

Tuberculosis of the hip in children

A retrospective analysis of 27 patients

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ABSTRACT

Background: We retrospectively evaluated the pretreatment radiological presentation and the clinicoradiological outcome at the completion of 1 year chemotherapy in osteoarticular tuberculosis of hip in children to prognosticate correlation between them.

Materials and Methods: We retrospectively analyzed the clinical and plain radiographic findings in 27 patients with an age of 12 years or younger in whom hip tuberculosis was diagnosed and treated between 2006 and 2010. The diagnosis was based on histopathology in 14 and clinicoradiological basis in 13 patients. The pre and post treatment plain radiographs were evaluated according to Shanmugasundaram radiological classification and our observations regarding unclassified cases which were not fit in this classification were suggested. The functional outcome at the completion of chemotherapy was assessed using modified Moon's criteria.

Results: The male female ratio was 11:16. The left hip was involved more frequently than the right (17:10). The average age was 7.37 years (range, 2-12 years). In the pretreatment radiographs, 9 hips were normal, 6 traveling, 4 dislocating, 1 protrusio acetabuli, 3 atrophic and 4 unclassified types (3 triradiate; 1 pseudarthrosis coxae). There were no Perthes and mortar pestle at the initial presentation. Posttreatment, the types changed to 9 normal, 3 Perthes, 1 protrusio acetabuli, 1 atrophic, 4 mortar pestle and 9 unclassified types (3 triradiate, 3 pseudarthrosis coxae and 3 ankylosed). There were 37% excellent, 18.5% good, 26% fair and 18.5% poor results. The prognosis was best with initial "triradiate" and normal types and worst with posttreatment atrophic and "ankylosed" types.

Conclusions: The Shanmugasundaram radiological types accurately predict prognosis only in normal types and "triradiate" pattern. The functional outcome is independent of radiological morphology of the hip in smaller children.

Key words: Hip, osteoarticular tuberculosis, pediatric

MeSH terms: Hip, tuberculosis, pediatric, osteoarticular

INTRODUCTION

Before the advent of modern antitubercular drugs, the treatment of tuberculosis hip was expectant. Arthrodesis was considered the ultimate aim for tubercular arthritis of hip as it was believed that mobility will reactivate the tubercular bacteria.¹⁻⁴ Plaster spica were used for 2-8 years before fusion was attempted in children leading to many complications.⁴ Gradually, with availability of antitubercular chemotherapy, concept of regaining or

restoring mobility in the diseased hip came into vogue. The management of tuberculosis hip in children aims at identifying the disease in predestruction stage, instituting multidrug antitubercular chemotherapy combined with necessary surgical interventions and restoring hip function to normal/near normal as possible.⁵ Although chemotherapy is highly effective, the presentation is frequently delayed and results compromised. It is believed that the most important variable predicting outcome is the radiological stage of the disease at presentation.^{5,6} However, later observers have described better results despite morphological changes in hip.⁷ Our aim in this retrospective series was to study pretreatment radiographic type and correlate it with the clinicoradiological outcome achieved at the completion of chemotherapy to find possible correlation between them.

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MATERIALS AND METHODS

We retrospectively analyzed the clinical and plain radiographs of 27 patients with an age of 12 years or younger in whom hip tuberculosis was diagnosed and treated at our center between 2006 and 2010. The Institutional Scientific Committee approved the study.

No attempt was made to elicit the range of movements at initial presentation due to associated pain and spasm. The diagnosis was based on histopathology in 14 and clinicoradiological basis in 13 patients. The histopathological criteria for diagnosis were the presence of chronic granulomatous inflammation with caseation and/or presence of epithelioid cells and lymphocyte configuration of tubercle. The clinical criteria were pain, limping, deformity and fullness around the hip joint, restriction of movements, presence of abscess with or without discharging sinus, limb shortenings. Plain radiological findings were osteopenia, diminution in joint space, erosions of articular margins, lytic lesions, pathological fractures, subluxations or dislocations. A combination of the above clinicoradiological findings in the presence of supportive laboratory investigations was used to make a diagnosis of tuberculosis. We classified the pretreatment and posttreatment radiological presentation according to Shanmugasundaram radiological classification [Table 1 and Figure 1].^{6,8} There were some hip involvements which cannot be classified based on these conventional types. Therefore, 8th type - unclassified was added to Shanmugasundaram radiological classification. Three different patterns were observed in the unclassified type - triradiate, pseudarthrosis coxae and ankylosed type. The triradiate pattern has a primary focus in the acetabular floor. The lesion appears and remains initially confined to the lower acetabulum. Rest of the hip remains unaffected. The pseudarthrosis coxae pattern is probably a result of primary femoral epiphyseal focus resulting in complete loss of femoral head and sometimes the femoral neck. This pattern signifies loss of cervicocephalic articulation.

