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Horizontal skin traction in abduction in physiotherapy management of Legg–Calvé–Perthes disease

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Abstract

Legg–Calvé–Perthes disease is one of the many types of avascular necrosis with etiologies that have not been clearly confirmed yet. It affects the hip joint and is more prevalent in boys between the ages of 3 and 10. The purpose of this paper is to present physiotherapy management of Legg–Calvé–Perthes disease (LCPD) with horizontal skin traction in abduction.

The treatment can be either conservative or operative. In both the cases, appropriate rehabilitation must be performed to facilitate the child's full recovery. The objective of the comprehensive treatment is to restore the shape of the affected head of femur. The entire course of the disease, from onset to resolution, may take as long as a few years. This article is intended as an effective guide to choosing suitable exercises in the given stage of treatment.

Keywords: Legg–Calvé–Perthes disease, therapeutic exercises, skin traction in abduction

Introduction

Avascular necroses (*necrosis aseptica ossium*) are a group of diseases characterized by necrosis of a bone or its fragments, and the full name suggests that they are not caused by microbial infections. Literary sources describe over 40 types of avascular necrosis depending on their place of occurrence. One of them is *Legg-Calvé-Perthes Disease*, LCPD (or

Osteochondrosis coxae iuvenilis in Latin). It is one of the most common hip joint conditions in children, being also referred to as idiopathic avascular necrosis. It is often accompanied by lesions within the femoral head or acetabulum taking the form of acetabular hypertrophy. As the disease runs its course, which may be long, first ischemic necrosis occurs, which is then followed by the revascularization of the epiphysis and its slow regeneration [1]. LCPD is the most common in boys between the ages of 3 and 10 [2,3,4].

Osteochondritis Coxae was first described in 1910 on the basis of X-ray images of hip joints in children in which changes to the anatomical structure of the head of femur were noticed [3,5].

The purpose of this paper is to systematize knowledge on horizontal skin traction in abduction in physiotherapy management of Legg–Calvé–Perthes disease.

Etiology

At present, there are many different views on the etiology of LCPD, with none having been sufficiently confirmed. The most frequently cited cause of LCPD is disruption of blood flow to the head of femur related to specific arterial vascularization of the proximal femoral epiphysis [2]. Other factors, such as genetic causes, increased mechanical pressure on the hip joint (frequent injuries) [6], femoral head and neck growth disorders, or elevated intraarticular pressure, are considered, as well [7,8].

Symptoms

The most typical clinical symptoms include groin, thigh and knee pain. In the initial stage of the disease, the ailment occurs mainly while walking and causes the patient to limp. Frequently, this symptom predates imaging findings, which is why LCPD is rarely diagnosed in its early stages. As the disease develops, the pain exacerbates. Additionally, more symptoms join in, such as a limited active and passive range of motion in the hip joint. This limitation mainly affects abduction and external rotation [2].

Stages of the disease

LCPD develops over a number of stages:

1. **The initial stage, referred to as „Synovitis”,** is usually the result of ischemia. Several-week-old synovitis provokes pain and limits motion in the hip. In this stage, radiographic lesions are small. Ultrasound exams reveal joint space widening, as well as fluid in the joint.
2. **The necrotic period** lasting approx. 6 to 12 months is characterized by collapse of the necrotic parts of the head of femur. In an X-ray, this is presented as sclerosis of the head.
3. **The fragmentation phase** lasts between one and two years. Here, the necrotic parts of the bone are resorbed, and the head of femur becomes deformed.
4. **The regeneration phase** lasts between 8 months and 3 years. It is characterized by the formation of new bone tissue and restoration of the shape of the femoral head [2].

Treatment

The main objective of LCPD treatment is to preserve or restore the proper range of motion (ROM) in the hip joint, particularly with reference to abduction [11]. During treatment, it is important to reduce the forces applied to the hip joint, correct the subluxation and allow for the revascularization of the necrotic bone [11,12,13,14]. According to Radło et al., this is the best preventive measure against secondary degeneration of this joint [15].

The treatment of LCPD can be either conservative or operative. The choice of the therapeutic method depends on such criteria as the child's age, the presence of risk factors, the

extent and severity of the disease, and the degree of damage to the femoral epiphysis, the epiphyseal plate and the metaphysis [14,16]. Many orthopedists agree that children less than 8 years old should receive conservative treatment, with surgical procedures to be applied in older patients. In order to reduce pain and increase the range of motion in the hip joint, horizontal skin traction in abduction is used on both the legs. The traction is applied until the pain is relieved, the exudate volume is decreased and the range of motion in the affected joint is restored [17,18]. The therapy is a 24h/day one, and usually lasts 7 to 9 days or until the ailments are gone [15].



Fig. 1. Horizontal skin traction in abduction in an 8-year-old boy.

This therapy leads to decreased muscular strength and mass, and circulatory, respiratory and gastrointestinal disorders. The introduction of appropriate physiotherapy management is recommended. The patient should perform suitable exercises while lying in supine, prone and lateral (on the healthy side) positions. During the exercises, the therapist may take off the weight or suspensions, if necessary.

