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Original Research Article

Epidemiological and clinical profiles of septic arthritis in children of 0-2 years of age in Eastern Uttar Pradesh, India

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ABSTRACT

Background: Septic arthritis identified as infectious arthritis is a serious joint infection following the invasion of joint cavities by infectious agents usually bacteria. Due to speediness of joint destruction untreated septic arthritis may result in morbidity and mortality.
Methods: Out of 71 sick children attending pediatric OPD/IPD of BRDMC Gorakhpur with musculoskeletal infection during November 2019 to October 2020, 52 patients of 0-2 years of age were enrolled for study. The computerized charts containing various parameters related to the epidemiological and clinical profiles of the patients were recorded and analyzed following statistical package for the social sciences (SPSS) version 23.
Results: Out of 52 children 28.8% were neonates under the age of 28 days, 73.1% were full-term infants and 23.1% were premature. Likewise, 17.3% of the cases were with low birth weight whereas 7.7% had a history of septic infection. Hip joints in 65.4%, knee joints in 23.1% and elbow and shoulder joints in 5.8% of patients were infected. 44.2% of cases had right side involvement, 36.5% left side, 19.2% e bilateral joints, 80.8% Mono-articular and 19.2% showed poly-articular involvement. 84.6% of cases showed joint pain whereas 92.3% showed joint swelling. In 20% patients microbial culture of joint fluid revealed the growth of *Staphylococcus aureus, Candida* spp, *E. coli and Pseudomonas* spp. In 78.8% cases no growth of any pathogen was recorded in their blood culture. Ultrasonography (USG) diagnosis revealed fluid collection at joints in 94.2% cases while 5.8% exhibited pus collection.
Conclusions: Septic arthritis was more common in males than females, monoarticular involvement was more common on the right side, hip joints were most affected joints and *Staphylococcus aureus* was the most common pathogen affecting the patients.

Keywords: Septic arthritis, Mono-articular involvement, Synovial fluid

INTRODUCTION

Septic arthritis is a supportive infection of joints mostly secondary in nature. It is regarded as one of the deep-seated infections in children. Global prevalence of the disease is around 0.3 per 1000 live births whereas in India it has been recounted as 0.6 per 1000 live births.[1-3] Septic arthritis (SA) has a predictable prevalence of approximately 4 cases per 100,000 children per year happening more recurrently in males of less than 5 years of age group 3. In case of the osteomyelitis (OM), a prevalence of 2 to 13 cases per 100,000 youngsters is estimated.[4] Overall, males are 1.2 to 3.7 times more affected than the females.[5]

Rai et al have made an Indian perspective study of neonatal septic arthritis and concluded that neonatal septic arthritis is a rare disease with predominant hip or knee

involvement.[6] Rudraprasad et al studied fungal septic arthritis in neonates and concluded that there is an increasing incidence of fungal septic arthritis and it should be kept in mind while treating neonatal septic arthritis.[7] Osteomyelitis and septic arthritis may be catastrophic affecting several degrees of disabilities. Rapid diagnosis and suitable treatment are required to diminish complications comprising vascular necrosis, growth disturbance, pathologic fractures, deep vein thrombosis, and sepsis. In strength to diminish such difficulties, advances in imaging techniques counting magnetic resonance imaging have permitted initial diagnosis of osteomyelitis and septic arthritis. Improvements in new antibiotics and vaccination laterally with progress in surgical techniques have enhanced the treatment outcome of the diseases. In this deference, the epidemiology of bone and joint infection is predicted to be evolutionary in the environment.[2] Septic arthritis is more common in males and the large joints are more often involved of which the knee is the most frequently elaborate joint.[8] *Staphylococcus aureus* remains the most shared causative organism accounting for more than 50.0% of cases.[9] The hip joint contribution (59.2%) was common with the majority of the mono-articular outline of the disorder (74.4%). The common consequence was satisfactory in 70.3% of subjects with quick diagnosis and management.[10] Due to the scarcity of signs and symptoms, neonatal septic arthritis frequently goes unrecognized at the establishment with possible sources of overwhelming difficulties counting the expiry of the newborn. *Staphylococcus aureus* is conveyed to be the common offender of this disorder worldwide, while other organisms isolated in culture comprise *Klebsiella pneumonae*, group B *Streptococci*, *Escherichia coli*, *Enterobacter* sp., *Kingella kingae*, and *Candida* spp. Ancillary hematogenous scattering of infectious creatures is the well-known approach to this infection. The ridiculous vascular supply and deficiency of synovial basement membrane in the joints of newborn infants are indications of this complaint.[2] The undeveloped immune system in neonates finds that the situation inclines to advancement speedily and principal to numerous dreaded situations such as sepsis, osteomyelitis, meningitis, abscess formation in tissue spaces, and urinary tract infection, in accumulation to the devastation of the articular cartilage and ossification centers. The latter difficulty accounts for long-term illness in such patients by restricting the normal movement of the affected joint.

