genuine research work carried out by me under the guidance of **DR.APARNA PALIT M.D.**, Professor, Department of Dermatology, Venereology and Leprosy at BLDE University's Shri B. M. Patil Medical College Hospital and Research Centre, Bijapur.

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List of abbreviations

S. aureus – *Staphylococcus aureus*

S. pyogenes – *Streptococcus pyogenes*

CoNS – Coagulase negative staphylococcus

MRSA - Methicillin resistant *Staphylococcus aureus*

CA-MRSA – Community acquired methicillin resistant *Staphylococcus aureus*

HA-MRSA – Hospital acquired methicillin resistant *Staphylococcus aureus*

GABHS – Group A beta hemolytic *Streptococcus*

PVL – Panton valantine leukocidin

BI – Bullous impetigo

NBI – Non-bullous impetigo

NF – Necrotizing fasciitis

SSSS – Staphylococcal scalded skin syndrome

AD – Atopic dermatitis

ESR – Erythrocyte sedimentation rate

ABSTRACT

Background- Cutaneous bacterial infections in pediatric age group constitute a major portion of the dermatological disorders. *Staphylococcus aureus* and *Streptococcus pyogenes* are the common causative agents. The prevalence of methicillin-resistant *Staphylococcus aureus* strains is reported to be increasing. MRSA, once thought to be as a nosocomial pathogen, is being increasingly reported in the community. A knowledge of the antimicrobial resistance of *Staphylococcus aureus* is important in the selection of antimicrobials for treatment.

Objectives- To study the different clinical types and bacterial agents causing pyoderma in children. To determine the incidence of community-acquired methicillin-resistant *Staphylococcus aureus* in childhood pyodermas.

Methods- It is a hospital based, cross-sectional, descriptive analytical study. Ninety seven children (<12 years) with pyoderma were recruited from dermatology out-patient department. Their demographic data regarding name, age, sex, occupation of parents/guardians, monthly income and address were recorded in the proforma. A detailed history of the illness regarding duration, onset, evolution, symptoms, other associated illness and recurrence were recorded. A complete clinical examination of the skin, nails, hair and mucous membrane was performed. After cleaning the surface pus is collected with two swabs from the depth of the lesion. Specimens were taken to the laboratory within two hours of collection and further processing was done in the department of microbiology. Gram staining, culture and antibiotic sensitivity was done for all pus samples. Methicillin resistance was detected using cefoxitin (30mcg) discs by disc diffusion method.

Results- Out of 97 cases of pyoderma, 67 were boys and 29 were girls with a male: female ratio of 2.34:1. Incidence of pyoderma was highest among school going children (n=60, 61.85%). Among 97 cases, 56 (57.7%) were primary pyodermas and 41 (42.3%) were secondary pyodermas. Among primary pyodermas, non-bullous impetigo (39.3%) was the commonest clinical type, followed by folliculitis (23.2%) and furuncles (12.5%). Scabies with secondary infection (46.4%) was the commonest clinical type seen in secondary pyodermas, followed by infective eczema (29.3%) and atopic dermatitis with pyogenic infection (12.2%). *Staphylococcus aureus* (49.5%) was the commonest pathogen isolated from pyodermas. MRSA was seen in 6.25% of cases.

Conclusion- Most of the pyodermas was caused by *Staphylococcus aureus.* Incidence of CA-MRSA is less in this region of India. The findings of this study need further confirmation from larger prospective studies in multiple settings in this geographic area.

Keywords- Pyoderma, community acquired MRSA.

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INTRODUCTION

Pyodermas are one of the commonest dermatoses seen in the pediatric age group, especially in the developing world. The most important factors responsible for skin infections among children include poverty, malnutrition, overcrowding and poor standards of hygiene. Various climatic factors also play a role in incidence of skin infections with hot and rainy seasons being the period of maximum occurrence.[1]

Cutaneous bacterial infections (pyodermas) may be divided into primary and secondary. Primary pyodermas arise in normal skin, whereas secondary pyodermas develop in diseased skin as a superimposed condition. The former usually involves a single pathogen, whereas the latter is often polymicrobial.[2]

Majority of the pyodermas are caused by Gram-positive bacteria, and less commonly by other Gram-negative organisms and anaerobes. Among various Gram-positive bacterial agents *Staphylococcus aureus* and group A *Streptococcus* sp. are the commonest cause for pyodermas.[3] These organisms cause a broad clinical spectrum of infections ranging from superficial pyodermas to invasive soft-tissue infections depending upon the organism, the anatomic location of the infections and host factors.

With the increased use of topical and systemic antibiotics, there has been emergence of penicillin-resistant strains of *S. aureus* since 1944.[4] This was followed by development and spread of strains resistant to synthetic penicillins. Development of resistance has made the treatment of staphylococcal infections a global challenge.

Methicillin-resistant *S. aureus* (MRSA) strains have become a major epidemiologic problem since 1970s.[4] MRSA was usually a hospital-acquired pathogen. Since late 1990s community-acquired MRSA has become more prevalent in children.[5]

The prevalence of CA-MRSA has increased enormously during the past few decades. For example, the incidence of CA-MRSA at a children's hospital in Texas increased to 315 per 10,000 admissions in the early 2000s from 3.8 per 10,000 admissions in the 1990s.[4]

With the changing trends in the etiology of pyoderma and emergence of drug resistant strains in the community, it is ideal to know the antibiotic sensitivity pattern of the bacteria before prescribing medicines.

Childhood skin infections constitute the commonest cause of attendance of children in dermatology department in this tertiary care hospital. This study has been undertaken to know the epidemiological pattern of pyogenic skin infections in this region of south India. Antibiotic sensitivity patterns of the isolated organisms have also been studied to know the prevalence of antibiotic resistant strains causing pyodermas in children in this region. Interpretation of study results may be of importance in the long run in terms of effective management of childhood pyoderma.

OBJECTIVES OF STUDY

i. To study different clinical types of pyoderma in children.

ii. To determine bacterial agents causing pyoderma in children.

iii. To study the incidence of community-acquired methicillin-resistant *Staphylococcus aureus* (CA-MRSA) in childhood pyodermas.

REVIEW OF LITERATURE

Cutaneous bacterial infections may be divided into primary and secondary types. Primary pyoderma tend to have a characteristic morphology and course, are incited by a single organism, and arise in normal skin.[2] Secondary pyoderma originate in diseased skin as a superimposed condition, and this results in an acute or chronic intermingling of the underlying skin disease and the infection. This may not follow characteristic course and the role of the bacteria may be difficult to assess.[2]

EPIDEMIOLOGY:

Prevalence and incidence

Cutaneous infections are major health problem in pediatric age group and are associated with significant morbidity. These constitute almost 30% of all outpatient visits. The prevalence of skin diseases among children in various parts of India ranges from 8.7% to 35% in school based surveys.[6]

The incidence of pyoderma was found to be 64.4% among all skin infections in an epidemiological study of skin diseases among school children in north India.[7] In another retrospective study of skin disorders in children (<12 years of age) conducted at New Delhi, 58.09% of the children had bacterial infections.[8]

Sex distribution

Occurrence in both the sexes is variable in different studies. Pyodermas are slightly more common in males compared to females approximately in the ratio of 1.1:1 to 1.7:1.[9,10] In few studies, females outnumbered males.[1]

Age distribution

Most of children with pyoderma are between 1 to <5 years (i.e., pre-school) of age.[1.6,9] This is because these children are exposed to unhygienic conditions due to improper care by the parents who are busy in work during day time as labourers.[1]

Seasonal variation

Most of the pyodermas are recorded during summer and rainy seasons.[1] This is attributed to the biting of insects, which lead to microtrauma and predispose the children to infections as rainy season is a favorable time for the breeding of insects.[11] High temperature and humidity of summer and rainy seasons favors rapid proliferation of pyogenic bacteria, which also leads to increased susceptibility to pyodermas.[11]

Socioeconomic status

Pyodermas are common in children with low socioeconomic status, because of poverty, under nutrition and overcrowding.

ETIOLOGY:

Staphylococcus aureus is the major pathogenic organism for many cutaneous bacterial infections, followed by group A *Streptococcus* in some cases. Others include *Streptococcus agalactiae* and group C and G *Streptococci*. Gram-negative pathogens like *Pseudomonas aeruginosa, Klebsiella* sp., *Escherichia coli* and anaerobes are involved rarely.[3]

S. aureus has been found to be the commonest pathogen present in more than 70% cases of all skin and soft tissue infections.[3] S. aureus was isolated in 80.8% cases in a community-based Indian study of 250 patients of pyoderma among all age groups.[12]

A study from India revealed the occurrence rate of CA-MRSA infection in a general population to be 11.8%.[12] In a study by Sardana *et al*,[10] bacterial isolates from community acquired pyoderma were comprised of 6.9% of MRSA.

Compared to HA-MRSA infections, CA-MRSA infections often occur in individuals who are immune-competent, can be virulent and fatal and susceptible to most non-β lactam antibiotics. In addition, CA-MRSA have the *pvl* gene, a virulence gene encoding a leukocyte-killing toxin, Panton-Valantine leukocidin.[10]

CLINICAL FEATURES:

Classification of pyodermas:[13]

I) Primary pyodermas A) Caused by *S. aureus* a. Impetigo b. Folliculitis c. Furuncle d. Carbuncle B) Caused by *S. pyogenes* a. Cellulitis b. Erysipelas C) Mixed infections a. Ecthyma b. Necrotizing fasciitis	II) Secondary pyodermas (following primary conditions can be infected with pyogenic organisms) a. Atopic dermatitis b. Scabies c. Insect bite reactions III) Toxin-mediated infections Staphylococcal scalded skin syndrome (SSSS)

Impetigo: It is the most common bacterial skin infection seen in children. It is a contagious, superficial infection caused by *S. pyogenes*, *S. aureus*, or a combination of both.[14]

Clinically two types of impetigo are seen:[15]

- Bullous impetigo
- Non-bullous impetigo (i.e., impetigo contagiosa)

Bullous impetigo (BI): BI is caused by an epidermolytic toxin produced by phage II staphylococci at the site of infection, causing intra epidermal cleavage by targeting desmoglein 1, a cell-cell adhesion molecule. It presents as flaccid, thin-walled bullae. The center of the bulla collapses but peripheral area may retain fluid as inner tube rim. Varnish like crusts may appear at the center, which when removed, reveal eroded base and collarets of moist scale.[14]

Non-Bullous Impetigo (NBI): NBI is more common (>70%).[15] NBI was once thought to be primarily a group A β-hemolytic streptococcal (GABHS) disease, but now appears to be caused by *S. aureus* also.[14] Streptococcal infection is characterized by surrounding erythema, satellite lesions, fever, and regional lymphadenopathy. It presents as small vesicle or pustule that ruptures to expose red, moist base. The dried cloudy yellow fluid forms a honey-colored crust, the hallmark of NBI. The sites most commonly affected are skin around nose and mouth (Figure-1). The palms and soles are not affected.

Folliculitis: It is an inflammation of the hair follicle. It is divided into superficial and deep, according to the depth of involvement.[16]

Bockhart's impetigo is a variant of superficial folliculitis. Clinically characterized by small, fragile, dome shaped pustule occurs at the infundibulum of hair follicle, often on the scalps of children and in axillae, extremities, and buttocks in few cases[16] (Figure-2).