The restoration of full motion in the hip joint can be accelerated by performing appropriate non-weight bearing exercises, using a system of suspensions:

- in a supine position – adduction and abduction of the legs to prevent pelvic compensation;
- in a lateral position on the healthy side – flexion and extension of the hip joint (here, the healthy leg is positioned in triple flexion to counter lordosis and prevent lumbar movement during hip joint extension) – such as in the play called “reach your heel out to the ball placed behind/in front of you”. The extension is only performed when the range of motion is unlimited.

While performing the above-mentioned exercises, if the ROM is painless the patient is recommended to keep their legs abducted as far as possible (while in a supine position) or extended (while lying on their healthy side). They can also be instructed to play the “stroke the teddy bear with your foot” game, while achieving an isometric contraction of the gluteus medius and the gluteus maximus. However, if the affected leg motion in abduction is still painful, isometric hip joint muscle exercises are to be performed, such as in the “do not let me move my leg” play.

Conservative treatment consists in, *inter alia*, completely unloading the affected leg. It is important to simultaneously apply appropriate exercises preparing the patient to walk on crutches.

The exercises are as follows:

1. Active and passive exercises with resistance against arm muscles, affecting for example:
 - the triceps brachii muscle – IP (initial position): supine, M (motion/activity): elbow extension, the “drive nails into the wall” play using a weight, or “draw the bow” using some elastic resistance;
 - the posterior part of the deltoid muscle - IP: prone, M: shoulder joint extension such as in the “start the plane – the wings are lifting up” play – the head is lying down;
 - the latissimus dorsi – IP: supine, M: extension, adduction and internal rotation in the shoulder joint such as in the “draw the band” play – the task is to „hide the band underneath your buttocks” while in a supine position, or IM: prone, clasp your hands or put a ball from one hand to the other and back above your buttocks while in a prone position without lifting the head in order to avoid engaging the lumbar erector spinae;
 - the middle part of the trapezius, the rhomboid muscles – IP: prone, M: pectoral girdle retraction: elevate the abducted arms up to 90° in the shoulder joint – play the plane or helicopter – depending on whether the elbows are extended or flexed.
2. Learning to stabilize the pectoral girdle – IP: the exercises are performed with different positioning of the arms, M: keeping a specific position; the arms are like on a statue while the therapist is the wind, pushing them in various directions. The patient’s job is to keep them in one position. Another similar exercise is to keep a ball between the hands while the therapist tries to take the ball away.
3. Exercises strengthening the healthy leg in order to prepare it for 100% load while walking on crutches, e.g.:
 - IP: supine, M: lifting the pelvis with the healthy leg flexed in the hip and the knee [the gluteus maximus is exercised]– such as in the „make way for the car” play;
 - IP: supine, with a large roller under the knee; M: knee extension; kicking a hanging balloon; the therapist applies resistance to the ankle; the exercise is referred to as “the crane lifts the load”.
4. Rectus abdominis muscle and external oblique muscle exercises – IP: supine; M: bending the torso:
 - driving a car along the leg from the hip to the knee and back;
 - passing the ball to the therapist or throwing it with either one or both shoulders elevated;
 - giving a high five to the parents or therapist.
5. Learning to stabilize the torso, IP: supine; M: attempting to keep a specific position
 - with legs flexed – stabilization through the knees if this does not cause pain in the hip joint;
 - with arms flexed up to approx. 90° in the shoulder joints and legs flexed in the knees (feet on the floor) – the therapist pushes on the hands and knees at the same time but in opposite directions, while the patient tries to keep their initial position.

In preventing the atrophy of postural and erector muscles, additional general fitness exercises are introduced, most of them being active or active with resistance, which are usually offered through plays due to the patients' young age.

Characteristically for the child's psychomotor development, especially in patients up to the age of 8, long-lasting exercises are unfeasible as the patient will quickly lose his or her focus and become distracted and bored. Therefore, one therapy session should last a maximum of 15 to 20 minutes and be held approx. 3 to 5 times a day.

The large number of different exercises and the necessity to adapt to the child's attention span requires cooperation between the therapist and the parents. The guardians are expected to encourage their child to perform the exercises many times during the day if all of the aforementioned objectives are to be attained. This is an important factor determining the patient's status after removing the traction and when learning to walk on crutches.

Summary

Although Legg–Calvé–Perthes disease has been known since 1910, no clear cause of the condition and no obvious treatment method have been found yet. The management method is adapted to the individual patient, taking into account many criteria, such as the patient's age, the severity of their illness, and other aspects. When searching for the best method, many orthopedists focus mainly on surgical treatment or compare the outcomes of conservative and surgical therapies. So far, no similar physiotherapy management of LCPD has been described in the literature, particularly with respect to treatment with the use of skin traction in abduction, even though there is a need for introducing this type of management.

It is necessary to systematize the directions of LCPD management due to the prevalence of disorders resulting from long-term immobilization. Also, attention must be paid to the need for systematizing the physical therapy management in the later stages of treatment that should be adapted to the therapeutic method chosen by the orthopedist. Moreover, it should be emphasized that the conservative treatment of this disease will only be effective if the physiotherapy management is carried out properly and appropriate parental cooperation and care is ensured.

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