Clinical and Microbiologic Findings in Cellulitis in Thai Patients

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Abstract

Background: Cellulitis is an inflammation of subcutaneous tissue in which infective, generally bacterial cause is proven or assumed. However, attempts to culture bacteria from lesions are often unsuccessful.

Method: One hundred and fifty cases diagnosed as cutaneous cellulitis at Siriraj Hospital between 1992 and 1995 were retrospectively studied.

Results: Our study in 150 adult Thai patients with cellulitis showed that the most common site of infection was the lower extremity. Forty two per cent of the patients had history of preceding local trauma. Fever and regional lymphadenopathy were detected in 77.3 per cent and 22.6 per cent respectively. Sixty nine per cent of patients had leukocytosis with a mean neutrophil ratio of 79.7 per cent of patients with underlying diseases predisposed to the infection, 61.6 per cent had positive lesional culture results in contrast to 31.6 per cent in patients without. Needle aspiration and blood gave low positive culture yields. The common organisms detected were *S.aureus* and *Streptococcus* group A (83%) in immunocompetent patients. Of immunocompromised patients, in one half of the cases gram negative bacteria were found.

Conclusions: This study showed that in immunocompetent patients, the major bacterial isolated in cellulitis were *S.aureus* and *Streptococcus* group A. In immunocompromised patients, gram negative bacteria were found in one half. These findings may help in the selection of antimicrobials before the results of bacterial cultures are available or in culture negative cases.

Key word : Cellulitis, Clinical Features, Microbiologic Study

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Cellulitis is an acute, subacute or chronic inflammation of subcutaneous tissue in which an infective, generally bacterial cause is proven or assumed[1]. In clinical practice; it manifests as a localized area of warm, tender, ill-defined erythematous patch with occasional vesicles, bullae or skin necrosis. The disease is frequently associated with systemic symptoms (e.g. fever, chills and malaise). Attempts to culture bacteria from swabs of the lesions, from biopsy material, from needle aspiration of saline-injected tissue and from fluid from blisters or erosion when present, are often unsuccessful[2-5]. Blood cultures and swabs from possible entry sites, e.g. wounds or inflammatory lesions, generally situated distal from the lesions, occasionally yield presumably relevant organisms. Nonetheless, investigators have found that needle aspiration cultures from patients with underlying conditions such as diabetes mellitus, lymphoproliferative and myeloproliferative disorders and cirrhosis yield pathogenic organisms at a low but tangible rate[3,6,7]. Knowledge of common bacterial causes of cellulitis enables the selection of empiric antimicrobial therapy before the results of bacterial cultures are available or in cases that bacterial cultures are negative or cannot be obtained.

There have been few studies in Thai patients with cellulitis. Therefore, we performed a retrospecitve study in patients admitted to the Department of Medicine, Siriraj Hospital with cellulitis. Clinical features and microbiologic culture results between patients who were immunocompetent and immunocompromised were compared.

Patients and Method

One hundred and fifty admitted cases diagnosed as cellulitis at Siriraj Hospital between 1992 and 1995 were included in the study. Patients were considered to have cellulitis based on findings of warmth, erythema with ill-defined border, edema, and pain or tenderness of the skin. Exclusions were made for patients with ulcerative lesions, abscesses or underlying osteomyelitis. Clinical features of patients and microbiological culture results were analyzed. Disease severity was divided into 3 groups i.e. mild, moderate and severe groups according to the degree of erythema, swelling, pain, tenderness, warmth of skin lesions. Patients who had fever were classified into moderate or severe groups and patients who had signs of septicemia were classified into the severe group. Cultures were done from spe-

cimens obtained with a swab from potential sites of origin of infection or any break in the skin in continuity with the area of cellulitis, needle aspiration[8] and skin biopsy (performed at the advancing margin of erythema). Clinical and laboratory findings were compared between patients who were immunocompetent (group I) and immunocompromised (group II).

