

Original Research Article

Efficacy of ultrasonography-guided sterile isotonic saline aspirate in the isolation of microorganism in the management of cellulitis

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ABSTRACT

Background: Cellulitis is an acute spreading infection of the skin and subcutaneous tissues characterized by local findings of tenderness, erythema, increased warmth, swelling, and regional adenopathy. Attempts to establish a precise bacteriologic diagnosis in most cases of cellulitis in adults are usually unrewarding, and therapy tends to be empiric. The aim of the study was to determine the efficacy of Ultrasonography guided sterile isotonic saline aspirate (UGSISA) in the isolation of microorganisms in the management of cellulitis.

Methods: A cross-sectional study with 100 patients suffering from lower limb cellulitis was performed. The most infected area was marked with ultrasonography, using the 21 G needle under sterile precaution; around 0.5 ml of sterile isotonic saline was injected into the most infected area and aspirated. The aspirate was sent for gram staining, cultured, and analyzed according to standard procedures.

Results: Needle aspirations in 100 patients were performed, and 30% had positive aspirants. The most common organism grown was Streptococci, and the least common was coagulase-negative Enterococcus, 2 patients had mixed infections. Major risk factors associated with lower limb cellulitis in our study were diabetes (54%) and spontaneous (20%).

Conclusions: In our study, as a routine diagnostic procedure, needle aspiration may not be justified for all cellulitis patients, though it may still be useful in patients where the most infected area was marked with ultrasonography before needle aspiration.

Keywords: Cellulitis, Ultrasonography, Needle aspirations

INTRODUCTION

Cellulitis is an acute inflammatory condition of the dermis, and subcutaneous tissue is usually found complicating a wound, ulcer, or dermatosis. Spreading and pyogenic, it is characterized by localized pain, erythema, swelling, and heat. Cellulitis may be caused by indigenous flora colonizing the skin and appendages, like *Staphylococcus aureus* (*S. aureus*) and *Streptococcus pyogenes* (*S. pyogenes*), or by a wide variety of exogenous bacteria.^{1,2} Streptococci are still sensitive to penicillin, but increasing

numbers of *Staphylococci* are not sensitive to beta-lactam-antibiotics.^{3,4}

Knowing the underlying bacteria could have a big impact on treatment outcomes and decrease complications. Failure to identify and treat bacteria from cellulitis can lead to the formation of abscess, septicemia, osteomyelitis, lymphangitis, necrotizing fasciitis, gangrene, and life-threatening complications. In immune-compromised patients, delay in starting treatment in-turn leads to early septicaemia. Earlier administration of sensitive antibiotic

will prevent all these complications and surgical procedure per se. On the other hand, blood cultures are only positive in 2-8% of skin infections, and soft tissue infections and skin swabs are not reliable in identifying the bacteria that caused the infection.⁵

Despite its frequency, however, the diagnosis and treatment remain empiric. The difficulty in isolating the etiologic agent and the lack of sound medical research to support a diagnostic approach has placed the clinician in a position of uncertainty. Several authors have recommended needle aspiration as the diagnostic procedure to identify the causative organisms in cellulitis.⁶⁻⁹

This procedure is not universally accepted as useful, however, and, even among the advocates, the best location for needle aspiration is controversial.¹⁰ Needle aspiration has not become part of standard diagnostic practice in patients presenting with skin and soft tissue infections. We decided to perform needle aspiration in all patients presenting with cellulitis or erysipelas at our hospital and monitor the sensitivity and clinical impact of the technique.

Aim

The aim of the study was to determine the efficacy of ultrasonography guided sterile isotonic saline aspirate (UGSISA) in the isolation of microorganisms in the management of cellulitis.

METHODS

This cross-sectional study included a total of 100 consecutive patients with localized cellulitis, attending at department of general surgery, ESIC medical college & PGIMSR, KK Nagar Chennai-78 from March 2019 to January 2020. The study was approved by the institutional ethical committee, and written informed consent of all patients was obtained based on inclusion and exclusion criteria. Written informed consent will be obtained from the patient the day before admission.

For all patients, age, sex, physical examination, complete blood, urine investigation, and needle aspiration were performed. All patients were suffering from lower limb cellulitis.

Inclusion criteria

All consenting patients with localized cellulitis of the lower limb were included.

Exclusion criteria

Cellulitis with class-III and IV, cellulitis with localized abscess, cellulitis with skin necrosis, cellulitis with septicemia, pregnancy, bleeding disorders, on anticoagulant and long-term steroids.

Needle aspiration technique

All needle aspirations were performed by the same investigator (P.N.) using identical techniques and materials in each case. Aspiration was done generally at an area of maximal inflammation, indicated by ultrasonography (USG) finding of the mixed echogenic area of inflammation.

Each aspirate site was cleansed with povidone-iodine solution, a 21-gauge needle attached to a 10 ml plastic syringe was inserted under USG guidance, and fluid injected into that site and aspirated. If the initial aspiration attempt fails to produce any visible material, the needle was left in place.

