International Journal Dental and Medical Sciences Research
Volume 3, Issue 2, Mar-Apr. 2021 pp 920-927 www.ijdmsrjournal.com ISSN: 2582-6018

A Clinical Study on Cellulitis Lower Limb: Clinical Appearance and Management

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Submitted: 01-04-2021 Revised: 08-04-2021 Accepted: 10-04-2021

ABSTRACT : Introduction: Cellulitis is a spreading bacterial infection of the dermis and subcutaneous tissue, characterised by erythema, swelling, warmth and pain. Cellulitis typically develops with break in skin integrity, such as fissure, cut, laceration, insect bite, or puncture wound in which provides entry to bacteria. It can affect any part but most commonly lower limb is involved. Theidentification of risk factors and timely intervention of lower limb cellulitis will reduce the risk of morbidity, systemic sepsis and multiple organ dysfunction. The aim of the study was to assess the risk factors of cellulitis lower limb and to study the clinical presentation and management of cellulitis lower limb.

Material and methods: The study was conducted at the General Surgery Department of Government Medical College and Associated Group of Hospitals, Kota (Rajasthan). A total of 60 cases of lower limb cellulitis was taken for the study.

Results: In our study 51.66% patients were above 60 years of age, which was explained by poor immune response and associated comorbidities. There was male (80%) predominance. Most patients had unilateral involvement (91.66%). Grade 3rd cellulitis was present in 68.33% of cases. Regarding risk factors diabetes mellitus (41.66%) is more common followed by infected traumatic ulcers and post bite cellulitis. Pus culture showed staphylococcus aureus and streptococcus species are most common. Majority of cases showed sensitivity towards Piperacillin tazobactam and imipenem antibiotics. Doppler performed showed no patients in the study had deep venous thrombosis. Osteolytic changes were noticed in 12% of population. Conservative management was done in 20% of patients, 70% of patients required wound debridement and fasciotomy, 10% required amputation. 34 patients had resultant wound which healed by secondary intention (70.59%) and rest were treated by split skin grafting (29.41%).The mortality was 1% of cases.

Conclusion: This study on cellulitis lower limb found out that diabetes mellitus is the most common risk factor. Early screening and good glycaemic control prevent the incidence of cellulitis lower limb. Hospital admission for severe forms of cellulitis, appropriate and emergency surgical interventions as needed, employing culture directed antibiotics, managing comorbidities can salvage limb and lives.

Keywords: Cellulitis, Lower Limb, diabetes mellitus Management.

I. INTRODUCTION

Cellulitis is a superficial, diffuse, spreading bacterial infection involving dermis and the subcutaneous layer, which occurs when the physical skin barrier, the immune system and/or the circulatory system are impaired. Its overall frequency reaching 204.8 per 100 000 patients from January 2002 to December 2013.[1]The incidence of lower limb cellulitis increased by 4.7% per annum. Cellulitis typically develops with break in the skin, such as fissure, cut, laceration, insect bite, or puncture wound. the It can occur in any part of body but is most common in the lower extremities followed by face, hands, torso, neck and buttocks respectively.[2,3] Various risk factors for cellulitis include traumatic injury, leg ulcers, intertrigo, overweight, lymphedema, diabetes mellitus, vasculitis, previous surgery, radiotherapy and immunocompromised states.[3,4] Causative organisms for cellulitis include Streptococcus pyogenes and Staphylococcus aureus followed by β haemolytic streptococci and gram-negative bacilli.[5,7].The mechanism is uncertain but may represent a vigorous systemic immunologic and inflammatory reaction to materials elaborated by streptococci (such as hyaluronidase and streptokinase) that precede apparent inflammation at the skin site. Stulberg et al described clinical hallmarks of cellulitis as, warmth, erythema, oedema with nonpalpable margins and tenderness of affected area, associated lymphangitis, regional lymphadenopathy and fever.[8], these often accompanied by fever, chills, tachycardia, hypotension, and confusion, and considerable leucocytosis. It is categorized as simple (uncomplicated) or complicated (necrotizing or non-necrotizing), or as purulent or nonpurulent.

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GRADING OF THE CELLULITIS:[6]
(Clinical Resource Efficiency Support Team-CREST:2005)
Class I
Patient will not have signs of systemic toxicity or any comorbidities and are routinely treated with oral antibiotics in the outpatient basis.