RESULTS

Of the 150 patients, 79 were men and 71 were women. Their age ranged from 15 to 88 years (mean 49.6 years). Table 1 shows underlying diseases of the patients. Twenty three patients (15.3%) had other diseases which did not affect the immune system, did not have predisposing risk factors to bacterial skin infection e.g. chronic edema from venous or lymphatic stasis, pitting edema from renal, liver or cardiac causes. (There were 10 cases of hypertension, 10 cases of coronary artery disease, two cases of Parkinsonism, one case of pneumonia.) Twenty eight patients (18.7%) had no underlying diseases. Ninety nine patients (64.7%) (group 2) had underlying diseases which predisposed to bacterial skin infections (secondary immunodeficiency)[9,10].

Table 2 compares demographic data and clinical findings between the two groups of patients. Because this study was done in admitted patients, the severities in most cases were moderate to severe. The most common site of infection in both groups was the lower extremity. History of preceeding local trauma, fever, regional lymphadenopathy and bul-

Table 1.   Underlying diseases.

Underlying diseases	No. of patients (%)
Group 1: Immunocompetent patients	51 (34.0)
Other diseases	23 (15.3)
No underlying diseases	28 (18.7)
Group 2: Immunocompromised patients	99 (64.7)
Diabetes mellitus	35 (23.3)
Malignancies	9 (6.0)
Hematologic malignancies	14 (9.3)
Cirrhosis	15 (10.0)
Nephrotic syndrome	15 (10.0)
Systemic lupus erythematosus	10 (6.7)
Aplastic anemia	1 (0.7)

Table 2.   Clinical features.

Findings	Group 1*	Group 2	Total
Number of cases	51	99	150
Male/ Female ratio	1.4:1	1:1	1.1:1
Age ($\bar{x} \pm$ S.D.)(yrs)	54.9 ± 21.9	46.8 ± 15.9	49.6 ± 18.6
Severity (%)			
mild	5.9	7	6.6
moderate	78.4	76.8	77.3
severe	15.7	16.2	16
Site (%)			
Head	13.7	8.1	10.0
Trunk	2.0	4.0	3.3
Upper extremity	17.6	9.1	12.0
Lower extremity	66.7	78.8	74.7
History of preceeding trauma (%)†	51.2	36.9	41.7
Fever (%)	72.5	79.8	77.3
Regional lymphadenopathy (%)††	21.6	23.3	22.6
Bullous lesion (%)†††	30.6	30.8	30.7

*, Group 1 are patients who had no underlying diseases which compromised the patients to bacterial skin infections. Group 2 are patients who had the underlying diseases.
† : total recorded number = 115
†† : total recorded number = 137
††† : total recorded number = 140

Table 3.   Positive bacterial culture results.

Group of diseases	Culture positive cases/no.of patients (%)	
	Lesional cultures*	Hemocultures
Group 1: Immunocompetent patients	12/38 (31.6)	3/36 (8.3)
Group 2: Immunocompromised patients	45/73 (61.6)	17/80 (21.3)
Diabetes mellitus	18/28 (64.2)	3/23 (13)
Malignancies	2/5 (40)	3/8 (37.5)
Hematologic malignancies	9/12 (75)	4/15 (26.7)
Cirrhosis	6/14 (42.9)	4/13 (30.8)
Nephrotic syndrome	6/8 (75)	3/12 (25)
Systemic lupus erythematosus	4/6 (66.7)	0/9 (0)
Total	57/111 (51.4)	20/116 (17.2)

*, Lesional culture include primary lesion, needle aspiration and skin biopsy culture.

lous lesions were detected in 41.7 per cent, 77.3 per cent, 22.6 per cent, and 30.7 per cent respectively.

When cases with hematologic malignancies and aplastic anemia were excluded, white blood cell (WBC) count ranged from 1.4 to 50 x 10^3/mm^3 (mean ± S.D. = 14132.1 ± 7415.2). Among these cases, 30.8 per cent of patients had WBC count of less than 10 x 10^3/mm^3. Thirty per cent of patients had WBC between 10 x 10^3 and 15 x 10^3/mm^3 and

39.1 per cent of patients had WBC count more than 15 x 10^3/mm^3. Percentage of neutrophil ranged from 36 per cent to 98 per cent (mean ± S.D.= 79.7 ± 13.2%).

Table 3 shows percentage of positive culture results. Lesional culture included primary lesion, needle aspiration and biopsy cultures. Patients in group 2 had 61.6 per cent positive culture results compared with 31.6 per cent in group 1. The diffe-

Table 4. Organisms from culture in 150 cellulitis patients.