It can be concluded that septic arthritis is a rare infection in newborns that commonly involves the hip or knee joints and predominantly follows the mono-articular pattern of affliction. Microbial etiology cannot always be detected. Overall outcome is good with prompt diagnosis and appropriate management.

However, a delay in seeking medical attention worsens the prognosis. Therefore, the present work was carried out with an objective to study and analyzed epidemiological and clinical profiles of septic arthritis in children of the age group of 0 day to 02 years of age of Eastern Uttar Pradesh, India.

METHODS

Study type

It was a prospective observational study and analyses.

Study place

The study was performed in the Department of Pediatrics, B. R. D. Medical College, Gorakhpur, an infection-prone region of Eastern Uttar Pradesh, India.

Study period

Study conducted for one-year period of time from November 2019 to October 2020. Out of 71 children attending OPD/IPD of the Medical College coming with musculoskeletal infection, only 52 patients/children ranging in the age group of 0 to 2 years with this infection were made available for study and experimentation.

Selection criteria

Guardians/parents who gave their consent to carry on the study on their children admitted to the hospital of the Medical College were included in the study.

Exclusion criteria

Guardians/parents who did not give their consent to carry the study on their children admitted to the hospital of the Medical College were excluded from the study.

Procedure

Computerized charts of the patients were prepared with Demographic data **(**age, gender, ethnic background), clinical data (medical history, comorbidities, site(s) of SA, body temperature, need for surgery, duration of hospitalization), laboratory data (complete blood cell count, C-reactive protein (CRP), blood and synovial fluid cultures and serologic tests for identification of Brucella (wherever necessary) and imaging (X-rays, ultrasound, bone scans, computed tomography (CT) examinations

Diagnosis of septic arthritis made based on Morreys criteria and along with raised C-reactive protein (CRP) value, increased erythrocyte sedimentation rate (ESR), reports of blood culture, and ultrasound of the joint).

Morrey's diagnostic criteria were followed to analyze data divided into two categories: major criteria i.e. pus aspirated from the joint, elevation of ESR and specific radiological changes in involved site; and minor criteria i.e. fever >38.3^{0}C (100.4^{0}F), joint pain increasing on passive motion, swelling of involved joint, satisfactory

response to antibiotic therapy, systemic symptoms of lethargy, malaise, irritability and the no other demonstrable pathological process.[11]

Statistical analysis

Statistical analysis was carried out using statistical package for the social sciences (SPSS) version 23. Mean/standard deviation (±SD) and percentage were used to analyze quantitative data meeting normal distribution.

RESULTS

Basic information of the patients such as the distribution of age, sex, type of delivery, birth weight, past history of similar complaints and history of extended hospital stay was recorded. Likewise, immunization status, joint affected distribution, site involved distribution, joint pain distribution, swellings at joint distribution and temperature distribution were also recorded as detailed in Table 1.

Significant variations were recorded in gestational age at the time of birth in terms of pre-term, full-term and post-term infants as detailed in Table 2.

While recording the distribution of joints involved such as hip joints, knee joints, elbow joints and shoulder joints, left, right and bilateral in various septic joints, mono-articular involvement was seen in 42 cases (80.8%) and poly-articular only in 10 (19.2%) cases. Several bilateral cases were in hip and knee involvement (Pearson's Chi-square test (p=0.263) (Table 3).

Blood analyses of the patients under study involved parameters viz. Hb (gm %), TLC (/mm^3), polymorphonuclear leukocytes (/mm^3), Lymphocytes (/mm^3), ESR (mm/min), and CRP (mg/l) which revealed significant variations among the patients are summarized in Table 4.

The microbial culture of joint fluid revealed the growth of *Staphylococcus aureus*, *Candida* spp., *E. coli and Pseudomonas* spp. while in cases over 80%, there was no growth of any pathogen (Figure 1). Likewise, in as many as 78.8% of cases of the blood culture, no growth of any pathogen was recorded at all (Figure 2). USG diagnosis revealed fluid collection at a joint in 49 patients (94.2%) while only in 3 patients (5.8%) exhibited pus collection at affected joints as shown in Figure 3.

