

# Normal hip radiographs in children presented with acute pain

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## Abstract

**Background:** An acutely painful hip in a child can be the presenting symptom in a number of conditions. One of the most important conditions of which is septic arthritis of the hip for which early diagnosis and treatment is essential. The focus of management in acute hip pain in a child is to rule out septic arthritis as the penalty for missing a diagnosis of septic arthritis of the hip in a child has serious consequences. The purpose of our study is to add to the available pool of data on hip pain, validate the predictive values published by preceding authors. We also hope that by presenting the breadth and scope of patients presenting with an acutely painful hip with normal radiographs, we can assist the physician in decision-making when confronted with this common diagnostic challenge. **Methods:** Retrospective review of all the patients who were admitted to our tertiary referral pediatric hospital with complaints of hip pain and pain referable to the hip between January 2016 and December 2019. A total of 207 patients 162 patients with normal x-ray were reviewed retrospectively with evaluation of history, physical examination, laboratory studies. Patients whose diagnoses were defined as transient synovitis were made by the attending physician based on result of a combination of some or all of the Laboratory tests. (presence of fever, full blood count, Erythrocyte Sedimentation Rate (ESR) and C-reactive protein (CRP) levels, negative blood culture, and effusion on ultrasound, and clinical picture of early resolution. Patients whose diagnoses were defined as septic arthritis or probable septic arthritis were made based on the findings of elevated ESR, CRP, positive blood culture or hip aspiration culture. **Results:** The 162 patients included 42 females and 120 males, with an age range from 6 months to 14 years. Of our cohort of patients admitted for hip pain, 111 patients were diagnosed as transient synovitis. 56 patients who were diagnosed as transient synovitis underwent ultrasound examination of the affected hip. 89.3% (50/56) had an effusion with a mean joint space thickness of 6.6mm. 10.7% (6/56) of the patients who underwent ultrasound examination had no demonstrable effusion. **Conclusions:** In patients with septic with hip pain and normal radiograph, the commonest diagnosis was transient synovitis comprising 67.9% of patients. Septic arthritis is the most important diagnosis to exclude and should be suspected if there is fever, inability weight bear and highly elevated levels of ESR and CRP needed

**Keywords:** Septic arthritis, Transient synovitis, hip pain in children, hip pain with normal radiograph.

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## INTRODUCTION

Hip pain can be only presenting symptoms in a child. Pain

is presenting symptom in a number of conditions. Few important conditions like fracture, slipped capital femoral epiphysis and Legg-Calve-Perthés disease can be easily diagnosed with radiographs.<sup>1</sup> Many others present as an acutely irritable hip with no immediately obvious diagnosis. Most important conditions of which is septic arthritis of the hip for which early diagnosis and treatment is essential. There is enough literature published about predictive criteria for diagnosis of septic arthritis as suspected cause of acutely painful hip and to differentiate it from other pathologies in children.<sup>2-7</sup> Primary focus of investigating acutely painful hip in children's is to rule out septic arthritis as cause of pathology. The penalty for

missing a diagnosis of septic arthritis of the hip in a child has serious consequences including destruction of the femoral head, degenerative arthritis and permanent deformity.<sup>8</sup> The purpose of our study is to validate the predictive values published by preceding authors and add to the available pool of data on hip pain. We will be able assist the physician in making decision when confronted with this commonly encountered clinical entity. Also hope that by presenting the breadth and scope of patients presenting with an acutely painful hip with normal radiographs clinicians will be able to overcome this diagnostic challenge.