The original syringe was replaced with one containing 0.5 ml of isotonic saline and then injected subcutaneously and immediately re-aspirated.

Microbiological culture technique

Aspirated material was promptly carried to the microbiology laboratory in the capped needle and syringe used for collection, where it was immediately inoculated onto culture media. For aerobic culturing, blood agar plate, mannitol salt agar plate, and MacConkey agar plate were used. After inoculation, the plates were incubated at 37°C for 24 hours. The next day depending on colony growth, further processing like gram staining, biochemical reaction, antibiotics sensitivity test was done.

RESULTS

There were 100 patients with lower limb cellulitis in this study. They ranged in age from 18 to 85 years (Figure 1). 68 were male, and 32 were female (Figure 2).

Major risk factors associated with lower limb cellulitis in our study were diabetes (54%) and spontaneous (20%). Other risk factors were direct trauma, dermatitis, lymphedema, and venous insufficiency (Figure 3).

Clinical findings of pain or tenderness, edema, redness, and fever were present in nearly all patients (Figure 4). Most cultures (70 patients, 70%) had negative growth.

The most common organism grown was Streptococci, and the least common was coagulase-negative Enterococcus, 2 patients had mixed infections (Figure 5).

The culture and sensitivity of the microbiological flora isolated from the cellulitis are shown in Table 1.

Duration of hospital stay was 6 days (mean) in the cases where organism detected, no growth cases have more than 10 days of hospital stay, this significantly reduced the treatment cost. In this study, 2 patients (2.8%) in 70 patients with no growth had undergone amputation.

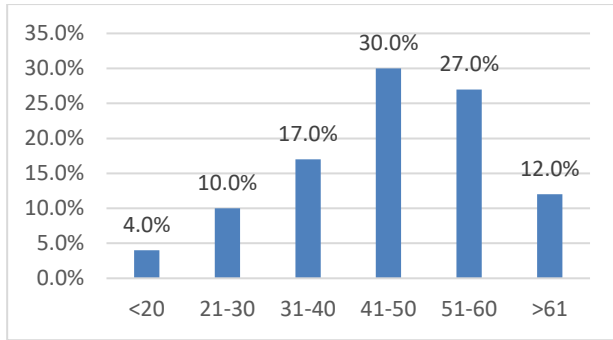


Figure 1: Distribution of age group.

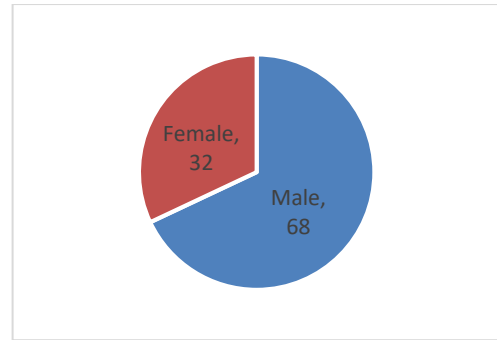


Figure 2: Distribution of gender.

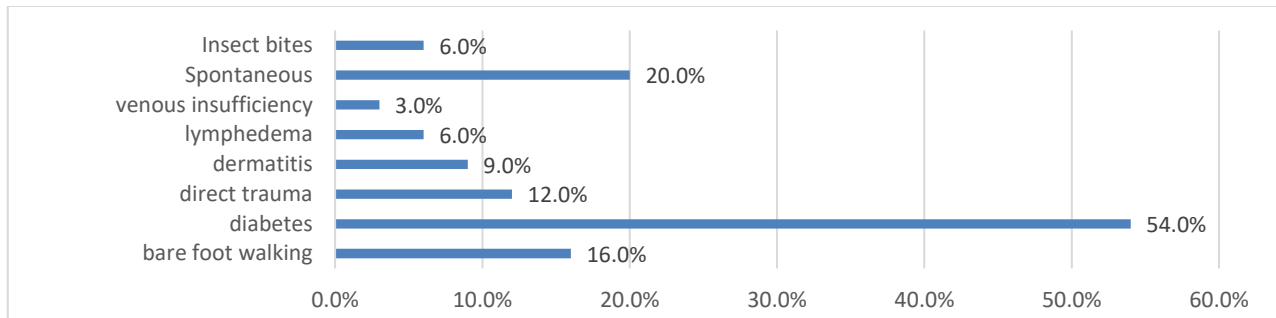


Figure 3: Distribution of risk factors.

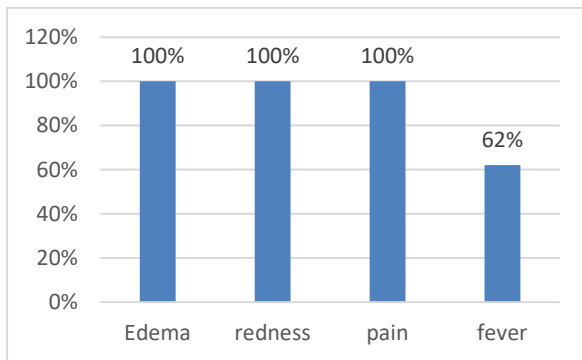


Figure 4: Distribution of presentation.

