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Original Research Article

A retrospective study of treatment of Tuberculous hip in children.

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Abstract: Skeletal tuberculosis in the paediatric age group is rare with an incidence of 5 to 6% of paediatric extra-pulmonary cases. This retrospective study was done on 35 children aged between 2 and 14 years between May 2013 to April 2016 with tuberculous hip aimed at analysing the pre and post treatment radiological features using Shanmugasundaram radiological types and their final outcome after ATT treatment, with or without surgical intervention as assessed by Moons' criteria. There was neither correlation between pre and post treatment radiological type nor was there any correlation between the post treatment radiological type and the functional outcome.
Keywords: Tuberculosis Hip, paediatric, Moons' criteria, Shanmugasundaram radiological type, retrospective study.

INTRODUCTION:

Skeletal tuberculosis in the paediatric age group is rare with an incidence of 5 to 6% of paediatric extra-pulmonary cases[1]. Hip tuberculosis constitutes 15 to 20% of osteoarticular tuberculosis[2]. The clinico-radiological course of osteoarticular hip tuberculosis following ATT is poorly documented in the literature. This retrospective study was done on children with tuberculous hip to analyse (a) whether there was a correlation between the pre and post treatment radiological types after ATT treatment, with or without surgical intervention. (b) whether the final post treatment radiologic type had any correlation with the functional outcome.

MATERIALS AND METHODS:

Retrospective analysis of children presenting with osteoarticular tuberculosis of hip treated at Department of Orthopaedics, SBMCH, Chrompet from May 2013- April 2016.

Inclusion Criteria:

1. Both male and female children were included in the study.
2. Only children aged below 14 years were included in the study.
3. Only freshly detected cases were included in the study.

Exclusion Criteria:

1. Children under 2 years and over 14 years were excluded.
2. Children who have had treatment with antibiotics, either ATT or otherwise, prior to presenting to us were excluded.
3. Hips operated elsewhere for establishing a diagnosis were also excluded.

Radiographic Analysis:

Routine both hips AP and frog lateral views were taken for the radiological analysis. Both pre and post treatment radiographic findings were staged using modified Shanmugasundram radiological classification (Fig.1, Table 1.)[3,4].

Clinical and functional outcomes were analysed using modified Moon's criteria for outcome assessment (Table 2)[5].

At the time of initial presentation, routine blood and urine investigations, Mantoux and chest x-ray were taken along with the radiological assessment for hip. Provisional diagnosis was arrived after the initial screening of the complete blood counts, ESR and CRP and ATT was started empirically. Radiological findings of the lung were documented. The ESR and CRP were checked every month during ATT treatment and used as a tool to record response to chemotherapy. Prior to initiation of ATT, lung function tests were carried out and then repeated every six weeks during the twelve months course of ATT (8 times).