## METHODS

This is retrospective study. All children presenting with hip complains of hip pain and pain referable to the hip, over a 30-month period at Raigad Hospital and research centre and Chirayu Children Hospital, were identified as part of a previously unpublished internal audit. A total of 162 children attended the A and E department with hip pain or suspected hip pathology between 1 January 2011 and 30 November 2017. Evaluation included recording of clinical history and complete physical examination. Laboratory studies with a complete and differential blood-cell count, measurement of the erythrocyte sedimentation rate and blood cultures is done for all patients. Additional serum analyses, such as measurements of the C-reactive protein level and testing for antinuclear antibody titers and rheumatoid factor, were performed on the basis of the physician's preference and the clinical presentation. Plain radiographs of the pelvis and the proximal part of the femur were made for all patients and were evaluated for the presence of fractures or other osseous lesions as immediate pathology. When suspected a septic arthritis as possible diagnosis, ultrasound examination of hip is carried out randomly. Arthrocentesis was performed when effusion is documented under fluoroscopic guidance in the radiology or operating suite. Patients were excluded from the study if no synovial fluid could be obtained with the arthrocentesis. Routine analysis of synovial fluid included a white blood-cell count and differential count, Gram stain, and culture. After evaluation, patients with the diagnosis of transient synovitis were treated with oral analgesics and hip protocol Pic 1. Patients with the diagnosis of septic arthritis underwent emergent surgical drainage of the hip joint and were started on empiric intravenous antibiotics. Medical records were reviewed for patient age, gender, disease history (duration of symptoms, previous health-care visit, recent antibiotic therapy and reason for the therapy, fever, and weight-bearing status), clinical findings (body temperature), radiographic findings, ultrasound findings, results of the arthrocentesis (amount and appearance of the aspirate), laboratory studies

(measurement of the erythrocyte sedimentation rate, serum white blood-cell count with differential, white blood-cell count with differential in the synovial fluid, and results of cultures of blood and synovial fluid), treatment, and complications. Weight-bearing status was determined from the clinical history. Fever was defined as an oral temperature of  $\geq 38.5^{\circ}\text{C}$  during the week prior to the evaluation or at the emergency room visit. A previous health-care visit was defined as any evaluation of the irritable hip by a health-care provider during the present illness. Patients whose diagnoses were defined as transient synovitis were made by the attending physician based on result of a combination of some or all of the Laboratory tests. Parameters including presence of fever, full blood count, Erythrocyte Sedimentation Rate (ESR) and C-reactive protein (CRP) levels, negative blood culture, and effusion on ultrasound, and clinical picture of early resolution and response to oral analgesics are considered in decision making. The diagnosis of presumed septic arthritis (Ten patients) was assigned when the white blood-cell count in the synovial fluid was  $\geq 50,000$  cells/mm<sup>3</sup> ( $\geq 50.0 \times 10^9/\text{L}$ ). The diagnosis of transient synovitis (117 patients; 118 hips) was assigned when there the white blood-cell count in the synovial fluid was  $< 50,000$  cells/mm<sup>3</sup> ( $< 50.0 \times 10^9/\text{L}$ ), the symptoms resolved without intravenous antibiotics or surgical intervention, and there was no further development of disease as reported in the medical records. Patients whose diagnoses were defined as septic arthritis or probable septic arthritis were made based on the findings of elevated ESR, CRP, and positive blood cultures.

## RESULTS

A total of 207 patients were admitted with complains ranging from hip, groin, and thigh pain, knee pain referable to the hip, limp and inability to walk. 31 of these patients had diagnosis, which included bony abnormalities on x rays and were excluded from the study. 14 patients were excluded from the study those had acute hip pain but had known diagnoses of hip pathology including hip dysplasia and pre-existing juvenile chronic arthritis. Another 28 patient had other established diagnosis (e.g referred pain, thigh abscess, leukemia, conversion disorder and muscular strain). The remaining 134 patients were reviewed retrospectively with evaluation of history, physical examination, and laboratory studies. There are 134 patients included in this study 73% male and 27% females. Distribution in various diagnostic arms (categories) and ethnic groups is shown in Table 1. The entire group of patients (100%) who was diagnosed to have septic arthritis had fever before presentation. 23 patients (20.7%) had fever in transient synovitis group, whereas only one patient (7.7%) had fever in hip contusion group.