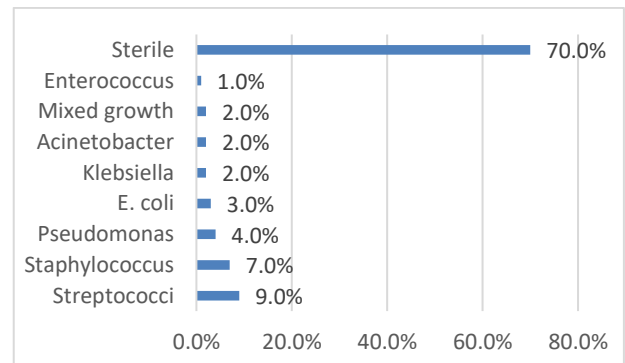


Figure 5: Distribution of organisms.

Table 1: Antibiotic sensitivity.

Antibiotics	Beta hemolytic streptococcus	K. pneumonia	S. aureus	P. aeruginosa	E. coli
Amoxyclav	8	1	5	R	R
Ofloxacin	7	2	3	1	R
Piperacillin TZ	7	2	4	1	R
Ceftazidime	3	1	1	1	1
Cefoperazone SB	2	1	2	1	1
Ciprofloxacin	R	1	4	R	R
Gentamicin	R	R	R	2	2
Amikacin	R	1	R	2	3
Cefuroxime	4	R	3	1	R
Erythromycin	R	R	R	R	R
Imipenem	9	2	5	3	3

Note: R- resistant.

DISCUSSION

Needle aspiration cultures can be very helpful and easy to perform with the minimally invasive diagnostic technique to identify the causative pathogen of cellulitis. According to existing literature review on needle aspiration reveals marked differences in results, with various studies showing positive aspiration rates ranging from 4 to 67%.¹⁰

A cross-sectional study of 100 patients suffering from lower limb cellulitis was studied to find the efficacy of UGSISA in the isolation of microorganisms in the management of cellulitis. There were 68 males and 32 females, suggesting more prevalence in males. In a study by Newell et al erythema, pain or tenderness, increased warmth, and swelling were clinical findings in nearly all patients.¹⁰ In our study, pain or tenderness, edema, redness, and fever were clinical findings in all patients. Diabetes (54%) and spontaneous (20%) were significant risk factors, and direct trauma, dermatitis, lymphedema, and venous insufficiency were other risk factors.

As some authors favor the margin of the lesion as the best localization to perform needle aspiration.¹¹ According to Piso et al none of the 25 aspirates showed a positive result these were disappointing, whereas the site of maximal inflammation yielded somewhat better results.⁵ Similar results were obtained in our study where 30% positive aspirates were found with the site of maximal inflammation selected by using ultrasonography before needle aspiration.

Streptococci and Staphylococcus aureus reported to be the most frequent causative agents of cellulitis in adults. However, many other organisms have been isolated from patients with cellulitis, including various members of the family Enterobacteriaceae, Pseudomonas aeruginosa, Pasteurella multocida, Streptococcus pneumoniae, and Haemophilus influenzae, to name a few.^{12,13}

Staphylococci and Streptococci are the most common causes of cellulitis. Indeed, most of the adults in our study population responded to specific antibiotic therapy covering these pathogens as described in the results. Apart from these two microorganisms, other organisms were also isolated from our patients; our findings emphasize that in compromised hosts and specific clinical settings, more unusual organisms may cause cellulitis and should be anticipated in selecting initial antibiotic coverage.

In normal care, needle aspirate culture is not recommended because the results rarely change the treatment strategy. Cultures from needle aspiration and punch biopsy are only positive in 20% of cases, even when collected from the leading edge of the inflammation.^{14,15} This shows that the illness is caused by a small number of bacteria, and that the growing symptomatic region within the skin was caused by extracellular toxins or inflammatory mediators provoked by the host. Despite the low yield from aspiration for individual patients, studies have produced

important findings for overall treatment strategies: data from a number of studies examining both needle aspiration and punch biopsy suggest that antimicrobial therapy for cellulitis should target gram-positive cocci in immunocompetent hosts, particularly *S. aureus* and *S. pyogenes*.¹

Limitation

Further studies with higher sample size required to prove the organism associated with risk factors.

CONCLUSION

In conclusion, in evaluating patients with cellulitis, our cross-sectional study demonstrates that needle aspiration after the most infected area was marked with ultrasonography successfully establishes a specific bacteriologic diagnosis in only a small percentage of cases which prevented the complications of disease and surgical intervention. It reduced the hospital stay and treatment outcome significantly.

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Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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