JCRMHS

Review Article

Journal of Clinical Case Reports, Medical Images and Health Sciences

Volume 4 Issue 2, 2023

Article Information

Received date: 09/03/2023

Published date: 08/05/2023

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*Key Words:

Legg- Calvé Perthes Disease, Gardasil® vaccine, case report

A Case of a child with Legg- Calvé- Perthes disease

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Abstract

Legg- Calvé- Perthes Disease (LCPD) can either be a unilateral or bilateral necrosis of the head of femur, and affects more male children and adolescents less than 15 years. The incidence of LCPD ranges from 0.4/100,000 to 29.0/100,000 children and has multifactorial aetiology where environmental, metabolic or genetic causes may come into play. It usually presents with hip pain and treatment could be surgical or non-surgical.

We present a case of LCPD in a 14 years old girl participating in a vaccine trial evaluating the safety and immunogenicity of HPV vaccines (DoRIS trial). The girl reported right hip pain which was associated with limping and limb shortening 15 months after completing the vaccination schedule. Pelvis x ray findings were suggestive of LCPD.

She was treated conservatively with vertical compensation (shoe rise), analgesics and follow up with some improvement. However, a follow up two years later revealed continued pelvic pain, limping and x ray showed right hip osteoarthritis and hairline transcervical fracture which will require surgical intervention.

We report a case of LCPD which stabilized after three months of conservative therapy but worsened two years later and required surgical intervention. The case was clinically concluded to have no relationship with the Gardasil® vaccine.

Introduction

Legg Calvé Perthes Disease (LCPD) is a common public health problem of the childhood that was firstly described in 1910 by three physicians working independently, including Thornton Legg, Jacques Calvé, and George Perthes. It affects children of the age between 2 and 15 years but more commonly children of the age between 4 and 8 years.1

LCPD's incidence ranges between 0.4/100,000 to 29/100,000 children with males being four times more affected than females, 2 and the disorder is bilateral in 10–24% of patients, with a correlation to inheritance in approximately 8–12% of patients.3

The aetiology of LCPD is unknown. However, different aetiological factors have been proposed and, in some cases, multiple aetiological factors that share common pathogenetic pathways have been documented. Predisposing factors that have environmental nature include race; whereby Caucasians are more affected than Asians than blacks; gender; males are more affected than females; exposure to more hours of sunlight reduces the likelihood of

DOI: 10.55920/JCRMHS.2023.04.001157

LCPD due to higher levels of vitamin D; People with low socioeconomic status are more likely to have malnutrition and therefore more prone to LCPD. Other predisposing factors include tobacco and wood smoke exposure, growth disturbances, low birth weight, obesity and inflammation. Also, people who are exposed to high mechanical overload like gymnastics and children who are highly active especially those with attention deficit hyperactivity disorder are more likely to have LCPD.3

Predisposing factors that have metabolic origin including among others, those that affect bone metabolism are considered risk factors for osteonecrosis and LCPD. These are High Density Lipoproteins (HDL), Tumour necrosis factor alpha (TNF-α) and interleukins (IL-1β, IL-6). Other factors include hypercoagulable states, inflammation and endothelium.3

Genetic predisposition to LCPD has also been shown in families with more than one affected family members in terms of either autosomal recessive or autosomal dominant inheritance depending on whether there is low or higher levels of family involvement respectively.3

The first stage of the disease is characterized by a temporary disruption in blood supply causing the head of femur to become necrotic.4 After a certain period of time, usually few weeks or lasting months to years, the damaged bone is reabsorbed and new bone is generated.5,6 The femoral head eventually heals, but during the disease process, deformity can develop, typically leading to gait disturbance, restricted mobility demonstrated by reduced range of motion of the affected hip joint, pain, and reduced physical activity.7 Occasionally the hip deformity is so severe that the child may require a total hip arthroplasty.8 Surgery is generally considered once skeletal maturity has been reached in late adolescence, usually around 17 years for females and 18 years for males. 9