Table 1: Basic information about patients under study (n=52).

Parameters	No. of patients	% value
Age distribution (days)		
≤28	15	28.8
29-60	20	38.5
61-120	12	23.1
>120	5	9.6
Sex distribution		
Male	35	67.3
Female	17	32.7
Type of delivery distribution		
NSVD	37	71.2
Cesarean	15	28.8
Birth weight distribution		
Normal	43	82.7
Low birth weight	9	17.3
Past history of similar complaints		
No	48	92.3
Yes	4	7.7
History of extended hospital stay distribution		
No	34	65.4
Yes	18	34.6
Immunization status		
Complete	44	84.6
Not complete	8	15.4
Joint affected distribution		
Hip joint	34	65.4
Knee joint	12	23.1
Elbow joint	3	5.8
Shoulder joint	3	5.8
Site involved distribution		
Right	23	44.2
Left	19	36.5
Bilateral	10	19.2
Joint pain distribution		
Present	44	84.6
Absent	8	15.4
Swelling at joint distribution		
Present	48	92.3
Absent	4	7.7
Temperature distribution (^{0}C)		
≤38.3	18	34.6
>38.3	34	65.4

Table 2: Gestational age at birth distribution among patients (n=52).

Gestational age at birth	Neonates		Infants		Total (%)
	No. of patients	Percentage	No. of patients	Percentage	
Pre-term	3	5.8	9	17.3	12 (23.1)
Full term	11	21.2	27	51.9	38 (73.1)
Post-term	1	1.9	1	1.9	2 (3.8)
Total	15	28.8	37	71.2	52 (100.0)

Table 3: Joint affected and site-involved distribution among patients (n=52).

Joint involved	Site involved (%)			Total (%)
	Right	Left	Bilateral	
Hip	11 (21.2)	15 (28.8)	8 (15.4)	34 (65.4)
Knee	7 (13.5)	3 (5.8)	2 (3.8)	12 (23.1)
Elbow	2 (3.8)	1 (1.9)	0 (0.0)	3 (5.8)
Shoulder	3 (5.8)	0 (0.0)	0 (0.0)	3 (5.8)
Total	23 (44.2)	19 (36.5)	10 (19.2)	52 (100.0)

Table 4: Distribution of laboratory variables.

Variables	Mean±SD	Median	Minimum	Maximum
Hb (gm %)	11.77±2.37	12.15	7.80	19.50
TLC (/mm^3)	15138±6262	13300.00	3900.00	33100.00
Polymorphonuclear leukocytes (/mm^3)	38.58±17.82	34.00	6.70	81.60
Lymphocytes (/mm^3)	40.52±15.97	43.00	5.60	66.70
ESR (mm/min)	18.90±8.67	20.50	2.00	43.00
CRP (mg/l)	45.66±37.19	34.50	1.60	125.30

Table 5: Correlation of blood and joint pus culture results.

Pus culture	Blood culture (%)				Total (%)
	No growth	CONS	*Staphylococcus aureus*	*Acinetobacter* spp.	
No growth	32 (61.5)	5 (9.6)	3 (5.8)	2 (3.8)	42 (80.8)
Staphylococcus aureus	4 (7.7)	0 (0.0)	0 (0.0)	0 (0.0)	4(7.7)
***Candida* spp.**	3 (5.8)	0 (0.0)	0 (0.0)	0 (0.0)	3 (5.8)
E. coli	2 (3.8)	0 (0.0)	0 (0.0)	0 (0.0)	2 (3.8)
***Pseudomonas* spp.**	0 (0.0)	1 (1.9)	0 (0.0)	0 (0.0)	1 (1.9)
Total	41 (78.8)	6 (11.5)	3 (5.8)	2 (3.8)	52 (100.0)

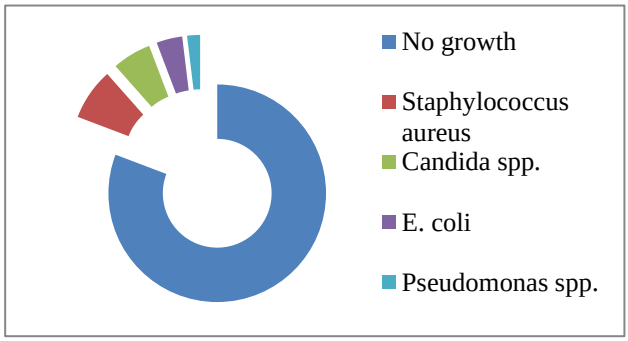

Figure 1: Microbial culture results.