Organisms	Specimen collection					Lesional culture*	
	Swab	Needle aspiration	Skin biopsy	Hemoculture	Bullae fluid	Group 1	Group 2
Streptococcus Group A	14	1	-	8	3	5	10
Streptococcus Group D	1	-	-	-	-	1	-
Staphylococcus aureus	14	1	1	2	6	5	11
Escherichia coli	5	-	-	4	1	1	4
Klebsiella pneumoniae	4	-	1	2	1	-	5
Pseudomonas aerugiosa	10	-	1	3	4	-	10
Proteus mirabilis	4	-	-	-	1	-	4
Aeromonas hydrophila	1	-	-	1	1	-	1
Total positive culture/total cases	53/94	2/24	3/3	20/116	17/43	12/38	45/73
%	56.4	8.3	100	17.2	39.5	31.6	61.6

*, Lesional culture include primary lesion, needle aspiration and skin biopsy culture.

rence was statistically significant (p<0.05). However, hemoculture results between the two groups had no statistical difference (p>0.05).

Table 4 shows organisms from various culture methods. Needle aspiration culture was done in 24 patients. The results were positive in 2 cases (8.3%). Biopsy cultures were taken in only 3 patients (group 2), all of them showed positive culture results. Hemoculture was positive in 20 of the 116 cases studied (17.2%). Of 43 patients whose lesions had bullae, 17 cases had positive bullae fluid culture (39.5%). Six patients had hemorrhagic bullae fluid, 2 had positive cultures from bullae fluid. Both were *Pseudomonas aeruginosa*. The remaining four cases had negative bullae fluid culture but in two cases hemocultures were positive i.e. *Streptococcus* Group A and *Aeromonas hydrophila*. Lesional culture in group 1 patients yielded mostly gram-positive organisms, whereas, in one half of the lesional cultures in group 2, gram negative bacilli were found.

Thirty out of 90 patients in group 2 (30.3%) had preexisting pitting edema at sites of cellulitis. The percentage of positive lesional culture results between patients who had and who did not have edema before cellulitis was not statistically different (p>0.05). The causative organisms in these 2 groups were not different.

DISCUSSIONS

Beta-hemolytic streptococci and *Staphylococcus aureus* are generally claimed in most cases of acute cellulitis in adults[5,11,12]. However, attempts to isolate organisms by primary lesion swabs, needle aspiration, biopsy and hemoculture gave low positive yields and in positive cultures, usually a small number of organisms are present.

Hook et al[5] reported that biopsy culture was positive in 10 of 50 patients (20%), while needle aspiration culture and blood culture were positive in 10 per cent and 4 per cent of their patients, respectively. However, in their study 21 (88%) of 24 patients with presumed primary sites of infection had positive primary lesion culture. Beta-hemolytic *streptococci* or *S.aureus* were the most frequent organisms isolated. In a large retrospective study of patients with cellulitis, a positive culture was demonstrated in only 15 (8.7%) of 173 needle aspirates[13].

Sach MK[14] postulated that organisms are rarely recovered from cellulitic lesions because phagocytic cells rapidly reduce the number of viable bacteria to extremely low numbers by phagocytosis and by producing mediators of inflammation in response. Kielhofner et al[6] reported that certain subsets of patients including diabetics and patients with malignancies had an increased likelihood of positive needle aspiration cultures. They hypothesized that, in addition to enhancing predisposition to bacterial skin infections in these patients, neutrophil chemotactic disorders might enhance the retrieval of microorganisms at the site of inflammation. This could be achieved by delayed leukocyte migration to the foci of infection.

We compared lesional culture between our group 1 and group 2 patients. The latter had positive cultures in 61.6 per cent in contrast with 31.6 per cent in group 1. The difference had statistical significance (p<0.05). Kielhofner[5] reported 12 of 17 patients with diabetes mellitus and all 6 patients with malignant disorders had positive needle aspiration cultures. Similar results were found in our study.

Organisms isolated in group 1 patients were mainly gram positive bacteria, mostly *S.aureus* and *Streptococcus* group A. One half of the organisms found in group 2 were gram positve cocci i.e. *S. aureus* and *Streptococcus* group A. The remainder were gram negative rod, the most common was Pseudomonas aeruginosa. *Klebsiella pneumoniae* and *Escherichia coli* were also frequently found.

