Cellulitis of Lower Limb- A Clinical and Microbiological Profile

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Abstract
Background: *Cellulitis is a common surgical condition defined as a spreading infection of the skin and subcutaneous tissue. The severity can vary from mild to life threatening condition. The risk factors of lower limb cellulitis, the common causative organisms, their sensitivity all remains controversial. This study aims at finding out the relative frequency of predisposing factors, the microbiological profile and sensitivity to aid in the better management of lower limb cellulitis.*
Methods: *This is a prospective study carried out in the Department of Surgery, Government Medical College Trivandrum. A total number of 60 patients were analysed.*
Results: *The commonest organism isolated was beta haemolytic streptococcus in the gram positive group, and klebsiella species in the gram negative group. Sensitivity to different antibiotics was analysed.*
Conclusion: *The predisposing factors identified for lower limb cellulitis include obesity, lymphedema, history of trauma and varicose veins. A larger study will be needed to assess the risk factors of lower extremity cellulitis.*
Keywords: *Cellulitis, lower extremity, sensitivity.*

Introduction

Cellulitis is spreading inflammation of subcutaneous tissue [1]. Cellulitis can affect any part of the body and its severity varies from mild to fulminent disease [2,3]. Though there is no abscess formation, pus discharge or ulceration in cellulitis; these can coexist if there are any associated comorbidities like diabetes or vasculitis.

Cellulitis is not a surgical emergency, but it can be life threatening if left untreated or inadequately treated [4]. There are cases reported in literature where cellulitis starting as trivial lesion progressing to life threatening condition. Mild cellulitis often goes unreported and can affect any individual irrespective of age, sex, race and ethnic group. However higher incidence is seen as age increases.

According to a retrospective study of international travelers by the geosentinal surveillance network, cellulitis was found to be more common in geriatric age group[5].

Statistics show that cellulitis account for about 3% of emergency hospital registration[6]. Among them majority, approximately 80% is associated with comorbidities like diabetes, filariasis & obesity[7].

For the study to be genuine and credible, we need more prospective studies were cases are picked out accurately after ruling out DD's like lower limb eczema, oedema with blisters, DVT & vasculitis. Majority of the previous studies were retrospective studies and their credibility is questionable. Despite the magnitude of problem, a good evidence based literature for management of cellulitis is

lacking and there are no national guidelines. No randamised controlled trials take into consideration the effects of treating the predisposing factors on recurrence of cellulitis.

As cellulitis have variable etiology in different epidemiological settings; eliciting a good history including patients geographical locality, travel history, immune status, recent trauma, recent surgery, previous antibiotic treatment, life style & exposure to animals and chemicals are key to developing an appropriate index of suspicion for specific etiological factors or agents.

A thorough physical examination not only of the affected part but also of the whole body and assessing the extension of inflammation into skin and underlying soft tissue is crucial in arriving at a correct diagnosis. Often, even this information will be insufficient in arriving at a clear diagnosis. In such cases an aspiration of tissue fluid or even a biopsy may aid in diagnosis. At times USG of the affected part may also be needed to assess the level of involvement and to rule out presence of gas or abscess[8]. Early fasciotomy or debridement may also be needed for diagnosis as well as therapeutic purpose especially in those with immune-compromised condition and necrotizing infection[9-11].

A recent Cochrane review concluded by Kilburn et al, show that it was not possible to define the best treatment for cellulitis in general, based on existing evidence[12].

All the above factors were considered, and a prospective study was conducted to determine the relative frequency of microbial isolates and its sensitivity pattern for better management of lower limb cellulitis and to prevent indiscriminate use of antibiotics.

