



Study On Subcutaneous Pressure In Cellitius Leg And Coorelation To Its Clinical Management

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Abstract

Background: Cellulitis, an infection of skin and subcutaneous tissue is usually managed conservatively and surgical intervention is required for local complications. The aim of this study was to correlate the subcutaneous pressure with the need for early surgical intervention in cases of lower limb cellulitis.

Methods: We prospectively measured subcutaneous pressures in the normal leg and in the leg with cellulitis. Patients managed with parenteral antibiotics were compared to those managed with parenteral antibiotics and surgical intervention with standard statistical tests.

Results: The median subcutaneous pressure was 3 mmHg and 9 mmHg in the normal leg and the other with cellulitis respectively. The mean of difference in subcutaneous pressure in legs with cellulitis compared to normal legs was 5.93 mmHg and 8.29 mmHg in the conservative group and surgical intervention group respectively. The difference in subcutaneous pressure between the normal leg and in the leg with cellulitis was statistically significant ($p < 0.001$). The difference in the average pressure between surgical intervention group and conservative group was 2.36 mmHg and was statistically significant ($p < 0.05$). The optimal threshold (difference in pressure) was identified as ≥ 7 with sensitivity of 85.7% and specificity of 57.1%. Area under the ROC curve (SE) was 0.71 (0.10) with 95% CI (0.51, 0.87).

Conclusions: The subcutaneous pressure in leg with cellulitis is a predictor for the need for early surgical intervention. It can be used as an adjunct in management and clinical decision making for cases of cellulitis of lower limbs.

Keywords: Cellulitis, Subcutaneous pressure, Superficial subcutaneous fasciotomy

Introduction

Cellulitis is an infection of skin and subcutaneous tissue. It results in inflammatory process causing fluid accumulation in the subcutaneous space with erythema of the skin, local warmth and tenderness(1). Most common cause is the bacterial infection but rarely fungal infection can also cause cellulitis. The incidence of cellulitis is more in middle aged and elderly population. In western population males are affected more than females. The lower extremity is the most common site for cellulitis in

adults(1). Lower limb cellulitis often results in prolonged hospitalization and long term morbidity. Almost one quarter of the patients with lower limb cellulitis required hospitalization. The mean duration of inpatient treatment for lower limb cellulitis was 10 days(2). The long term morbidity includes chronic edema, persistent leg ulceration and 29% of the population who had cellulitis of the leg will have recurrence within 3 years(3). The most common bacterial organism causing cellulitis is the skin

commensals like streptococci and staphylococci. The site of breach in skin integrity is the point of entry of the organisms. The infection pathogenesis is worsened due to associated comorbidities like Diabetes mellitus, chronic renal disease, lymphedema and other immune compromised conditions. (4) Cellulitis is usually managed conservatively with antibiotics and limb elevation. The surgical intervention is required in case of local complications like abscess, necrotizing soft tissue infection and systemic complications like severe sepsis with multiple organ involvement. (5) There is a lack of good evidence based literature for the management of patients with lower limb cellulitis. It is an important healthcare issue due to the loss of work and financial burden for patients because of the prolonged hospital stay and long term morbidity. There are no standardized guidelines for the management of lower limb cellulitis. In clinical practice it is variable depending on the experience of treating physician/surgeon. (6,7)

Methodology

We prospectively studied patients with unilateral cellulitis of the leg admitted in Department of General Surgery, Apollo Institute Of Medical Sciences, Murakambattu, Chittoor, Andrapradesh, India, between January 2023 and May 2023. Cellulitis of the leg was defined by presence of pain, swelling and erythema of the leg. Patients with subcutaneous abscess, necrotising soft tissue infection, leg ulcers or skin necrosis, chronic lymphedema, bilateral cellulitis, deep vein thrombosis and partially treated cellulitis of the leg were excluded. Demographic data, symptoms, signs and comorbid illnesses were documented after obtaining informed consent from patients. The site of maximum swelling with tenderness in the leg with cellulitis was identified and the circumference of the leg was measured. The distance of this site was measured from tibial tuberosity in the leg with cellulitis. The circumference of the normal leg was measured at the same distance from tibial tuberosity. After local anaesthetic cream application, the subcutaneous pressure was measured at one point in the normal leg and at 4 points in the leg with cellulitis at the same distance from tibial tuberosity. In the leg with cellulitis, the subcutaneous pressure was measured at 4 different sites (anteromedial, anterolateral, posteromedial and posterolateral) along