It is distinct from the dislocating type as it lacks a femoral head. The third pattern, ankylosed hip is old or healing disease with ankylosis.

Following diagnosis, the children were treated with initial 4 weeks rest (hip spica for children <5 years and traction for children >5 years) followed by early ambulation as pain subsided and patients were able to tolerate weight bearing. Multidrug antitubercular chemotherapy was given for 1 year⁹⁻¹¹ (isoniazid, rifampicin, ethambutol and pyrazinamide for 2 months and thereafter isoniazid, rifampicin for 10 months). Open reduction was performed in all 4 cases with dislocating types at initial presentation. Abscess decompression was required in 3 patients with large clinically palpable cold abscesses. The clinicoradiological evaluation was carried out at completion of 1 year multidrug antitubercular chemotherapy. Clinical outcome evaluation was based on criteria based on modified Moon's *et al.* outcome assessment [Table 2].⁹

Table 1: Modified Shanmugasundaram radiological types for pediatric hip tuberculosis

Type	Radiology
Normal type	Joint space is normal. There may be cysts or cavities in the femoral head, neck or acetabulum, but there is no gross destruction of subchondral bone
Travelling acetabulum	The acetabular roof is affected and there is proximal migration of the femoral head
Dislocating type	Hip gets dislocated or subluxated
Perthes type	The hip is sclerotic. Distinction from true Perthes disease may be extremely difficult
Protrusio acetabuli	The medial acetabulum is diseased and eroded
Atrophic type	Decreased joint space. Probably the result of subchondral erosion
Mortar and pestle	There is destruction of either femoral head or acetabulum or both leading gross mismatch between the articular surfaces
Unclassified*	Triradiate: Primary focus near acetabular floor. Involvement of nonweight bearing lower acetabulum Pseudarthrosis coxae: Loss of cervicocephalic articulation due to destroyed femoral head and sometimes neck Ankylosed: Fibrous or bony ankylosis

*Note: Common patterns observed in unclassified category. However, due to limitation of small sample size validations of the type 8 - unclassified was not done. It is clinical observation

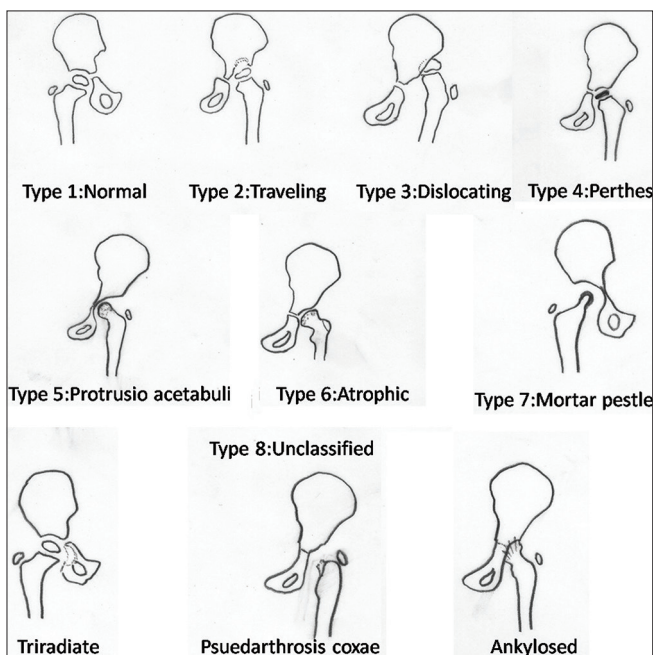


Figure 1: A line diagram of hip joint showing original 7 radiological types of Shanmugasundaram and unclassified type 8