Materials and Methods

This study was conducted in the Department of Surgery Medical College Trivandrum during 2014-2015. We recruited the patients after obtaining clearance from the institutional ethics committee. All patients admitted in the surgical wards of Medical College Trivandrum were eligible to be recruited in to the study. Patients above the age of 18 years old were only considered eligible for the study. All patients with suspected necrotizing fascitis were excluded from the study. Moreover, patients with ulcer foot were excluded. In addition, patients with associated cellulitis in another area apart from the lower limbs were not included in the study. We included all consecutive patients eligible for the study. All data were taken in a structured and standardized case report form. Data were taken by the investigator. Case report form included various variables we planned to study like demographic variables, details of admission and discharge, presenting complaints, clinical examination findings. We collected data about the location of the cellulitis, presence of lymphoedema, varicose veins, dermatological diseases and presence or absence of peripheral pulses. Biochemical parameters like fasting blood sugar, liver function tests, renal function test, blood routine, ultrasound, venous and arterial Doppler of lower limb. In addition, culture and sensitivity was done.

We followed the declaration of Helsinki at the time of design and conduction of the study. All data was then entered into a computer database. Enough precaution was taken to safeguard the confidentiality of all patients at all phases of the study.

The diagnosis of the cellulitis was arrived at consensus of two independent consultants. Only those cases diagnosed as cellulitis by both consultants were considered for the study.

All measurements were taken in international units wherever appropriate. Biochemical investigations were carried out after calibration of the instruments.

All data were analyzed in SPSS and R statistical software. Continuous data were summarized in mean and standard deviation or median and interquartile distance. Categorical data were summarized with percentage or proportions. Comparison of means was tested with t test and ANOVA for two and multiple groups respectively. p-value less than 0.05 were considered as significant.

Results

A total of 60 patients were studied during the study period. Of these, majority were males 47(78.3%). Table 1 shows the baseline characteristics of the patients we studied. Most frequent medical condition associated with cellulitis in the lower limb was diabetes mellitus. In our study, 37 (61.7%) patients had diabetes mellitus. Edema was present in 56 (93.3%).

Table 1: Baseline characteristics

Characters	Overall
n	60
Age (mean (sd))	54.42 (11.86)
Sex = female/male (%)	13/47 (21.7/78.3)
Duration (days). (median [IQR])	7.00 [5.00, 8.25]
Trauma = no/yes (%)	47/13 (78.3/21.7)
History	
Varicose veins = no/yes (%)	57/3 (95.0/5.0)
POVD = no/yes (%)	51/9 (85.0/15.0)
Lymphedema = no/yes (%)	58/2 (96.7/3.3)
CLD = no/yes (%)	56/4 (93.3/6.7)
DM = no/yes (%)	23/37 (38.3/61.7)
Skin disorder = no/yes (%)	56/4 (93.3/6.7)
Smoking = no/yes (%)	28/32 (46.7/53.3)
Alcoholism = no/yes (%)	26/34 (43.3/56.7)
HIV = no/yes (%)	57/3 (95.0/5.0)
Obesity = no/yes (%)	40/20 (66.7/33.3)
DVT = no/yes (%)	57/3 (95.0/5.0)
Examination	
BP = no/yes (%)	37/23 (61.7/38.3)
Edema = no/yes (%)	4/56 (6.7/93.3)
lymphatics = no/yes (%)	30/30 (50.0/50.0)
BMI (median [IQR])	25.00 [24.00, 30.00]
Varicose vein = no/yes (%)	58/2 (96.7/3.3)
Peripheral pulses = no/yes (%)	15/45 (25.0/75.0)

All these patients with cellulitis had microbiologically positive infections. The most common organism associated with cellulitis in our study was streptococci. Streptococci were positive in 28 (46.7%) patients. Table 2 shows the microbiological profile of the study population. Culture and sensitivity of the microbiological flora isolated from the cellulitis is shown in table 3.