Furuncles: A furuncle or boil is a deep-seated inflammatory nodule that develops around hair follicle, usually from a preceding, more superficial folliculitis and often involving into an abscess. Furuncles arise in hair bearing sites, particularly in regions subjected to friction, occlusion, and perspiration, such as neck, face, axillae and buttocks. A furuncle starts as a hard, tender, red folliculocentric nodule that enlarges and becomes painful and fluctuant after several days. It ruptures with discharge of pus and often a core of necrotic material.[16]

Carbuncle: A carbuncle is a more extensive, deeper, communicating, infiltrated lesion that develops when suppuration occurs in thick inelastic skin when multiple, closely set furuncles coalesce. It is rare in children. It characteristically occurs as an extremely painful lesion at nape of the neck, the back, or thighs. Fever and malaise are often present, and the patient may appear quite ill. It results in permanent scar after healing.[16]

Cellulitis: It is a painful, erythematous infection of the dermis and subcutaneous tissues that is characterized by warmth, edema, and advancing borders. Cellulitis commonly occurs at breaks in the skin, such as surgical wounds, trauma, tinea infections, or ulcerations, but occasionally presents in skin that appears normal. Cellulitis can occur on any part of the body. The most common sites of cellulitis are the legs and digits, followed

by the face, feet, hands, torso, neck, and buttocks. It is caused by GABHS and staphylococci in adults.[17]

Erysipelas: It usually presents as intensely, erythematous infection with clearly demarcated raised margins, and often with associated lymphatic streaks. Common sites are legs and face.[17] It is an acute group A β-hemolytic streptococcal infection. Occasionally few cases caused by streptococci of group C or G have been reported in adults. Group B streptococcus is often responsible in the causation of erysipelas in children. Rarely *H. influenzae* may cause it. It is characterized by local redness, heat, swelling, and a highly characteristic raised, indurated border. The onset is often preceded by prodromal symptoms of malaise along with constitutional features like chills, high fever, headache, vomiting, and joint pain. The skin lesions may vary from transient hyperemia followed by slight desquamation to intense inflammation with vesicles and bullae.[18]

Ecthyma: It is a pyogenic infection of the skin characterized by the formation of adherent eschar, beneath which ulceration occurs. It was formerly regarded as a streptococcal infection, since many cases yield a pure culture of *Streptococcus pyogenes*. From others both streptococci and staphylococci are isolated, and from some lesions only staphylococci are detected. Small bullae or pustules on an erythematous base are soon surmounted by a hard crust of dried exudate, which increases in size by peripheral accretion. The base may become indurated and a red oedematous areola is often present. The crust is removed with difficulty, to reveal a purulent, irregular ulcer. The buttocks, thighs and legs are most commonly affected.[17]

Necrotizing fascitis (NF): It is a rare, rapidly progressive, and potentially fatal infection of the superficial fascia and subcutaneous tissue. NF is rare in children. It has been reported in 0.08 per 100000 children per year with most lesions reported on the trunk.[18] GABHS has been the most frequently incriminated agent. Clinical manifestations in NF starts around a week after the initiating event, followed 24 to 48 hours later by erythema or purple discoloration. After 48 to 72 hours, the skin turns smooth, bright, and the serous or hemorrhagic blisters develop. Without treatment, necrosis develops and by the fifth or sixth day, the lesion turns black with necrotic crusts. Removal of the crusts shows fascial tissue and brown grayish secretion.[18]

Staphylococcal scalded skin syndrome (SSSS): It is an exfoliative dermatosis in which most of the body surface becomes erythematous and the necrotic superficial epidermis strips off. The disease is caused by one or more exfoliative toxins elaborated by some strains of *Staphylococcus aureus*. The initial event is usually a localized staphylococcal infection. This may be in the skin or at a distant or 'occult' site. A few days later, patients develop fever, irritability and skin tenderness. A widespread erythematous eruption follows, which progresses rapidly to blister formation. The tender skin becomes gathered into folds and, as it shrinks, leaves raw areas which are extremely painful. The condition usually heals within 7–14 days[17] (Figure-3).

Secondary pyoderma:

Following primary conditions can be infected secondarily with pyogenic organisms. Atopic dermatitis is the most common inflammatory skin condition in children, affecting 5-20% of pediatric population worldwide.[19] Bacterial infection with *S. aureus* is the most common complication of AD.[19] The loss of integrity of the skin barrier

in AD makes stratum corneum more susceptible to colonization by *S. aureus*. In addition, AD patients may have increased bacterial adhesion, defective bacterial clearance, and decreased innate immune response.

Scabies is the common infestation seen in pediatric age group. Microtrauma caused by repeated itching predisposes skin for bacterial infection, causing impetiginization (Figure-4).

Insect bites lead to microtrauma and predisposes to bacterial colonization and infection, leading to impetigo and furunculosis.

Trauma and surgical wounds are also affected by secondary infections with bacteria and hampers wound healing.

LABORATORY INVESTIGATIONS

Most of the cases of pyoderma show mild leucocytosis and slightly raised ESR. In cases associated with atopy, eosinophilia may be seen.

Materials like pus, fluid from bulla, exudate from lesions, swabs from anterior nares are used for Gram staining and for culture and sensitivity in many studies.[1,9,10,12] Gram stain helps in differentiating between Gram-positive and Gram-negative organisms causing pyoderma.

Swabs from anterior nares have been used to detect incidence of carriage rate of staphylococci in patients with pyoderma and also in normal children in many school based studies.[20]

Most of the studies on pyoderma isolated *Staphylococcus aureus* and *Streptococcus pyogenes*. Even mixed infection with both was found in some studies.[1,10,12]

DIFFERENTIAL DIAGNOSIS:

Common pyodermas like non-bullous impetigo should be differentiated from seborrheic dermatitis, atopic dermatitis, allergic contact dermatitis, herpes infection and scabies. In case of bullous impetigo, contact dermatitis, bullous insect bites, fixed drug reactions and erythema multiforme should be considered.[16]

The prevalence of pediatric dermatoses in various parts of India ranges from 8.7% to 35% in school-based surveys.[6] The pattern of skin diseases in India is different across the states, rural and urban areas, and hilly regions.[6]

Bacterial skin infections was the most common condition seen among pediatric dermatoses in various studies conducted across India.[7,8,21] In a study of primary pyoderma in children from Pondicherry, most commonly affected age group was seen to be 1-4 years.[1] The commonest pyoderma was impetigo contagiosa (46%), followed by folliculitis, bullous impetigo, furunculosis and ecthyma. In bacteriological analysis, 47.5% of isolates grew *S. aureus* alone, 26.7% grew *S. aureus* and *S. pyogenes*, whereas 13.3% grew *S. pyogenes* alone.[1]

In a study by Ahmed *et al*,[22] from Rajasthan, highest incidence of pyoderma was seen in the first decade of life and more than 80% of cases belonged to middle and lower income group. Impetigo was highest clinical condition followed by infective eczema, furunculosis, folliculitis, cellulitis, ecthyma, and carbuncle. *S. aureus* isolates were found in 52.6% and 15.7% were β-hemolytic streptococci and 13% were mixed organisms.[22]

In a study by Sardana *et al*,[10] among eighty-nine children with pyoderma, 66.3% were of primary pyoderma and 33.7% were of secondary pyoderma. Among primary pyoderma furuncles were commonest followed by folliculitis, and impetigo. Secondary

pyoderma consisted of cases associated with scabies, pediculosis, atopic dermatitis, tinea capitis and infective eczema. *S. aureus* was most common (48.31%) pathogen isolated followed by group B *Streptococci* (27%).[10]

Pyodermas are the commonest dermatoses encountered in pediatric age group. Because of increase in antibiotic resistant strains in the community, treatment of pyoderma has become a challenge to the clinicians. Hence it is necessary to do culture and antibiotic sensitivity test before prescribing antibiotics for the treatment of pyodermas. A study on prevalence of microbial organisms causing pyoderma and their antibiotic sensitivity pattern will help the clinicians in future to provide empirical treatment in such cases, where facilities for the laboratory tests are not available.

METHODOLOGY

SOURCE OF DATA:

A hospital based, cross-sectional, descriptive analytical study on clinical and microbiological study of pyoderma in children with special reference to community-associated methicillin resistant Staphylococcus aureus was conducted in the department of Dermatology, Venereology and Leprosy, B. L. D. E University's Shri B. M. Patil Medical College Hospital and Research Center, Bijapur. Ninety seven children (<12 years) with pyoderma were recruited from the out-patient department (OPD). Informed consent was taken from all the parents/guardians of the children. Detailed demographic data were collected. The study was conducted between October 2009 to August 2011.

METHOD OF COLLECTION OF DATA:

Inclusion criteria:

Children up to 12 years of age attending the Dermatology, Venereology and Leprosy out-patient department were included in the study.

PROCEDURE:

In all the subjects included in the study, demographic data regarding name, age, sex, occupation of parents/guardians, monthly income and address were recorded in the proforma.

A detailed history of the illness regarding duration, onset, evolution, symptoms, other associated illness and recurrence were recorded. History of similar illness in the

siblings/family members, atopic history and immunization history were also recorded. A complete clinical examination of the skin, nails, hair and mucous membrane was performed.

After cleaning the surface pus is collected with two swabs from the depth of the lesion. Care was taken not to touch the adjacent skin margins.

Specimens were taken to the laboratory within two hours of collection and further processing was done in Department of Microbiology.

Laboratory procedures:

Gram staining – One swab was used for Gram staining. Heat fixed smears were prepared from the sample and Gram staining was done. The smears were examined under microscope and, Gram positive cocci arranged in singly, pairs and clusters were seen along with pus cells (Figure-5 and 6).

Culture – The other swab was used to inoculate into blood agar and Mac-Conkey's agar. The media were incubated aerobically at 37^0 C overnight and observed for growth next day.

Blood agar – *S. aureus* yielded golden yellow, 2-3 mm in diameter, circular, smooth, shiny, opaque, convex, easily emulsifiable, β-hemolytic (Figure-7).

CoNS yielded white to grayish-white, circular colonies (1-2mm) and non-hemolytic.

Streptococcus pyogenes species yielded grayish-white, tiny (0.5-1mm) circular and β-hemolytic colonies. Whereas other *Streptococcus* species yielded non-hemolytic colonies.

The following biochemical tests were done for the identification of *Staphylococcus aureus.*

Catalase test.

Tube coagulase test.

Mannitol fermentation test.

Antimicrobial sensitivity test was performed by disc diffusion method. The antimicrobials tested included penicillin (10U), erythromycin (15mcg), tetracycline (30mcg), cephalexin (10mcg), cloxacillin (10mcg), pefloxacin (5mcg), piperacillin + tazobactum (100/10mcg), cefaperazone + sulbactum (75/30mcg), gentamycin (10mcg), ciprofloxacin (5mcg), amoxyclav (30mcg), cefuroxime (30mcg), azithromycin (15mcg), bacitracin (10U), linezolid (30mcg), oxacillin (1mcg) and cefoxitin (30mcg) (Figure-8).

Methicillin resistance was detected using cefoxitin (30mcg) discs by disc diffusion method (Figure-9).

STATISTICAL ANALYSIS:

The observations pertaining to parameters under study among the pediatric age group were expressed as percentage.

Z test has been applied for testing differences of proportion based on gender and different age groups.