Table 2: Modified Moon's criteria for outcome assessment

Grading	Criteria
Excellent	Pain free and normal ambulation; sitting cross legged and squatting possible
Good	Slight pain, occasional; no compromise in activities; uneasy squatting
Fair	Mild pain, rarely moderate pain with unusual activities, may require analgesics; no effect on average activities; some limitation in squatting and cross legged
Poor	Moderate and marked pain; limitation of ordinary activity and serious limitation of activities

RESULTS

There were 27 patients with affection of 27 hip joints. There was no resistance of the organism to anti tubercular treatment during the period under observation. The male female ratio was 11:16. The left hip was involved more frequently than the right (17:10). The average age was 7.37 years (range 2-12 years). The patient profile, pretreatment Shanmugasundaram radiographic type and posttreatment clinoradiological outcome is given in Table 3. In the pretreatment radiographs, 9 hips were normal, 6 traveling, 4 dislocating, 1 protrusio acetabuli, 3 atrophic and 4 unclassified type (3 triradiate and 1 pseudarthrosis coxae). There were no Perthes and mortar pestle at the initial presentation. Posttreatment, the types changed to 9 normal, 3 Perthes, 1 protrusio acetabuli, 1 atrophic, 4 mortar pestle, 9 unclassified types (3 triradiate, 3 pseudarthrosis coxae and 3 ankylosed) [Figures 2-5]. There were 37% excellent, 18.5% good, 26% fair and 18.5% poor results as per the Moon's criteria. The prognosis was best with initial triradiate pattern (3 excellent/3 hips; 100%) and normal (7 excellent to good/9 hips; 78%) types [Table 3 and Figure 3]. For

clinical outcome, excellent to good outcome was seen with posttreatment 8 out of 9 normal, 1 out of 3 Perthes, 2 out of 4 mortar pestle and 4 unclassified types (3 triradiate and 1 pseudarthrosis coxae pattern). Thus, except for triradiate pattern and most normal types, for other Shanmugasundaram radiological types, there were different clinical outcomes especially in smaller children [Figures 2, 4 and 5].

DISCUSSION

Skeletal tuberculosis in the pediatric age group is uncommon with a reported incidence of 5-6% of pediatric extra pulmonary cases.¹⁰ Hip tuberculosis constitutes nearly 20% of all cases of skeletal tuberculosis.¹¹ The exact proportion of tubercular hip affection in the pediatric age group is not known but the disease is rare. There is a paucity of literature regarding osteoarticular tuberculosis of hip in children with only few dedicated series available in recent indexed English literature and probably none from the Indian subcontinent.^{6,7} Thus, the clinicoradiological course in osteoarticular tuberculosis of hip following modern anti tubercular chemotherapy is scantily studied.^{6,7} Our aim in this

Table 3: Patient profile (n=27)⁶

Age (in years)	Sex	Side of affection	Radiographic stage at presentation	Posttreatment radiographic staging	Clinical outcome*	Additional findings posttreatment radiographs
9	Female	Left	Normal	Normal	Good	Focal erosion near teardrop
7	Female	Left	Traveling	Mortar pestle	Fair	-
5	Female	Right	Unclassified (triradiate)	Unclassified (triradiate)	Excellent	Sclerosis and ossification near teardrop
5	Female	Left	Traveling	Normal	Excellent	Coxa magna
11	Male	Left	Atrophic	Unclassified (pseudarthrosis coxae)	Fair	-
7	Male	Left	Traveling	Mortar pestle	Good	-
11	Female	Left	Atrophic	Unclassified (pseudarthrosis coxae)	Good	Intermediate perthes+protrusio acetabuli stage
8	Male	Right	Unclassified (triradiate)	Unclassified (triradiate)	Excellent	Sclerosis and ossification near teardrop
3	Female	Right	Normal [#]	Normal	Excellent	Coxa magna
11	Female	Right	Normal	Perthes	Poor	-
5	Male	Left	Protrusio acetabuli	Normal	Excellent	Coxa magna
9	Female	Left	Traveling	Atrophic	Poor	-
4	Male	Left	Traveling+dislocating [*]	Perthes	Fair	-
11	Female	Left	Normal	Normal	Excellent	-
2	Female	Right	Normal	Perthes	Excellent	Epiphysis fragmented
12	Female	Left	Normal	Normal	Good	-
8	Male	Right	Unclassified (triradiate)	Unclassified (triradiate)	Excellent	-
11	Male	Right	Normal	Mortar pestle	Fair	-
3	Male	Left	Dislocating ^{#s}	Protrusio acetabuli	Fair	-
8	Female	Left	Traveling+dislocating [*]	Unclassified (ankylosed)	Poor	-
5	Female	Left	Traveling	Unclassified (ankylosed)	Poor	-
8	Female	Right	Normal	Normal	Excellent	Cystic changes in acetabular roof
4	Male	Left	Atrophic	Normal	Fair	-
5	Male	Right	Normal (neck lesion)	Normal	Excellent	-
11	Male	Right	Unclassified (pseudarthrosis coxae)	Unclassified (pseudarthrosis coxae)	Fair	-
10	Female	Left	Traveling	Unclassified (ankylosed)	Poor	-
6	Female	Left	Dislocating	Mortar pestle	Good	-