Table 2: Microbiological profile

Variable	[ALL] N=60
Microbiology:	
Klebsiella	6 (10.0%)
Mixed growth	5 (8.33%)
Pseudomonas	13 (21.7%)
Staphylococcus	6 (10.0%)
Sterile	2 (3.33%)
Streptococci	28 (46.7%)

Table 3: Antibiotic sensitivity

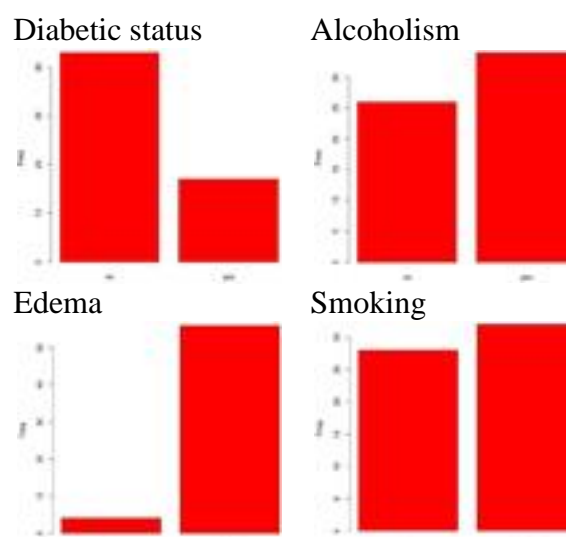|	Beta hemolytic streptococcus	K.pneumonia	Staph. aureus	Pseudomonas aeroginosa
Penicillin	80.3	-	82.3	-
Amoxyclav	86.4	20.8	92.8	-
Oxacillin	74.0	-	40.7	-
Piperacillin TZ	100	100	100	100
Ceftazidime	-	35.8	-	93.5
Cefaperazone SB	85.1	100	87.1	90.3
Ciprofloxacin	-	58.1	66.6	61.2
Gentamicin		-	54.1	32.2
Amikacin	-	68.5	-	77.4
Cefuroxime	-	-	77.7	-
Erythromycin	78.3	-	-	-
Imipenam	100	100	100	100

Figure: 1 Predisposing factors

In this study, as given in figure 1, there were 32(53.3%) smokers. In addition, 34 (56.7%) of patients consumed alcohol regularly. Most of the patients (93.3%) had peripheral edema, 37 (61.7%) had diabetes. When patients were classified as per the CREST classification, 35(58.3%) of the patients belonged to the class II, followed by 10(16.6%) in class IV, 8 (!3.3%) in class III and then with 7(11.6 %) patients in class I. Table 4 shows the details of the details of patients catagorized by CREST classification.

Table 4: Overall analysis

Variable	[ALL] N=60	1 N=7	2 N=35	3 N=8	4 N=10	p. overall
Age	54.4 (11.9)	50.7 (17.9)	54.7 (10.1)	54.4 (16.0)	56.1 (10.3)	0.833
Sex:						0.069
Female	13 (21.7%)	1 (14.3%)	8 (22.9%)	4 (50.0%)	0 (0.00%)	
Male	47 (78.3%)	6 (85.7%)	27 (77.1%)	4 (50.0%)	10 (100%)	
Duration. days.	6.77 (3.04)	6.86 (4.26)	7.06 (2.67)	6.12 (3.14)	6.20 (3.61)	0.803
H/O trauma:						0.003
no	47 (78.3%)	2 (28.6%)	31 (88.6%)	5 (62.5%)	9 (90.0%)	
yes	13 (21.7%)	5 (71.4%)	4 (11.4%)	3 (37.5%)	1 (10.0%)	
H/O lymphedema:						0.664
no	58 (96.7%)	7 (100%)	34 (97.1%)	8 (100%)	9 (90.0%)	
yes	2 (3.33%)	0 (0.00%)	1 (2.86%)	0 (0.00%)	1 (10.0%)	
H/O.DM:						0.001
no	23 (38.3%)	7 (100%)	8 (22.9%)	3 (37.5%)	5 (50.0%)	
yes	37 (61.7%)	0 (0.00%)	27 (77.1%)	5 (62.5%)	5 (50.0%)	
H/O smoking:						0.257
no	28 (46.7%)	4 (57.1%)	17 (48.6%)	5 (62.5%)	2 (20.0%)	
yes	32 (53.3%)	3 (42.9%)	18 (51.4%)	3 (37.5%)	8 (80.0%)	
H/O alcoholism:						0.283
no	26 (43.3%)	4 (57.1%)	15 (42.9%)	5 (62.5%)	2 (20.0%)	
yes	34 (56.7%)	3 (42.9%)	20 (57.1%)	3 (37.5%)	8 (80.0%)	
Microbiology:						0.572
Klebsiella	6 (10.0%)	0 (0.00%)	5 (14.3%)	1 (12.5%)	0 (0.00%)	
Mixed growth	5 (8.33%)	0 (0.00%)	3 (8.57%)	1 (12.5%)	1 (10.0%)	
Pseudomonas	13 (21.7%)	1 (14.3%)	5 (14.3%)	2 (25.0%)	5 (50.0%)	
Staphylo-coccus	6 (10.0%)	1 (14.3%)	5 (14.3%)	0 (0.00%)	0 (0.00%)	
Sterile	2 (3.33%)	0 (0.00%)	1 (2.86%)	0 (0.00%)	1 (10.0%)	
Streptococci	28 (46.7%)	5 (71.4%)	16 (45.7%)	4 (50.0%)	3 (30.0%)	
Diabetic status:						0.002
no	43 (71.7%)	1 (14.3%)	30 (85.7%)	5 (62.5%)	7 (70.0%)	
yes	17 (28.3%)	6 (85.7%)	5 (14.3%)	3 (37.5%)	3 (30.0%)	