Table 1: Modified Shanmugasundaram radiological classification

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

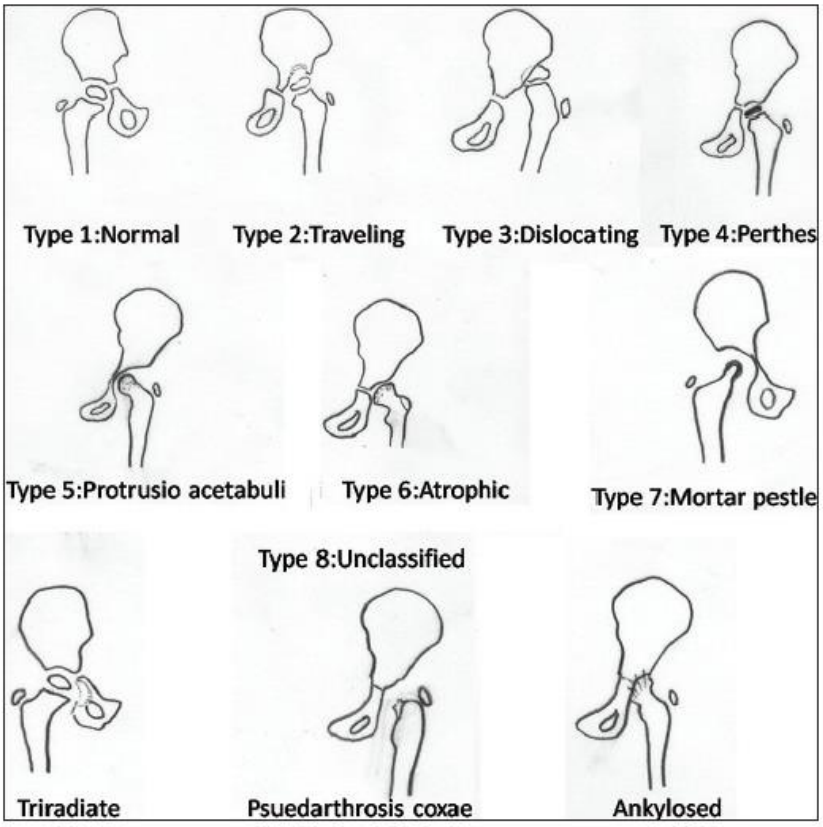


Fig. 1: Modified Shanmugasundaram radiological classification of TB Hip

Table 2: Modified Moon's criteria

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

On admission paractemol suspension were given for pain relief and children were made strictly non weight bearing, with institution of skin traction. The children were divided broadly into two categories, one requiring only ATT and the other requiring surgery in addition to ATT. Those that require surgical intervention with ATT, were taken up for joint drainage, lavage and debridement, after anaesthetic fitness. Simple synovectomy were performed with preservation of the articular cartilage to the maximum extent possible. Even loosely connected articular cartilage were preserved. If they were of the dislocating type, they were operated for femoral varus osteotomy, in the same sitting to reposition the femoral head into the acetabula. Material for HPE were collected during the surgery which included excised synovium and debrided tissues. The joint aspirate was sent for culture and cytological study and PCR. Lack of growth of any pyogenic bacteria were concluded as being strongly positive for tuberculosis. Cytological examination of the aspirate was done to look for the presence of lymphocytes and giant cells which concludes in favour of tuberculosis, rather than the normal neutrophils and plasma cells. This also helped in eliminating the other differential diagnosis like septic arthritis, perthes disease and transient synovitis. Culture for M. tuberculosis and PCR test of aspirates and tissue specimens were done routinely. High protein diet along with ATT was continued post operatively, based on clinico-radiological diagnosis and not waiting for conclusive culture or tissue diagnosis. Post operatively the hips were immobilised in a hip spica cast for a period of 12 weeks. During this period of immobilization, static hip strengthening exercises were taught and encouraged. This was followed by skin or skeletal leg traction for an additional period of 4 weeks. During this period, gentle active assisted hip mobilization were encouraged for 10 minutes in every waking hour of the day.

The following ATT drugs were employed for chemotherapy:

Table 3: ATT drugs and their abbreviations.

Isoniazid	[H]
Rifampicin	[R]
Pyrazinamide	[Z]
Ethambutol	[E]

A modification of the WHO recommendation for osteoarticular tuberculosis were adopted as follows.

Table 4: ATT regimen in children with radiologically normal appearing hip[2+10=12 months]

Intensive phase	Continuation Phase
$2[H_7R_7Z_7E_7]$	10 $[R_7H_7]$

Table 5 : ATT regimen in children with radiological evidence of osteoarticular tuberculosis[4+8=12 months]

Intensive phase	Continuation Phase
$4[H_7R_7Z_7E_7]$	8 $[R_7H_7]$

RESULTS:

Table 6: Age Distribution Table.

Age group	No. of Cases	Percentage(%)
2-5	3	8.57
5-8	27	77.14
8-10	4	11.42
10-13	1	2.85
Total	**35**	**100**

Table 7 : Sex Distribution Table.

Sex	No. of Cases	Percentage(%)
Male	13	37.14
Female	22	62.85

Table 8: Side of affection

Side	No. of Cases	Percentage(%)
Right	16	45.7
Left	19	54.3

The mean follow up was for 20 months. The diseased hips healed in all the 35 cases. There were no drug reactions or intolerance, hence all 35 patients successfully completed the 12 months ATT regimen. The mean ESR value of 63mm per hour returned to around 15mm per hour after 8 to 12 weeks of ATT regimen. The average CRP values at the beginning of treatment was 4.2 mg/dL. These averages at the end of 3rd, 6th, 9th and 12th month of treatment were 0.62mg/dL, 0.12mg/dL, 0.08mg/dL and 0.05mg/dL

respectively. Hence it was observed that both ESR and CRP levels improved with response to chemotherapy.

In the 30 operated cases, the joint aspirate did not grow any pyogenic bacteria. In 24 of the 30 operated cases, cytology of the aspirate demonstrated WBC's, necrotic cells, giant cells, epithelioid cells and sheets of lymphocytes. This finding was considered contributory towards the diagnosis of tuberculosis. In 21 of the 30 operated cases the excised synovium and the debrided tissue showed classical tuberculous granuloma(fig. 2). M. tuberculosis culture was positive in 18 of the 30 operated cases. Rapid PCR assay was positive in 26 cases.