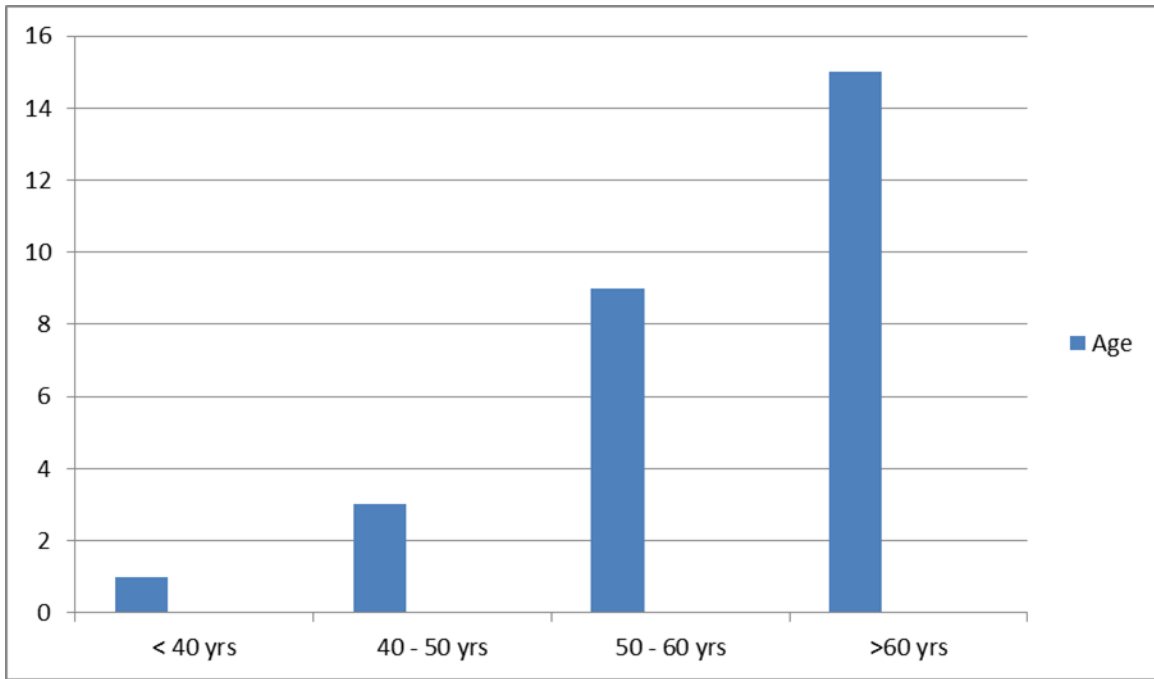
the highest circumference of the leg with maximum swelling and tenderness. Four different sites were used for measurement as cellulitis with edema is not always circumferential. The subcutaneous pressure was measured with Stryker intra compartmental pressure monitor and 18 gauge side port needle with saline prefilled syringe.¹⁰ The needle was inserted at an angle of 45 degree with the skin. The tip of the needle with side port was inserted into the subcutaneous space and 1 cc of saline was injected. After waiting few seconds pressure reading was taken. The stable pressure value was documented in the normal leg and the monitor was reset to measure subcutaneous pressure at different sites in the leg with cellulitis. The subcutaneous pressure was measured at the time of admission for all the 36 patients and they were followed up. Out of 28 patients, 14 patients received only parenteral antibiotics and other 14 patients underwent surgery along with parenteral antibiotics either at the time of admission or later due to local or systemic complications as assessed by the treating surgeon

