CASE REPORT

Lead intoxication and knee osteoarthritis after a gunshot: long-term follow-up case report

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SUMMARY

This case is of a man who suffered gunshots and developed saturnism. Projectiles were removed from the abdomen, but one was left in the knee for 14 years. The patient presented with weight loss, headaches, loss of sight, tiredness, cramps, painful joints and trembling. We identified ataxic movements such as intense trembling of the limbs and anaemia. The abdominal pain caused eight internments in different hospitals, and the patient always received the diagnosis of intestinal subocclusion. We removed the bullet and did a wide synovectomy. The patient did not receive a clinical treatment with chelates. The symptoms of lead poisoning ceased, but he developed knee osteoarthritis, during the 7 years of follow-up.

INTRODUCTION

We present a case of an adult male, who suffered a fracture to the knee joint, caused by a projectile from a firearm. Initially, he was treated without surgery and the projectile remained intra-articular for 14 years, leading to lead poisoning. The metallic fragment was removed after the aforementioned period and intoxication receded. No chelate was used for detoxification, noting that the evolution of the disease could be seen. Four years after the surgery, the patient had arthritic pain in the knee. The patient was informed of and he consented to the present publication.

CASE REPORT

In 2006, we applied orthopaedic treatment at the hospital to a 42-year-old Caucasian man, gardener, presenting with pains and restricted movement of his left knee. The patient stated that 14 years ago he had been attacked with a firearm which resulted in a fracture to the left knee and lesion to the abdomen. On the day of accident, the patient was admitted for abdominal surgery and removal of the projectile. The fractured knee was treated conservatively and the projectile was left within the joint.

During the next few years, the patient began feeling abdominal pains which led to eight internments at different hospital units. He always received the diagnosis of intestinal subocclusion. The patient, furthermore presented with weight loss, headaches, loss of sight, tiredness, cramps, painful joints and trembling. The aforementioned symptoms were so intense that the patient was unable to work. We identified ataxic movements such as intense trembling of the limbs and anaemia.

X-rays taken of the left knee revealed the intra-articular projectile from a firearm in the posterior lateral region of the knee, with small metallic

fragments distributed around the three compartments of the knee, there were irregularities to the surface of the joint and reactionary bone formation, most evident in the patellofemoral joint. The amount of lead found in the blood stream was 129 µg/dL (figure 1).

We assessed lead poisoning and the need to remove the metallic fragments. Surgery was started through the anterior approach of the left knee, where the synovial membrane was found to be highly impregnated with lead, whereby a broad synovectomy was performed (figure 2).

The projectile was removed through a second access point to the rear side of the region. In the days following the operation, improvements were noted with respect to pain and mobility of the joint. The wound healing was uneventful (figure 3).

An anatomopathological study of the fragments from the joint revealed the impregnation of the synovial and fibrofatty tissues with the blackened material, from giant cell reaction, as in a foreign body, and chronic mononuclear inflammatory infiltration (figure 4).

The patient was sent for clinical treatment, with chelation. Yet, was unable to undergo treatment due to personal and social problems, even so, lead poisoning receded even without clinical treatment.

Six months after the operation, pain in the left knee improved significantly, leading to a greater movement of the knee. All other aforementioned symptoms had also improved, and the abdominal cramps for that period had ceased. A reduction in trembling and involuntary movement was evident.

In the following year the patient was asymptomatic. No treatment was requested by the patient for

Figure 1 X-rays of the left knee in anteroposterior and lateral views. They show the metallic bullet posteriorly in the lateral compartment and metallic fragments dissolved in the joint.

To cite: Gameiro VS, Araújo GCSde, Bruno FMM. *BMJ Case Rep* Published online: [please include Day Month Year] doi:10.1136/bcr-2013-009404

Figure 2 The knee with lead dissolved intra-articular.

intoxication alleging that the improvement was spontaneous. Another sample of the blood was taken, 17 months after surgery, where 48 µg/dL of lead was found to be present.

During the last 7 years, we have been following the case and found that in the first years after the procedure, the patient returned to their daily activities gradually. However, over the last 4 years, he has developed a constant moderate pain on the left knee, restricting movement to the joint and crepitation. X-rays revealed subcondral sclerosis, reactional peripheral bone formation (osteophytes) and a reduction of the articular gap in the left knee joint (figure 5).

At present, there are no signs of lead poisoning and the blood sample revealed 28 µg/dL. A graph of lead concentrations in the blood over the years is presented in figure 6.

