

## Research Article

# Prospective study on sociodynamics of cellulitis in general surgical unit

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**Received:** 05 February 2015

**Accepted:** 03 March 2015

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## ABSTRACT

**Background:** Cellulitis is a potentially serious infection that commonly recurs. The identification of preventable dynamic factors could reduce infection related morbidity and cost and improve patient management. The aim of this study was to identify the dynamic factors associated with cellulitis, including analysis of risk factors associated with cellulitis in either limb and in other parts of the body.

**Methods:** We conducted a prospective study on 110 patients with cellulitis in either limb and in other parts of the body, who were admitted in septic ward of all units of King George hospital between period of December 2013 to December 2014. The factors such as low socioeconomic status, illiteracy, rural area, nutritional status and associated co-morbid conditions and their effect on outcome of patient were studied. Univariate analyses were performed to describe the study.

**Results:** The median age of the participants was 62.5 years. The following risk factors were strongly and independently associated with cellulitis and outcome of the patient; illiteracy (OR, 4; P value 0.010), age above 50 years (OR, 0.110; P value 0.000), residing in rural areas (OR, 4.008; P value 0.006), low socioeconomic status (OR, 0.241; P value 0.030) and associated co-morbid conditions (OR, 0.390; P value, 0.032).

**Conclusion:** Patients usually presented in the late stage of disease because of illiteracy, ignorance and poor knowledge. Patients should be educated to routinely inspect their feet, and the importance of appropriate footwear should be emphasized. Patients who are actively involved in their care can improve their quality of life and have a better outcome.

**Keywords:** Cellulitis, Socioeconomic status, Literacy, Co-morbidities

## INTRODUCTION

Cellulitis is an inflammatory condition of the skin and subcutaneous tissue, characterized by erythema, swelling, warmth, and pain. The etiologic agents are most often *Streptococcus pyogenes* and *Staphylococcus aureus*, followed by non-group A beta-hemolytic streptococci and gram-negative bacilli.<sup>1,2</sup> Cellulitis is a common medical emergency, the severity of which varies from mild to life threatening. The infection can occur any site in the body; lower limbs are affected in >70% of cases.<sup>1</sup> Risk factors for cellulitis of the lower limbs include the presence of

sites of entry for the etiologic agent and predisposing factors, such as being overweight and having lymphedema.<sup>3,4</sup> Sites of entry are commonly created by traumatic injury, leg ulcers, and possibly, dermatophytic toe web intertrigo.<sup>3,5</sup> Two recent case-control studies addressing risk factors for cellulitis demonstrated a significantly higher rate of toe web intertrigo in the patient group.<sup>3,4</sup> Although dermatophytes do not cause cellulitis, they lead to scaling and fissure formation and, by disruption of the skin, provide a niche for bacteria that could enter the body. Two reports have confirmed the presence of pathogenic bacteria, such as beta-hemolytic

streptococci and *S. aureus*, in abnormal toe webs of cellulitis patients.<sup>5,6</sup>

The skin is a milieu for controlled bacterial growth. Skin supports the growth of commensal bacteria, which protect the host from pathogenic bacteria. Environmental and local factors, host immunity, and organism adherence and virulence are intricately related to cutaneous infection. Resident gram-positive bacteria include *Staphylococcus*, *Micrococcus*, and *Corynebacterium* sp. *Staphylococcus aureus* and *Streptococcus pyogenes* are notoriously pathogenic in the skin. Gram-negative organisms such as *Pseudomonas aeruginosa*, *Pasteurella multocida*, *Capnocytophaga canimorsus*, *Bartonella* sp., *Klebsiella rhinoscleromatis*, and *Vibrio vulnificus* are not typical resident skin microflora but may cause cutaneous infection.

Cellulitis often requires hospitalization, especially for elderly patients, who frequently have co-morbid conditions. The morbidity related to immediate complications and frequent recurrences and the cost of management warrant efforts to better understand the risk factors. We present data from a prospective study mainly on the socioeconomic status and locality of the patient.