Statistical Analysis

Frequency distribution with percentages was used to describe categorical data while descriptive statistics (e.g. mean, median, standard deviation) were obtained for continuous variables. We used Shapiro Wilk test to check for the normality assumption of the distribution of the data for choosing statistical tests. Comparison of difference in the circumference and the pressure of the normal leg and leg with cellulitis was done using paired t test or Wilcoxon signed rank test depending on the distribution of the data. Comparison of pressure measured at four different sites of leg with cellulitis was done using paired t test. We define the maximum pressure in the leg with cellulitis as the highest pressure measured at the four different sites for further analysis. The difference in the effect of distance measured from tibial tuberosity on the pressure measured in the leg with cellulitis was answered by using Kruskal Wallis test. The difference in the pressure measured between normal and the maximum pressure in the leg with cellulitis was calculated. The mean difference in subcutaneous pressures between the surgery and the antibiotic only group was tested using two tailed independent sample t-test and also presented with 95% Confidence Interval (CI).

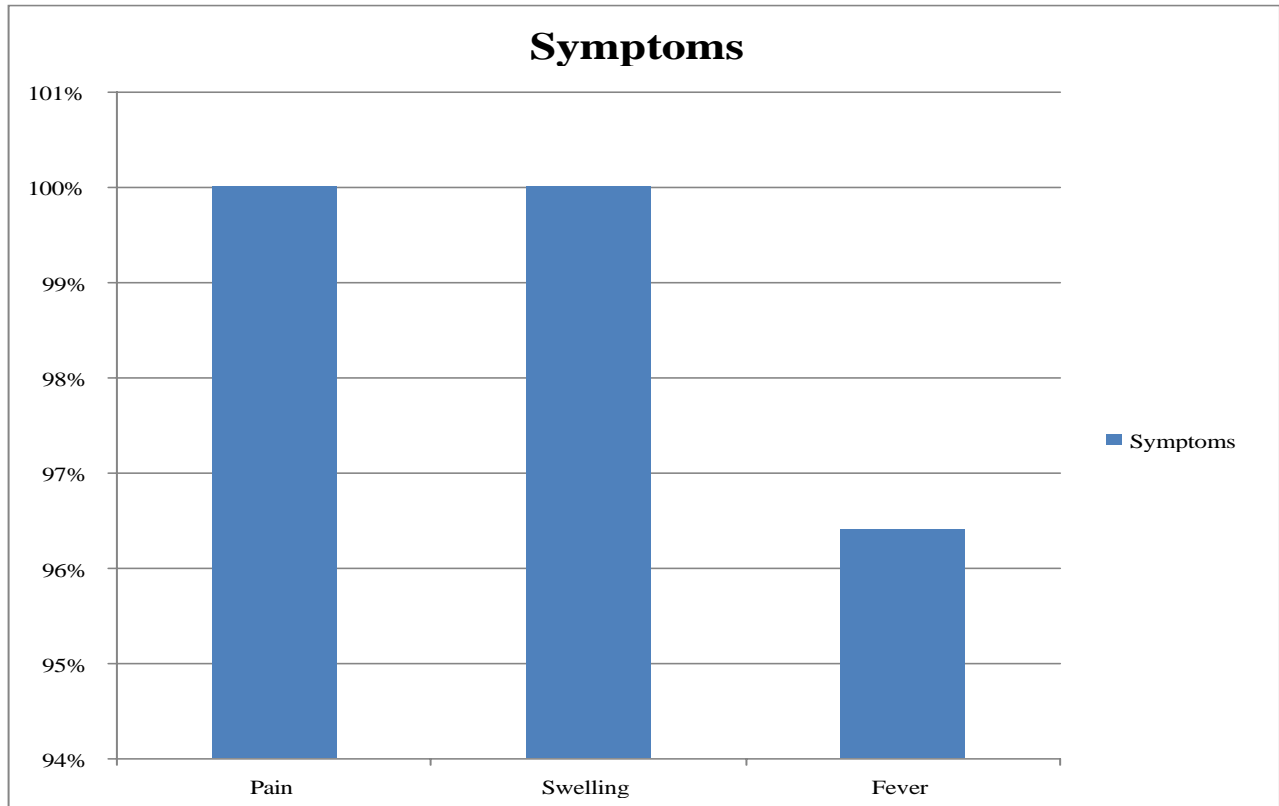
Results

Graph :1 Age distribution of patients in the study group

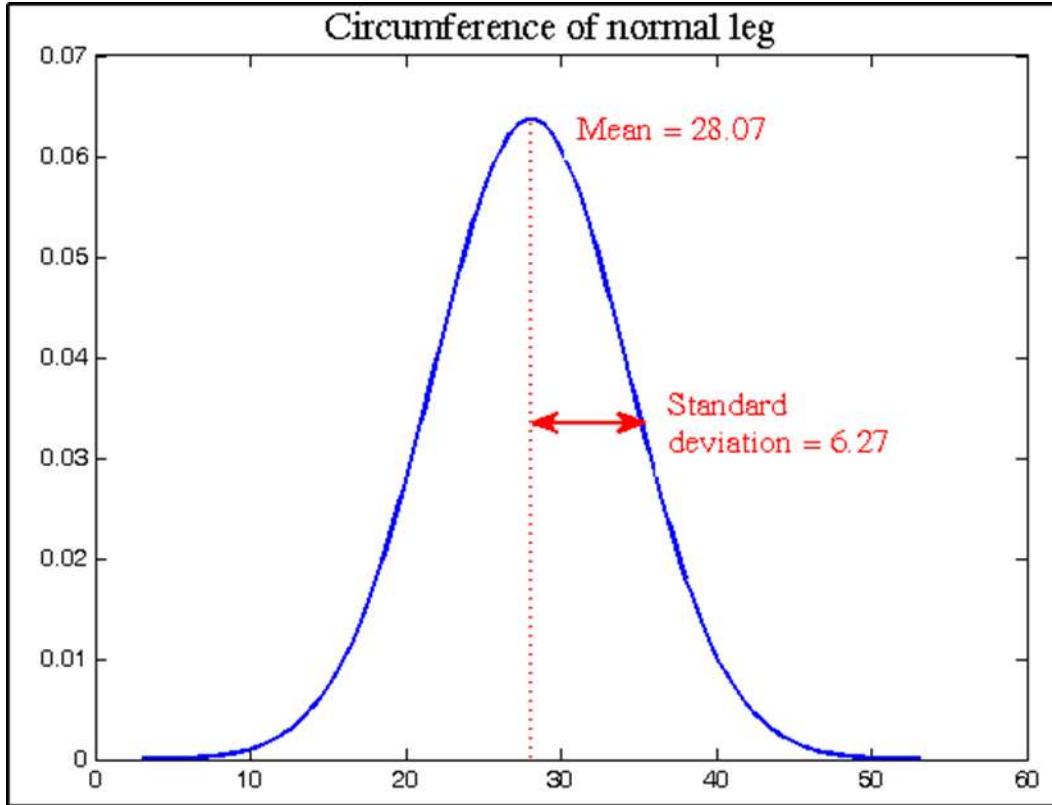


Graph :2 CLINICAL PRESENTATIONS

The common clinical presentations were pain, swelling and fever. Pain and swelling was present in 100% of the study group and fever was present in 96% of the study group Most of the patients had medical comorbidities like Diabetes Mellitus, Hypertension and Renal disease.