⁶Open reduction performed in all dislocating types (patients 13, 19, 20 and 27), ^{*}Modified Moon's criteria, ^sVarus osteotomy added later for stabilization, [#]Presentation similar to septic arthritis and drainage performed. Tubercular diagnosis established histopathologically, ^{*}Considered as dislocating type for calculation purpose



Figure 2: An 11 year old girl child (case 7) (a) X-ray left hip joint anteroposterior view showing pretreatment atrophic type head. (b and c) x-ray left hip joint anteroposterior view showing changes during treatment, course protrusio acetabuli and perthoid type changes respectively (d) x-ray left hip joint anteroposterior view showing post treatment pseudarthrosis coxae pattern (e and f) clinical photographs showing range of motion (post treatment)

retrospective series was to study pretreatment radiographic type and correlate it with the clinicroadiological outcome achieved at the completion of chemotherapy to find possible prognosticating correlation between them.

The initial radiological presentation of tubercular hip in children has been mainly described according to distribution of the primary site of infection (acetabular roof, femoral neck, epiphysis, trochanteric apophysis, synovium, undetermined)^{5,12} or Shanmugasundaram 7 types (normal, travelling acetabulum, dislocating, Perthes, protrusio-acetabuli, atrophic, mortar and pestle).^{6,8,9} Mortar and pestle and atrophic types originally described for adults by Shanmugasundaram were also reported in the pediatric series by Campbell and Hoffman.⁶ However, there are some hip involvements which cannot be classified based on these conventional types. We added an additional radiological type to the Shanmugasundaram radiological classification - unclassified based on different

primary site of infection and extent of involvement found in our series. The unclassified type included three different patterns - triradiate, pseudarthrosis coxae and ankylosed. The ankylosed presentation following treatment have been referred in other series also.^{4,6,8} All radiological types were observed in our pediatric series either during the initial presentation or during the course of treatment. Perthes and mortar pestle types were not present in the pretreatment presentation. Another finding was initial clinical presentation with advanced radiological destruction (except normal and triradiate) in our population (12/27; 44%).

The new radiological types described in the present series could possibly indicate the treatment and prognosis. In triradiate pattern, the lesion being extra articular, prolonged hip immobilization is not required and the patient could be mobilized quickly and permitted early weight bearing as local symptoms subside. Pseudarthrosis



Figure 3: An 8 years old boy (Case 8) (a and b) X-ray of right hip joint anteroposterior and frog leg lateral views showing triradiate pattern with pathological fracture in pubic rami (c and d) X-ray anteroposterior and frog leg lateral views showing posttreatment radiological pattern remained the same with sclerosis in the lesion and healing of pathological fracture (e and f) clinical photographs of same patient showing excellent results

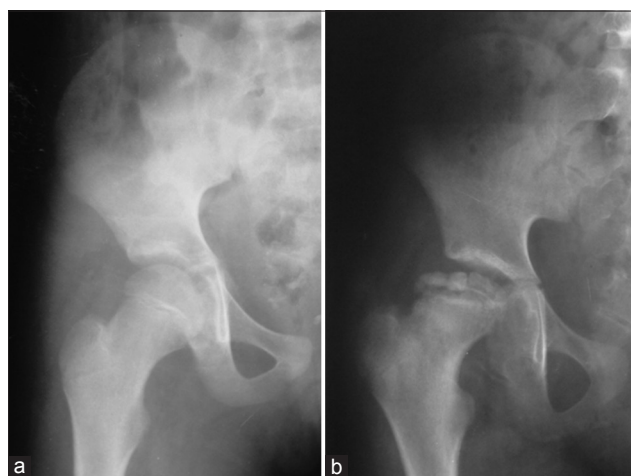


Figure 4: X-ray right hip joint anteroposterior view of a 11-year-old girl child showing (a) pretreatment normal type radiographs. However, there was associated tubercular abscess in right hip region. (b) Following treatment, Perthes radiological type became manifest with epiphyseal fragmentation. There was fixed flexion deformity of 20° in the hip with no other movements possible. The outcome was classified as poor

