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A study of the risk factors of soft tissue infections in infants at tertiary health care centre

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Abstract

Background: Skin and soft tissue infections (SSTIs) are clinical entities of variable presentation, etiology and severity that involve microbial invasion of the layers of the skin and underlying soft tissues. SSTI is a common health-care problem in the pediatric patient population. Children, especially those under 3 years of age, appear to be particularly vulnerable to these infections. **Methodology:** This study was conducted at Microbiology department of tertiary care centre for a period of 18 months. 250 children who visited the IPD and OPD at Pediatric Surgery Department and those were less than one year of age were included for the study. Clinical features suggested skin and soft tissue infection. **Result:** Most common risk factor in this study was daily massage with oils (94.8%). Other risk factors were trauma (79.6%), body piercing (19.2%) and previous hospitalization (14%). None of the case had history of attending day care centre, diabetes or presence of some other risk factor. **Conclusion-** The initial assessment of any child with a skin or soft tissue infection involves taking a thorough but focused history. Details such as the onset of signs and symptoms, progression of disease, previous hospitalization, association with trauma, body piercing, bite injuries and systemic symptoms can help clarify causative organisms as well as the treatment approach.

Keywords: Infants, risk factor, infection, soft tissue, pediatric

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Introduction

Skin and soft tissue infections (SSTIs), most commonly cellulitis or cutaneous abscess, are one of the most common infections encountered in the pediatric age group, especially in the developing world.[1,2] Skin and soft tissue infections (SSTIs) are clinical entities of variable presentation, etiology and severity that involve microbial invasion of the layers of the skin and underlying soft tissues. Human skin serves as the first line of defense against microbial infection as a physical barrier; by secreting low pH, sebaceous fluid and fatty acids to inhibit growth of pathogens; and by possessing its own normal flora, thus deterring colonization by other pathogenic organisms.[3] Because of its delicate and intricate anatomy and physiology, the skin is very prone to irritation, abrasions or trauma, as well as the development of lesions generated from within its own structures (e.g., folliculitis). These infections in infants occur when skin integrity is compromised as a result of change in bacterial load on the skin, the availability of bacterial nutrients, excessive skin moisture due to daily oil massage. Poor

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control over diabetes can lead to serious infections. Cuts, animal bites, ear piercing etc. such traumatic events causes wounds which increase the risk of infections and formation of abscesses.[2]

The presence of specific risk factors may potentiate SSTIs, and may dictate their etiology, the course of disease and the response to specific treatments. The presence of risk factors for developing an SSTI has not been shown to correlate with disease severity.[4] Thus, the use of risk factors for diagnostic purposes requires further investigation. Risk factors may be organized into two categories. First, there are patient-related factors, which may predispose to disease or have prognostic implications. Risk factors in this category include body piercing, daily massage with oils, previous hospitalization and attending day care centres. These factors independently correlated with the development of SSTI.

Multiple patient-related risk factors may correlate to a poorer prognosis, more rapid progression of disease, slower healing and, also, more resistant pathogens. Certain risk factors (chronic renal or liver failure, asplenia, immunocompromised state, vascular insufficiency or neuropathy) should be considered in the determination of disease severity.

The second category is etiological risk factors. The mechanism of injury (traumatic events, animal bites and diabetes) or specific exposures increases the likelihood of SSTIs caused by specific microbes. There is overlap between risk factors in this grouping and those listed in the above group.

During the initial evaluation, it is important to determine whether the infection is superficial or deep, and whether it is localized or spreading. Prompt treatment is essential if the infection appears to be spreading, as the sequelae can be life threatening. The true prevalence of SSTIs is unknown because mild infections are typically self-limiting and patients do not seek medical attention. Nonetheless, SSTIs are encountered often in both the outpatient and inpatient settings. If diagnosed early and treated appropriately, these infections are almost always curable, but some have the potential to cause serious complications such as septicemia, nephritis, carditis and arthritis if diagnosis is delayed and/or treatment is inadequate. Therefore, this study was undertaken to study the risk factors in infants attended tertiary care hospital.

Materials And Methods

This prospective study was conducted at Microbiology department of tertiary care center after getting the necessary ethical approval from the Institutional Research Committee. The duration of the study was for 18 months. 250 children who visited the IPD and OPD at Pediatric Surgery Department and those were less than one year of age were included for the study. Those who had Hospital acquired infection after 48 hours of admission and who refused to participate were excluded from the study.