The disease can be graded according to Catterall (1971) or Salter and Thompson (1984), based on the extent of epiphyseal lesion and extent of subchondral fracture visible on x rays in the early stages of the disease respectively. Herring (1992) provided the most recent grading which was based on the height of the lateral pillar of the femoral head epiphysis in the fragmentation period of the disease.3

Both surgical and non-surgical interventions have shown effectiveness once deployed on case-by-case basis and are aimed at preventing deformity of the femoral head, incongruence of the affected hip, and early onset of coxarthrosis (hip osteoarthritis). The main good prognostic indicators are onset of the symptoms at early age and the degree to which the femoral head (early stages) has been affected. 10, 11

Case presentation

A 14 years old primary school girl, participating in a HPV vaccine trial (Dose Reduction Immunobridging and Safety study of two Human Papillomavirus (HPV) vaccines among Tanzanian girls- DoRIS) evaluating the safety and immunogenicity of the single dose of HPV vaccines versus two and three doses. The girl was enrolled and randomized to receive three doses of a nonavalent (HPV 6/11/16/18/31/33/45/52/58) HPV vaccine, Gardasil®.

She was apparently healthy, however fifteen months after receiving a third and last dose of Gardasil® vaccine she came to the research clinic complaining of pain for three months. The pain involved the right hip which started on the pelvis area and progressively increased in intensity to involve the hip and the lower leg both on the right side. The pain was associated with limping and progressive right lower limb shortening. She reported no history of trauma and also no history of chronic illness. None of her family members had experienced similar complaints.

Full blood picture showed lymphocytosis, eosinophilia and neutropenia, Mean Corpuscular Volume (MCV) and Mean Corpuscular Haemoglobin (MCH) were slightly below the normal range with normal haemoglobin level and Red Blood Cells (RBCs) slightly above normal. Results for sickle cell disease were negative. General and systemic examination findings were also within normal range. Local examination of the right lower limb revealed shortening, with a discrepancy of approximately 2cm (between right

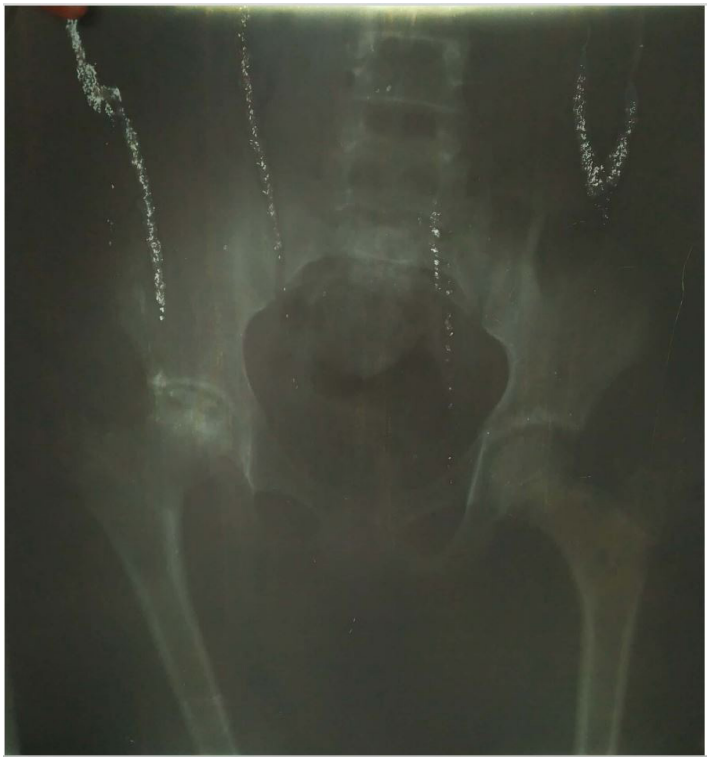

Figure 1: *Pelvis X ray image of the patient-AP view- three months after onset of symptoms*

DOI: 10.55920/JCRMHS.2023.04.001157

and left lower limbs), no swelling on the pelvic area, pelvic compression test was positive, right hip was tender on flexion with reduced range of motion on abduction and internal rotation.