coxae generally indicates an advanced disease. The hip might be unstable and limb shortened and treatment may be needed accordingly. Ankylosed pattern is usually a late disease or posttreatment sequelae. Treatment would mainly aim at deformity correction at the hip, if the condition has become painless. The prognosis was best with initial “triradiate” and worst with posttreatment

atrophic and “ankylosed”. The pseudarthrosis coxae signified loss of cervicocephalic articulation. The prognosis remained variable in this variety.

We believe that the radiological classification of tuberculosis hip proposed by Shanmugasundaram⁸ is a description of various stages of disease rather than distinct radiological types i.e. one encounters the different radiological types in the same patient during the course of the disease. The changing “stages” with treatment as observed in our series strengthens our proposition. The radiological morphology of tubercular hip is thus a cross sectional observation of the disease process which is influenced by multiple factors - initial focus (synovial or bony), localization of bony focus, severity of the disease process, age of the child, immunity status, duration from disease onset, treatment taken/intervention done, radiological view and exposure part, etc. The severity increases in travelling acetabulum, dislocating, Perthes, protrusio-acetabuli, atrophic, mortar and pestle types, pseudarthrosis coxae and ankylosed patterns. The primary site of infection will determine whether the lesion will advance as travelling acetabulum (initial focus: acetabular roof), dislocating (exudative response/chronic synovial hypertrophy/capsular incompetence/advanced destruction hip capsule), protrusio-acetabuli (initial focus: advanced triradiate/acetabular floor), atrophic