Discussion

The study was conducted under the Department of Surgery, Government Medical College Trivandrum. Our intention was to find out the microbiological spectrum and culture sensitivity in cellulites of lower limb. Based on the clinical features, routine blood investigations, culture from infected skin and subcutaneous tissue, a total of 60 patients were studied and the diagnosis of cellulitis was made [13].

In our study the estimated bacteriological spectrum and culture reviled 33.3% of beta haemolytic streptococci, 8.3% of staphylococcus aureus, 6.6% klebsiella pneumonia, 5% pseudomonas aeruginosa and 10% mixed growth.[14].

Gram positive organisms mainly beta haemolytic streptococci were the predominantly seen type in our study. This was in concordance with the findings of Erikson B et al in which beta haemolytic streptococci were detected in 34% of the patients.[15, 16] Fifty patients with cellulitis were prospectively evaluated by Edward W Hook III et al and made similar conclusions [17]. Beta haemolytic streptococci were isolated from 17 primary lesions and coagulase positive staphylococci from 13 primary lesions.

With respect to the antibiotic sensitivity, most of the beta haemolytic streptococci were sensitive to pencillins and erythromycin and most of staphylococci species were sensitive to pencillin and pipperacillin tazobactam combination.[18] Regarding gram negative organisms pseudomonas and klebsiella species were sensitive to Imipenam, aminoglycosides, and pipperacillin tazobactam[19]. In concordance with our study the results obtained by Siggurdsson et al showed that all staphylococcus aureus and beta haemolytic streptococci were sensitive to pencillins. The etiology of bacterial cellulitis was determined by fine-needle aspiration. But contradicting to our study the most common bacteria isolated was staphylococcus aureus.

Lymphedema, obesity, venous insufficiency, and dermatological diseases were shown to be independently related to cellulitis of lower extremity by Dupuy A et al in their study[20]. Among 60 patients in the present study, 76 % were overweight, 21.6 % were with varicose veins, 61.7% patient were associated with diabetes mellitus, 21.3% had previous history of trauma and 3.3% had lymphedema. A larger study will be needed to assess the risk factors of lower limb cellulitis.

In the present study the most common gram positive organism isolated was beta haemolytic

streptococci and klebsiella species among the gram negative group. The main associating factors which could be identified include certain factors like overweight, obesity, diabetes mellitus, previous history of trauma and varicose veins.

Acknowledgement

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