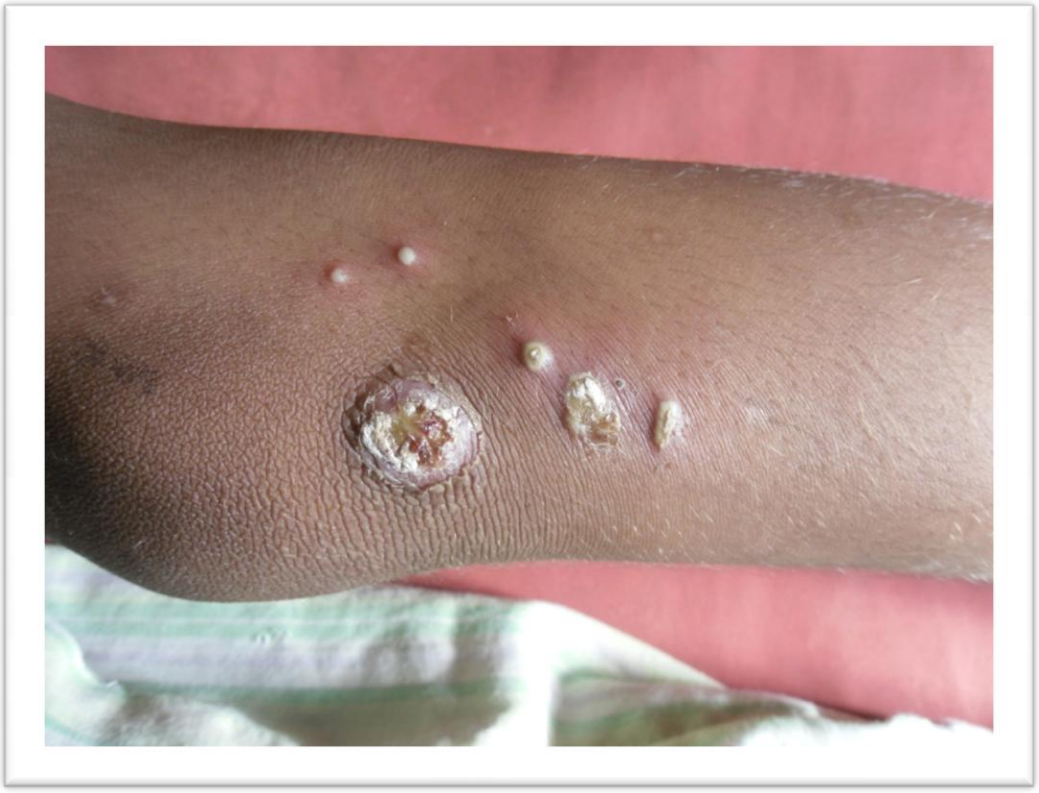


Fig 2: Superficial folliculitis

Fig 1: Honey coloured crusts in impetigo contagiosa.

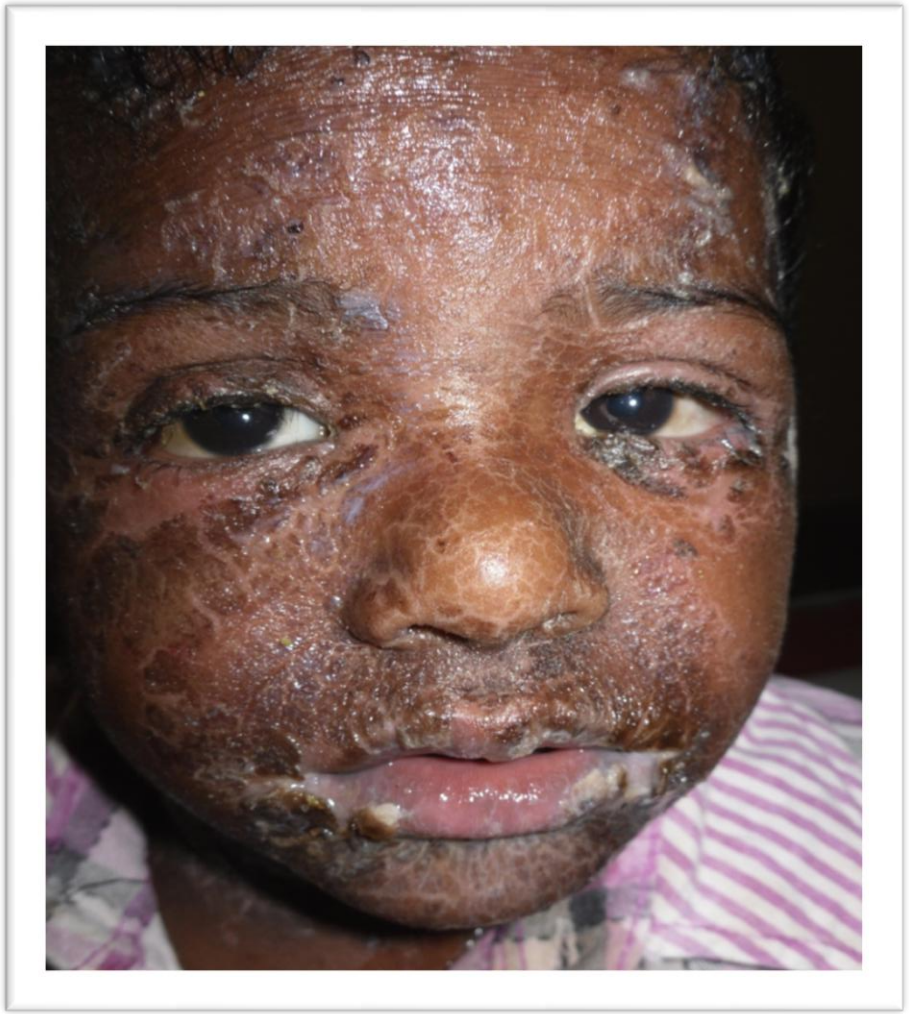


Fig 3: Perioral radial fissures in SSSS.

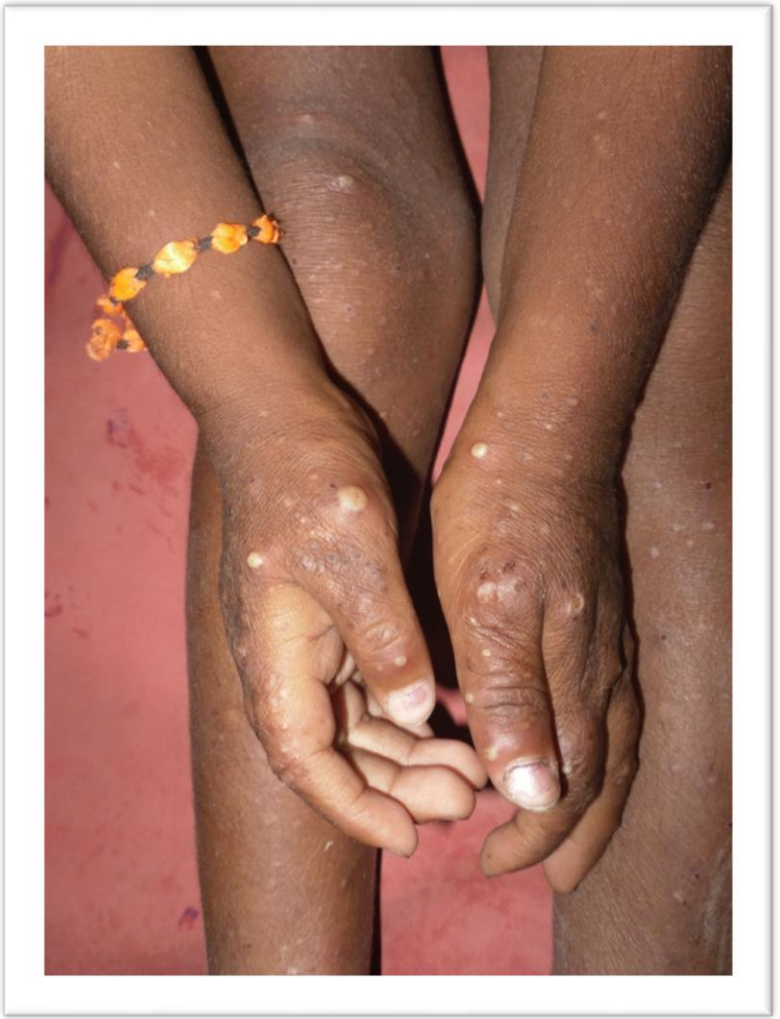


Fig 4: Scabies with secondary infection

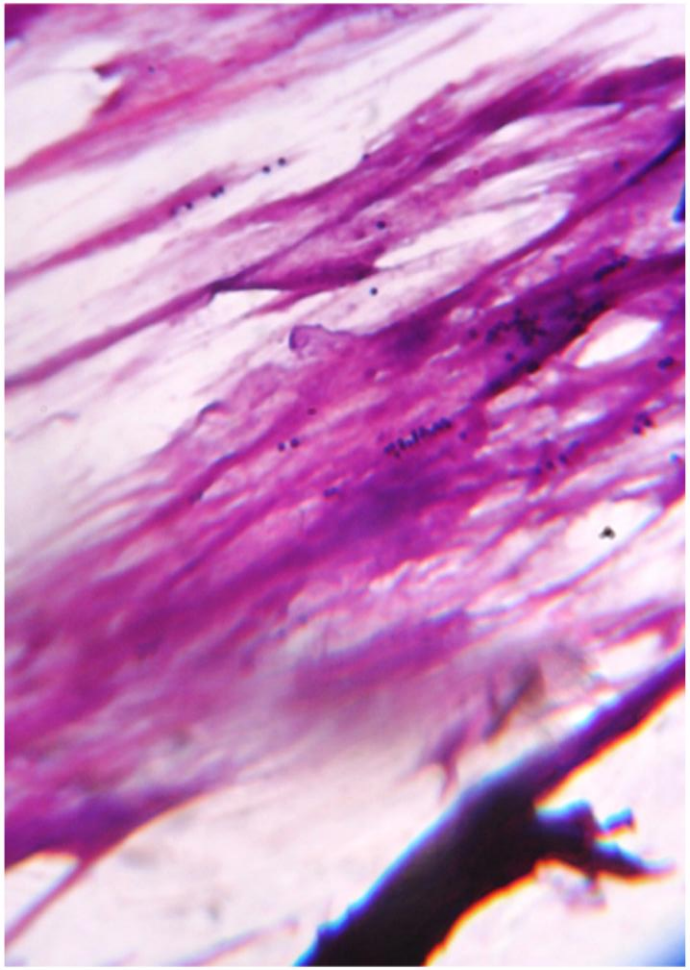


Fig 5: Gram stain from pus showing Gram positive cocci lying singly, in pairs and clusters.

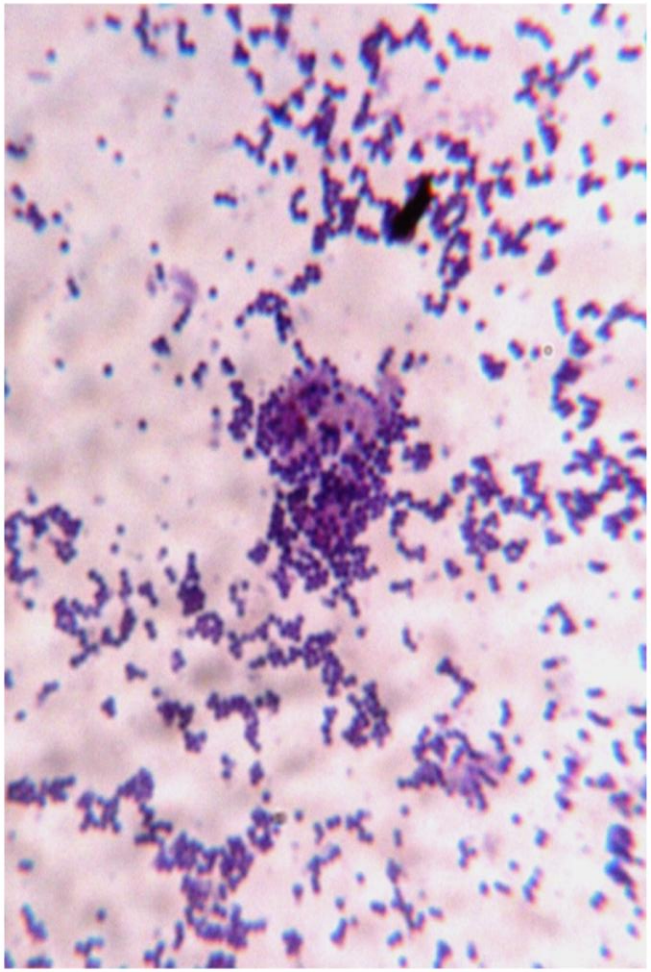


Fig 6: Gram stain from culture showing Gram positive cocci.