At the beginning of the study, diagnosis of skin and soft tissue infection was done based on some clinical features such as redness, swelling, pain, hemorrhage, warmth, crepitus.

Pus or exudate was collected from the depth of the lesion by either aspiration or using at least two sterile cotton swabs after cleaning the wound with sterile normal saline and surrounding skin with alcohol. Care was taken not to touch the adjacent skin margins. Then the swabs were transported in sterile cotton plugged test tubes. After reaching the laboratory the swab was inoculated on Blood agar, and MacConkey agar plates and these plates were incubated aerobically at 37 for 24-48 hours. Direct smears were made from the second swab on a clean grease free glass slide. The smear was heat fixed by flaming over the bunsen burner. Gram staining was done for the smears so made and examined under oil immersion objective to note the various morphological types of bacteria, Gram reaction, presence or absence of inflammatory cells.

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After 24 hrs. of incubation, plates were examined for any growth and plates showing no growth were incubated further for next 24 hrs. The plates are discarded if there was no growth after 48 hrs. From the plates showing growth, secondary smears were prepared and biochemical tests were put up for identification. All the aerobic bacteria were identified by Gram stain morphology, cultural characteristics, pigment production, haemolysis on blood agar, motility and conventional biochemical tests for aerobic bacteria as per standard guidelines.

Results

A total of 250 children less than 1 year of age with clinical features suggestive of skin and soft tissue infection were included in the present study.

Table 1: Gender-wise distribution

Sex	No. of cases	Percentage
Male	143	57.2
Female	107	42.8
Total	250	100

Out of these 250 cases, 143 (57.2%) were male and 107 (42.8%) were female (Table 1).

Table 2: Distribution of risk factors

Risk factor	No. of cases	Percentage
Animal bite	3	1.2
Trauma	199	79.6
Body piercing	48	19.2
Daily massage with oil	237	94.8
Previous hospitalization	35	14
Attended Day care centre	00	00
Diabetes	00	00
Other	00	00

The risk factors which predisposed to the occurrence of SSTIs were studied in the present study. Most common risk factor in this study was daily massage with oils (94.8%). Other risk factors were trauma (79.6%), body piercing (19.2%) and previous hospitalization (14%). None of the case had history of attending day care centre, diabetes or presence of any other risk factor. (Table 2)

Table 3: Distribution of clinical signs of SSTIs

Clinical signs	No. of cases	Percentage
Heat	248	99.2
Redness	246	98.4
Localized swelling	240	96
Localized tenderness	209	83.6
Purulent discharge	177	70.8
Fever	170	68
Abscess	74	29.6

248 heat (99.2%), redness 246 (98.4%) and localized swelling 240 (96%) were the commonest clinical signs present in all the 250 cases of SSTIs. The other signs present were localized tenderness 209 (83.6%), purulent drainage 177 (70.8%), fever 170 (68%) and abscess 74 (29.6%) of cases (Table 9). Out of 177 cases having purulent discharge, 98 (55.36%) cases had impetigo, 79 (44.63%) had furuncle, 26 (14.68%) had cellulitis and 15 (8.17%) had erysipelas. (Table 3)

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Table 4: Distribution of risk factors and growth on culture media

Growth	No growth	Gram positive	Gram negative
Risk factors			
Animal bites	00	02	01
Trauma	83	56	60
Body piercing	22	11	14
Daily massage with oils	101	67	68
Previous hospitalization	19	07	08
Attended day care centre	00	00	00
Diabetes	00	00	00
Others	00	00	00

Chi Square=12.24; df=12; p>0.05; Not significant

In one case with AFB positive, there was history of TB in family.

Inoculation of samples on routine culture media such as blood and MacConkeys agar showed growth of gram-positive organisms in 74 cases and gram negative organisms in 78 cases, whereas 4 cases showed mixed growth. (Table 4)

Discussion

SSTIs are suppurative microbial invasions of the epidermis, dermis and subcutaneous tissues characterized by induration, erythema, warmth, and pain or tenderness. Local manifestations may be accompanied by systemic signs and symptoms, such as fever, chills, malaise and, at times, hemodynamic instability. Due to variable etiologies, presentations and severities, the diagnosis of SSTIs is difficult and the real challenge is to efficiently differentiate those cases that require immediate attention and intervention, whether medical or surgical, from those that are less severe. In the literature search it was observed there is lack of data in infant population. Hence, this study was undertaken to study the risk factors in infant population with skin and soft tissue infections.