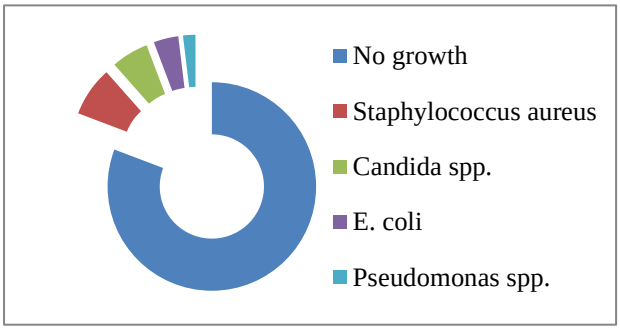

Figure 2: Blood culture result.

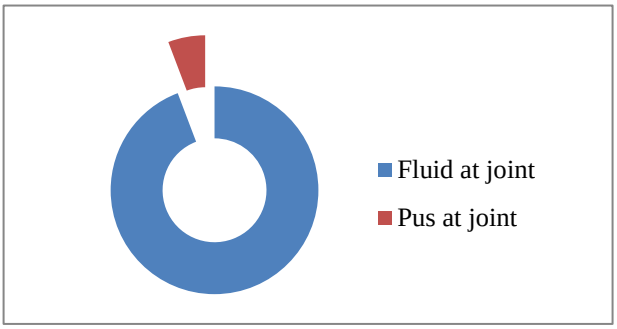

Figure 3: USG diagnosis distribution.

A correlation between blood and joint pus culture was also analyzed which is detailed in Table 5.

DISCUSSION

During the present study epidemiological and clinical profiles of Septic arthritis among patients of 1 day to 2-year age group have been studied and analyzed. A detailed comprehensive history was obtained of musculoskeletal infection evaluation along with other associated co-morbidity which is in concomitance with the methodology adopted by Rai et al and Rudraprasad et al.[6,7] The age of

the patients during the present study were 15 days to 1.5 years of which 15 (28.8%) were neonates under the age of 28 days. Rudraprasad et al, reported the mean age of patients was 18 days (7 days to 28 days).[7]

Male patients were found more affected (67.3%) than female ones (32.7%) with a male: female ratio 2: 1, Al Saadi et al have reported a male: female ratio 2.4: 1 whereas Rudraprasad et al and Rai et al have reported the male-female ratio 1.3:1.[6,7,12] The reasons behind this paradox need further investigation. Likewise, during the present study, out of a total of 52 patients taken into account, 38 (11 neonates and 27 infants) patients were full-term infants, and 12 (3 neonates and 9 infants) patients were premature which is contrary to the work of Rudraprasad et al where it has been reported that out of 132 subjects only five children were born prematurely.[7] Similarly, in the present study out of 52 cases, 15 (28.8%) cases were born via cesarean delivery and 37 (71.2%) cases were born via normal spontaneous vaginal delivery which is in contrary to the reports of Rudraprasad et al where out of 132 subjects only 6 were born by LSCS.[7] Once again in the present study, only 17.3% of cases were of low birth weight whereas Rudraprasad et al have reported 65% of subjects having low birth weight.[7]

The present study revealed 65.4% of hip joints were involved whereas Rai et al have reported hip joint involvement in 59.2% of subjects.[6] Likewise, the present study revealed knee joint involvement in 23.1% of cases and elbow and shoulder joint involvement in 5.8% of patients each. This is contrary to the report of Mue et al who reported the knee was the commonest joint involved (45.7%) followed by the hip joint 31.4%.[13] Nevertheless, Cohen et al have reported the knee (39.7%), hip (28%), and ankle (13.8%) were the most commonly involved joints.[14] Narang et al in their study found that hip and knee were the most commonly involved joint (48%) each and 32% of the cases had multiple joint involvement.[1] During the present study, it was found that mono-articular involvement was seen in 80.8% of cases and poly-articular only in 19.2% patients. Rai et al have reported the mono-articular pattern of affliction in 74.4% of subjects whereas Al Saadi et al reported that the joint involvement was monoarticular in 97.0% of knees, and hips were affected in 75.0% of patients.[6,12]

