Hip range of motion in Perthes' disease: comparison of pre-operative and intra-operative values

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Abstract

Background Children with early Perthes' disease and clinical loss of motion are commonly noted to have normal or almost normal hip range of motion (ROM) when examined under anesthesia (EUA). Despite anecdotal comments about this observation, no series has documented these findings. The lack of such data led to this study.

Methods Consecutive patients with unilateral Herring class B or C Perthes' disease in mid to late Waldenstrom's fragmentation stages who failed a non-operative course of hip motion restoration had hip range of motion (ROM) documented pre-operatively and intra-operatively by a single, experienced pediatric orthopedic surgeon. The opposite normal hip's ROM was used as the control. Joint congruity was assessed arthrographically.

Results Twenty-seven patients, 6–10 years old (average 7.9 years) with early Perthes' disease were reviewed. Twenty-one of 27 patients (77.7%) had full or almost full hip ROM of the involved side when examined under anesthesia (EUA). Six patients (22.3%) had limited abduction (<50 degrees) and underwent an adductor tenotomy that normalized hip ROM. Five of these six patients were older than 8 years. Intra-operative arthrography did not demonstrate lack of containment, hinge abduction or joint incongruity.

Conclusions Loss of hip ROM in this series of patients

with early Perthes' disease without intra-articular incongruity was due to pain and muscle spasm which were obviated by anesthesia, demonstrating essentially normal hip ROM in the majority of patients. Pre-operative bed rest and traction was not required to restore ROM in this group of patients.

Keywords Perthes' disease · Hip range of motion

Introduction

A common clinical scenario during treatment of early Perthes' disease is a patient who develops progressive loss of hip range of motion (ROM) or has inability to regain hip ROM despite a variety of management techniques. Concern exists for progressive epiphyseal deformity with loss of containment. If surgery is indicated, fear of development of a stiff hip post-operatively becomes a factor of surgical judgment [1]. Pre-operative bed rest and traction have been suggested as methods to restore hip ROM in Perthes' disease but no data has been presented that objectively documents hip ROM change pre- and post-traction treatment in a specific group of patients, especially in the early stages of the disease. Limited and conflicting data is available regarding the pre-operative impact of traction for patients with late stages of Perthes' disease and hinge abduction [2, 3, 4].

The author's clinical observation that children with early Perthes' disease and loss of range of motion commonly had normal or almost normal hip ROM when examined under anesthesia (EUA) just prior to planned hip surgery stimulated this review since no reported series has documented these findings. The lack of such data led to this study that compares pre-operative and EUA hip ROM evaluated by a single examiner in a consecutive series of patients with

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unilateral Perthes' disease in its early stages with arthrographic documentation of joint congruity.

Materials and methods

Inclusion criteria were failure of non-operative management to restore hip ROM, including compliant, therapy-guided exercises, activity modification, and oral non-steroidal anti-inflammatory medication use for at least three months. Patients had early Perthes' disease with Herring class B or C unilateral involvement with mid to late Waldenstrom fragmentation stages as seen on weight-bearing antero-posterior pelvis and lateral non-weight-bearing hip radiographs. Pre-operative internal rotation was less than 10 degrees in extension and abduction less than 40 degrees in extension. Individual hip pre-operative ROM values within 7–10 days of surgery were determined by a single examiner using standard methods with special emphasis on stabilization of the pelvis to eliminate erroneous pseudo-motion. No traction was used at any time during treatment. Under general anesthesia, passive ROM of each hip was determined in all planes by the same examiner using the above noted techniques. The opposite normal hip served as ROM control at both examinations. A dynamic hip arthrogram of the involved hip was done in multiple planes to assess hip containment, articular deformity and joint congruity and to rule out intra-articular causes of loss of ROM such as hinge abduction or loose bodies prior to application of Petrie casts.

Results

Twenty-seven patients, 23 boys and 4 girls, 6–10 years of age (average 7.9 years) met the above inclusion criteria.

All patients had normal ROM of the uninvolved hip. Twenty-one of 27 patients (77.7%) had ROM of the involved hip that was equivalent to or within 5 degrees of ROM of the opposite hip with EUA. Six of the 27 patients (22.3%) had diminished abduction (<50 degrees) of the involved hip and underwent a percutaneous adductor longus tenotomy. Five of these six patients were older than 8 years old. All patients of this sub group had loss of ROM similar to that of the group with diminished motion and regained ROM within 5 degrees of the normal hip post tenotomy. There was radiographic evidence of a minimally displaced subchondral fracture in five patients including three > 8-years-old in the group requiring tenotomy. No arthrographic evidence of lack of containment, articular incongruity or hinge abduction was seen in any of the 27 cases.