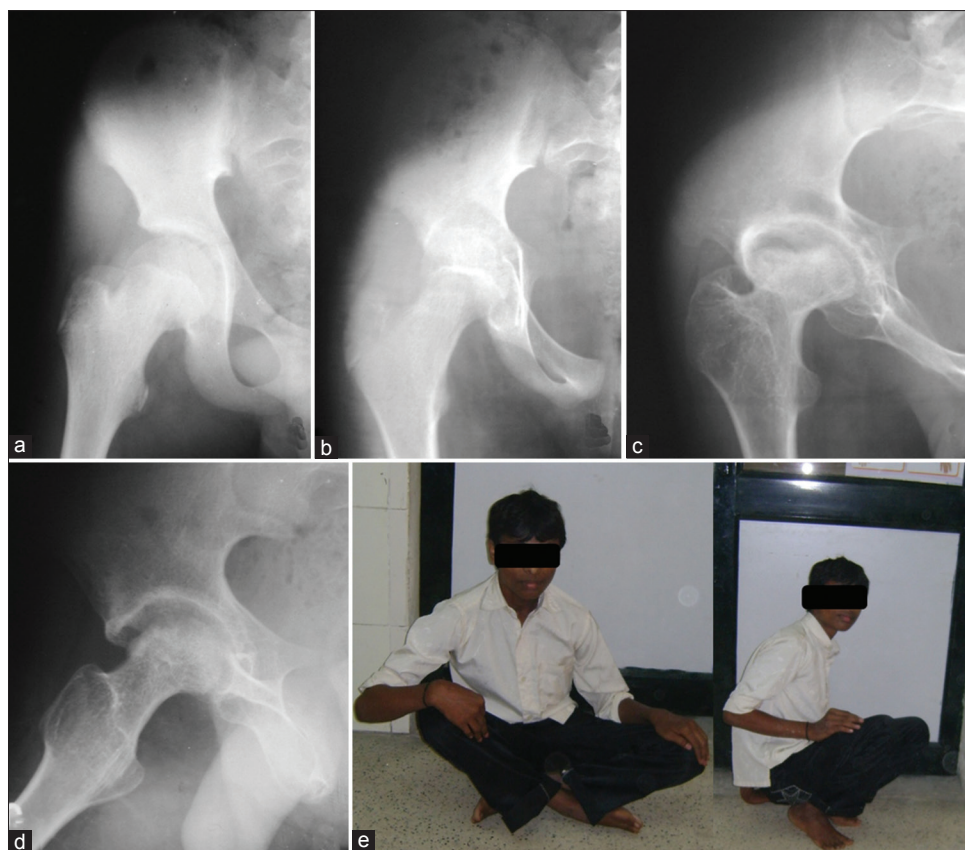


Figure 5: X-ray right hip joint anteroposterior view in a 11-year-old male child showing (a) pretreatment normal type. (b and c) Intermediate radiographs. (d) Posttreatment mortar pestle appearance. (e) Clinical photograph showing restricted crosslegged sitting and squatting

(initial focus: ?synovium); mortar and pestle (initial focus: Femoral head and acetabulum); pseudarthrosis coxae (initial focus: Femoral epiphysis); ankylosed (healing/old). In advanced cases with extensive joint destruction, distinction between these radiological types becomes difficult and it is impossible to determine whether initial lesion was synovial or osseous in nature or from where did it originate.

In post anti tubercular chemotherapy era (1950), Campbell and Hoffman described the outcome in pediatric hip tuberculosis in two series.⁶ In the first series ($n = 28$) with shorter immobilization period and short course chemotherapy, the outcome has been described as excellent in 43% of hips, good in 28.5%, fair in 3.5% and poor in 25% respectively. In the other series ($n = 46$) with longer immobilization and chemotherapy, the outcome has been excellent in 41% of hips, good in 19.5%, fair in 6.5% and poor in 33% respectively. The better results were obtained with normal and Perthes types in their series. Traveling, mortar pestle and atrophic types had poorer results. In another pediatric series of 43 children by Moon *et al.*, results were described as excellent to good in 73%, fair in 18% and poor in 9% respectively.⁷ Poor results were obtained with protrusio acetabuli and mortar pestle types in this series.

Our series had 37% excellent, 18.5% good, 26% fair and 18.5% poor results.

Campbell and Hoffman demonstrated that Shanmugasundaram radiological appearance of the hip at presentation accurately predicts the final outcome.⁶ However, later series by Moon *et al.*, have shown that disease healing and residual pain did not correlate with the radiological stage.⁷ In their series, 22 patients had morphological changes on plain radiographs with no clinical abnormalities at the time of followup. The present series also had similar conclusions namely the clinical outcome correlates poorly with radiological morphology. Except for triradiate pattern and normal types, other Shanmugasundaram radiological types (pre or posttreatment) did not correlated closely with the clinical outcome. Triradiate pattern is a focal lesion in a relatively nonweight bearing area of the acetabulum and normal type is an early disease and therefore better prognosis appears logical. However, pretreatment presentation as traveling, dislocating and atrophic types indicated poorer results. Our study thus exposes the knowledge gap and need for a better classification and prognosticating factors in tuberculosis of the hip.

The limitations of study are its retrospective nature, short followup, different radiological types at presentation, different management in age groups and surgical interventions in selected patients. Valid statistical methods could not be utilized because of smaller numbers in each group. There are chances that the radiological features could have been affected by other factors (e.g. premorbid condition, multifocal involvement, clinical management, etc.). However, tuberculosis of the hip region in children is a rare disease and conclusions have to be drawn on a small sample size. Long term followup is highly desirable in view of weight bearing characteristics, growing epiphysis in children, high remodeling potential of hip and to detect late recurrences, if any. Unfortunately, these children often fail to followup soon after anti tubercular treatment is over. The plain radiographs provide only an approximate morphology of a complex hip joint. The radiological type although may remain same posttreatment, but there may be differences in bony density and texture. Better delineation may be obtained by sophisticated imaging methods such as magnetic resonance imaging (MRI) and computed tomography scan and these should be done where necessary. It helps in diagnosis, planning treatment and explaining prognosis.

The Shanmugasundaram radiological types accurately predict prognosis only in normal types and “triradiate” pattern. The functional outcome is independent of radiological morphology of hip in smaller children. Hence the Shanmasundaram’s radiological classification (1983) cannot be relied upon to prognosticate pediatric patients except in few select types.

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