Class II
a) Patient Have systemic illness
b) Do not have any systemic illness but have some comorbidity like
i. Peripheral vascular disease
ii. Chronic venous insufficiency
iii. Morbid obesity Which can affect the resolution of infection.

Class III
Patient have
i. Significant systemic problems
ii. Unstable comorbidities
iii. Limb threatening infection due to vascular compromise

Class IV
i. Severe life-threatening infections like necrotising fasciitis.
ii. One which is associated with Sepsis syndrome.
iii. Cellulitis in Immuno compromised individuals.

Differential diagnosis of cellulitis includes lower leg oedema, hematoma, necrotizing fasciitis, lymphedema, deep venous thrombosis, compartment syndrome, pyoderma gangrenosum and pretibial myxoedema (Cox et al).[9] Cellulitis is a clinical diagnosis but may require investigations to know the severity as in leucocytosis, raised CRP levels, ASO titres in suspected Streptococcal infections, X-ray to rule out gas gangrene or underlying osteomyelitis(Trubo R) or necrotizing fasciitis.[10]Colour Doppler is done to rule out DVT/ Venous insufficiency. Swab cultures are done to isolate the causative organism and blood cultures to know if bacteraemia is present.

MANAGEMENT OF CELLULITIS: -
ANTIBIOTIC REGIMEN: - Combination of antibiotics sensitive to both staphylococcus and streptococcus bacteria.
DRY SKIN- keep skin dry. As edema resolves skin wrinkles and may slough away.
WET SKIN: - control exudate with absorbent dressing to reduce mace ration of surrounding skin.
OEDEMA: - limb elevation
PAIN: - regular analgesics according to need of patient.
INFLAMMATION: - monitor area, mark with skin marker pen to monitor whether cellulitis is resolving or advancing.

EXERCISE**:** - dorsiflexion and planta flexion of foot exercise will add drainage of oedema.

Most cellulitis recovers completely, however few may show complications including gangrene of infected parts, lymphangitis, lymphadenitis, shock, acute glomerulonephritis and renal failure, acute respiratory distress syndrome, sub-acute bacterial endocarditis and rarely death. Most cellulitis heals completely however in patients of venous insufficiency, lymphedema, diabetes mellitus, immunocompromised patients can have recurrences. Many antibiotics used for infections caused by bacteria have become resistant which have become global threat to healthcare. Antibiotic resistance is mainly associated with its irrational use.[16]
The aims of this study were to evaluate the risk factors, pathogenesis, disease progression, the clinical profile and complications of lower limb cellulitis to reduce morbidity and mortality.

II. METHODS

The study was carried out prospectively and was conducted at the General Surgery Department of Government Medical College and Associated Group of Hospitals, Kota (Rajasthan). The study proposal was submitted for approval by the Ethical committee of Government Medical College, Kota. The study was conducted after the approval of the Ethical committee.
All the patients coming to the Surgery Department with complaints of painful Red Swelling in lower limb were evaluated for lower limb cellulitis.
The diagnosis of lower limb cellulitis was made in the presence of:
(i) Inflammation (Red painful swelling with increased local temperature)
(ii) Pus or clear fluid discharge
(iii) PYREXIA
(iv) Elevated inflammatory markers (raised WBC, ESR & CRP)

Sample Size- A total of 60 cases of lower limb cellulitis was taken for the study.
Selection and the exclusion of the patients was done according to the criteria given below.

Inclusion Criteria: -

Study patients qualifying definition of lower limb cellulitis and admitted to the hospital, above18 years of age

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The information about the lower limb cellulitis and its management along with complications was given to the patients and informed consent was taken from those who are willing to take part in the study.
The pretested proforma was used to collect relevant information including demographic data, clinical findings, lab investigation and follow up events.

III. RESULTS

The following findings were observed in our analytical study regarding the management of lower limb cellulitis, conducted in Government Medical College Kota. Totally 60 such patients were included in the study and the result being analysed as follows.

AGE& SEX DISTRIBUTION

Sl.No.	Age Group	No of cases
1	21 – 30	1
2	31 – 40	4
3	41 – 50	11
4	51 – 60	13
5	>60	31

Out of the 60 patients studied 1 belonged to 21-30 years, 4 belonged to the age group 31-40years, 11 belonged to 41-50 years, 13 belonged to 51-60 years and 31 were from the age group more than 60 years from which it is evident that as the age increases, the incidence of cellulitis increases.
Out of 60 patients 48 patients are male and only 12 patients are females indicating males are more commonly affected.