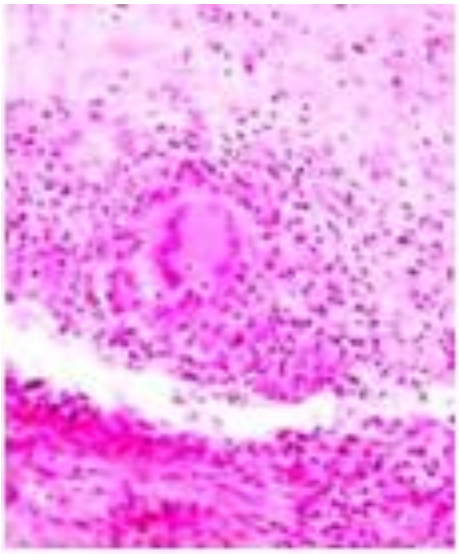


Fig. 2. Granulomatous inflammation - a multinucleated Langerhans' giant cell in the middle of granuloma.

Its multiple nuclei are arranged in a horse shoe shape at one pole of the cell. Some epitheloid cells are seen around the Langerhans' giant cell.

Post surgery, all the 30 operated cases were immobilised in a hip spica for 12 weeks. In the non operated cases skin traction was applied bilaterally for the 12 weeks, after initiation of ATT. For an additional period of 2 months (8 weeks) gentle assisted hip mobilisation was encouraged in bed as pain permitted. This regimen was encouraged to be done for 10 minutes of every waking hour. Partial weight bearing was initiated after 20 weeks of bed rest and progressed gradually to full weight bearing by the 28th week. For the single patient who required varus osteotomy, partial weight bearing was initiated only after 5 months, which progressed to full weight bearing from the 6th month onwards.

Radiological type was determined for both pre-treatment(Table. 9 and 12) and post-treatment (table. 10 and 12) X-rays employing the modified Shanmugasundaram classification.

Table 9: Pre-treatment radiographic findings

Type	Number of hips	Percentage(%)
Normal	11	31.4
Travelling	9	25.7
Dislocating	4	11.4
Travelling+dislocating	2	5.7
Protrusio acetabuli	2	5.7
Atrophic	3	8.6
Unclassified	4	11.4

Table 10 : Post-treatment radiographic findings

Type	Number of hips	Percentage(%)
Normal	10	28.5
Perthes	4	11.4
Protrusio acetabuli	2	5.7
Atrophic	2	5.7
Mortar and Pestle	6	17.1
Unclassified	11	31.4

The functional outcome assessment was done as per modified Moon's criteria(Table 11 and 12)

Table 11: Percentage of functional outcome clinically as by Moons' criteria

Outcome	No. of cases	Percentage(%)
Excellent	10	28.5
Good	8	22.9
Fair	9	25.7
Poor	8	22.9

In the so called radiologically normal looking hip, some amount of regional osteoporosis was observed in the femoral head and neck, which upon treatment completion, returned to their normal density. In none of the cases avascular necrosis or bony ankylosis was an outcome. Even in the worst case scenario, the post treatment radiography showed that reasonable proportions of the femoral head were preserved. X-rays were taken at intervals of six weeks, after ATT initiation. It was observed that radiological features of disease control were apparent, as early as 3 months and complete cessation of disease process were visible by 6 months. The 9th and the 12th month x-rays showed the healing and the healed radiological stage respectively. It was observed that the radiological outcomes stabilised by the 12^{th} month and no further improvements were observed in the next 20 months of follow-up.

In the fair and poor categories there was 10 to 15 degrees of hip flexion contractures and limitation of about 10 degrees of internal rotation. Surprisingly none of them in this category had any painful limp at the end of treatment. The hip flexion contactures had caused a shortening of the limb by about 1.5 cm which was well