**Table 1:** Sex and Ethnic group distribution in study group

		TS	SA	HC	TOTAL
		N=111	N=10	N=13	N=134
SEX	FEMALE	26(23.4%)	7 (70 %)	1 (23.1%)	36(26.9%)
	MALE	85(76.6%)	3(30.0%)	10(76.9%)	98 (73.1)
ETHNIC GROUP	CHINESE	74	5	9	88
	INDIANS	12	2	1	14
	MALYE	19	1	3	25
	OTHERS	6	0	0	6

**Table 2:** Statistical significance of presence of fever, URTI and Weight bearing status in each diagnostic arm

		Pearsons Chi-Square Test	TS	SA	HC	TOTAL
			N=111	N=10	N=13	N=134
FEVER	p=0.000	YES	23 (20.7%)	10 (100%)	1 (7.7%)	34 (25.4%)
		NO	88 (79.3%)	0(0%)	12(92.3%)	100 (74.6%)
URTI	P=0.046	YES	31 (27.9%)	1(10%)	NA	32 (12.9%)
		NO	80 (72.1%)	9(90%)	13(100%)	102 (76.1%)
Weight Bearing	P=0.000	YES	58 (52.7%)	0(0%)	12(92.3%)	59 (44.4%)
		NO	52 (47.3%)	10 (100%)	1 (7.7%)	74 (55.6%)

31 patients (27.9%) in transient synovitis group had Upper Respiratory Tract Infection as a preceding symptom before presentation for hip pain. Although only one patient (10%) diagnosed as septic arthritis had any preceding Upper Respiratory Tract Infection before. The entire group of patients with septic arthritis group (100%) could not weight bear of affected side on presentation; whereas 58 patients (52.7%) could walk with weight bearing on affected side in transient synovitis group. 92% patients could not weight bear on affected side in hip contusion group. Only 66 patients of entire cohort (49.3%) had underwent ultrasound, which was ordered randomly. 83.9% patients in transient synovitis group who underwent ultrasonography had average median collection of 6mm on ultrasonography (95% CI 4.84, 8.02) 90% patients with septic arthritis who underwent group had median collection 6 mm (95% CI 5.53, 7.93). Statistical influence of each parameter is detailed as below. Age found to be statistically significant in different diagnostic arms (p=0.000). Median age of presentation is 5 yr in population diagnosed with transient synovitis group (TA), 3 yrs in septic arthritis group and 9yr in hip contusion (HC)group. Duration of symptoms before presentation is also found statistically significant (p=0.003) in different diagnostic groups. Median delay of presentation was 3 days in Septic Arthritis (SA) group, 2 days in Transient synovitis (TS) group and 1 day in Hip Contusion (HC) group. Temperature (T Max) recorded is also found significant (p=0.000) in different diagnostic groups. Median temperature recorded in Septic Arthritis (SA) is 39.0°Celsius, 37.0°Celsius in Transient Synovitis (TS) group and 36.7°Celsius in Hip Contusion (HC) group. Erythrocyte sedimentation rate (ESR) recorded is also found significant (p=0.000) in different diagnostic groups. Median ESR recorded in Septic Arthritis group (SA) is 100mm/hr, 11mm in Transient Synovitis (TS) group. C-reactive protein (CRP) value is found significant (p=0.000) in different diagnostic groups. Median CRP reading recorded in Septic Arthritis group (SA) is 52.35mg/L, 4.0 mg/L in Transient Synovitis (TS) group. Total leucocytes count (TW Max) (p=0.277) and size of effusion on ultrasound (p=0.957) is not found significant in different diagnostic groups.

**Table 3:** Statistical influence of each parameter with median value and 95 %CI

Parameters	Chai- Square test	Group	Median Value	Low	95% CI High
Age	P= 0.000	TS	5 yrs	5.08	5.98
		SA	3 yrs	2.06	8.38
		HC	9 yrs	7.33	10.5
Duration of Symptoms(Days)	P=0.003	TS	2 days	2.17	3.43
		SA	3 days	1.58	3.82
		HC	1 days	0.82	1.49
T Max (° Celsius)	P=0.000	TS	37.0° Celsius	37.08	37.31
		SA	39.0° Celsius	38.23	39.61
		HC	36.7° Celsius	36.59	37.12
TW Max	P=0.277	TS	10.800	10.13	12.54
		SA	11.700	9.59	16.53
		HC	9.750	-30.27	49.77
ESR (mm)	P=0.000	TS	11.00	13.34	20.89
		SA	100.00	68.85	132.35