Pelvic x ray revealed "Decreased joint space with osteoporosis and dislocation at the head of femur. Radio-opacification was noted in the head of femur"

From the clinical presentation, local examination and x ray findings, the Orthopaedic (OT) surgeon reached the diagnosis of Legg Calvé Perthes Disease (LCPD) and further referred the girl to a paediatric OT surgeon who also reached the same diagnosis and suggested that the most probable predisposing factor was an early childhood pelvis trauma which went unnoticed and unattended. At the orthopaedic workshop; they noted right Lower Limb Deformity (LLD) with 2.5cm shortening and recommended vertical compensation (right shoe rise), analgesics and three monthly follow up.

There was a notable improvement on the general condition and pain reduction following three monthly follow up to one year and the girl was still on shoe rise (vertical compensation). The OT surgeons considered that a girl had stabilized and recommended further surgical intervention after reaching the age of 18 years.

Follow up pelvic x ray two years later (three years from the start of the symptoms) showed features of Right side chronic perthes disease. Also, the articular margins were sclerotic with marginal osteophyte formation. Noted was also hairline transcervical fracture of the femoral neck and the normal bone density was preserved.

The orthopaedic surgeon advised planning for total hip arthroplasty and continuation of analgesics, joint support and vertical compensation while waiting for the surgical procedure.

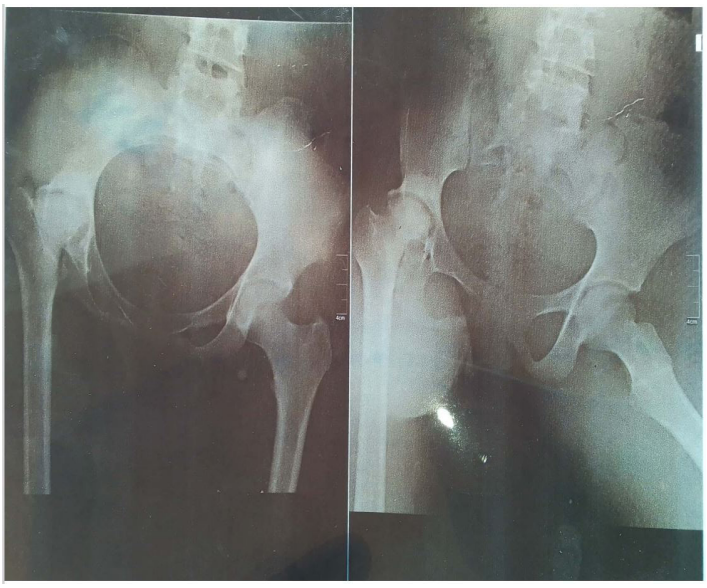

Figure 2: *Pelvis X ray image of the patient-AP view*

Discussion

Though we have limited information in terms of the predisposing factors for our patient's diagnosis, we could consider a pelvis trauma in early childhood to be the predisposing factor for a disruption of femoral head blood supply that led to LCPD. Our patient did not report a history of pelvis trauma, but children in these settings may be injured and fail to report especially if the pain is not severe due to fear of punishments.

The findings from the haematological tests (Full Blood Picture, FBP) were suggestive of the ongoing inflammatory condition and a possibility of an allergic reaction and/or helminthic and viral infections. LCPD has an inflammatory pathogenetic pathway but there were no clinical features suggestive of infection or allergies. We ruled out sickle cell disease which is one of the causes of avascular necrosis of the femur based on the negative sickle cell test result. We also did not consider genetic causes because none of the family members reported history of the same complaints as our patient. Unfortunately, we could not confirm this, due to lack of access to whole genome sequencing. We were also limited in terms of access to investigations on hypercoagulable states. Thus, it was not possible to rule this out, but the patient had no clinical features suggestive of hypercoagulable state.