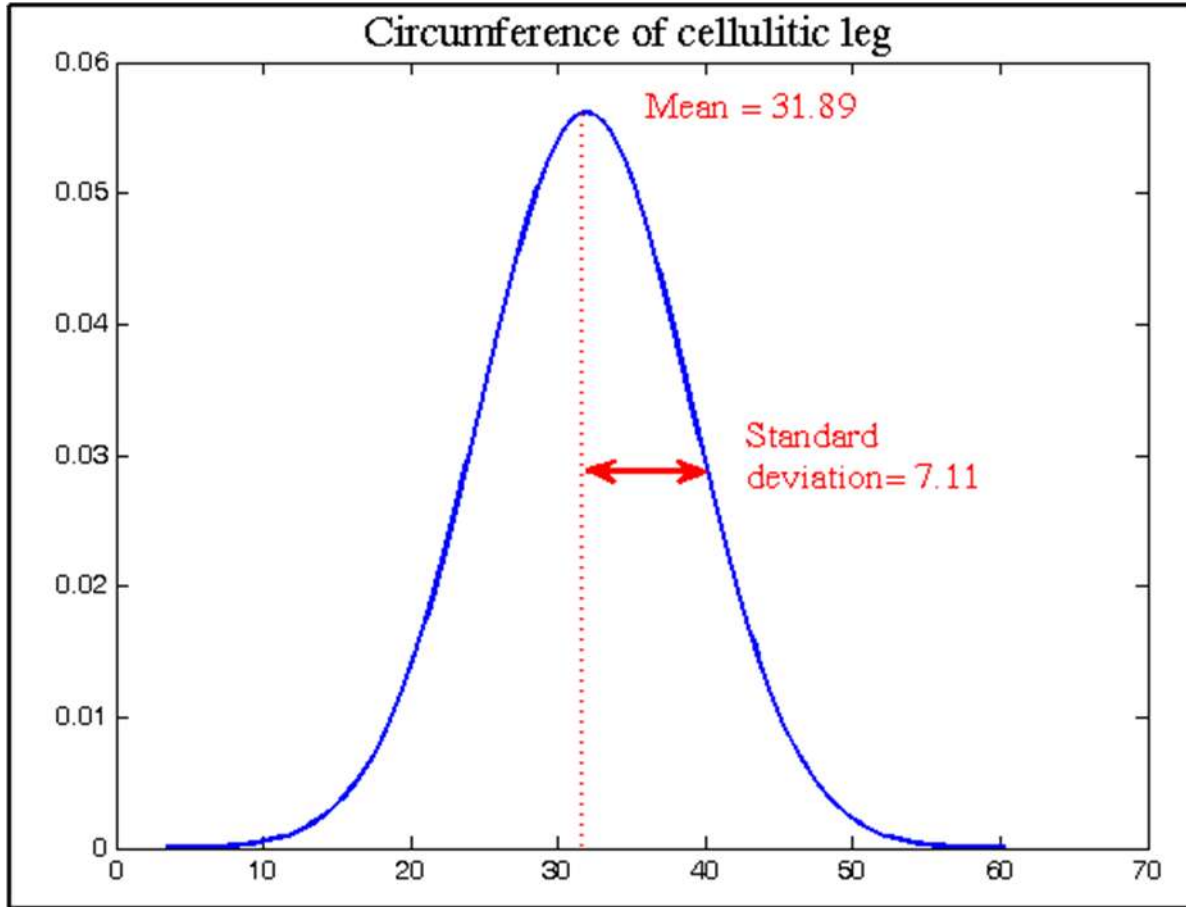


Graph :3 cirumference -I



Bell curve with the mean of 28.07cm and standard deviation of 6.07 cm for normal leg circumference

Graph :4 circumference-II



The mean circumference of the cellulitic leg was 31.89cm. There was increase in circumference of the cellulitic leg when compared to the normal leg