A total of 250 children less than 1 year of age with clinical features suggestive of skin and soft tissue infection were included in the present study. Out of these 250 cases, 143 (57.2%) were male and 107 (42.8%) were female. Rani *et al.*[5] found SSTIs more commonly among males (56%) than females. In several other studies conducted by Ghadage DP *et al.*[6] and Andrews RM *et al.*[7] similar pattern of gender distribution was found.

Although multiple risk factors for skin and soft tissue infections have been described, there are no studies specifically addressing this issue. There are many events that can serve as etiologic factors to skin and soft tissue infections. Some of them are trauma, daily massage with oils, animal or insect bites, body piercing and previous hospitalization etc. Types of wounds (e.g., puncture, animal bite) may also give a clue as to which organisms are likely to be causing a particular infection.

Most common risk factor in this study was daily massage with oils (94.8%). Other risk factors were trauma (79.6%), body piercing (19.2%) and previous hospitalization (14%). None of the case had history of attending day care centre, diabetes or presence of some other risk factor.

In the present study 94.8% cases had history of daily massage with some oils. Natural vegetable or plant oils (for example, mustard, sunflower, sesame, coconut, olive, and soybean oils) have emollient properties and in many low- and middle-income countries application of these to the newborn infant's whole body surface is a widespread traditional practice.[8] But, topical application of oils has not been shown to reduce the risk of infection or its associated

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morbidity or mortality, and may increase the risk of infection with coagulase-negative staphylococci in a study by Cleminson *et al.*[8]

There are several means by which bacteria penetrate the skin barrier. The most common route is through a break in the barrier by a trauma or body piercing. In present study, 19.2% cases had history of body piercing in the form of nose or ear piercing.

Body piercing involves puncturing of the skin or mucosae with subsequent insertion of foreign bodies, such as rings, bars, or other jewelries. In some procedures, the cartilage is also pierced, as in case of "high piercing" of the ear involving the cartilage of the pinna. Common sites of piercing in infants include ears and nose.[9]

While most body piercings are not problematic, the potential for localized infections, as well as associated systemic diseases, is present so long as the piercing site remains open.[70] These infections may become an even more invasive problem with the emergence of community acquired methicillin resistant *Staphylococcus aureus* (CA-MRSA).[10]

Ear cartilage piercing is popular, and the site can become infected with *Staphylococcus aureus* and *Pseudomonas aeruginosa*.[11] Infections generally manifest within 2 to 4 weeks of piercing. Exquisite tenderness is often associated with infections involving the cartilage.

History of animal bite (dog bite) was present in three cases. These three cases yielded growth of *Staphylococcus aureus* in two cases (66.66%) and *Escherichia coli* in one case (33.33%). The microbiology of infected bite wounds from dogs is similar to that of the organisms that colonize the dog's oral cavity and less frequently, isolates may also come from the environment and patients' skin. In one multicenter study, the *Staphylococcus* spp. and *Escherichia coli* were isolated from dog bite wounds in 46% and 6% of cases respectively.[12]

Heat 248 (99.2%), redness 246 (98.4%) and localized swelling 240 (96%) were the commonest clinical signs present in all the 250 cases of SSTIs. The other signs present were localized tenderness 209 (83.6%), purulent drainage 177 (70.8%), fever 170 (68%) and abscess 74 (29.6%) of cases. Systemic signs were not seen in any of the case.

Inoculation of samples on routine culture media such as blood and MacConkeys agar showed growth of gram positive organisms in 74 cases and gram negative organisms in 78 cases, whereas 4 cases showed mixed growth.

Conclusion

Pediatric surgical department visits for pediatric skin and soft tissue infections are on the rise. The physician must be able to recognize and diagnose a wide spectrum of diseases, ranging from benign conditions to those that are immediately life threatening. The diagnosis is often clinical, and treatments must be tailored to the most likely organisms present in a given population of patients.

The initial assessment of any child with a skin or soft tissue infection involves taking a thorough but focused history. Details such as the onset of signs and symptoms, progression of disease, previous hospitalization, association with trauma, body piercing, bite injuries and systemic symptoms can help clarify causative organisms as well as the treatment approach.

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