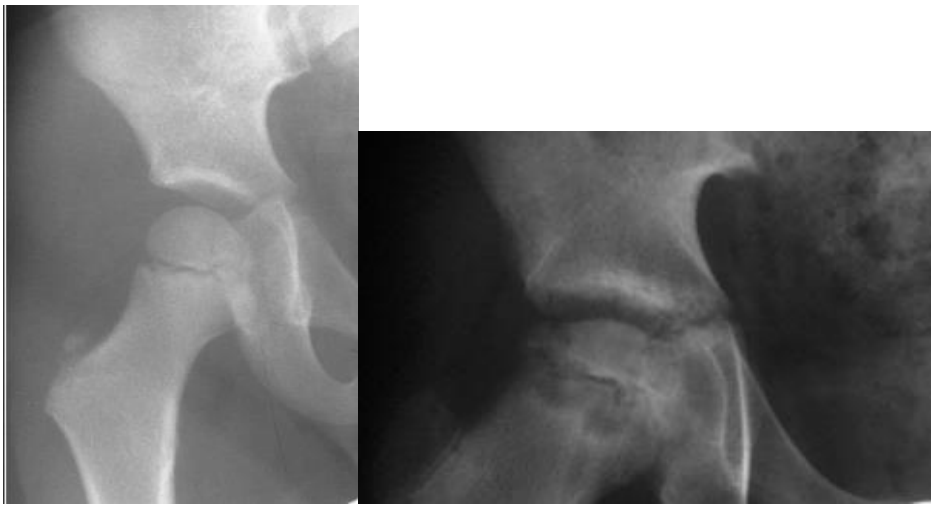
compensated by the pelvic tilt and no obvious limp could be seen in the gait.

Table 12: Distribution of cases based on the radiological and clinical outcomes

Sl. No.	Pretreatment radiographic type	Posttreatment radiographic type	Clinical outcome (Moons' Criteria)
1	Normal	Normal	Good
2	Normal	Normal	Excellent
3	Normal	Normal	Excellent
4	Normal	Normal	Good
5	Normal	Normal	Excellent
6	Normal	Normal	Excellent
7	Normal	Perthes	Poor
8	Normal	Perthes	Excellent
9	Normal	Mortar pestle	Fair
10	Normal	Perthes	Poor
11	Normal	Protrusio acetabuli	Fair
12	Travelling	Normal	Excellent
13	Travelling	Mortar pestle	Fair
14	Travelling	Mortar pestle	Good
15	Travelling	Atrophic	Poor
16	Travelling	Unclassified(ankylosed)	Poor
17	Travelling	Unclassified(ankylosed)	Poor
18	Travelling	Mortar pestle	Fair
19	Travelling	Atrophic	Good
20	Travelling	Unclassified(ankylosed)	Poor
21	Dislocating	Mortar pestle	Good
22	Dislocating	Protrusio acetabuli	Fair
23	Dislocating	Unclassified(ankylosed)	Poor
24	Dislocating	Mortar pestle	Good
25	Travelling+Dislocating	Perthes	Fair
26	Travelling+dislocating	Unclassified(ankylosed)	Poor
27	Unclassified(triradiate)	Unclassified(triradiate)	Excellent
28	Unclassified(triradiate)	Unclassified(triradiate)	Excellent
29	Unclassified(triradiate)	Unclassified(triradiate)	Excellent
30	Unclassified(pseudarthrosis coxae)	Unclassified(pseudarthrosis coxae)	Fair
31	Atrophic	Normal	Fair
32	Atrophic	Unclassified(pseudarthrosis coxae)	Fair
33	Atrophic	Unclassified(pseudarthrosis coxae)	Good
34	Protrusio acetabuli	Normal	Excellent
35	Protrusio acetabuli	Normal	Good

Case Illustrations

Case 1:

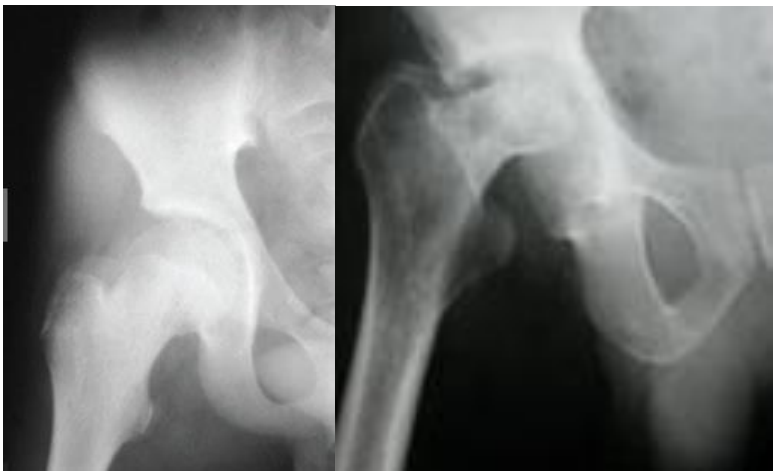


Pretreatment **Post treatment**

Clinical outcome

Fig. 3 : A 10 year old boy, showing pretreatment normal type and post treatment fragmented perthes type with excellent functional outcome.

Case 2:



Pretreatment Post treatment

Clinical outcome

Fig. 4 : A 9 year old girl, pretreatment normal type and post treatment mortar and pestle type, clinical picture showing restricted range of movement in the right hip while sitting cross legged and squatting.

