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Acute phase reactants in evaluation and management of acute bone and joint infection in paediatrics patients

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Abstract

Background: The study was conducted to evaluate Roll of Acute Phase Reactants in evaluation and management of Acute Bone and Joint infection in Paediatrics Patients.

Material and Methods: Prospective Observational and interventional study of 30 patients at our centre Government Medical College and District Hospital, between age of 3 month to 14 yrs with suspected acute infection of bone or joint.

Results: Staphylococcus aureus was the most common pathogen causing osteomyelitis/septic arthritis. In this study Conservative treatment with use of antibiotics remains the backbone of treatment supplemented by arthotomy. On day of admission mean CRP in both septic arthritis and acute osteomyelitis patients was significantly high compared to mean ESR. We have found an elevated CRP is a strong independent indicator of septic arthritis and acute osteomyelitis, and we have demonstrated its utility in simplifying diagnostic predictive models.

Discussion and Conclusion: In present study of 30 patients with acute osteomyelitis or septic arthritis, the sensitivity of elevated ESR on admission to detect an osteoarticular infection was 93%. Using CRP alone gave only a slightly better sensitivity of 96%. But combining these two markers gave a sensitivity of 100%.

Keywords: Acute phase, evaluation, acute bone, paediatrics patients

Introduction

Acute-phase reactants such as erythrocyte sedimentation rate and C-reactive protein have traditionally been used as markers for inflammation and as a measure of “sickness index” in infectious and noninfectious conditions. Acute bone & joint infections in pediatric age group are a growing problem with potential for systemic after effects, since they can progress to irreversible joint damage and sepsis. Diagnosis of acute joint or bone infection in children is frequently difficult, since this disease may initially be asymptomatic ^[1]. Early diagnosis pharmaceutical and surgical treatment are necessary to reduce permanent damage.

Acute septic arthritis may develop as a result of hematogenous seeding, direct introduction, or extension from a contiguous focus of infection. The pathogenesis of acute septic arthritis is multifactorial and depends on the interaction of the host immune response and the adherence factors, toxins, and immunoavoidance strategies of the invading pathogen ^[2].

Acute hematogenous osteomyelitis is primarily a disease of young children, presumably because of the rich vascular supply of their rapidly growing bones ^[4-6]. Infecting organisms enter the bone through the nutrient artery and then travel to the metaphyseal capillary loops, where they are deposited, replicate, and initiate an inflammatory response. Metaphyseal localization results from sluggish blood flow, the presence of endothelial gaps in the tips of growing metaphyseal vessels, and lack of phagocytic cells lining the capillaries ^[6-9]. Large colonies of bacteria surrounded by glycocalyx obstruct capillary lumens, impairing phagocytosis and antibiotic penetration ^[10].

Acute bone & joint infections of childhood comprise essentially three entities, septic arthritis (SA), osteomyelitis (OM), and their combination (OM + SA).

The serums CRP challenge the traditional position of ESR for diagnostics and follow up of invasive bacterial infections such as osteoarticular infections of childhood.

The increases and decreases of CRP are so clear cut and fast (increased values are seen within 6 to 8 hours, and the doubling time is only 8 hours) that they have the potential to influence treatment. Furthermore, if the infection subsides, the levels decline by approximately 50% a day [27].

A negative CRP measurement is of great value, because it is a strong argument against potential SA, OM, or OM.

Material and Method

We conducted a prospective Observational and interventional study of 30 patients at our centre Government Medical College and District Hospital, Ratlam between May 2018-December 2018. We evaluated patients 5 times (on day of admission, 3, 10, 28th days and 2 month). We included patients with suspected acute infection of bone or joint, between age 3 months to 14 yrs, Presenting within 48 hours of onset of symptoms of acute infection with No previous antibiotic treatment taken.

Patients who were younger than 3 month and older than 14 years, those who received previous antibiotic therapy and Immunodeficient patients were excluded from the study.

The selected patients who satisfied the above inclusion criteria were then registered, all history and clinical details were recorded in the history sheet.

Study protocol

On arrival analgesics and Intravenous fluids given. All routine investigations along with differential and total leucocyte count done. All patients investigated for baseline ESR and Quantitative CRP, Blood culture and synovial fluid culture were sent as required, X-ray and USG of affected part done, Broad spectrum IV antibiotics with symptomatic treatment (analgesic, antipyretic, i.v. fluid, splintage) started after sending samples. Joint aspiration or arthrotomy done as required.

Level of CRP on treatment measured on-day of admission 3rd, 10th, 28th day & 2nd month. CRP value >20 mg/litre highly suggestive of acute bone and joint infection. Level of ESR on treatment measured on-day of admission 3rd, 10th, 28th day & 2nd month. ESR value >20 mm/hr highly suggestive of acute bone and joint infection.

Observations and Results

The detail of the various variables and data is presented as follows.

Age and sex distribution

Sample of 30 patients is taken out of which maximum numbers of cases were seen to fall in age group between 3months-3years with male predominance.

