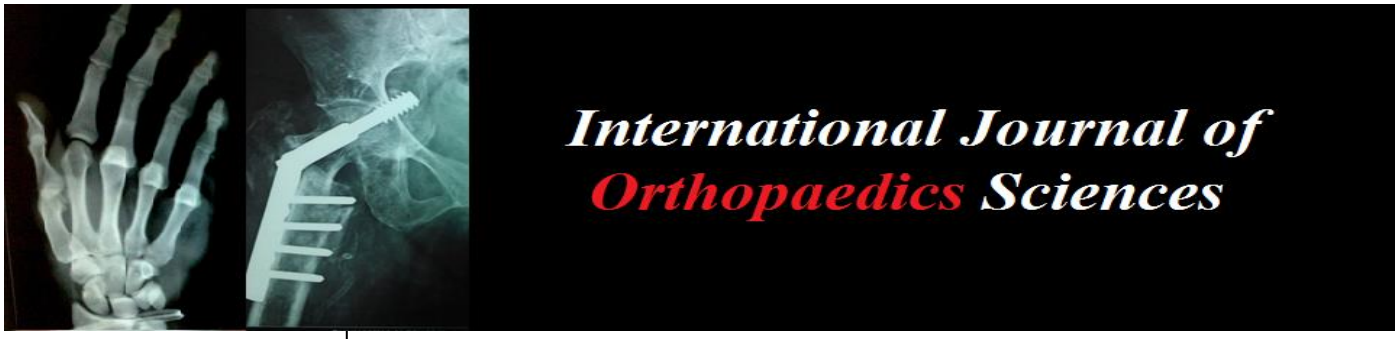

E-ISSN: 2395-1958
P-ISSN: 2706-6630
IJOS 2019; 5(4): 796-799

www.orthopaper.com
Received: 16-08-2019
Accepted: 18-09-2019

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Short-term outcome of late presenting neonatal septic arthritis

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DOI: https://doi.org/10.22271/ortho.2019.v5.i4n.1776

Abstract
Septic arthritis can lead to serious morbidity and mortality. In developing countries most of the cases of septic arthritis presents late, Diagnosis is crucial and often missed. Septic arthritis is already studied, but there is under reporting of neonatal septic arthritis from under developed regions.
Aim: To assess the short-term outcome following surgical intervention in patients of neonatal septic arthritis presenting late.
Methods: It is a prospective study conducted at tertiary health care center from June 2014 to June 2017. Neonate who presented late (≥ 5 days of symptoms) were included. Total of 110 cases were studied. Diagnosis was made using Modified Kocher's criteria and USG. Arthrotomy was performed in arthrocentesis positive patients. On follow up Patients were clinically and radiologically reassessed using Bennet Scoring System to check for sequalae. Data was collected and analyzed statistically using SPSS software.
Results: Mean total leukocyte count, ESR and CRP were 17,000, 51 and 54 respectively. Excellent results were observed in 10% patients. Good, fair and poor results were obtained in 33.6%, 45.5% and 10.9% patients respectively.
Conclusion: Septic arthritis leads to significant morbidity in patients who report late to the specialty even after early surgical intervention. There is a need of awareness programme to educate parents to recognize early features of septic arthritis. The clinicians should pick up and refer the patients as early as possible to the concerned specialty to improve the outcome of neonatal septic arthritic.

Keywords: Septic arthritis, neonatal, outcome, *Klebsiella*, arthrotomy, bennett's criteria

1. Introduction
Septic arthritis is infection of the joint with bacterial or fungal microorganisms [1]. It is an orthopedic emergency that should be dealt with early or else it can lead to serious morbidity and mortality [2]. Diagnosis of septic arthritis is very crucial and challenging. Delay in diagnosis and management can lead to serious sequalae like joint damage, subluxation, dislocation etc [2]. Outcome also depends upon factors like age, type of organisms, virulence, resistance pattern and duration of infection [3]. Septic arthritis is more common in developing countries compared to developed ones [2]. Although well studied in pediatric age group, the neonatal septic arthritis is under-reported from the developing countries [4]. Combined with the fact that patients usually present late, in our settings, due to lack of knowledge and subtle initial signs thereby affecting the outcome. Owing to this we conducted this study to assess the short-term outcome in patients who presented late during the clinical course of disease.