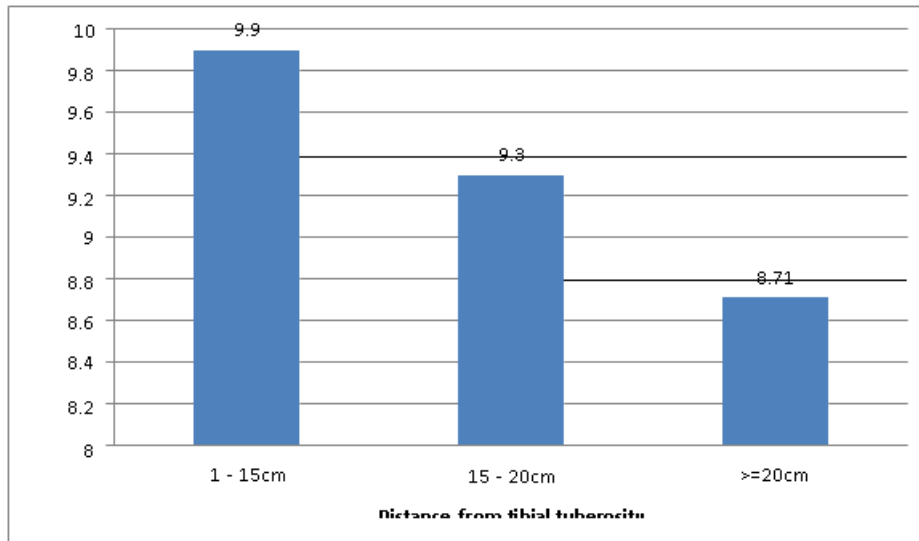
Table :1 Subcutaneous Pressure

Measures	Normal leg pressure	Maximum pressure in cellulitic leg	Change in pressure
Mean	2.29	9.39	7.11
Minimum	-4	4	2
Maximum	6	16	16

SD	3.05	3.40	2.95
25th percentile	-5.00	7.00	4.25
50th percentile	3.00	9.00	7.50
75th percentile	5.00	12.00	9.00

Table 1 Subcutaneous pressures in normal leg, cellulitic leg and the increase in subcutaneous pressure documented as change in pressure

GRAPH :5 Bar chart showing the mean subcutaneous pressure in the cellulitic leg with respect to the distance from tibial tuberosity.



The distance from tibial tuberosity was different for different individuals. But there was no statistically significant difference in subcutaneous pressure with respect to distance from tibial tuberosity.

Discussion

Current guidelines recommend conservative management for cellulitis, which includes antibiotic, anti-inflammatory medications and anti-edema measures. If there is an ascending infection with systemic sepsis or necrotizing soft tissue infection, surgical intervention is usually undertaken.(8) The decision for the surgical intervention in severe

cellulitis with skin changes are made by the treating surgeon based on subjective assessment. There are no standardized criteria for the surgical intervention in cellulitis of the leg. The attempt of measuring the subcutaneous pressure and correlating to the surgical intervention was done mainly to define criteria for surgical intervention. This study revealed that the patients who had surgical intervention, the

subcutaneous pressure in the cellulitic leg was significantly high when compared to the patients who were managed conservatively. (9)The measurement of subcutaneous pressure at the time of admission will be useful in deciding the treatment option. The patients who had high subcutaneous pressure at the time of admission ended up in surgery later due to failure of conservative management. In this group of patients, early surgical intervention can prevent ascending infection with systemic sepsis, extensive debridement due to progressing necrotizing soft tissue infection and avoid prolonged use of antibiotics and hospital stay.(10)This study, to the best of our knowledge, is the first to study subcutaneous pressures in legs of people with cellulitis. The study population was similar to that described in literature with a predominance of older people and men. The clinical presentations were also classical with diabetes mellitus as a major risk factor. Most of the patients received Inj crystalline penicillin and cloxacillin for *Streptococci* and *Staphylococci*. Subcutaneous pressures were elevated in patients with cellulitis of the leg when compared to the normal leg. (11)The increase in subcutaneous pressure in leg with cellulitis was significantly higher in group of patients who underwent surgery. The differences in subcutaneous pressure between the normal and the leg with cellulitis is measurable. The results of this study suggest that correlating the difference in the subcutaneous pressures between a normal and affected leg will be of use in clinical decision making for surgical intervention.(12)

Conclusion

Decision for early surgical intervention in managing cellulitis of the leg is usually based on the surgeon's experience and clinical decision-making skill. However, measuring subcutaneous pressure will allow the surgeons to make a decision for early surgical intervention and prevent local complications, extensive debridement which prolong the hospital stay and cost of management in lower limb cellulitis.

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