			HC			
CRP	P=0.000		TS	4.00	6.94	16.91
(mg/L) max			SA	52.35	37.15	163.83
U/S	P=0.957		TS	6.00	5.53	7.39
effusion size (mm)			SA	6.00	4.84	8.02
Duration	P=0.000		TS	2.00	2.42	3.05
of hospital			SA	12.50	8.83	20.57
(Days)			HC	2.00	1.11	2.43

## DISCUSSION

Transient synovitis of the hip is one of the most common causes of hip pain and limp in young children. Its cause is still largely unknown.<sup>9</sup> Primarily diagnosis of transient synovitis made based on negative lab results and presence of joint effusion. Although Dorr *et al.* demonstrated that not all TS had effusion.<sup>10</sup> Siu *et al.* mentioned limitations in study, that the diagnosis of transient synovitis was made only by exclusion and spontaneous resolution of symptoms.<sup>11</sup> Also no sonographic signs served to differentiate sterile, purulent, or hemorrhagic effusion.<sup>12</sup> Effusion is seen in both Transient synovitis and Septic Arthritis, so its presence is not diagnostic.<sup>13</sup> Transient synovitis has an uncertain etiology and remains a diagnosis of exclusion.<sup>8</sup> According to Del Beccaro *et al.*<sup>2</sup> children with septic arthritis of the hip had significantly higher initial temperature of 38.1 °C versus 37.2 C, P =.000014, mean erythrocyte sedimentation rate (44 mm/hr versus 19 mm/hr, P = .000001), and mean WBC count (13,200/mm<sup>3</sup> versus 11,200/mm<sup>3</sup>, p = .02). High chance of septic arthritis is in patients with rectal temp >38 deg, ESR >20 mm/hr, CRP > 20mg/dl. If 2 of 3 are present 100% sensitive and 89% specific for septic arthritis According Beach *et al.*<sup>4</sup> scoring system; if 2 or more present high risk of having septic hip and should have U/S exam and aspiration: Hip pain on examination. Fever T>38. ESR > 20/mmhr.

Kocher *et al.*<sup>18</sup> identified 4 variables as 99.6% predictive of septic arthritis: Fever >38.5. ESR > 40mm/hr. Non weight bearing. TW > 12 x 10(9)/L.

Although Luhmann *et al.*<sup>6</sup> only found 59% predictive value using their own patient set Role of MRI. Various ways have been reported for differentiating septic arthritis and transient synovitis of the hip.<sup>7,17,18</sup> Discriminating these two diseases is difficult but important. Several studies have been focused on differentiating septic arthritis from transient synovitis of the hip in children.<sup>2,5</sup> Kocher *et al.*<sup>5</sup> used retrospective data to develop a clinical prediction algorithm for differentiating the two conditions. Lee *et al.*<sup>15</sup> and Jung *et al.*<sup>7</sup> also reported radiologic findings that differentiated these diseases. Nevertheless, the ability to predict septic arthritis is minimal. Kwack *et al.*<sup>16</sup> retrospectively studied MRI findings in nine patients with septic arthritis and 11 with transient synovitis were. The clinical diagnoses were based on findings at physical

examination, laboratory studies, and joint aspiration and bacteriologic study. The MRI findings were analyzed with emphasis on the grade of joint effusion, alterations in signal intensity in the soft tissues and bone marrow, and the presence of decreased perfusion at the femoral head. They have concluded that Decreased perfusion at the femoral epiphysis on fat-suppressed gadolinium- enhanced coronal T1-weighted MRI is useful for differentiating septic arthritis from transient synovitis. Ultrasonography is limited in the evaluation of septic arthritis. It is a sensitive modality for the detection of joint effusions in many anatomic locations. However, it is not reliable in characterizing the effusion or its cause. The thickness of the capsule and the echogenicity of the fluid are not good predictors of infection in the joint. Occasionally, ultrasonography can be helpful for guiding needle aspiration of the affected joint.<sup>19,20</sup>

## CONCLUSION

In patients with septic with hip pain and normal radiograph, the commonest diagnosis did transient synovitis comprise 83% of patients. Septic arthritis is the most important diagnosis to exclude and should be suspected if there is fever, inability weight bear and highly elevated levels of ESR and CRP.

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