2. Aim
To assess the short-term outcome following surgical intervention in patients of neonatal septic arthritis presenting late.

3. Methods
It was a prospective study conducted at tertiary health care center from June 2014 to June 2017. Patients in neonatal age group who presented late (≥ 5 days after onset of symptoms) were included in the study.

Patients beyond neonatal age and those presenting early (≤ 5 days after onset of symptoms) were exclude from the study. Total of 122 neonatal septic arthritis cases were included in study. Twelve patients were lost in follow up. Out of remaining 110 patients 45 were preterm and 65 were term patients. History of cesarean delivery was present in 39. Patients were diagnosed using Modified Kocher's criteria (Instead of non-weight bearing, Painful joint movements were considered) and ultrasonography. They were admitted in neonatal intensive care unit and baseline blood investigation including blood for culture and sensitivity were sent hours after admission. Empirical broad-spectrum antibiotics covering gram-positive and gram-negative organisms were started immediately. Mini Anterior approach arthrotomy (2 to 3 cm incision, plane between sartorius and TFL) was performed in arthrocentesis positive patients. Wound closure was done leaving capsular incision open with corrugated rubber drain in situ. Pus was sent immediately for culture and sensitivity. Post-surgery patients were monitored in intensive care unit and antibiotics were changed according to sensitivity pattern. Parenteral antibiotics were instituted for average of 7 days. Patients were discharged on oral antibiotics once there was clinical improvement and CRP was less than 6. But in cases with other systemic involvement and fungal infection, parenteral antibiotics were continued for 21 days. Antibiotics were given for total of 4 weeks. Follow up was conducted every 2nd week for 2 months then 6th monthly up to the age of 3 years. Patients followed up were examined clinically and evaluated with blood count, CRP and USG. In cases with recurrence of symptoms, repeat arthrotomy was performed. Patients were clinically and radiologically reassessed using Bennet Scoring System to check for sequalae. Data was collected and analyzed statistically using SPSS software.

4. Results

A total of 110 patients were studied over a period of two years. The mean age of patients was 22 days (7 days to 28 days). Male female ratio was 1.3:1. Mean weight was 2.58kgs. Hip was most commonly involved joint (Table: 1).

Table 1: Frequency of joint involvement

Joint	Unilateral	Bilateral	Multiple joint involvement	Total joint involvement
Hip	53	20	6	99
Knee	18	3	4	28
Shoulder	6	0	2	8
Elbow	4	0	0	4

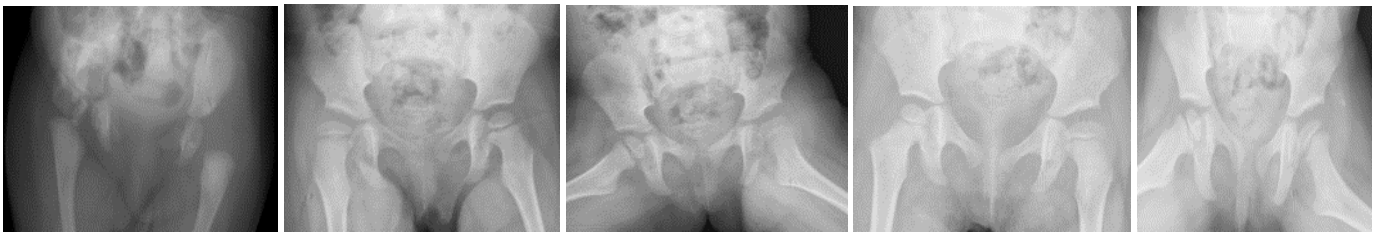
Clinical features were painful range of movement (97%) paucity of movements (80%), swelling over joints (36%), lethargy (21%), fever (15%). Mean total leukocyte count, erythrocyte Sedimentation rate (ESR) and C-reactive protein (CRP) were 17,000, 51 and 54 respectively.

Twenty-one cases were complicated (associated with osteomyelitis, pathological fracture, dislocation) whereas eighty-nine cases were only septic arthritis. Preoperative sonography of joint showed synovial effusion in all patients. In five Patients dislocation of hip joint was also picked up by sonography. The mean time taken to report to the specialty from onset of symptoms was 10.4±2.2 days. All patients underwent arthrotomy with a mean duration of 5.2 hours after admission. Pus culture was negative in 31.9% cases. *Klebsiella* was most common microorganism found in the pus cultures. Other organisms are listed in Table 2. Twelve cases required repeated arthrotomy out of which 10 cases required during hospital stay and 2 cases developed recurrence of symptoms during follow up.

