# Limited knee extension — A reliable indicator of a successful closed reduction of Developmental Dysplasia of Hip

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## Abstract

A clinical observation of 49 hips in children who had closed reduction and application of hip spica for developmental dysplasia of hip (DDH) was undertaken in our department. A clinical sign of "Limited Extension at ipsilateral knee" was observed after successful closed reduction of the hip. This sign was absent if the hip was not reduced. This sign was due to hamstring tightness after successful closed reduction. We suggest that the presence of this sign is a reliable indicator of successful closed reduction and also an indicator of the vulnerability of the proximal femoral epiphysis to increased pressures during positions of immobilization.


**Keywords:** Closed reduction of DDH, Extension lag, Position of hip.

## Introduction

Avascular necrosis (AVN) of the proximal femoral epiphysis and growth disturbance after closed reduction of DDH are well known complications; the incidence of which varies from 0-67% in different case series,[1,2] which suggests that the rigour of search for the diagnosis and the strictness with which the criteria are interpreted are important in determining the reported rates.[1,2] The length of follow-up also influences the incidence. Overall prevalence of avascular necrosis following closed reduction of DDH found an overall prevalence of 47% with 39% total and 8% partial involvement. The position of immobilization of the hip in extreme abduction and internal rotation gives more stability but has been shown to be associated with AVN and growth disturbance of proximal femoral epiphysis.[3]

## Patients and Methods

In a consecutive series of 49 children who had closed manipulation and application of hip spica under general anaesthesia using image intensifier confirmation, a specific clinical finding of limited extension at the ipsilateral knee was observed after successful closed reduction. The included children's ages ranged from 6 to 18 months. Children of less than 6 months of age normally tend to have some limitation of extension at the knee at that age so the sign is less noticeable and distinct. This limits the value of this sign in the younger infant and hence children below 6 months of age were not included in the study.

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## Results

All hips after closed reduction were immobilised in a hip spica cast in human position. Before application of cast a

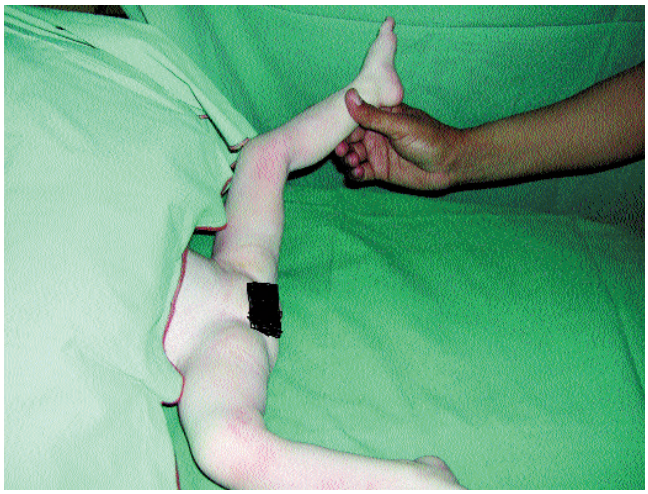

**Figure-1:** Extension lag at knee after manipulation.

'Limited extension at the knee' was observed (Figure-1). This disappeared when the hip was dislocated (Figure-2) and reappeared on successful closed reduction. The degree of flexion deformity/extension lag varied with the position of the hip and was found to be greater in frog the position (Maximum flexion around the axis of the neck of femur) and in positions of extreme internal rotation of the hip as compared to the human position of hip (flexion 90-100 degrees and abduction of 40-50 degrees).The reduced capacity to achieve full extension at the knee remained consistent throughout the procedure. This deformity became less pronounced with time and was completely resolved within 2-3weeks when the child was brought back for reassessment and change of spica cast.

**Figure-2:** No lag before manipulation. (hip is still out).

## Discussion

Controversy concerning the etiology and pathogenesis of AVN in patients with DDH still exists, although most authors presently agree that the changes observed are vascular in nature. Nicholson et al[4] discovered in 1954 that the pressure on the vascular system of the femoral head may cause intra- and extra-capsular obstruction leading to Avascular necrosis of femoral head. They attributed their findings to mechanical obstruction of the vessels. Several authors have reported experimentally induced ischaemia or AVN of the proximal femoral epiphysis after hip joint tamponade was applied in immature dogs and rabbits.[4-6]

This sign (presence of extension lag at the knee after successful closed reduction of a DDH) is most likely due to tight hamstrings. Thus it is this tightness that could cause an increase in the transepiphyseal pressure in the hip and cause growth disturbance syndrome affecting the physis and epiphyses of the proximal femur.[7,8] We also observed that the extension lag/flexion deformity at knee is increased in a marked abduction position and in positions of extreme internal rotation.This further substantiates the fact that raised transepiphyseal pressures are in fact the cause of growth disturbance.[9,10] The authors advise against driving the femoral head into the acetabulum by forced extension of the knee as this can raise transepiphysial pressure and may cause AVN.

## Conclusion

We have described a "clinical sign", which can be used to indicate successful closed reduction of the hip. It also gives an indication of a safe position of immobilization in spica cast as the extension lag increases in frog leg position and in positions of forced internal rotation of femur (which have a higher incidence of AVN). Any position that accentuates the tendency for the extension lag/flexion deformity to increase, is likely to enhance the risk of physeal or epiphyseal damage.

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