The present study exhibited 84.6% cases of joint pain and 92.3% cases of swelling at the joints. A study carried out by Kenneth et al found that decreased range of motion and joint tenderness is present in 100% of cases, joint swelling in 60% of cases, the warmth of affected joint in 21.4%, and erythema in 35.7% of cases.[15] Al Saadi et al reported the most frequent clinical features were pain (92.0%), fever (77.0%), limitation of joint movement (77.0%), and joint swelling (72.0%).[12]

The present study revealed that 65.4% of cases had having temperature >38.3 ^{0}C. This is similar to the study carried out by Issa who reported fever in 80.7% of the patients.[16] The reason behind the low percentage may be the inability of the infants to mount appropriate responses against bacteria resulting in decreased temperature. Thus, the absence of fever does not rule out the diagnosis. It was recorded that mean and standard deviation of hemoglobin, TLC, poly-morphonuclear leukocytes, lymphocytes, ESR and CRP was 11.77±2.37 gm%, 15138±6262/mm^3, 38.58±17.82/mm^3, 40.52±15.97/mm^3, 18.90±8.67 mm/min, and 45.66±37.19 gm/l, respectively. The acute phase reactants such as CRP and ESR are often markedly raised. Other markers of limited diagnostic value are synovial fluid/serum glucose ratio below 0.5, increased synovial lactate, and a positive mucin test. Paakkonen et al reported that if CRP and ESR remain normal for 3 d after admission, osteoarticular infection is unlikely to be present.[17] Agarwal et al reported the yield could be increased if synovial tissue is also cultured for organism isolation and identification.[18] The blood cultures may be positive (22.0%) even when joint aspirates are negative.

In the present study pus culture bacteriological culture grown in the affected joint was 19.2% and blood culture was 21.2%. The bacteriological culture grown in 19.2% blood and/or synovial fluid cultures were positive in which *Staphylococcus aureus* (7.7%) was the predominant pathogen. Paakkonen et al reported that in approximately 18–70% of cases, no organisms can be identified (culture-negative septic arthritis).[17] Kang et al reported that the gram staining of joint fluid is positive for organisms in approximately 30% of cases.[19] Agarwal et al reported the yield could be increased if synovial tissue is also cultured for organism isolation and identification.[18] The blood cultures may be positive (22.0%) even when joint aspirates are negative. Rudraprasad et al reported that 72% had no growth on initial culture.[7] Yadav et al found that fluid showed isolates in 72.0% of cases.[10] The most common organism was *Staphylococcus aureus* (62.0%) followed by *Streptococcus pneumonia* and Gr. B *Streptococcus*. Blood culture could grow the organism in 34.0% of cases only. Rai et al have stated *Staphylococcus aureus* is the most common culprit for this condition worldwide.[6]

The findings presented in this paper show the results of USG diagnosis and found fluid collection at joint in the 94.2% of cases and only in 5.8% of cases shows pus collection at the affected joint. Plumb et al reported that ultrasonography detects joint effusions and it has emerged as the preferred investigation in pediatric hip septic arthritis.[20] It has high sensitivity and fluid effusions as low as 1–2 ml can be detected. Ultrasound can also guide needle aspirations of deep joints, especially the hips. Further, ultrasound cannot distinguish between infective and non-infective collections such as juvenile arthritis.[18]

Limitations

Limitations of the study were: limited study periods (only 12 months) and low incidence of the illness during the study period obliged to carry out study on a smaller sample size of only 52 patients/children; a joint fluid examination

of all the afflicted joints in a few cases could not be done due to the unavailability of parental consent; and being a tertiary-care center, some patients admitted to BRD Medical College were referred from nearby hospitals already administered various antimicrobials impacting initial blood and joint fluid culture during experimentation.

CONCLUSION

The present study revealed that males are more prone to females (2:1), hip joints involvement (65.4%) is more than knee joints (23.1%) and elbow and shoulder joints (5.8%, each), right side (44.2%) is more involved than left side (36.5%) and bilateral joints (19.2%), mono-articular involvement (80.8%) is much more than poly-articular (19.2%). Pus culture (bacteriological culture) exhibited growth in 19.2% and blood culture in 21.2% of affected joints. *Staphylococcus aureus* is the most common pathogen isolated in 7.7% of the patients. USG diagnosis in affected joints exhibited fluid collection in most of the cases (94.2%) whereas pus collection was only in a few patients (5.8%).

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