Table 2: Patient demographics

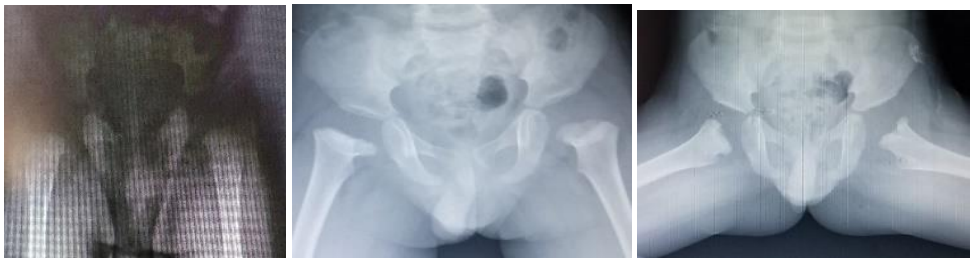
Mean Age	**22.4± 6.1**
Males	63
Females	47
Mean Birth weight	2.6±0.6
Preterm	45
Term	65
Normal vaginal delivery	71
Cesarean	39
Average delay in presentation	10.4±2.2
Culture +ve	75 (68.1%)
K. pneumoniae	22(24.2%)
Candida	17(18.7%)
S. aureus	6(6.6%)
E. coli	6(6.6%)
MRSA	4(4.4%)
Enterobacter	4(4.4%)
Enterococcus	2(2.2%)
Streptococcus	1(1.1%)
Culture -ve	35 (31.9(%)
Comorbidities	43(47%)
Pneumonia	14 (12.7%)
Meningitis	7(6.36%)
Sepsis	7(6.36%)
Neonatal Seizures	6 (5.45%)
Jaundice	5 (4.5%)
HIE	2 (1.8%)
Hypoglycemia	2 (1.8%)

At time of final follow up the results were assessed as per the Bennet's criteria. Excellent results were observed in 10% patients (Figure.1). Good and fair results were obtained in 33.6% and 45.5% patients respectively. Poor outcome was observed in 10.9% patients (Figure.2).



A: 25 days neonate with left hip septic arthritis at present **B:** Follow-up at 2 years **C:** Follow-up at 2 years **D:** Follow up at 3 years of age **E:** Follow up at 3 years of age

Fig 1: Left to right (25 days old neonate with left hip septic arthritis, 2 and 3 years follow up radiograph in AP and frog leg lateral view) shows excellent results both clinically and radiologically, though slight coxa magna is seen there is still potential to remodel.



F: Bilateral Septic arthritis in 17 days neonate **G:** At 2 years 6 months follow-up **H:** At 2 years 6 months follow-up

Fig 2: Left to right (17 days old neonate with bilateral septic arthritis hip, 2 years 6 month follow up radiograph in AP and frog leg lateral view) shows complete destruction of femoral epiphysis.

5. Discussion

Septic arthritis in neonates is difficult to diagnose and often missed and leads to seriously disabling sequalae which can be prevented if promptly treated in early stage of infection. Arthrotomy decompresses joint, thereby reducing articular damage and chances of avascular necrosis besides providing samples for culture and sensitivity [5]. In our study mean age at time of presentation was 22 days and predominantly male neonates were affected (male female ratio 1.3:1). Similar observations were made by other authors [6]. Hip joint was involved in 90% patients with predilection for left side (58.9%). Hip involvement with left sided predominance is reported by other authors too [7]. In our experience, the parents would report to hospital after noticing reduced limb movements on the affected side (80%). Other features recorded were swelling over joints (36%), lethargy (21%) and fever (15%). Painful range of movement was elicited during the examination in 97% patients. Li *et al.* reported local swelling in 36.5% and fever 13.5% which is in coherence with our study [5]. However, pseudoparesis was seen in only 50% of patients in this study. This difference is probably due to the delayed presentation and advanced disease in our cohort of patients. Another study by Riccio *et al.* reported pseudoparesis in 90% patients and painful movements in 93% patients which is in concordance to our findings [8]. Twenty-one cases were complicated by osteomyelitis (n=13), pathological fracture (n=3) and dislocation (n=5).

