

Original Research Paper Medical Science etrospective and Prospective Study of the Role of Ischial Weight

Retrospective and Prospective Study of the Role of Ischial Weight Bearing Orthosis in Perthes' HIP

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ABSTRACT Background: Legg Calves Perthes disease (LCPD) is a disease of the hips in young children characterized by varying degrees of the avascular necrosis of the femoral ossific nucleus. Aim of treatment is containment of femoral head in acetabulum and to remove deforming mechanical pressure from the joint during the disease course.

Objective: Aim of this study was to determine the effect of Ischial Weight Bearing orthosis in perthes disease.

Materials and Methods: This Retrospective and open ended Prospective study was done on patients treated for LCPD. Clinical examination and interviews conducted at time intervals of three months, 6 months and one year to assess the various parameters like Range of motion, Trendelenburg sign, Mose grading, Stulberg grading and Reimer Migration Index.

Results: 20 patients were enrolled in this study with mean age of onset of symptoms 9.65 years of which 15 (75%) were male and 5 (25%) were female. Right sided hip joint involvement was seen in 9 cases (45%) while left side in 11 cases (55%). Trendelenburg sign was found to be positive in all patients at initial evaluation which decreased to 40% of cases at 1 year. Mean Hip flexion range improved by $23.00\pm5.33^\circ$, abduction by $22.67\pm5.77^\circ$, internal rotation by $19.0\pm5.0^\circ$, but no significant change was seen in external rotation and extension. Change of grade in Mose grading by atleast one grade was seen in 20% of patients. Grade change in Stulberg classification categories was seen in 20% at the end of 1 year follow up. Reimer's migration index change was insignificant.

Conclusion: Our study presents favourable results with Ischial weight bearing orthosis. Ischial weight bearing orthosis can be regarded as a salvage method for Perthes' disease providing improved range of motion and symptomatic improvement in patients due to pain relief and improvement in gait.

KEYWORDS : Legg Calves Perthes disease, Conservative, treatment, Weight Bearing Orthosis

Introduction

Legg Calves Perthes' disease (LCPD) is a disease of the hips in young children. The disease is characterized by varying degrees of the necrosis of the femoral ossific nucleus. It is most common in the age range of 4 to 8 years, but has been reported in children as young as 2 years of age and in the late teen agers. It is most common in boys than girls by a ratio of 4:1. Incidence of bilateralness is about 10 % to 12 %.⁽¹⁾

Epidemiologic factors associated with LCPD include previous family history (10 %), abnormal presentation such as breech or transverse lie, racial ethnic factors, lower birth weight and abnormalities of growth hormone dependent somatomedin (males).⁽²⁾

The cause of LCPD remains unknown; it has been thought to be an inflammatory disease, secondary to trauma or a developmental disorder. Mostly accepted theory is the interruption of the vascular drain-

age intraosseous venous hypertension or increased blood viscosity, leading to a decreased blood flow. $\ensuremath{^{(3)}}$

Prognostic factors associated with disease include deformity of femoral head, hip joint incongruity, age of onset, extent of epiphyseal involvement, growth disturbance secondary to premature epiphyseal closure, protracted disease course, acetabular and femoral head remodelling potential, type of treatment and stage during which treatment is initiated.^(4,5)

AIM of treatment in LCPD is to remove mechanical pressure from the joint during the disease course. Options include traction, orthotic device, physical therapy and surgical intervention (permanent joint damage). Current treatment options for children over 8 year of age include prolonged non-weight bearing, osteotomy (femoral, pelvic), and the hip distraction method using an external fixator which relieves the hip from carrying the body's weight.

The aim of this study was to determine the effect of Ischial Weight Bearing orthosis in LCPD.

Material and Method

This was Retrospective and open ended Prospective type of study, it included, all the patients treated for LCPD in the Dept. of Physical Medicine and Rehabilitation at King George's Medical university, Lucknow, from 2013 to 2015.

Patients enrolled in outdoor/ indoor, for treatment and rehabilitation options provided, followed by regular follow up. Interviews conducted subsequently to assess the various parameters like ROM, Trendelenburg sign, Mose grading, Stulberg grading¹⁶ and Reimer Migration Index between the different time intervals at three months, six months and one year.

Migration index=AC/AB, where, AC is the part of head outside of acetabulum and AB is the measurement of widest part of head of femur.

After detailed clinical & radiological evaluation of the patients and collection of relevant data, patients were provided IWB orthosis over affected limb (figure 1). Orthosis was advised to be used whenever patient bears weight over lower limb, so that weight of body does not come over head of femur. Exercise programme for affected limb was advised including Range of Motion exercises and strengthening exercises to be followed throughout the study period.

Figure 1 : Clinical image of patient with Ischial Weight **Bearing Orthosis**





Results

This study includes 20 patients, of which 15 (75%) were male and 5 (25%) were female with mean age of onset of symptoms 9.65 years. The side of involvement was right side in 9 cases (45%) while left side in 11 cases (55%). Trendelenburg sign was found negative in the 40 % of cases in final result, but at first day of follow up all the 20 patients were Trendelenburg sign positive. In study done by us, flexion improved by 23.00±5.33° (Table-1), abduction by 22.67±5.77°, internal rotation by 19.0±5.0° (Table-2), but no significant change in external rotation and extension.