Fig 7: Circular, smooth, shiny colonies of *S. aureus* on blood

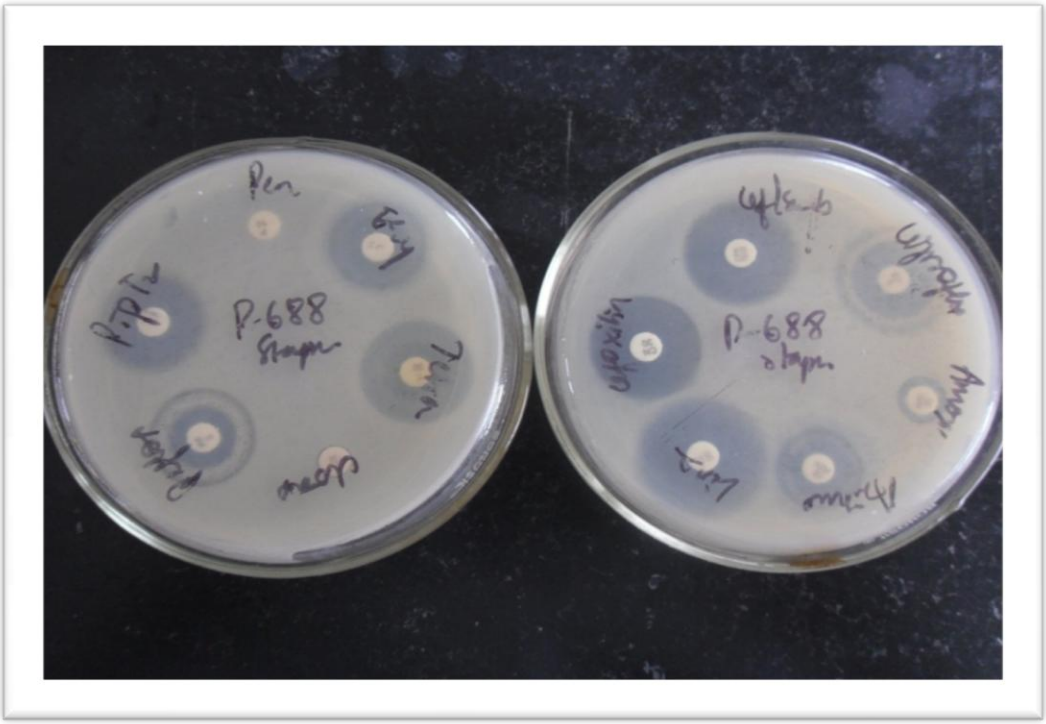


Fig 8: Antibiotic sensitivity pattern by Kirby-Bauer disc diffusion method.

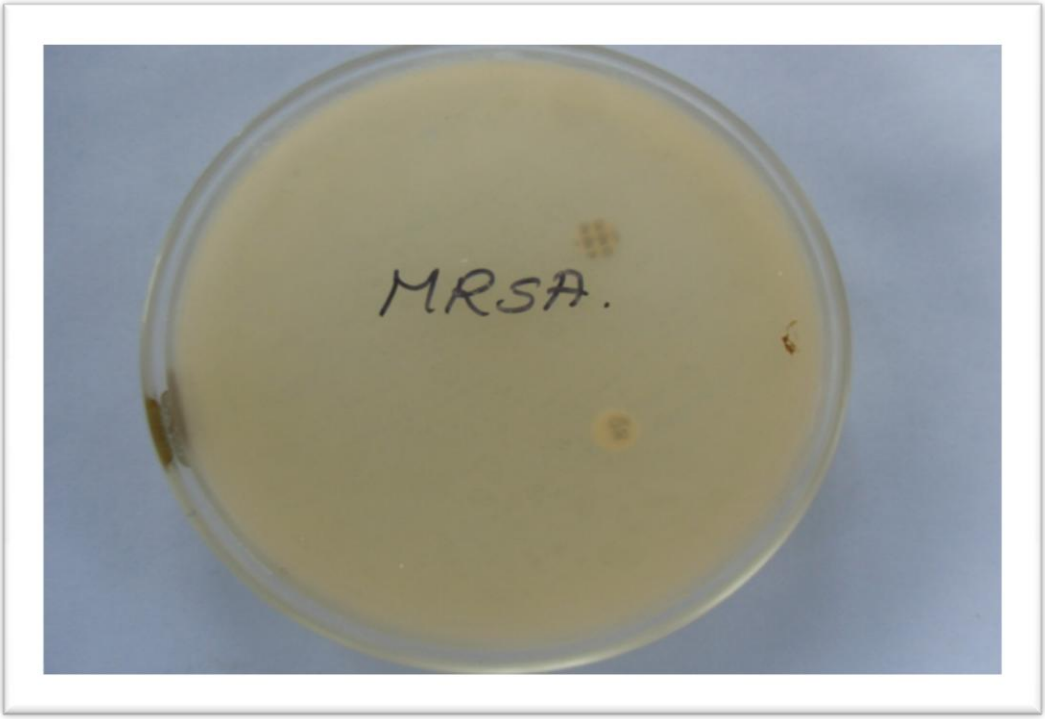


Fig 9: MRSA sensitivity on Muller-Hilton agar plate by Kirby-Bauer disc diffusion method.

RESULTS

A hospital-based, cross-sectional, descriptive analytical study was conducted from October 2009 to August 2011. Total ninety seven children with pyoderma were included in the study.

AGE AND SEX DISTRIBUTION:

Children up to 12 years of age were included in the study. Patients were categorized into 4 groups according to age; infants (<1 year), toddlers (1-<3 years), pre-school (3-<5 years) and school going (>5 years). Incidence of pyoderma was highest among school going children (n=60, 61.85%), followed by preschool children (n=22, 22.71%) and toddlers (n=10, 10.3%). Incidence of pyoderma was least in infants (n=5, 5.15%).

Among 97 children 68 were boys (70.1%) and 29 were girls (29.9%), the sex ratio being 2.34:1.

Table 1: Age and sex distribution of children with pyoderma

Age (years)	Male (%)	Female (%)	P-value
<1	3 (3.1)	2 (2.1)	0.650
1 - <3	7 (7.2)	3 (3.1)	0.194
3 - <5	13 (13.4)	9 (9.3)	0.365
>5	45 (46.4)	15 (15.4)	0.0003
TOTAL	68 (70.1)	29 (29.9)	0.0009

P<0.05, statistically significant

Boys were affected more commonly than girls and the gender difference in the occurrence of pyoderma was statistically significant (P<0.05). School going boys were more commonly affected than other age groups and the age difference in the occurrence of pyoderma was statistically significant in boys (P<0.05).

Figure 10: Sex distribution in children with pyoderma

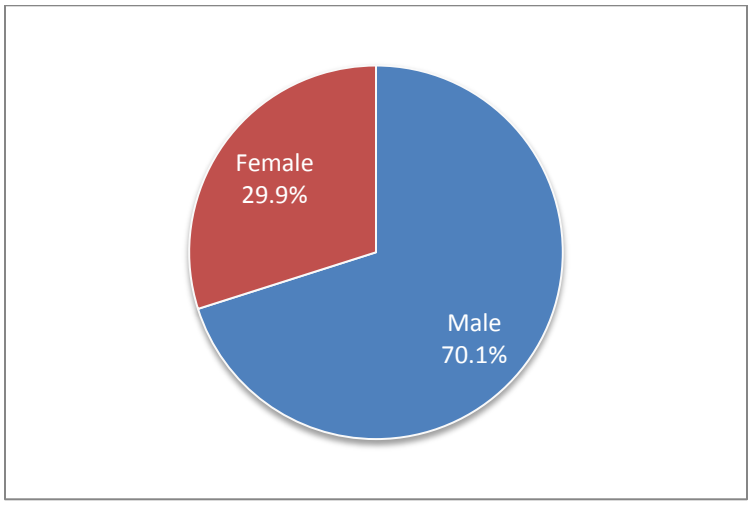
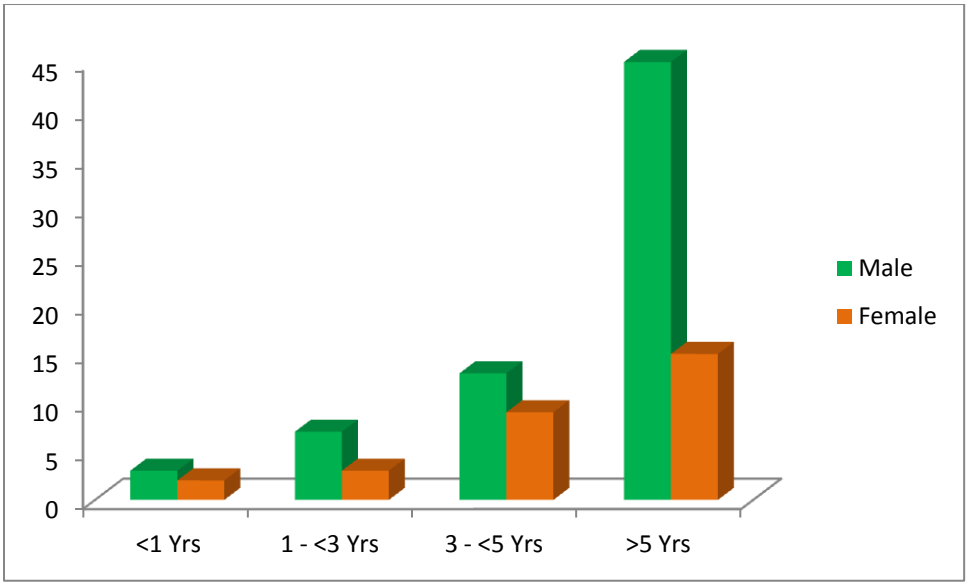


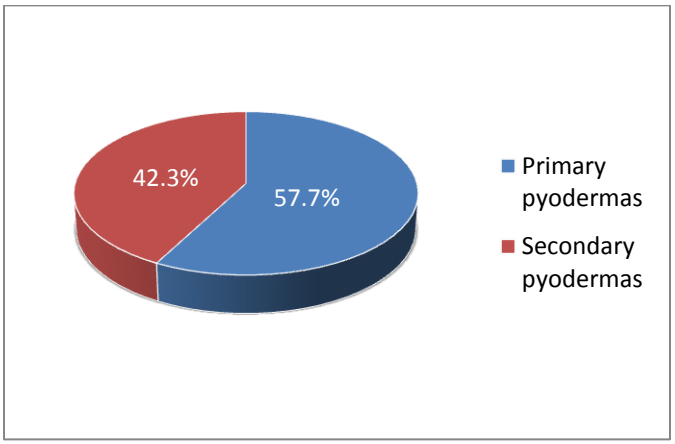
Figure 11: Sex wise age distribution in children with pyoderma



Clinical types of pyoderma:

Of the ninety seven cases, 56 (57.7%) were primary pyodermas and 41 (42.3%) were secondary pyodermas.