Discussion

Perthes suggested that, "Loss of motion is the result of mechanical relationships which result from the incongruity of the joint surfaces, and reflex muscle spasms or joint adhesions play no role" [5]. What causes the loss of hip ROM? Many factors have been proposed. Pain due to synovitis, subchondral fracture and/or muscles spasm is thought to lead to abnormal hip posture during gait with progressive development of secondary contractures of the adductors, psoas and hip capsule. Additional loss of hip ROM in patients with more advanced Perthes' disease can be caused by mechanical factors such as progressive joint incongruity due to femoral head and acetabular deformity, hinge abduction, or osteochondritis dissecans and chondral or osteochondral loose bodies.

The impact of bed rest and traction on restoration of hip ROM in children with Perthes' disease has not been well documented. Serlo et al. [4], during a study of femoral venous pressure in Perthes' disease, reviewed 14 patients treated with 7–14 days of Russell's traction and found a combined hip ROM improvement of 33 degrees. Clinical and radiographic traction goals were not defined. Neither the stage of the disease nor the specific arcs of hip motion studied were reported. Kaillo and colleagues [6] noted a minimal increase in intra-articular pressure in nine patients with Perthes' disease but did note that pressure increased with hip extension. They suggested that "Traction with the hip in the painless position of flexion/external rotation does not seem to offer any significant advantage". They also cautioned about potential adverse effects of traction in hip extension. Richards and Coleman [7], in a review of treatment of subluxated Perthes' disease hips prior to closed reduction and adductor tenotomy, noted that pre-operative traction was used in "several" patients early in the study but was later abandoned since no change in hip ROM was achieved. No intra-operative arthrograms were done and no comment was made regarding intra-operative hip ROM. In Reinker et al.'s [3] study of 26 patients with Perthes' disease and hinge abduction in the late stages of Perthes' disease, bed rest with progressive traction was used until the hinge abduction was eliminated by radiographic determination. The time required for the loss of the hinge abduction was not specified nor were the specifics of traction position given. No intra-operative hip ROM data was reported. Killian and Niemann [2] treated six Perthes' patients for hinge abduction with 7–15 additional days of femoral skeletal traction after failure of 10–14 days of split Russell's traction. Initial skeletal distraction was done in adduction with abduction only after the femoral head cleared the acetabular rim to avoid impingement. No pre- or intra-operative data was given regarding specifics of change in hip ROM [3]. Petrie et al. [8] used bed rest or

traction, the type and duration of which were not identified, as a prelude to abduction cast management. A goal of 45 degrees of abduction was set. If this was not met, adductor tenotomy was done and traction reinstituted. No specific data was given concerning hip ROM intra-operatively. Lloyd-Roberts et al. [9], in a report on upper femoral osteotomy management for Perthes' disease, noted that, "Preliminary traction was not used unless the hip was irritable. It has been found that under anesthesia, passive movements are greatly increased and the enforced rest of a hip spica after operation seems to insure that this range is rapidly restored on its removal". No supporting data of specific pre-operative or intra-operative hip ROM were presented to document this observation.

In the present series of patients with early Perthes' disease, the vast majority of hips had essentially normal motion once pain and muscle spasm were eliminated during anesthesia. A small group of primarily older children had a myotendinous adduction contracture which, once released, restored almost full hip ROM. Overall, hip ROM, as assessed by careful clinical examination by a single observer, was essentially normal at EUA. Lack of containment, intra-articular deformity or hinge abduction was not seen arthrographically in this group of patients with early disease. Documentation of possible intra-articular causes of loss of ROM was an integral part of the study.

A control group treated by traction was not done since assessment of traction was not the purpose of the study. Data in the literature provided little objective evidence to support traction use, especially in patients with early phases of the disease. Traction may be required and perhaps be of benefit in cases of severe deformity, especially in older children, and in cases with intra-articular deformity in later stages of the disease. Skeletal traction would provide the most direct vector and perhaps be more effective following preliminary soft-tissue releases. Duration of treatment and clinical and radiographic goals

need to be determined pre-traction and gains in hip ROM and hip congruity documented intra-operatively.

The diminished hip ROM seen pre-operatively in the vast majority of patients with early Perthes' disease in the current series appears related to pain and muscle spasm with a minority of patients requiring a percutaneous adductor longus tenotomy to restore abduction. Given these findings, the concern is diminished for loss of hip ROM following other surgery for Perthes' disease in these early phases. Intra-articular factors as causes of loss of hip ROM were ruled out in this study. This work represents the first documentation of pre-operative and intra-operative hip ROM assessed by a single, experienced examiner with joint congruity confirmed arthrographically in a defined group of patients with early Perthes' disease in the fragmentation stage.

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