Table 1: Table show male female age group

Age Group	Male	Female	Total
3 mth-3 yr	7	6	13
3 yr-6 yr	5	2	7
6 yr-9 yr	2	0	2
9 yr-12 yr	4	2	6
12 yr-14 yr	1	1	2

1) Sex distribution

Male predominance was observed with 68% and female having 32%.

2) Total OM and SA case distribution

Out of total patients, 83.33% cases were of septic arthritis and

16.66% cases were of acute osteomyelitis.

3) Laterality

In present study osteomyelitis affected lower limb most commonly in Tibia (more on right) whereas septic arthritis involved knee joints more commonly (Rt>Lt). All cases in the study had unilateral involvement.

4) Blood culture

Staphylococcus aureus was the most common pathogen causing osteomyelitis/septic arthritis.

Table 2: Table show organism number

Organism	No of Patients
Staph aureus	24
Pseudomonas	3
Sterile	3

6) Procedure

Conservative treatment with use of antibiotics remains the backbone of treatment supplemented by arthrotomy.

Table 3: Table show procedure number

Procedure	No of Patients
Conservative	21
Arthrotomy	7
Biopsy	2

Statistical analysis

In our study 30 patients were included, 25 patients had a diagnosis of septic arthritis and 5 patients had acute osteomyelitis. On applying unpaired t test on both septic arthritis and acute osteomyelitis patients with CRP & ESR on day of admission, 3rd day, 10th day, 28th day and 2 month. On day of admission mean CRP in both septic arthritis and acute osteomyelitis patients was significantly high compared to mean ESR, P value <.05 which is statistically significant.

On 10th day mean CRP value 18.63 mg/l and mean ESR value was 28.48mm/hr, so we can correlate early normalization of CRP compared to late normalization of ESR. P value <.05 which is statistically significant.

Unpaired t-test applied over 30 patients for correlation between patient who underwent any surgical procedure on acute osteomyelitis and septic arthritis with patient who received conservative treatment. In both these groups mean value of CRP on day 10 was >22.12mm/hr in patient undergoing any surgical procedure, and mean CRP in non-operative group was >15.84mm/hr on day 10. This correlation is statistically significant (P value <0.05).

On applying Unpaired T test mean CRP of 30 patients under evaluation on day 10 the correlation between patients of septic arthritis and acute osteomyelitis group, the normalization of CRP was earlier in acute osteomyelitis group. This correlation was statistically significant (P value <0.05).

We have found an elevated CRP is a strong independent indicator of septic arthritis and acute osteomyelitis, and we have demonstrated its utility in simplifying diagnostic predictive models

Discussion

We studied 30 children aged 3 months to 14 years with acute osteoarticular infection (Positive blood culture alone sufficed if the joint showed indisputable signs of acute arthritis and joint effusion was confirmed by aspiration and/or ultrasound) with a predetermined series of ESR, CRP [11].

The concentrations of serum CRP, an acute phase protein, initially rise and thereafter decreased rapidly during the course of acute bacterial arthritis or osteomyelitis in children. On the contrary ESR rises slowly during several days and then normalizes slowly during several weeks.

In present study CRP is better for assessment of followup in both OM & SA. CRP is a simple test carried out with readily available laboratory equipment, nephelometer or turbidimeter, and it requires only a finger prick sample of blood. It can be done frequently during the acute phase of illness.

CRP increases and decreases much more quickly than ESR. CRP was clearly elevated on admission, peaked within 48 hours and normalized in about 1 week. In contrast ESR continued increasing, despite active treatment, until Day 5 and required more than 1 month to normalize. The rapidity of change in CRP value is of a major clinical relevance because CRP also has the potential for detecting complications sooner than other laboratory indices.

Serum C-reactive protein (CRP) is a good guide in monitoring the course of illness, and the antimicrobials can usually be discontinued if the symptom and signs subside and CRP has decreased to <20 mg/L^[20].

Our study proves that Quantitative CRP an ESR done serially in acute osteoarticular infections are very helpful in firstly the diagnosis and secondly the monitoring of treatment.

Conclusion

In our study 30 patient were included. The most common etiologic agent was "Staphylococcus aureus". C-reactive protein value and erythrocyte sedimentation rate were elevated on the day of admission in all cases. CRP values peaked on day of admission in most of the cases and ESR peaked on day 28. CRP normalizes <20mg/l on day 10. ESR normalized <20mm/hr on day 28. The infections were initially treated with broad spectrum antibiotic therapy intravenous. Once the culture sensitivity reports were available antibiotics were changed accordingly. Nine patients out of 30 underwent at least one surgical procedure.

Treatment (Broad spectrum IV antibiotics with symptomatic treatment (analgesic, antipyretic, i.v. fluid, splintage) given after sending samples. Joint aspiration or arthrotomy done as required.

Complications: No complications were seen during the study.

We conclude that quantitative CRP and ESR used together are very useful for diagnosis as well as monitoring treatment progression of patients of acute bone and joint infection.

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