Figure 12: Incidence of primary and secondary pyodermas



Among primary pyodermas, the commonest clinical type was non-bullous impetigo (39.3%), followed by folliculitis (23.2%), and furuncles (12.5%). Secondary pyoderma consisted of cases associated with scabies (46.4%), followed by infective eczema (29.3%), and atopic dermatitis (12.2%).

Figure 13: Incidence of different clinical types of pyoderma

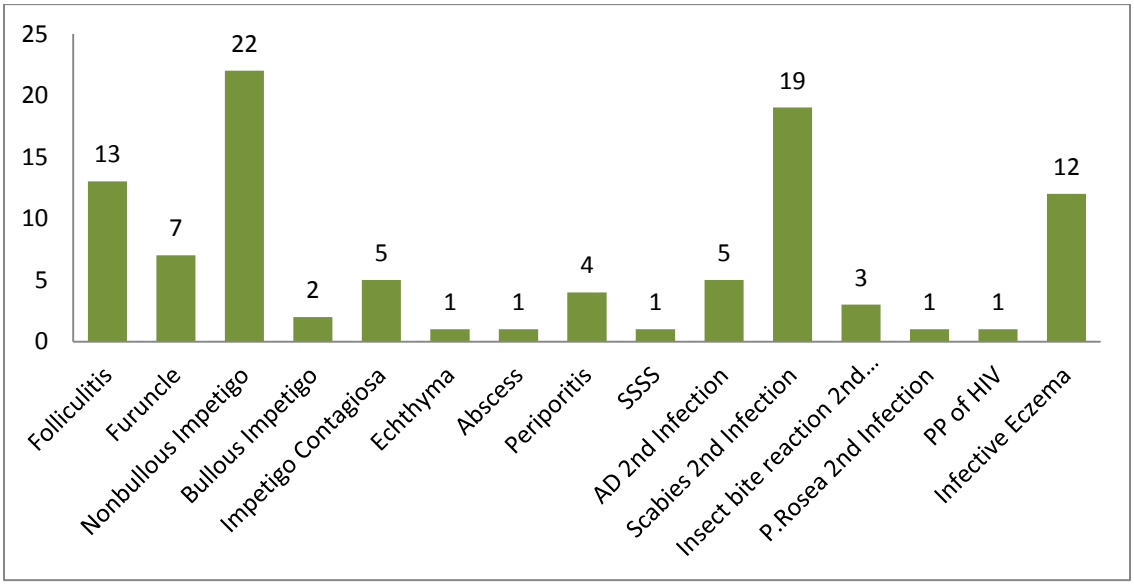


Table 2: Sex wise occurrence of primary pyodermas

Pyoderma	M (%)	F (%)	Total (%)	P-value
Folliculits	9 (23.7)	4 (22.3)	13 (23.2)	0.151
Furuncle	6 (15.8)	1 (5.5)	7 (12.5)	0.054
Non Bullous Impetigo	13 (34.2)	9 (50)	22 (39.3)	0.365
Impetigo Contagiosa	2 (5.3)	3 (16.7)	5 (8.9)	0.650
Bullous Impetigo	2 (5.3)	0 (0)	2 (3.6)	0.316
Echthyma	1 (2.6)	0 (0)	1 (1.8)	0.155
Abscess	1 (2.6)	0 (0)	1 (1.8)	0.316
Periporitis	3 (7.9)	1 (5.5)	4 (7.1)	0.312
SSSS	1 (2.6)	0 (0)	1 (1.8)	0.316
TOTAL	38	18	56	0.001

P<0.05, statistically significant

Table 3: Sex wise occurrence of secondary pyodermas

Pyoderma	M (%)	F (%)	Total (%)	P-value
Atopic Dermatitis with secondary infection	5 (16.7)	0 (0)	5 (12.3)	0.023
Scabies with secondary infection	14 (46.7)	5 (45.4)	19 (46.3)	0.029
Insect bite reaction with secondary infection	2 (6.7)	1 (9.1)	3 (7.3)	0.560
P. Rosea with secondary infection	0 (0)	1 (9.1)	1 (2.4)	0.316
Pruritic papules of HIV	1 (3.3)	0 (0)	1 (2.4)	0.316
Infective eczema	8 (26.6)	4 (36.4)	12 (29.3)	0.233
TOTAL	30	11	41	0.0008

P<0.05, statistically significant

Both primary and secondary pyoderma were commoner in boys as compared to girls and this gender difference was statistically significant (P<0.05) for both the variants. Non-bullous impetigo was the commonest clinical variant observed in both sexes (39.9%).

Among secondary pyodermas, scabies with pyogenic infection was the commonest (46.3%) followed by infected atopic dermatitis. Both these conditions were commoner among boys (P<0.05) as compared to girls.

Bacteriology of pyodermas:

Among ninety seven cases of pyoderma 79 samples yielded growth and 18 samples were sterile. Growth of *Staphylococcus aureus* was seen in 48 samples (49.5%) followed by coagulase negative staphylococci (CoNS) in 17 samples (17.6%). *Streptococcus* sp. was isolated in 12 samples (12.4%). Diphtheroids and Gram negative non-fermenters were seen in one sample each. None of the samples grew mixed bacterial agents. Among 48 *S. aureus* samples 45 were MSSA (93.75%) and 3 were MRSA (6.25%).

Table 4: Bacteriology of pyodermas

Isolates	Cases (%)
S. aureus	48 (49.5)
S. pyogenes	12 (12.4)
CONS	17 (17.6)
Diphtheroids	1 (1.0)
Gram -ve non-fermenter	1 (1.0)
Sterile	18 (18.5)
TOTAL	97

Figure 14: Bacterial isolates from culture

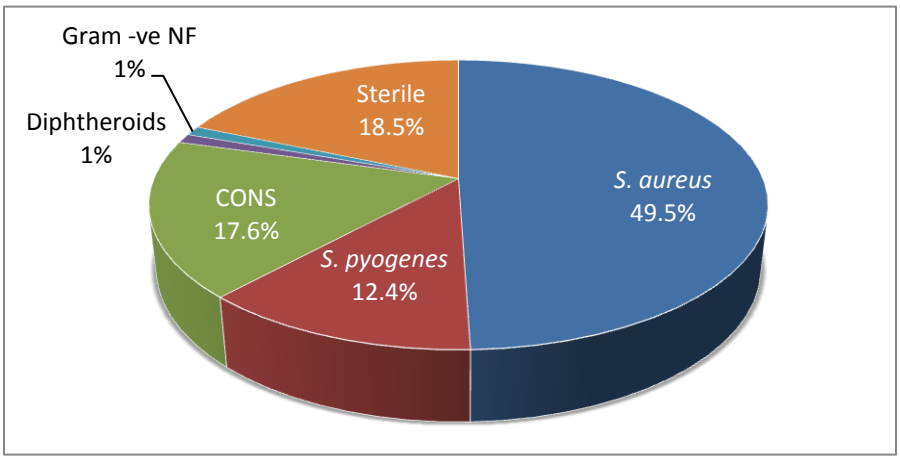


Table 5: Clinico-bacteriological profile of cases of pyodermas

Pyoderma	*S. Aureus*	*S. Pyogenes*	CONS	Diphtheroids	Gram -ve NF	Sterile
Folliculitis	9	0	2	0	0	1
Furuncle	6	1	0	0	0	0
Nonbullous Impetigo	9	3	5	0	0	5
Bullous Impetigo	1	0	0	0	1	1
Impetigo Contagiosa	3	1	1	0	0	0
Echthyma	0	0	0	1	0	0
Abscess	1	0	0	0	0	0
Periporitis	3	0	1	0	0	0
SSSS	1	0	0	0	0	0
Atopic dermatitis 2nd Infection	3	2	0	0	0	0
Scabies 2nd Infection	9	4	2	0	0	4
Insect bite reaction 2nd Infection	1	0	2	0	0	0
P.Rosea 2nd Infection	0	0	0	0	0	1
PP of HIV	0	0	0	0	0	1
Infective Eczema	2	1	4	0	0	5
Total	48	12	17	1	1	18

S. aureus was the commonest isolate seen in both primary and secondary pyodermas. Folliculitis, furuncles, non-bullous impetigo and scabies with pyogenic infection were caused by *S. aureus* in majority. CoNS was second most bacteria causing pyoderma followed by *S. pyogenes*.

Table 6: Antibiotic sensitivity pattern of *S. aureus* isolates:

Antibiotic	MSSA			MRSA		
	S	I	R	S	I	R
Pen	2	0	35	0	0	3
Ery	26	0	14	1	0	1
Tet	31	1	1	3	0	0
Cep	12	2	22	0	0	3
Clo	4	0	35	0	0	3
Pef	12	5	21	1	0	2
P+T	37	4	3	3	0	0
C+S	28	2	2	0	0	2
Gen	14	0	4	2	0	0
Cip	30	2	8	0	1	2
Acl	3	1	30	1	0	1
Cfu	21	0	9	1	1	0
Azi	26	1	12	0	0	2
Lin	36	0	4	3	0	0
Cfx	45	0	0	0	0	3

Most of the bacterial strains were resistant to penicillin, cloxacillin and amoxicillin+clavulanic acid. Highest sensitivity was to piperacillin + tazobactum followed by linezolid and cefoxitin.

DISCUSSION

Cutaneous bacterial infections in children is becoming a challenge to the clinician because of increase in emergence of antibiotic resistant strains. *Staphylococcus aureus* is a major human pathogen causing these infections.[10] Methicillin-resistant *Staphylococcus aureus* (MRSA) was first described in England in 1961, shortly after methicillin became available for use in clinical practice.[10] MRSA, which was earlier seen only in hospitals has become epidemic in the community resulting in severe and recurrent pyoderma in both children and adults.

In the present study, incidence of pyoderma was more among school goers with 60 out of 97 cases (61.85%) being school children. Incidence of pyoderma was least among infants, found in 5 cases (5.15%). Many studies on childhood pyodermas showed highest incidence of pyoderma in pre-school children;[1,9,10] however, in this study this age group ranked second in occurrence of pyoderma. This may be due to increased exposure of school going children to the external environment and cross infection from other children in the schools.

The results of the present study shows a male predominance with male: female ratio of 2.34:1. The gender difference in the occurrence of pyoderma was statistically significant ($P<0.05$). In a study by Nagmoti *et al*,[9] males outnumbered females in the ratio of 1.6:1. Similar sex ratio was seen in the studies by Nagaraju *et al*,[12] and Sardana *et al*.[10] Boys were more commonly involved in all the age groups in this study with statistically significant gender difference ($P<0.05$) among school goers.

Most of the children in the present study belonged to low income group families and few were from middle and upper-middle income group families. Similar trend was seen in a study by Mathew *et al*.[1] Poverty, lack of personal hygiene, illiteracy and overcrowding may be the predisposing factors for these children to acquire pyogenic infections.

The duration of the illness in majority of the cases ranged from 7 to 30 days in the present study. The main factors responsible for late presentation are lack of awareness among the parents regarding the disease, its consequences and lack of proper treatment facilities. Practice of using native medicines in the rural areas may also be a contributing factor.

The pyodermas were categorized into primary and secondary based on clinical presentation. In the present study, primary pyoderma comprised of 56 cases (57.7%) and secondary pyoderma was seen in 41 cases (42.3%). In a study by Sardana *et al*,[10] 66.29% of the cases belonged to primary pyoderma and 33.71% cases belonged to secondary pyoderma. Nagaraju *et al*[12] have reported 68.8% primary pyoderma and 31.2% secondary pyoderma among the studied patients. Both primary and secondary pyodermas were commoner in boys as compared to girls with statistical significance (P<0.05%) in the present study.