## METHODS

We analyzed the cases of 110 patients with cellulitis at any site of the body who had been hospitalized in the septic ward of the King George Hospital, a tertiary care hospital. The period analyzed was 1 year, from December 2013 to December 2014. The data required (age, sex, infection site, length of hospital stay, socioeconomic status, nutritional status, education and area etc.) were obtained by chart review. We studied the cellulitis includes both superficial and deep cellulitis.

The study population consisted of patients aged >14 years who were hospitalized because of acute cellulitis on either limb or other part of the body. The study was approved by the hospital ethics committee. All participants signed an informed consent statement.

Inclusion criteria for patients were as follows: 1) presence of cellulitis, defined as a demarcated cutaneous inflammation that was associated with fever, chills or leukocytosis. Exclusion criteria as follows: 1) hospitalization within the 4 weeks preceding the present admission. 2) Age less than 14 years. 3) Patients discharged within 3 days of admission and OP cases.

### Data collection and microbiological analyses

We completed a questionnaire for each patient obtained socioeconomic status, education of the patient, co-morbid conditions, locality of the patients, procedure received, organism isolated, duration of stay in hospital and outcome. Patient was examined both upper and lower extremities, and obtained samples from the affected limb

and sent for microbiological analysis. Diabetes mellitus was recorded for patients with laboratory confirmed disease. Any quantity or type of current smoking was recorded. Blood cultures were performed if it was deemed clinically indicated by the physician.

All the data were collected and processed using version 16.0 of the SPSS statistical package for Macintosh. Qualitative variables were expressed as absolute numbers and relative frequencies (percentages) and quantitative variables.

## RESULTS

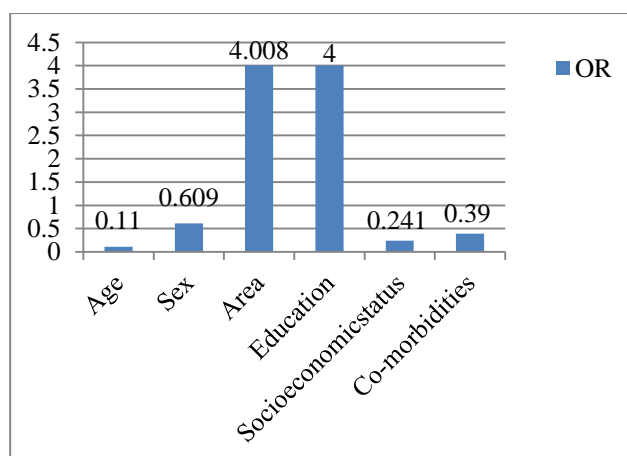
A total of 110 patients with cellulitis were admitted to the septic ward during the period studied, 85 males and 45 females. Male to female ratio was 3.4:1. Males are affected more than females, 85 (77.3%) and 25 (22.7%) cases respectively. The mean hospital stay was 11.2 days. We also found statistically significant differences on comparing age and mean hospital stay (Longer stays with increased age). Out of 110 patients in our study 2 patients underwent above knee amputation, 5 patients underwent below knee amputation, 13 patients underwent skin graft after debridement.

We divided the patients into groups in every parameter that is 1) age; <50 years and >50 years 2) sex; female and male 3) area: rural and urban 4) education: literate and illiterate 5) socioeconomic status: APL (above poverty line) and BPL (below poverty line) 6) co-morbidities: co-morbid and non-co-morbid.

**Table 1: Showing univariate analysis of dynamics of cellulitis.**

Outcome	Odds ratio	P value	(95% conf. interval)
Age	0.110	0.000	0.04228233 - 0.289585
Sex	0.609	0.343	0.21955 - 1.693654
Area (Rural or urban)	4.008	0.006	1.489865 - 10.78292
Education (Literate illiterate)	4	0.010	1.394932 - 11.4701
Socioeconomic status	0.241	0.030	0.0666052 - 0.8725365
Co-morbidities	0.390	0.032	0.1652997 - 0.9239477

Table 1 shows univariate analysis of dynamic factors of cellulitis. It would appear that patients age above 50 years were strongly associated with cellulitis and outcome of the patient and would be statistically significant difference (OR, 0.110; P value 0.000) followed by patients residing in the rural area (OR, 4.008; P value 0.006), illiterates (OR, 4; P value 0.010), low socioeconomic status (OR, 0.241; P value 0.030) and associated co-morbid conditions (OR, 0.390; P value 0.032).