DISCUSSION

The high level of incidents involving firearms had required orthopaedic surgeons to treat lesions caused by projectiles from the same. Treatment must include whether or not to remove the metallic fragments from the body, as on some occasions the removal of the fragment could lead to delicate operations, and broad dissection of the tissue and increase in the morbidity of a patient who is already debilitated by the trauma.

When the metal is lodged in the soft tissues, a fibrosis capsule ensues, impeding communication with the circulatory system and absorption of the lead. However, when the fragment is retained in the joint, the synovial liquid impedes the reaction with the foreign body and dissolving and absorption of the metal occur.^{1 2}

Some studies have noted an increase in serum levels of lead in patients with extra-articular lesions, yet few cases of

symptomatic clinical intoxication.^{3 4} Sanders *et al*,⁵ in a literary review, stated that the neurological and genetic toxicity mechanisms of lead can penetrate practically all bodily tissue. Exposure to relatively low levels of lead can lead to behavioural antisocial cognitive and psychotic disturbances.⁶

The present acceptable limit for plasmatic lead is 40 µg/dL,⁷ yet there are differences to biological limits of lead, in the organism, in terms of race and age.⁸

The literature refers to less than 100 cases of intoxication from removed projectiles from firearms.³ Wherein, of these, the hip joint was the most common.⁹ It is believed that the knee is more serious due to its greater synovial area.

Lead poisoning appears clinically in the circulatory system (anaemia and basophilic stippling), digestive system (anorexia, vomiting, constipation and abdominal cramps), cardiovascular system (systemic hypertension) and nervous system (peripheral and encephalopathic neuropathy),¹⁰ which may lead to death.¹¹

Lead poisoning is treated with chelates before and after the surgical removal of the metal.¹² A majority of the articles present chemical medication to reduce the levels of lead in the blood stream. We had found this in some literature, with the evolution of intoxication without the use of chelates¹³; however, intoxication levels in the blood stream were lower and with fewer symptoms than our patient.

Arthroscopy had been utilised in the removal of metallic fragments from articulations before.¹⁴ Good results have been reported in acute cases without the need for radical synovectomy. Though in the case of advanced cases, cleaning tissue of the impregnated joint is difficult when using arthroscopy.

Figure 3 The knee after removal of the metal and open synovectomy.

Figure 4 Histology with H&E stain showing impregnation of the synovial and fibrofatty tissues with the blackened material, from giant cell reaction, as in a foreign body and chronic mononuclear inflammatory infiltration.

Figure 5 X-rays in anteroposterior views of right and left knees, lateral view of the knee and axial view of the patella. These pictures demonstrate signs of osteoarthritis in the three compartments of the knee, and the difference for the contralateral joint.

Rhee and Martin detail directives for handling of projectiles retained in the limbs. Prophylactic removal of the fragments from the joints and bursae is recommended, through arthroscopy if possible, to avoid devastating complications from arthropathy and saturnism. They suggested, furthermore, that fragments in soft tissue should just be observed. In cases of intoxication chelation with EDTA, d-penicillamine and dimercaprol should be instituted both before and after the removal of the metal, until the presence of lead in the system is depleted.¹⁵

The presence of metallic fragments in the joint accelerates the degenerative process, directly through friction with the surface of the joint and mechanical destruction of the cartilage, and indirectly through constant inflammatory stimulus in the synovial. Thus, this may lead to secondary osteoarthritis in the long term.¹⁶ The patient presently shows clinical and radiological signs of osteoarthritis in the knee and is awaiting suitable conditions for total knee arthroplasty to treat the disease.

This paper presents the lead intoxication evolution after removal of the metallic intra-articular source. One can observe the reduction of blood stream levels, slowly, yet it was sufficient to improve the clinical condition of the patient, allowing him to return to his daily routine, without the need for further clinical treatment for the infirmity. It is clear that this paper does not recommend an exclusively surgical approach, but to relate a rare fact that occurred during our working activities, and to draw attention to the possible consequences when leaving a intra-articular projectile in the body.

Figure 6 The lead concentrations in the blood.

Contributors VSG drafted the case report and gave final approval of the text. FMMB did the clinical examination of the patient and collected the information regarding the x-ray images and histology. GCSdA wrote the text, organised the bibliographic review and discussion.

Competing interests None.

Patient consent Obtained.

Provenance and peer review Not commissioned; externally peer reviewed.

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