In this study, among primary pyodermas non-bullous impetigo was the commonest clinical type with 22 cases (39.3%) affected, followed by folliculitis in 13 cases (23.2%). Similarly in a study conducted at Pondicherry, impetigo contagiosa (46%) and folliculitis (44.2%) were the commonest primary pyodermas.[1] Nagaraju *et al*[12] have

showed similar results with 29.6% cases of impetigo contagiosa and 11.6% cases of folliculitis among their patients with primary pyodermas. Non-bullous impetigo was commoner in boys as compared to girls. Most of the lesions were seen on extremities followed by on face and trunk. Many cases were associated with fever and pruritus. Regional lymphadenopathy was noted in few cases of impetigo. Staphylococcal scalded skin syndrome was seen in one child in the present study, with extensive skin lesions over face and neck. The child responded well to systemic amoxicillin and cloxacillin and topical mupirocin ointment.

Among secondary pyodermas, scabies with secondary infection was the commonest clinical type seen in 19 (46.3%) out of 41 cases, followed by infective eczema in 12 cases (29.3%). In a study by Sardana *et al*,[10] similar results were seen; scabies with secondary infection was seen in 25.84% and infected atopic dermatitis was seen 2.2%. In the present study, atopic dermatitis with secondary infection was seen in 5 cases (12.3%) and all of them were boys. Most common sites involved were lower limbs and face.

Out of 19 cases of scabies with pyogenic infection, 14 were boys and 5 were girls and this gender difference was statistically significant ($P<0.05$). In all these cases trunk and extremities were involved. Few cases showed involvement of face and genitalia. Many of them had family history of scabies either in siblings or parents. This may be due to overcrowding and poor hygiene in the family. Fever and regional lymphadenopathy were associated in few children with secondary pyoderma.

In the present study, one child had retroviral disease and presented with pruritic papules with secondary infection, resulting in pustules. This case was treated with systemic amoxicillin and cloxacillin, and responded well to the treatment. Pus culture did not grow any organismin this patient.

Among ninety seven pus samples, *S. aureus* was the commonest organism grown in 48 cases (49.5%) followed by CoNS in 17 cases (17.6%) and *Streptococcus* sp. in 12 (12.4%). In the present study 18 (18.5%) pus samples were sterile on culture. This was comparatively higher than other studies conducted by Sardana *et al*[10] and Nagaraju *et al*.[12] This may be attributed to inadequate antibiotic treatment received by the children previously. Mathew *et al*.[1] have demonstrated *S. aureus* isolates in 47.5% cases among total 120 cases. Nagmoti *et al*[9] have reported *S. aureus* isolates in 45%, followed by *S. pyogenes* isolates in 35% of their patients. In a study by Sardana *et al*,[10] 43.8% isolates were *S. aureus.* Nagaraju *et al*[12] reported 80.8% of *S. aureus* isolates among 250 cases in their study. From the results of the above studies it is evident that *S. aureus* is the commonest causative agent for bacterial skin infections across India.

S. aureus was the commonest cause of folliculitis, furuncles, non-bullous impetigo and scabies with secondary infection in the present study. This finding is comparable to results of other studies conducted by Mathew *et al*,[1] Nagmoti *et al*,[9] and Nagaraju *et al*.[12]

Incidence of CA-MRSA infection in the present study was 6.25%. Similar incidence was observed in a study by Sardana *et al*.[10] This shows comparable incidence in the occurrence of CA-MRSA in both north and south India.

Most of the *S. aureus* strains isolated in the present study were resistant to penicillin, cloxacillin and amoxicillin+clavulanic acid. Various other studies also reported high resistance to penicillin group of drugs.[1,9,12] Highest sensitivity was recorded to piperacillin+tazobactum followed by linezolid and cefoxitin in the present study.

The results from the present study highlight the role of *S. aureus* in the causation of pyodermas in children. The sample size in the present study is small because of time constraint. Further evidence from larger prospective studies is needed to know the incidence of MRSA in the childhood pyodermas in this region of south India.

CONCLUSION

Pyodermas are the commonest dermatoses encountered in pediatric age group, especially in developing countries. *Staphylococcus aureus* and *Streptococcus pyogenes* are attributed as commonest pathogens causing pyodermas. MRSA infections are becoming commoner these days resulting in recurrent skin infections. The change in antibiotic resistance pattern has become a challenge to the clinicians globally.

Most of the children in the present study belonged to school going age. Incidence of pyoderma was more in boys compared to girls, which may be due to increased exposure of the boys to the external environment in Indian society. *Staphylococcus aureus* was the commonest pathogen isolated in the present study.

Highest resistance was observed to penicillin which is used by many clinicians in rural areas. This was followed by resistance to cloxacillin and amoxycilin+clavulanic acid. These are the drugs commonly used by the clinicians for empirical treatment of childhood pyodermas. Hence, this data regarding antibiotic resistance pattern of common bacterial pathogens will be helpful for the clinicians in this region in future. Incidence of MRSA causing childhood pyoderma was found to be low in this study.

To conclude, it is necessary to find out the antibiotic sensitivity pattern of the causative organism of childhood pyoderma before prescribing medications, the increase in drug resistant strains of bacteria in the community is a threat to treat these common ailments.

SUMMARY

A hospital based, cross-sectional, descriptive analytical study on clinical pattern and microbiological organisms causing pyoderma in children was conducted between October 2009 to August 2011. Children up to 12 years of age attending the dermatology out-patient department were included in the study. Demographic and clinical data of the patients were collected. After thorough clinical examination pus is collected from skin lesions. Gram staining, culture and antibiotic sensitivity were tested.

Following are the salient observations:

- School going children were the commonest age group associated with pyoderma.
- Male: female ratio was 2.34: 1.
- Most of the cases occurred during summer and rainy season.
- Many of the children belonged to lower socioeconomic status.
- Of the 97 cases, 56 (57.7%) were primary pyodermas and 41 (42.3%) were secondary pyodermas.
- Non-bullous impetigo (39.3%) was the commonest clinical type among primary pyodermas, followed by folliculitis (23.2%) and furuncles (12.5%).
- Scabies with secondary infection (46.4%) constituted majority of secondary pyodermas, followed by infective eczema (29.3%).
- Out of 97 pus samples, 79 yielded growth and 18 were sterile.
- All growth showed monomicrobial pattern. Mixed infection was not detected in any case.

- *Staphylococcus aureus* (49.5%) was the commonest isolate seen, followed by coagulase negative staphylococci (17.6%) and *Streptococcus* sp. (12.4%).
- Among 48 *S. aureus* samples 45 were MSSA (93.75%) and 3 were MRSA (6.25%).
- Most of the bacterial strains were resistant to penicillin, cloxacillin and amoxicillin + clavulanic acid.
- Highest sensitivity was seen with piperacillin + tazobactum followed by linezolid and cefoxitin.

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ANNEXURE

PROFORMA

B.L.D.E.U'S SHRI B. M. PATIL MEDICAL COLLEGE HOSPITAL AND RESEARCH CENTRE, BIJAPUR.

Department of Dermatology, Venereology and Leprosy.

SL.NO: Date: OP. No:

Name: Age: Sex: Male/Female

Socioeconomic status: Address:

1. Complaints :
2. Duration:
3. Type of lesions:
4. Distribution of lesions:
5. Associated symptoms and severity:
6. Others:

7. Personal history: No. of child- Diet-Veg / Mixed.
   Breast feeding- H/o Atopy-
   Immunization status:

8. Family history: Any similar complaints in the siblings- Yes/No.
   Type of house: Kaccha/ Pakka No. of rooms:
   No. of persons: Surroundings: Hygienic/Unhygienic

9. General Physical Examination: Weight- Height-
   Nutritional status:

Pallor	Cyanosis	Clubbing
Icterus	Edema	Lymphadenopathy

Cutaneous examination:

Mucous membrane:

Nail changes:

Hair changes:

10. Systemic Examination:

Respiratory system: Cardiovascular system:

Central nervous system: Per abdomen:

11. Diagnosis:

12. Investigations:

Hb%:

Total count:

Differential count:

ESR:

Peripheral blood smear:

Urine routine: Albumin- Sugar- Microscopy-

Stool examination:

Others:

Gram stain:

Culture:

Biochemical tests:

Detection of MRSA:

Sensitivity pattern:

SAMPLE INFORMED CONSENT FORM BLDEU'S SHRI B. M. PATIL MEDICAL COLLEGE HOSPITAL AND RESEARCH CENTRE, BIJAPUR-586 103

RESEARCH INFORMED CONSENT FORM

TITLE OF THE PROJECT:- CLINICAL & MICROBIOLOGICAL STUDY OF PYODERMA IN CHILDREN WITH SPECIAL REFERENCE TO CA-MRSA.

PG GUIDE:- DR. APARNA PALIT.

PG STUDENT:- DR. SIDRAMAPPA. R. WARAD.

PURPOSE OF RESEARCH:-

I have been informed that this project will study the incidence of community acquired methicillin-resistant staphylococcus aureus in bacterial pyodermas in children.

BENEFITS:-

I understand that my child's participation in this study will help the investigator to understand the disease better and will help in the management of the disease.

PROCEDURE:-

I understand that relevant history will be taken and my child will undergo detailed clinical examination after which necessary investigation will be done whenever required.

RISK AND DISCOMFORTS:-

I understand there is no risk involved and my child will experience minimal pain during the procedures performed.

CONFIDENTIALITY:-

I understand that medical information produced by this study will become a part of my child's hospital records and will be subjected to the confidentiality and privacy regulation of the said hospital. Information of a sensitive personal nature will not be a part of the medical records, but will be stored in the investigator's research file.

If the data are used for publication in the medical literature or for teaching purposes no names will be used and other identifiers such as photographs and audio or videotapes will be used only with my special written permission. I understand I may see the photographs, videotapes and hear the audiotapes before giving this permission.

REQUEST FOR MORE INFORMATION:-

I understand that I may ask more questions about the study at any time concerned. The researcher is available to answer my questions or concerns. I understand that I will be informed of any significant new findings discovered during the course of this study, which may influence my continued participation.

REFUSAL OR WITHDRAWAL OF PARTICIPATION:-

I understand that my child's participation is voluntary and I may refuse to participate or may withdraw consent and discontinue participation in this study at any time without prejudice. I also understand that the researcher may terminate my child's participation in this study at any time after he has explained the reasons for doing so and has helped arrange for my child's continued care by my own physician if this is appropriate.

INJURY STATEMENT:-

I understand that in the unlikely event of injury to my child resulting directly from my child's participation in this study and if such injury were reported promptly, then medical treatment will be available to me, but no further compensation will be provided. I understand that by my agreement for my child's participation in this study, I am not waiving any of my legal rights.

I have explained to (patient's / relevant guardian's name) the purpose of the research, the procedures required, and the possible risks and benefits to the best of my ability in patient's own language.

_____ _____

Investigator / P. G. Guide Date

I confirm that …….(Name of the PG guide / chief researcher) has explained to me the research, the study procedures that my child will undergo, and the possible risks and discomforts as well as benefits that I may experience. I have read and I understand this consent form. Therefore, I agree to give my consent for my child's participation as a subject in this research project.