Streptococcus group D was isolated in one patient. This organism might be either a true pathogen or contamination. Culture for anaerobic bacteria was not done in these cases.

Our study showed that when there were bullae on cellulitic lesions, bullae fluid cultures were positive in 39.5 per cent, the most common organism was *S.aureus*. Needle aspiration culture and hemoculture yielded low positive results, at 8.3 per cent and 17.2 per cent respectively. A positve result of 8.3 per cent included 2 of 24 cases in whom the procedure was applied. There was no statistically signi-

ficant difference between hemoculture results in group 1 and group 2 patients. Skin biopsy culture results could not be evaluated because of the small sample size.

There were no differences in clinical features i.e. fever, regional lymphadenopathy, bullous lesions, site of lesions between group 1 and group 2 patients.

In summary, our study in 150 adult Thai patients with cellulitis showed that the most common site of infection was the lower extremity. Forty-two per cent of the patients had a history of preceding local trauma. Fever and regional lymphadenopathy were detected in 77.3 per cent and 22.6 per cent of the patients respectively. Sixty-nine per cent of patients had leukocytosis (WBC count of more than 10×10^3 mm^3) with mean neutrophil count of 79.7 per cent. Patients who had underlying diseases predisposing to bacterial skin infection, had 61.6 per cent positive lesional culture results in contrast to 31.6 per cent of patients who had no risk factors. Needle aspiration culture and hemoculture gave low positive yields. The common organisms detected were *S.aureus* and *Streptococcus* group A. In patients with diseases predisposing to bacterial skin infection, one half of the cases were caused by gram negative bacteria. Empirical antimicrobial therapy for patients with cellulitis in our country could be guided by the findings in this study.

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การศึกษาโรค Cellulitis และเชื้อที่เป็นสาเหตุในผู้ป่วยไทย

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คณะผู้วิจัยได้ศึกษาลักษณะทางคลินิก และเชื้อที่เป็นสาเหตุของโรค cellulitis ในผู้ป่วยใน จำนวน 150 ราย ของ ภาควิชาอายุรศาสตร์ รพ.ศิริราช ตั้งแต่ปี พ.ศ. 2535–2538 พบว่าผู้ป่วยร้อยละ 41.7 มีประวัติการกระทบกระแทกหรือ สิ่งของที่มตำก่อนเกิดรอยโรคบริเวณนั้น ไข้และต่อมน้ำเหลืองโตเฉพาะที่ พบได้ร้อยละ 77.3 และ 22.6 ตามลำดับ ภาวะ เม็ดเลือดขาวเพิ่มจำนวนพบได้ 69.2% โดยมีค่าเฉลี่ยสัดส่วนร้อยละของนิวโตรฟิล คือ 79.7 ในกลุ่มผู้ป่วยที่มีภูมิคุ้มกันต่อ การติดเชื้อต่ำลง พบว่าการเพาะเชื้อจากรอยโรคให้ผลบวก 61.6% เทียบกับกลุ่มที่มีภูมิคุ้มกันปกติซึ่งให้ผลบวกเพียง 31.6% สิ่งส่งตรวจจากการเจาะดูดด้วยเข็มและจากเลือดให้ผลบวกน้อย ในกลุ่มผู้ป่วยที่มีภูมิคุ้มกันต่อการติดเชื้อปกติ เชื้อที่ พบมากได้แก่ *Staphylococcus aureus* และ group A *Streptococci* (83%) ส่วนกลุ่มผู้ป่วยที่มีภาวะภูมิคุ้มกันต่อการติด เชื้อต่ำ เชื้อที่เป็นสาเหตุครึ่งหนึ่งเป็นเชื้อแกรมบวก และอีกครึ่งหนึ่งเป็นเชื้อแกรมลบ ผลการตรวจพบนี้จะช่วยนำไปสู่ การเลือกใช้ยาปฏิชีวนะในการรักษาผู้ป่วย ที่ไม่อาจเพาะเชื้อได้ ในผู้ป่วยหนักที่ไม่อาจรอผลเพาะเชื้อได้ และในผู้ป่วยที่การ เพาะเชื้อให้ผลลบ

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