GRADE OFCELLULITIS

Grading of cellulitis taken in this study has been done as per CREST criteria. The study is being conducted in the patients who need hospital admission for cellulitis, it covers principally the patients belonging to grades II, III and IV.

Sl.No.	Grade	No. of cases
1	II	12
2	III	41
3	IV	7

Out of the 60 patients studied maximum number of individuals i.e., 41 individuals belong to the grade III cellulitis, whereas 12 patients and 7 patients belongs to grade II and IV respectively.

LIMBINVOLVED

In our study, we have observed that 55 patients had unilateral lower limb involvement and 5 patients had bilateral lower limb involvement, patients with oedema going for cellulitis like patients with CKD and cardiac failure, patients with history of barefoot walking with web space infections were candidates who presented with involvement of both lower limbs.

THE CAUSE OFCELLULITIS

Various causes were studied for being responsible for the cellulitis in the study group such as web space infections, diabetes mellitus, bites, infected traumatic ulcers, infected venous ulcers, cellulitis imposing on the lymphoedematous limb and in the oedematous limb of the renal failure and cardiac failure patients, and in few patients exact cause of the cellulitis could not be made. The result can be tabled as follows

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Cause	No. of Patients
Diabetes mellitus	25
Infected traumatic wounds	7
Chronic kidney disease	5
Bites	8
Web space infections	3
Oedema in cardiac failure	3
Lymphedema	2
Unknown	7

The study shows that diabetes mellitus is responsible for most cases of cellulites in the study group, followed by the traumatic infected ulcers and post bite cellulitis. It is to denoted that the lower limb oedema occurring in chronic kidney disease, lymphedema and cardiac failure constitutes a considerable proportion as the aetiology for the cellulitis in our study group. Also, in about 11.66% individuals the exact cause responsible for the cellulitis is unknown.

MICRO-ORGANISMSCULTURED

Of the 60 patients studied in 30 patients the infection is mono- microbial, in 14 patients the infection is poly-microbial and in about 16 patients no growth has been cultured.

The individual organisms cultured is tabled below

Sl.No.	Organisms	No. of Patients
1	Staphylococcus aureus	20
2	Streptococcus SP	14
3	Klebsiella SP	14
4	Proteus SP	11
5	E-Coli	3
6	Pseudomonas SP	3
7	No Growth	16

From the table above we can see it is Staphylococcus and streptococcus SP were the predominant organisms responsible for the cellulitis in the study group other organisms responsible include klebsiella SP, proteusSP, pseudomonas SP, E. coli.

SENSITIVE DRUGS

Among the 60 patients in our study 44 patients were found culture positive. The sensitivity pattern for the organisms cultured was studied and the results is

Sl.No.	Antibiotic	No. of Patients
1	Piperacillin – Tazobactum	36
2	Cephalosporin group	24
3	Imipenam	33
4	Amikacin	11
5	Ciprofloxacin	9
6	Cloxacillin	3

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7	Ampicillin	4
8	Gentamycin	6

We can see that piperacillin – Tazobactum and imipenam are the two group of antibiotics which tend to have the maximum sensitivity for the common organisms causing cellulitis. The result is plotted on the chart as follows.

CIRCULATORY CHANGESOBSERVED

With the Doppler study being conducted in all the patients in our study group, the result obtained is table as follows.

Sl.No.	Changes observed	No. of Patients
1	No flow in calf vessels	0
2	Monophasic flow in peroneal artery	3
3	Monophasic flow in posterior tibial artery	2
4	Venous insufficiency	2
5	Deep vein thrombosis	0

BONE INVOLVEMENT

In cases of diabetes mellitus, bite injuries especially in cases of snake bite at site of bite the toes or the metatarsals underneath showed lytic changes, or destruction due to the gangrenous changes otherwise no other bony changes were noticed in the patients.Osteolytic changes were noticed in 12% of population.

TREATMENT

Treatment of the individuals varied according to the severity of the disease, some patients were managed conservatively with parenteral antibiotics, the anti-inflammatory agents and limb elevation so as to reduce the associated oedema, while majority of the others required surgical wound debridement with or without decompression of the fascial compartment by a fasciotomy. Very few patients needed amputation of the limb.

Sl. No.	Management	No. of cases
1	Conservative	12
2	Wound debridement	15
3	Wound debridement with fasciotomy	27
4	Amputation	6

It is observed that around 42 patients in the study group required surgical debridement, 27 of them required decompression of the muscular compartment by means of a fasciotomy. Around 10% of individuals in the study group required amputation.