_____ _____

Participant / guardian Date

_____ _____

Witness to signature Date

Key to master chart

Sl. no – Serial number

OPD no – Out patient department number

M – Male

F - Female

DOD – Duration of disease

D – Days

Mn – Months

Asso. Symp – Associated symptoms

Wt – Weight

Ht – Height

TRU – Trunk

UL – Upper limbs

LL – Lower limbs

GEN – Genitalia

LNP – Lymphadenopathy

MRSA – Methicillin resistatnt *Staphylococcus aureus*

MSSA – Methicillin sensitive *Staphylococcus aureus*

SCAB 2nd INF – Scabies with secondary infection

NB Impetigo – Non-bullous impetigo

INF Eczema – Infective eczema

IBR 2nd INF – Insect bite reaction with secondary infection

PP of RVD – Pruritic papules of retroviral disease

AD 2nd INF – Atopic dermatitis with secondary infection

Impet cont – Impetigo contagiosa

Bul Impet – Bullous impetigo

S. aureus – *Staphylococcus aureus*

S. pyogenes – *Streptococcus pyogenes*

CoNS – Coagulase negative staphylococcus

S – Sensitive

R – Resistant

I – Intermediate

PEN – Penicillin

ERY – Erythromycin

TET – Tetracycline

CEP – Cephalexin

CLO – Cloxacillin

PEF – Pefloxacin

P+T – Piperacillin + Tazobactum

C+S – Cefaperazone + Sulbactum

GEN – Gentamycin

CIP – Ciprofloxacin

ACL – Amoxyclav

CFU – Cefuroxime

AZI – Azithromycin

BAC – Bacitracin

LIN – Linezolid

CFX – cefoxitin

MASTER CHART

MASTER CHART

Sl no	OPD No	AGE	SEX	Income	D O D	ASSO. SYMP	Atopy	WT	HT	Body parts involved					DIAGNOSIS	LNP	Gram	CULTURE	MRSA	ANTIBIOTIC SENSITIVITY														
				/month				(Kg)	Ft'In	FACE	TRU	UL	LL	GEN			stain		/MSSA	PEN	ERY	TET	CEP	CLO	PEF	P+T	C+S	GEN	CIP	ACL	CFU	AZI	BAC	LIN	CFX
1	261615	6 Y	M		7 D	ITCHING	-	14	3'3	-	-	-	+	-	SCAB 2ND INF	-	+	*S. pyogenes*	-	S	-	R	S	-	-	S	R	R	-	I	S	R	S	-	-
2	261970	5 Y	M		15 D	FEVER	-	13	3'1	+	+	+	+	-	NB IMPETIGO	-	+	*S. aureus*	MSSA	R	-	S	S	-	-	S	S	S	-	R	S	S	-	-	S
3	268863	12 Y	M		5 D	-	-	29	4'11	-	+	+	+	+	SCAB 2ND INF	-	+	*S. aureus*	MSSA	R	-	S	R	-	-	S	S	-	-	R	S	S	-	-	S
4	270530	10 Y	F		8 D	-	-	22	4'3	-	-	+	+	-	NB IMPETIGO	-	+	*S. pyogenes*	-	S	-	R	S	-	-	S	S	-	-	S	S	R	S	-	-
5	274040	6 Y	F		4D	-	-	14	3'3	+	-	+	-	-	NB IMPETIGO	-	+	*S. aureus*	MSSA	R	-	I	R	-	-	I	R	-	-	R	R	R	-	-	-
6	275734	6 Y	F		8 D	FEVER	-	15	3'2	+	-	-	-	-	NB IMPETIGO	-	+	*S. aureus*	MSSA	-	-	S	R	-	-	S	S	-	-	R	S	S	-	-	S
7	276686	10 Y	M		20 D	FEVER	-	23	4'2	-	+	-	-	+	SCAB 2ND INF	+	+	*S. aureus*	MSSA	S	-	S	S	-	-	S	S	-	-	I	S	S	-	-	S
8	283046	6 Y	M		30 D	-	-	13	3'1	-	-	-	+	-	INF ECZEMA	-	+	CONS	-	S	S	S	S	-	-	S	R	-	-	S	S	S	S	-	S
9	290101	8 Y	F		4 D	FEVER	-	18	3'10	-	-	+	+	-	INF ECZEMA	-	+	STERILE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10	291025	4 Y	M		4 D	-	-	11	2'10	+	-	-	+	-	NB IMPETIGO	-	+	STERILE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11	293829	1 Y	M		30 D	FEVER	-	9	2'3	+	-	-	+	-	INF ECZEMA	-	+	*S. pyogenes*	-	S	S	R	S	-	-	S	S	-	-	S	S	S	S	-	-
12	296325	6 Y	M		30 D	FEVER	-	17	3'6	-	-	+	+	-	NB IMPETIGO	+	+	CONS	-	R	S	S	R	-	S	R	-	-	S	R	S	S	-	S	-
13	1202/10	4 Y	M	3500	15 D	FEVER	-	13	2'11	+	+	+	+	+	SCAB 2ND INF	+	+	*S. pyogenes*	-	S	S	R	S	S	S	S	-	R	S	S	S	-	S	S	-
14	28210	8 Y	M	10000	3 D	-	-	27	4'3	-	-	+	+	-	IBR 2ND INF	-	+	CONS	-	S	S	S	S	S	S	-	S	S	-	S	S	S	S	-	-
15	35003	8 Y	M	12000	10 D	-	-	21	3'11	+	-	+	+	-	ECTHYMA	-	+	*Diptheroid*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
16	47982	5 Y	M	3000	2 Mn	-	-	13	3'2	-	-	-	+	-	INF ECZEMA	+	+	CONS	-	S	S	R	R	R	R	-	-	R	-	R	I	S	-	S	-
17	3697	8 Y	M	3000	20 D	-	-	20	3'11	+	+	+	+	-	PP OF RVD	+	+	STERILE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
18	69770	9 Y	M	15000	3 D	-	-	21	4'2	-	-	-	+	-	FURUNCLES	+	+	*S. aureus*	MRSA	R	R	S	R	R	R	S	R	S	I	R	I	R	-	S	R
19	70873	3 Y	F	2500	2 Mn	COLD	-	10	2'10	+	-	-	+	-	INF ECZEMA	+	+	CONS	-	S	S	R	R	R	R	S	S	S	-	S	S	S	-	S	-
20	76455	6 Y	M	10000	10 D	-	-	13	3'2	+	-	+	-	-	NB IMPETIGO	-	+	*S. aureus*	MSSA	R	S	S	R	R	R	S	I	S	R	R	S	S	-	S	S
21	83288	10 Y	F	9000	15 D	ITCHING	-	29	4'6	-	+	-	+	-	NB IMPETIGO	-	+	CONS	-	S	R	S	S	S	I	S	S	R	S	S	S	R	-	S	S
22	85077	6 Y	M	6000	30 D	FEVER	+	15	3'4	-	+	-	+	-	NB IMPETIGO	+	+	*S. pyogenes*	-	S	S	S	S	S	I	S	S	S	I	S	S	S	S	S	-
23	94357	7 Y	M	20000	5 D	-	-	17	3'9	+	-	-	-	-	PERIPORITIS	-	+	CONS	-	R	S	S	R	R	R	S	I	S	I	R	S	R	-	S	-
24	99497	8 Y	F	15000	4 D	-	-	17	3'9	+	-	-	-	-	PERIPORITIS	-	+	*S. aureus*	MSSA	S	S	S	R	S	S	S	S	S	S	S	R	S	-	S	S
25	163308	3 Y	F	6000	8 D	-	-	14	3'2	-	-	-	+	-	NB IMPETIGO	+	+	STERILE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
26	164579	6 Y	M	18000	8 D	-	-	18	3'7	-	+	+	-	-	FURUNCLES	-	+	*S. aureus*	MSSA	R	S	S	R	R	R	I	R	R	R	R	R	S	-	S	S
27	181240	7 Y	M	25000	8 D	COUGH	-	21	3'11	-	-	-	+	-	FURUNCLES	-	+	*S. aureus*	MSSA	R	S	S	R	S	S	I	I	R	R	R	S	I	-	S	S
28	203260	7 Y	M	10000	6 D	FEVER	-	17	3'9	-	-	-	+	-	FURUNCLES	-	+	*S. pyogenes*	-	R	R	S	R	R	S	R	R	R	R	R	R	R	-	R	-
29	223120	5 Y	M	3000	15 D	FEVER	-	14	3'3	-	+	+	+	-	SCAB 2ND INF	-	+	STERILE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
30	223124	7 Y	M	3000	10 D	FEVER	-	13	3'4	-	+	+	+	+	SCAB 2ND INF	+	+	*S. aureus*	MSSA	R	S	R	R	R	R	S	S	S	S	R	S	S	-	R	S
31	283090	2 M	F	1000	1.5Mn	-	-	4	2'0	+	+	+	+	+	SCAB 2ND INF	+	+	STERILE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