Table 1: Change in Flexion (In Degree) from Day 1 to last follow up:

Follow-up time	Mean±SD	p- Value
3 months	15.00±5.98	0.02
6 months	16.00±5.75	0.02
9 months	17.00±5.10	0.02
12 months	23.00±5.33	0.01

Table2 : Change in Internal rotation (In Degree) from Day 1 to last follow up:

Follow-up time	Mean±SD	p- Value
3 months	8.00±7.58	0.04
6 months	10.0±6.12	0.04
9 months	15.00±7.07	0.02
12 months	19.0±5.0	0.01

On first time presentation we have 8 (40%) patients graded as good according to Mose grading, 8 (40%) patients were graded as fair and 4 (20%) were poor. But the final result is 10 patients (50%) were graded as good according to Mose grading, 6 (30%) Patients were graded as fair and 4 (20%) were poor. In our study the result is 10 patients (50%) were graded as grade I, 6 (30%) Patients were graded as grade II and 4 (20%) were grade III according to Stulberg classification. But at the time of enrollment we have 8 patients (40%) graded as grade I, 8 (40%) patients were graded as grade II and 4 (20%) were grade III. (figure 2). In this study Reimer's migration index changes from 23.25±12.19 to 23.86±12.67 which is insignificant change.

Figure 2 : Serial x ray images of another patient at different follow up periods



Discussion-

The optimal treatment for Perthes' disease is still unknown. Perthes' disease is not a common condition, constituting about 2% of all hip pathology⁶. For these reasons, non-operative treatment, which may be appropriate in younger patients with initial stage, is less successful and disappointing in the later stages and late onset age group.^{7,8}

The goal of our study was to evaluate the results of IWB orthosis as a treatment option for cases of Perthes' disease. The aim of this method of treatment is to allow recovery of the femoral head by effectively relieving the mechanical force on the capital femoral epiphysis.

We included the children of age more than 6 years with duration of symptoms of less than one year of either sex. In our study out of total 20 patients, 15 (75%) patients were male and 5 (25%) were female, which is in accordance with the male dominant incidence of this disease. The mean age at the onset of symptoms in our study was found to be 9.65 years which is slightly lower than the mean age of incidence found in the study done by Randall T. Loder *et al* (2011).⁹ They reported mean age of 9.8 years in Indian subcontinent as compared to 6.9 years in white races.

In this study the side of involvement of hip was on right side in 9 cases (45%) while in 11 cases (55%) involved the left side. There is no pre dominance of the side involved in earlier studies. Grzegorzewski A. *et al*¹⁰ found bilateral involvement in 8-24% of cases, but in our study no any case of bilateral involvement was found. **Wang, Li** et al (1995)¹¹ stated, out of 124 patients with 141 affected hip 38% patients shows Trendelenburg sign negative in final outcome. Wild A *et al* (2003)¹² also found that out of 54 patients 45% shows Trendelenburg sign negative after use of lschial weight bearing orthosis. In our study Trendelenburg sign was found negative in the 40% of cases in final result.

Range of motion were found to be improved with IWB orthosis and ROM exercises of hip (though final outcome still awaited at the skeletal maturity), it is in accordance with study of **Wang, Li** et al (1995)¹¹ and Wild A, Westhoff B, Raab P, Krauspe R¹² (2003).Flexion improved by 28°, abduction by 25°, internal rotation by 20° in their study.

Improvement in the range of motion observed in our study is also comparable with the overall improvements in range of motion in the study done by G. Bergmann *et al*(1994).¹³

They show flexion improved by 25°, abduction by 20°, internal rotation by 15°. In our study flexion improved by 23°, abduction by 22°, internal rotation by 19°, which is similar to the all previous studies done.

According to the criteria of Mose, 12 (35 per cent) had a fair result, and 22 (65 per cent) had a poor result and no hip had a good result, in a study done by A G Martinez; S L Weinstein; F R Dietz (1992)⁷ on 34 patients and M. H. M. Harrison; M. P. A. Menon (1966).¹⁴

In a study done by Petrie JG et al.¹⁵ in 1971 using the criteria from Moses' end-result classification system, they reported that good results were achieved in 60% of the patients, fair results in 31%, and poor results in 9%.

On first time presentation we have 8 (40%) patients graded as good according to Mose grading, 8 (40%) patients were graded as fare and 4 (20%) were poor.

But the final result is 10 patients (50%) were graded as good according to Mose grading, 6 (30%) Patients were graded as fare and 4 (20%) were poor. Which shows that use of IWB orthosis may helpful in early stage of disease but it does not have any effect in later stage.

On the basis of the classification of Stulberg et al., there were fourteen (41 per cent) grade I results, eighteen (53 per cent) grade II results, and two (6 per cent) grade III results in a study done by A G Martinez; S L Weinstein; F R Dietz (1992)⁷ on total 34 patients. In our study the result is 10 patients (50%) were graded as grade I, 6 (30%) Patients were graded as grade II and 4 (20%) were grade III. But at the time of enrolment we have 8 patients (40%) graded as grade I, 8 (40%) patients were graded as grade I and 4 (20%) were grade III. Some improvement in Stulberg classification grade II patients, favours use of IWB orthosis in those conditions where sphericity of head of femur was not damaged completely due to LCPD.

Radiological parameter Reimer's index was found to be improved non significantly in present study which is similar to study done by Cooperman, Daniel R.; Stulberg, S. David (1986)⁸ who observed that function and pain following the procedure was good but radiographic parameters did not change significantly.

Cooper man Daniel R. et al $(1986)^8$ done study on 58 patients with Perthes' disease and observed mean change in RMI. There was change in Reimer's migration index, which was from (23.25 ± 12.19) to (23.86 ± 12.67) in our study. The change is insignificant.

Conclusion

Our study presents favourable results with lschial weight bearing orthosis. Ischial weight bearing orthosis can be regarded as a salvage method for Perthes' disease providing improved range of motion and symptomatic improvement in patients due to pain relief and improvement in gait.

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