OUTCOME

The outcome of the treatment done has been studied, whether it is universal, or whether patient remained with a wound that needs, further managements or patient had some residual deformity or the patient had expired because of the comorbidities complicating the disease.

It can be seen from the table that almost all the patients managed conservatively, had an uneventful recovery and among those needed surgical intervention, 34 patients had the residual wound that needed further attention, 6 patients remained with disability and around 1 patient died because of the disease.

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MANAGEMENT OF THEWOUND

34 patients in the study group with resultant wound were managed ultimately with either a split thickness or allowed to heal by secondary intention. It can be observed that around 10 cases (29.41%) of the resultant wounds were managed with split skin grafting and remaining 24 cases (70.59%) of the wounds healed by secondary intention

IV. DISCUSSION

A prospective case series study, included 60 patients who got admitted for lower limb cellulitis and its complications, under all surgical units of Govt medical college, during the span of one year and eight months as the study group. The results observed from the study are discussed here,

Regarding the age distribution it was observed that 51.66% patients were above 60 years of age, it is evident that as the age increases, the incidence of cellulitis increases, and it has also been studied that the severity of the disease increases with the age, both the inferences correlate with the clinical study done by Balaji Sharma et al in which 45% of cases were from the age group above 60 years. This is being explained by the comparatively poorer immune response and the associated comorbidities in the elderly population.[11]

In our study there were 80% males and 20% females, among the 60 patients and this increased male preponderance is supported by clinical study done by Reina khadilkar et al in which 70% males and 30% females, while in Balaji et al study 85% male and 15% female .[12,13]

In present study out of the 60 patients studied maximum number of individuals, i.e. 41 individuals belong to the grade III cellulitis, whereas 12 patients and 7 patients belong to grade II and IV respectively. One consideration to be offered here is, the study is being conducted in the inpatients of the surgical wards, and most early forms of cellulitis are managed on the outpatient basis, our study tend to project the increased incidence of severe forms of cellulitis.

In our study, we have observed than 91.66% of the patients had unilateral lower limb involvement and 8.34% of the patients had bilateral lower limb involvement which is supported by Deshpande SG et al and Balaji Sharma et al in which7.6% and 6% patients had bilateral lower limb involvement respectively.[11,13] In our study, cases in whom both lower limb are involved include the patients with oedema going for cellulitis like patients with chronic kidney disease and cardiac failure, patients with history of barefoot walking with web space infections, and few patients with unknown aetiology.

In our study, incidence wise diabetes mellitus is responsible for most cases of cellulitis (41.66%) in the study group, followed by the traumatic ulcers which have been infected and post bite cellulitis. It is supported by a clinical study Reina khadilakar et. Al and Balaji Sharma et al.[11,12] In which Diabetes was a major co-morbid condition and uncontrolled glycaemic levels result in rapid spread of cellulitis whereby it can become life threatening or fatal necrotising fasciitis.

It is to be noted that cellulitis superimposing on the lower limb oedema occurring in chronic kidney disease, lymphedema and cardiac failure constitutes a considerable proportion as the aetiology for the cellulitis in our study group. In about 7 individuals the exact cause of cellulitis is unknown.

Out of the 60 Patients studied in 50% patients the infection is mono microbial and in 23.34% patients the infection is poly microbial and in about 26.66% patients no growth has been cultured. Staphylococcus SP (33.33%) and streptococcus SP (23.33%) were the predominant organisms responsible for the cellulitis in the study group, which is supported by study mustafavi S et al in which streptococcus was found to be positive in 16% and Staphylococcus was found to be positive in 9% with total positive cultures obtained in 38% cases.[14] Other organisms observed in the study group include Klebsiella SP, Proteus SP, pseudomonas SP and E coli.

In our study 44 patients were found culture positive, the sensitivity pattern studied for the organisms showed piperacillin-tazobactum and imipenam were the two groups of antibiotics which tend to have the maximum sensitivity for the common organisms causing the cellulitis. Balaji Sharma et al study shows similar results in which out of 100 cases 69 patients were found culture positive with piperacillin-tazobactum and imipenam group have maximum sensitivity for cultures organism.[11] Cephalosporin group of antibiotics, amikacin, ciprofloxacin and gentamycin are found to be effective in good proportion of individuals.