**Figure 1: Showing odds ratio of parameters.**

**Table 2: Showing lesion sites.**

Lesion site	No. of patients	% of patients
Face	2	1.8
Upper limb	15	13.6
Lower limb	70	63.6
Genitals	16	14.5
Trunk	7	6.3

The most common lesion sites were the lower limbs (70 cases), with no significant differences between the right or left limb, followed by genital cellulitis (16 cases), the upper limbs (15 cases), trunk (7 cases) and the face (2 cases).

**Table 3: Organisms isolated in patients studied.**

Organism	No. of patients	% of patients
E. coli	37	33.6
Klebsiella species	11	10
Pseudomonas	26	23.6
Proteus	12	10.9
Staphylococcus aureus	5	4.5
Streptococci	7	6.36
Fungal infections	2	1.8
No organisms	10	9.09

The most common organisms isolated from the affected sites are E. coli (33.6%).

## DISCUSSION

Our study confirms cellulitis mostly affect the lower limbs, a finding in agreement with those of other studies, which have reported lower limb involvement at times in excess of 85% of patients.<sup>1,7,8,11</sup> The percentage of patients with lower limb lesions in our series was 73.6%, with the genitalia and upper limb next common sites. Several authors have attempted to identify predisposing

factors by analyzing data from each patient’s history and classifying these as local and general risk factors. In agreement with reports of previous series, we found statistically no significant sex-related difference.<sup>11,12</sup>

A study by Weng et al.<sup>9</sup> conducted in the UK investigated 610 patients with diabetes attending an inner city hospital for the first time, and found that those individuals living in areas classified as ‘deprived’ were 3.5 times more likely to experience foot ulceration or amputation compared to individuals living in areas classed as ‘intermediate’, and were twice as likely to experience these complications compared to those living in more ‘prosperous’ areas. Bihan et al.<sup>10</sup> conducted a cross sectional prevalence study that included 135 patients with diabetes admitted to a French hospital. In our study patients living in rural area were 1.75 times more likely to experience septic diseases which are similar to Weng et al. study with minimal difference.

Age is not generally considered a risk factor for cellulitis, although some studies show slightly higher incidence in individuals over age 45; the elderly and those with diabetes mellitus are at increased risk for more severe disease.<sup>13</sup> In our series group of patients over age 50 and with co-morbidities like diabetes, hypertensive, HIV and CRF etc. were most likely involved which is similar to above study.

It is worth mentioning that most of diabetic neuropathic foot ulcer patients in developing countries like ours are illiterate with little awareness and almost no diabetic education.<sup>14</sup>

The incidence of cellulitis and outcome are more common in poor literacy patients in our series. This is due to some of the traditional treatments that are commonly used for a pain include covering the affected area with heated herbal leaves, rubbing with tiger balm or Gac core alcohol and using bear bile. However many people have suffered serious consequences as a result of these treatments which can lead to joint stiffness, muscle wasting or blisters on skin.

## CONCLUSIONS

Patients usually presented in the late stage of disease because of illiteracy, ignorance, poor knowledge and low income. Patients should be educated about the local application of native medicamentosa like pain balms which causes serious complications and to routinely inspect their feet, and the importance of appropriate footwear should be emphasized. Patients who are actively involved in their care can improve their quality of life and have a better outcome.

*Funding: No funding sources*

*Conflict of interest: None declared*

*Ethical approval: The study was approved by the institutional ethics committee*

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DOI: 10.5455/2320-6012.ijrms20150504

**Cite this article as:** Chakravarthy DS, Gandeti KK, Subramanyam GS, Yeddula VJ, Gera A. Prospective study on sociodynamics of cellulitis in general surgical unit. *Int J Res Med Sci* 2015;3:1052-5.