If not diagnosed and treated early substantial morbidity may be associated with septic arthritis.

Early diagnosis and treatment are critical if complications are to be minimized [9]. Later on damage to articular cartilage (secondary to proteolytic enzymes released from synovial cells) begins rapidly [10]. Unfortunately, the mean time taken to report to the specialty from onset of symptoms was 10.4±2.2 days in our study which is partly due to low incidence and subtle signs and symptoms [11] and partly due to inadequate primary health care and referral systems especially in rural India [12]

Mean total leukocyte count, ESR and CRP were 17,000, 51 and 54 respectively. ESR was raised in 92 (83.6%) patients and CRP in 108 (98.2%) patients. Chen *et al.* reported high ESR and CRP in 82% and 100% patients [13]. CRP is the most commonly used biomarker to diagnose infection and it can be measured in laboratories within about one hour using a very small volume of serum. CRP levels are usually very low, but rise over 12-24 hours to detectable concentrations following an infectious or inflammatory stimulus [14]. In addition to its ability of helping in diagnosis of septic arthritis, CRP levels can be used to monitor the duration of parental antibiotic therapy and convalescence and discharge of the patients from the hospital [15]. Patients were discharged on oral antibiotics once their CRP levels were less than 6. Preoperative sonography of joint showed synovial effusion in all patients. In five Patients dislocation of hip joint was also picked up by sonography. USG is considered as the investigation of choice in septic arthritis as even 1-2 ml of fluid or pus can be accurately detected [16]. A false negative rate of 5% due to too early presentation has been reported in literature [17]. However, as all the patients in our study presented late there were no false negative scans. Sonography has the advantage of assessing complications of septic arthritis like dislocation, subluxation and osteomyelitis [6]. In our study sonography discovered dislocation in 5 patients of hip septic arthritis.

Once aspiration revealed pus, arthrotomy with anterior approach was performed. The pus was sent for culture and sensitivity and empirical antibiotics were started in immediate post-operative period. Pus culture was negative in 32% cases, as most of the patients had received broad spectrum antibiotics prior to hospitalization. Prehospital antibiotics were probably responsible for growth of fungal elements in 17 (18.7%) patients. Deshpande *et al.* observed similar negative cultures rates in their patients [18] although they noticed only 7% fungal infections. However, it has been observed that the rates of fungal septic arthritis are increasing over a period of time due to rampant use of antibiotics [19]. Other organisms isolated from the pus specimens were most commonly gram negative *Klebsiella* (24.2%) and E. Coli 6 (6.6%) followed by *S. aureus* 6 (6.6%) and MRSA 4(4.4%). It has been observed that in the recent past gram negative organisms have replaced gram positive organisms as the most common cause of septic arthritis [19]. Besides, the type of organism isolated from the specimen depends upon the type of hospital, local dominant flora and patient characteristics (gestational age, birth weight, postnatal age, associated conditions) [20].

In our study satisfactory results (excellent + good) were seen in 43.6.2% patients while as unsatisfactory results (fair+ poor) were seen in 56.4% patients. Lee *et al.* [3] reported poor outcome using Bennett's criteria in 48% patients. However mean time to presentation from the onset of symptoms in this study was 4.32 days only. It is well established that the outcome of septic arthritis in children is associated with site, age, treatment delay, and the organism responsible [3]. Time of onset and delay in presentation and intervention is independent predictor of outcome in neonatal septic arthritis [6]. Thus, an early diagnosis and prompt referral is the cornerstone for optimum results.

6. Conclusion

Septic arthritis leads to significant morbidity in patients who report late to the specialty even after early surgical intervention. There is a need of awareness programme to

educate parents to recognize early features of septic arthritis. The clinicians should pick up and refer the patients as early as possible to the concerned specialty to improve the outcome of neonatal septic arthritic.

7. Acknowledgements

There is no disclosure.

Special thanks to Dr. Mir Fahiem Ul Hassan (MCH Paediatric surgery, fellow in Paediatric urologist) and Dr. Sohael khan (MS Orthopaedics, fellow in spine surgery) for their support.

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