In our study all the 60 patients in the study group were done Doppler evaluation of the arterial and venous system to study the circulatory change, associated with the cellulitis of the lower limb. We noticed 5% of the patients showed monophasic flow in peroneal artery and 3.33% had monophasic flow in posterior tibial artery and venous insufficiency has been noticed in 3.33% of individuals. None of the patients had no flow in the

calf vessels and no patients was seen to have deep venous thrombosis. This result is supported by Afzal MZ et al in which only concurrent incidence of deep venous thrombosis and lower extremity cellulitis is rare.[15] This is also supported by Balaji Sharma et al.[11]

In our study regarding the treatment, we have noticed that around 25% patients in the study group required surgical debridement only, 45% required decompression of some muscular compartment by means of a fasciotomy along with surgical debridement. 20% of patients with less severe form of cellulitis were managed conservatively with parenteral antibiotics, the anti-inflammatory agents and limb elevation so as to reduce the associated oedema. 10% of individuals in the study group required amputation, because of the loss of almost all viable soft tissues and the possibility of sepsis syndrome because of the badly infected limb. Similar results were obtained in Balaji Sharma et al study in which around 75 patients in the study group required surgical debridement, 48 of them required decompression of the muscular compartment by means of a fasciotomy. Around 12% of individuals in the study group required amputation. Compare to a clinical study Deshpande sg et al in which 65% patients with lower limb cellulitis were managed with conservative management and surgical intervention done only in 35% cases.[13] There is difference between Deshpande sg et al and present study. This difference is because our study is being conducted in the inpatients of the surgical wards, and most early forms of cellulitis are managed on the outpatient basis.

In present study regarding the outcome of the management, almost all the patients managed conservatively had uneventful recovery, around 34 (56.66%) of the patients had the residual wound that needed further attention, 6 (10%) of the patients remained with disability (amputation being done), and one patient died because of the comorbidities complicating the illness, especially diabetes mellitus. In 10 cases (29.41) of the patients, resultant wounds persisted as the raw area after preparing the same, they were managed with split skin grafting, and remaining 70.59% of the wounds were allowed to heal by secondary intention. Similar results were obtained in Balaji Sharma et al in which 61 patients in the study group with resultant wound were managed ultimately with either a split thickness (28%) or allowed to heal by secondary intention (72%).[11]

V. CONCLUSION

- As the age increases, the incidence of cellulitis increases and the severity of disease as well.
- Males have the higher incidence of cellulitis compared to females.
- As our study group is principally comprising of surgical inpatients, higher grades of cellulitis are more common.
- In this study, diabetes mellitus, has been the most common cause (overall) of the cellulitis in the patients followed by infected traumatic ulcer and post bite cellulitis.
- Staphylococcus SP and streptococcus SP are the common organisms responsible for the cellulitis in the study group, which correlates, with the literature.
- Piperacillin-tazobactum and imipenam are the most sensitive antibiotics in majority of cases, this shows the emerging resistance for the commonly used antibiotics (ampicillin, cloxacillin and cephalosporins)
- Circulatory changes in the form of altered arterial flow pattern has been noticed in 11% of the individuals and in around 4% of the individual's venous reflux has been noticed.
- No patient in the study has had deep venous thrombosis.
- 12% of the patients showed underlying lytic changes in bone.
- 17% of patients were managed conservatively. 72% patients in the study group required surgical debridement, 47% in this group required fasciotomy, and 11% of individuals in the study group required amputation.
- All the patients managed conservatively had an uneventful recovery and 60% of the patients had the residual wound that needed further attention 12% of the patients remained with disability, and 1% of the study group patient expired because of the comorbidities complicating the illness.
- Majority of the resultant wounds healed by secondary intention 72% rest were managed by split skin grafting 28%.

This study on lower limb cellulitis found that diabetes mellitus is the most common cause besides traumatic infected ulcer, post bite cellulitis, chronic kidney disease also contributing. Early diabetes mellitus screening and good glycaemic control prevent the incidence of cellulitis lower limb.

Educating the people regarding proper foot care, foot wear usage can prevent cellulitis occurring due to web space infections, cracks in the sole, trivial trauma in the foot.

Hospital admission for the severe forms of cellulitis, appropriate and emergency surgical intervention as needed, employing culture directed antibiotics, managing the comorbidities can salvage the limbs and lives.

Conflict of interest- Nil
Funding: No funding sources
Ethical approval: The study was approved by the institutional ethics committee

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