Case 3:

Pretreatment **Post treatment**

Fig. 5 : Showing pre treatment normal type radiograph but due to development of tubercular abscess, destruction and fragmentation of femoral head has occurred, making it a perthes type hip. The functional outcome was poor with FFD of 30 degrees and further flexion of 25 degrees.

Case 4:

Pretreatment **Post treatment**

Fig. 6: Showing x-ray of right hip AP view pre treatment normal type head and the post treatment was the protrusio variety. Surprisingly the functional outcome was fair, with limitations in hip rotations.

DISCUSSION:

Tuberculosis is an endemic disease in India. Of this, skeletal tuberculosis constitutes about 5 to 6% of extrapulmonary tuberculosis. Skeletal tuberculosis in children is rare. Tuberculosis of hip accounts for about 20% of skeletal tuberuculosis, however the exact statistics for paediatric age group is not documented[6, 7]. There were two objectives of this study. One was to determine, if there was any correlation between pre-treatment and post-treatment radiological type. The other objective was to determine, if there was any correlation between the end radiological type and the functional outcome, as determined by Moons' Criteria[4, 5].

Campbell and Hoffman had showed that the Shanmugasundaram radiological appearance of the hip at presentation accurately predicts the final outcome[8]. However a later series by Moon et al had shown that disease healing and residual pain did not correlate with the radiological type[5]. In our series of 35 children we too observed that there was no demonstrable correlation between either pre-treatment radiological type and the end outcome type or the end radiological type and the

functional outcome, as assessed by Moons' criteria. This once again highlights the necessity of high degree of clinical suspicion in treating "Irritable Hips" in the paediatric age groups and when suspected should better be screened by higher investigations like MRI and Scintigraphy.

In our study, about 50% of the initial normal radiological type continued to be normal at the end of the treatment and they had good to excellent functional results. The other pretreatment normal radiological type progressed to various other types like mortar pestle, perthes and protrusio acetabuli type and did not have functional outcome which could be correlated. In our series unclassified(triradiate) type persisted with same radiological type post treatment and all had excellent functional results. 2 cases of Atrophic type in our series progressed to normal type post treatment and one had good and one had excellent functional outcome. The other initial radiological types did not have any correlation with the post treatment radiological type. The post treatment radiological type also did not have any correlation to the functional outcome. So we concluded that the initial radiological status has no predictive value with regard to the final radiological type, neither it could predict what the final functional outcome would be.

Early diagnosis and effective ATT, for an adequate period of time treats osteoarticular tuberculosis without much residual deformity and gives good functional outcome. It also emphasises the necessity, of not hesitating to operate when there are indicative radiological changes in the involved hip. While synovectomy and joint lavage with debridement are the back bone of surgical intervention, every effort is taken to save every availabIe healthy articular cartilage on the femoral head and acetabula, even if they appear partially loosened or have lost their normal sheen[9]. This is because unlike in septic arthritis, cartilagenous destruction in osteo-articular tuberculosis is mechanical(due to load bearing) and not enzymatic[10]. This ensures that during the recovery phase, much of the articular cartilage rehabilitates to give functionally good range of movement to the hip joint, despite radiologically visible residual deformities. Post-spica hip immobilisation followed by the use of skin traction helped in reducing loss of joint space, by maintaining hip joint motion and permitting mobilisation exercises in recumbancy. ESR and CRP are good prognosticators of response to ATT. Clinico-radiological assessment is more valid than waiting for confirmatory histopathology report or culture reports to initiate ATT, thereby preventing delay in chemo-initiation. In this regard PCR assays are quick to come by, but it needs to be emphasised that a negative PCR does not rule out tuberculous involvement[11]. Weight bearing is avoided for approximately 5 months after ATT initiation and progressed to full weight bearing only after the 7th month. It is important to emphasise that tuberculosis being a systemic disease requires, apart from ATT, a high protein diet, Pyridoxine supplementation and vitamin D, while monitoring liver function tests and ophthalmic reviews, once in 6 weeks.

Short comings of the study is that it is retrospective in nature, two different ATT regimens for the two groups, a small and unequal number of each radiological type and an unequal follow up period in each case.

CONCLUSION:

In osteoarticular hip tuberculosis, clinico-radiological assessment is the mainstay to initiate ATT. There is no correlation between the initial radiological type and final end radiological type. Similarly the end radiological type does not correlate with the functional outcome. Early ATT initiation and early surgical intervention helps in early healing and better functional outcomes, so that even when coxarthrosis supervenes in adulthood, joint replacement surgery would be easy.

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