32	313752	11 M	M	10000	8 D	FEVER	-	8	2'3	+	+	+	+	-	AD 2ND INF	+	+	*S. aureus*	MSSA	R	S	S	S	R	S	S	S	S	S	-	S	S	-	S	S
33	778/11	3 Y	F	5000	8 D	-	-	16	2'11	+	-	-	-	-	NB IMPETIGO	-	+	*S. aureus*	MSSA	R	R	-	R	R	R	S	S	S	S	-	-	R	-	S	S
34	777	1 Y	F	5000	4 D	EAR DISCHARGE	-	10	2'4	+	-	-	-	-	INF ECZEMA	-	+	*S. aureus*	MSSA	R	R	-	S	R	S	S	S	R	S	-	R	R	-	R	S
35	1299	3 Y	M	2000	2 D	FEVER, COUGH	-	15	3'2	-	+	+	+	-	NB IMPETIGO	-	+	STERILE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
36	10003	10 Y	M	1000	5 D	-	-	25	4'4	-	-	-	+	-	FOLLICULITIS	-	+	*S. aureus*	MRSA	R	S	S	R	R	S	S	R	S	S	-	S	-	-	S	R
37	15840	9 Y	F	3000	15 D	-	+	28	4'3	-	-	-	+	-	FOLLICULITIS	+	+	*S. aureus*	MSSA	-	S	S	S	R	R	S	S	S	S	-	-	-	-	S	S
38	31832	10 Y	M	6000	30 D	ITCHING	-	21	3'11	-	+	+	+	+	SCAB 2ND INF	+	+	*S. aureus*	MSSA	R	R	-	R	R	R	S	-	S	S	-	S	-	-	R	S
39	30761	6 Y	F	7000	7 D	FEVER, ITCHING	-	18	3'3	+	+	+	+	-	P.ROSEA 2ND INF	-	+	STERILE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
40	43645	11 Y	M	4000	7 D	ITCHING	-	30	4'6	-	-	-	+	-	NB IMPETIGO	+	+	CONS	-	S	S	-	S	S	S	S	-	S	S	-	S	-	-	S	-
41	45086	12 Y	M	5000	10 D	FEVER	+	30	4'6	+	-	+	+	-	AD 2ND INF	+	+	*S. aureus*	MSSA	R	R	-	R	R	S	S	-	S	S	-	R	R	-	S	S
42	55684	5 Y	M	4000	15 D	-	+	17	3'3	-	+	-	+	-	NB IMPETIGO	+	+	*S. aureus*	MSSA	R	S	-	S	S	S	S	-	S	S	-	S	-	-	S	S
43	57405	4 Y	M	4000	15 D	FEVER	-	16	3'4	+	-	+	+	-	NB IMPETIGO	+	+	STERILE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
44	58094	1 Y	F	7000	30 D	FEVER	-	7	2'2	+	+	+	+	-	SCAB 2ND INF	-	+	CONS	-	R	R	-	R	R	R	S	-	S	S	-	R	-	-	S	-
45	61136	8 Y	F	3500	15 D	-	-	20	3'11	-	+	+	+	-	SCAB 2ND INF	-	+	*S. aureus*	MSSA	R	R	-	R	R	R	S	-	S	S	-	R	-	-	S	S
46	66864	3 Y	M	30000	5 D	FEVER, XEROSIS	+	12	3'1	+	-	-	-	-	FURUNCLES	+	+	*S. aureus*	MSSA	R	S	-	R	R	R	S	-	-	S	-	S	-	-	S	S
47	72902	9 M	M	3000	20 D	FEVER	-	7	2'1	-	-	-	+	-	INF ECZEMA	-	+	STERILE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
48	77792	8 Y	M	7000	6 D	-	-	27	4'2	-	-	-	+	-	NB IMPETIGO	+	+	*S. pyogenes*	-	S	S	-	S	S	R	S	-	-	S	-	-	-	S	S	S
49	77933	1 Y	M	1500	10 D	-	-	8	2'3	-	+	+	+	-	AD 2ND INF	+	+	*S. pyogenes*	-	S	S	-	S	S	R	S	-	-	S	-	-	-	-	S	S
50	80382	10 Y	F	8000	20 D	-	-	30	4'6	-	-	-	+	-	INF ECZEMA	+	+	*S. aureus*	MSSA	R	S	-	S	R	R	-	-	-	S	-	S	-	-	S	S
51	86682	11 Y	M	2000	30 D	FEVER	-	24	4'1	-	+	+	+	-	SCAB 2ND INF	+	+	CONS	-	R	S	S	S	R	S	S	S	-	S	S	S	S	-	S	-
52	96632	6 Y	M	15000	10 D	-	-	21	3'8	+	-	-	-	-	FOLLICULITIS	-	+	*S. aureus*	MSSA	R	S	-	R	R	-	S	-	R	R	R	-	S	-	S	S
53	103454	8 M	F	20000	1 D	-	-	6	2'3	+	-	-	-	-	FOLLICULITIS	-	+	*S. aureus*	MSSA	R	R	S	R	R	R	S	S	S	S	R	S	R	-	S	S
54	103938	8 Y	M	5000	3 D	-	+	18	3'11	+	-	-	-	-	FOLLICULITIS	+	+	*S. aureus*	MSSA	R	S	S	R	R	R	S	S	I	R	R	S	S	-	S	S
55	112785	9 Y	M	6000	10 D	FEVER	-	22	3'10	-	-	-	+	-	INF ECZEMA	+	+	STERILE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
56	117608	4 Y	M	4000	6 D	-	-	13	2'11	+	-	-	-	-	FOLLICULITIS	-	+	CONS	-	R	R	S	R	R	I	S	S	S	I	R	I	R	-	S	-
57	119123	10 Y	M	8000	5 D	-	-	25	4'3	-	-	-	+	-	FOLLICULITIS	+	+	CONS	-	S	R	S	S	S	R	S	S	S	S	S	S	I	-	S	-
58	121487	5 Y	M	4000	8 D	-	-	16	3'2	+	-	-	-	-	IBR 2ND INF	-	+	CONS	-	R	S	R	R	R	I	S	S	-	S	R	S	S	-	S	-
59	122192	10 Y	M	8000	12 D	-	-	21	4'11	+	-	+	+	-	NB IMPETIGO	+	+	STERILE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
60	125728	10 Y	F	14500	30 D	-	-	19	3'9	-	-	-	+	-	FOLLICULITIS	-	+	*S. aureus*	MSSA	R	S	S	R	R	S	S	S	-	S	R	S	S	-	S	S
61	125296	7 Y	F	10000	7 D	FEVER	-	16	3'8	-	-	-	+	-	NB IMPETIGO	+	+	CONS	-	R	S	S	R	R	S	S	S	-	S	R	S	S	-	S	-
62	125703	4 Y	M	6000	15 D	-	-	14	3'3	-	+	+	+	-	SCAB 2ND INF	-	+	*S. aureus*	MSSA	R	S	S	-	-	S	S	S	-	S	R	R	R	-	R	S
63	125704	5 Y	M	6000	12 D	-	-	15	3'6	-	+	+	+	+	SCAB 2ND INF	-	+	STERILE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
64	127158	3 Y	F	15000	20 D	-	-	13	3'1	+	-	-	-	-	IBR 2ND INF	-	+	*S. aureus*	MSSA	R	S	S	R	R	R	S	S	-	I	R	S	S	-	S	S
65	127370	3 Y	M	13000	4 D	-	-	9	2'11	+	-	-	-	-	PERIPORITIS	-	+	*S. aureus*	MSSA	-	S	S	R	R	R	S	S	-	S	R	S	S	-	S	S

66	127797	2 Y	M	2000	30 D	-	+	11	2'10	+	-	-	+	-	FOLLICULITIS	+	+	*S. aureus*	MSSA	-	R	S	R	R	S	S	S	-	S	R	S	R	-	S	S
67	134528	7 Y	M	6000	7 D	VARICELLA	-	15	3'7	+	-	-	-	-	PERIPORITIS	-	+	*S. aureus*	MSSA	-	S	S	S	R	S	S	S	-	S	R	S	S	-	S	S
68	136377	4 Y	F	7000	15 D	PEDICULOSIS	-	24	4'4	+	-	-	-	-	FOLLICULITIS	-	+	*S. aureus*	MSSA	-	S	S	-	R	R	S	S	-	R	R	R	S	-	S	S
69	136705	4 Y	F	3000	30 D	-	-	10	2'10	+	-	+	+	-	IMPET CONT	+	+	*S. aureus*	MSSA	-	R	S	-	R	S	S	S	-	S	R	S	R	-	S	S
70	138427	5 Y	M	6500	5 D	FEVER	-	16	3'6	+	-	-	+	-	IMPET CONT	+	+	*S. pyogenes*	-	-	S	I	S	S	R	S	-	-	R	S	S	S	-	S	-
71	138793	4 Y	F	5000	5 D	FEVER	-	11	2'11	-	+	-	-	-	IMPET CONT	-	+	*S. aureus*	MSSA	-	S	S	-	R	R	S	S	-	R	-	S	S	-	S	S
72	148010	2 Y	F	10000	15 D	FEVER	-	10	2'3	-	+	+	+	-	SCAB 2ND INF	+	+	*S. aureus*	MSSA	R	S	S	-	R	I	S	S	S	S	R	-	S	-	S	S
73	148486	8 Y	M	10000	3 D	-	-	24	4'2	-	-	-	+	-	ABSCESS	+	+	*S. aureus*	MSSA	R	S	S	-	R	R	S	S	S	S	R	-	S	-	S	S
74	159428	10 Y	M	12000	15 D	KER PILARIS	+	22	3'11	-	-	-	+	-	INF ECZEMA	+	+	CONS	-	R	S	S	S	R	S	S	S	S	S	R	-	S	-	S	-
75	163261	4 Y	F	3000	1.5Mn	-	-	13	3'1	+	-	-	-	-	NB IMPETIGO	+	+	*S. aureus*	MSSA	R	S	S	I	R	R	S	-	-	S	R	-	S	-	S	S
76	164391	9 Y	M	20000	2 D	-	-	23	4'1	-	-	-	+	-	NB IMPETIGO	+	+	CONS	-	R	S	S	S	-	R	S	-	-	R	R	-	S	-	S	-
77	164399	3 Y	F	6000	4 D	-	-	11	2'7	-	+	+	+	-	IMPET CONT	-	+	CONS	-	R	S	S	S	S	S	S	-	-	S	S	-	S	-	S	-
78	166023	5 M	M	10000	10 D	-	+	7	2'3	+	-	-	+	-	NB IMPETIGO	-	+	*S. aureus*	MSSA	R	S	S	S	S	I	S	-	-	S	S	-	S	-	S	S
79	168082	9 Y	M	6000	10 D	-	-	19	3'10	-	-	-	+	-	INF ECZEMA	+	+	STERILE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
80	158161	11 Y	M	10000	4 D	LICH PLANUS	-	26	4'2	-	-	+	+	-	FURUNCLES	+	+	*S. aureus*	MSSA	R	S	S	S	R	-	S	-	-	S	R	-	S	-	S	S
81	172500	3 Y	M	6000	3 D	-	-	9	2'10	+	+	+	+	-	SSSS	+	+	*S. aureus*	MSSA	R	R	-	I	R	R	S	-	-	S	S	-	R	-	S	S
82	177378	6 Y	M	8000	30 D	-	-	15	3'5	+	+	+	+	+	SCAB 2ND INF	+	+	*S. aureus*	MSSA	R	S	-	S	R	R	S	-	-	S	R	-	S	-	S	S
83	177994	3 Y	M	5000	6 Mn	ITCHING	+	13	2'10	+	+	+	+	-	AD 2ND INF	-	+	*S. pyogenes*	-	R	R	S	S	R	R	S	-	-	I	S	-	R	-	S	-
84	179483	4 Y	M	10000	5 D	ITCHING	-	13	3'0	+	+	-	+	-	BUL IMPET	+	+	*S. aureus*	MSSA	R	R	-	R	R	I	R	-	-	S	R	-	R	-	S	S
85	179484	1.5 Y	M	10000	15 D	FEVER	-	9	2'4	+	-	-	+	-	BUL IMPET	-	+	STERILE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
86	15647	6 Y	F	4000	15 D	FEVER	-	18	3'7	-	+	+	+	+	SCAB 2ND INF	-	+	*S. pyogenes*	-	R	S	S	R	R	R	R	S	-	S	R	-	R	-	S	-
87	182924	10 Y	M	8000	3 D	FEVER	+	24	4'5	-	-	-	+	-	FOLLICULITIS	+	-	GR -VE NF	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
88	184503	3 Y	M	6000	2 Mn	-	+	11	2'10	+	-	-	-	-	INF ECZEMA	+	+	STERILE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
89	186515	1.5 Y	M	5000	7 D	ITCHING	-	10	2'5	-	-	+	+	-	FOLLICULITIS	-	+	STERILE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
90	188448	8 Y	M	3000	3 D	-	+	21	4'1	-	-	+	+	-	FOLLICULITIS	-	+	*S. aureus*	MSSA	R	R	S	-	R	R	S	S	-	S	R	-	S	-	S	S
91	192460	1 Y	M	6000	10 D	CONVULSIONS	-	9	2'0	+	+	-	+	-	IMPET CONT	-	+	*S. aureus*	MSSA	R	R	S	R	R	I	I	S	-	S	R	-	S	-	S	S
92	192550	6 Y	M	10000	15 D	-	-	15	3'6	-	+	+	+	-	SCAB 2ND INF	+	+	STERILE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
93	192623	1.5 Y	M	5000	6 D	FEVER	-	9	2'4	-	-	+	+	-	SCAB 2ND INF	-	+	*S. aureus*	MSSA	R	R	S	S	R	I	R	S	-	I	R	-	R	-	S	S
94	203081	6 Y	F	15000	10 D	KER PILARIS	-	18	3'7	-	-	-	+	-	FURUNCLES	-	+	*S. aureus*	MRSA	R	-	S	R	R	R	S	-	-	S	S	-	R	-	S	R
95	202779	5 Y	M	40000	6 Mn	FEVER	-	19	3'7	-	+	+	+	-	SCAB 2ND INF	+	+	*S. pyogenes*	-	R	S	S	-	S	S	S	-	-	S	S	-	S	-	S	-
96	205732	9 Y	F	4000	30 D	FEVER	-	20	3'11	-	-	+	-	-	NB IMPETIGO	-	+	*S. aureus*	MSSA	R	S	S	-	R	S	S	S	-	S	R	-	S	-	S	S
97	206070	3 Y	M	3000	2 Mn	ITCHING	-	10	2'9	-	+	+	+	-	AD 2ND INF	+	+	*S. aureus*	MSSA	R	R	S	-	R	R	R	S	-	R	R	R	R	-	S	S