Analgesics and Vertical compensation (shoe rise) were our first line of management so as to relieve pain and pressure on the affected hip joint respectively. This would prevent further damage to the femoral head and early onset of hip osteoarthritis. The approach has also been stipulated in some studies. This was an important step while waiting for surgery to reconstruct the affected hip joint once the bone has attained maturity. The age of 17-18 years is considered the most appropriate age for surgery because bone maturity would have been attained. Despite these measures, follow up done two years later (at the age of 17 years) our patient had developed hip osteoarthritis and a hairline transcervical fracture which necessitated surgical intervention.

This could be probably be due to late start for hip pain at the age of 14 years which is associated with poor prognosis compared to onset of symptoms at 4-8 years which is associated with good prognosis. Follow up pelvic x ray images at the age of 17 years (3 years post the onset of symptoms) also suggested an advanced disease with lesion of the femoral head that has covered more than 50% of the area. All these poor prognostic indicators suggested the need for total pelvis arthroplasty.

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Total hip arthroplasty (THA) also called total hip replacement surgery is one of the most cost-effective and consistently successful surgeries performed in orthopaedics. It involves reconstructing a damaged hip joint usually by removing the damaged parts and replacing them with implants. The surgery follows after a prolonged hip pain, hip osteoarthritis, reduced range of motion of the hip joint and reduced quality of life of the patient. In general, THA provides even more reliable and consistent positive results compared to its counterpart procedure, the total knee arthroplasty. 12,13,14

Our patient is a recipient of Gardasil® vaccine and was participating in a clinical trial that was evaluating the safety and immunogenicity of a single dose of HPV vaccine versus two and three doses and she started experiencing hip pain fifteen months after the last vaccine dose. However, vaccine exposure was ruled out to have any reasonable relationship with LCPD since there is limited data that indicate any association between bone abnormalities and the vaccine. Some studies have reported an overlap between vaccination and the post HPV- vaccination disorders such as a combination of orthostatic dysregulations, chronic regional pain syndrome and cognitive dysfunction, though the exact pathogenesis was unclear and no bone pathology was mentioned.15

Conclusion

LCPD still has no known aetiology although previous studies have suggested a range of predisposing factors including pelvis trauma. We think our patient is a case of unrecognised pelvis trauma which led to the avascular necrosis of the head of femur and hence LCPD.

Patients with poor prognostic indicators which include disease onset at more than 9 years of age and advanced femoral head lesion are prone to develop further deformity of the femoral head, incongruence of the affected hip, and early onset of hip osteoarthritis therefore vertical compensation to prevent damage to the femoral head and early planning for surgical intervention after reaching bone maturity is required.

Also, in our case, lack of temporal association between vaccination and disease onset, we do not think there is relationship between exposure to a nanovalent HPV vaccine and LCPD.

Declarations

Ethical Statement (ethical approval, consent to participate and for publication): The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee(s) and with the Helsinki Declaration (as revised in 2013). Written informed assent and consent were obtained from the study participant and her parent, respectively, for publication of this case report and accompanying images. Copies of the written assent and consent are available for review by the editor in chief of this journal.

Availability of data and materials: All data, images and any other patient information in this case report is available in the data storage section of the Mwanza Intervention Trials Unit- National Institute for Medical Research Mwanza Centre and is currently not publicly available. Other information referenced in this case report is available in the internet and can be accessed.

Competing interests: The authors declare that there were no competing interests in this case report.

Funding: DoRIS trial from which this case report was written is funded by the UK Department for International Development (DFID)/MRC/Wellcome Trust Joint Global Health Trials Scheme (MR/N006135/1) and the Bill and Melinda Gates Foundation (OPP1167526). The funders of the trial did not have any role in the design of this case report, data collection and analysis, data interpretation or writing of this report.

Authors contributions: PM prepared, organized and coordinated the manuscript, JC, GC, CM, SK, KB, DW, CL contributed in writing the manuscript. All authors read and approved the final manuscript.

Acknowledgement: Authors wish to express their gratitude to all those who participated in gathering data that supported the preparation of this paper. This includes the DoRIS study staff at Mwanza Intervention Trials Unit/ Tanzania National Institute for Medical Research- Mwanza Centre, Radiology staff at the Sekou Toure Regional Referral Hospital and the consultant orthopaedic surgeons for providing the diagnostic support.

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