Lead arthropathy: a cause of delayed onset lead poisoning

Wilfred C.G. Peh, F.R.C.R.1, William R. Reinus, M.D.2

1 Department of Diagnostic Radiology, University of Hong Kong, Queen Mary Hospital, Hong Kong
2 Mallinckrodt Institute of Radiology, Washington, University School of Medicine, St. Louis, Missouri, USA

Abstract. Patients who suffer gun shot wounds often have retained bullet fragments within their bodies. These are usually of no clinical consequence. We describe three patients with retained bullets within their hip joints. One of these patients, who had extensive ground intra-articular bullet fragments and secondary osteoarthritis of the hip, presented with signs, symptoms, and laboratory data consistent with lead intoxication. The bullet and metallic fragments were removed surgically with good clinical response. Two patients whose bullets were implanted entirely within the femoral head and whose joints showed smaller degrees of lead fragmentation had no symptoms of lead intoxication. The degree of intra-articular fragmentation of the bullet and the surface area of lead exposed to synovial fluid are emphasized as decisive factors with respect to appropriate therapy.

Case reports

Case 1

A 73-year-old man complained of having suffered from increasing weakness, progressive difficulty in carrying out activities of daily living, and shortness of breath over the past 2 weeks. He also complained of accentuation of longstanding bilateral leg pain that resulted from a gunshot wound to his right hip 52 years earlier. For several months he had suffered from decreased appetite and chronic epigastric pain. He had a past history of hypertension, cholecystectomy, and left hernia repair.

Physical examination, including the neurological examination, showed no abnormalities. His hemoglobin concentration and hematocrit were 6.9 g/dl and 21.7% respectively. His white blood cell count was 6000/dl, platelet count was 234000/dl, and his reticulocyte count was elevated at 5.7%. A peripheral blood smear showed marked polychromasia with occasional target cells, histiocytes, and ovalocytes. The patient was investigated for hemolytic anemia and an autoimmune process was excluded. His haptoglobin level was 133 mg/dl, a direct Coombs test was negative, and his bone marrow biopsy showed features of refractory anemia with ring sideroblasts. His iron, TIBC, ferritin, and vitamin B12 levels were all normal. An upper gastrointestinal barium series was normal. The patient's serum lead level was markedly elevated at 460 μg/dl (normal <25 μg/dl).

Radiographs showed a bullet partially embedded in the medial portion of the right acetabulum and partially protruding into the joint space (Fig. 1a). There were several tiny metallic fragments within the joint cavity. The right hip joint had changes of severe osteoarthritis, with osteophytes, joint space narrowing, subchondral cysts, and sclerosis. The left hip joint was normal. The patient was given three units of packed red blood cells and underwent removal of the intra-articular bullet fragments together with a total hip replacement (Fig. 1b). He made a satisfactory recovery with symptomatic improvement.

Case 2

A 71-year-old woman complained of vague abdominal discomfort. She had many medical problems including hypertension, hiatus hernia, obesity, hypercholesterolemia, and a history that included hysterectomy, knee ligament surgery, and post-traumatic removal of her left eye. She had a remote history of a gunshot wound to the right hip. Except for mild bilateral lower limb edema and hypertension, the findings of physical examination were nega-
tive. Her hematocrit was 42.2% and her hemoglobin concentration 13.6 g/dl. With the exception of a cholesterol level of 250 mg/dl, her laboratory results were normal. A radiograph of her right hip, obtained because of right leg pain and swelling, showed a large bullet fragment projecting over the intermedial aspect of the right femoral head (Fig. 2). There were some small fragments which followed the contour of the hip joint and were most likely intra-articular. Because of these findings, the plasma lead concentration was determined, but it was normal (4 μg/dl).

Case 3

A 68-year-old man with a long history of tobacco abuse complained of increasing dyspnea, productive cough, left-sided chest pain, and 20 lbs (9 kg) weight loss over 3 months. A chest radiograph and subsequent computed tomography showed a left hilar mass and a large left pleural effusion. Cytological analysis of some aspirated pleural fluid was consistent with a diagnosis of adenocarcinoma. A bone scan showed foci of abnormal radiopharmaceutical uptake in the calvaria, left fifth and sixth ribs, the right hip, and the left femoral neck. Also noted was a small photopenic defect in the femoral head. Correlation radiographs of the right hip showed a large bullet fragment embedded within the femoral head (Fig. 3). There were a few tiny fragments that appeared to lie in the soft tissues outside the joint proper. Moderate osteoarthritis was present, particularly in the superolateral aspect of the hip joint. The patient had no signs or symptoms attributable to systemic lead poisoning, but the plasma lead concentration was not determined. His hemoglobin level was 9.5 g/dl and his hematocrit was 28%, consistent with anemia. This was thought to be anemia of chronic disease and was not pursued. He was treated with palliative radiotherapy for inoperable adenocarcinoma of the lung.

Discussion

The first report of lead poisoning from retained bullets appeared in the English-language literature in 1874 [1], but lead poisoning of this etiology was not verified by biochemical measurement of plasma lead concentrations until 1942 [2]. A 1988 literature review identified only 23 fully documented cases of lead toxicity secondary to retained lead missile fragments [3].

The clinical diagnosis of lead poisoning in adults is often difficult, as symptoms may be intermittent and nonspecific and may manifest at variable periods after bullet entry. The onset of symptoms has ranged from 3 weeks to 48 years after trauma [2-13]. We believe that the 52-year interval in our first case represents the longest documented delay of a clinical presentation of plum-bism secondary to a gut shot wound.

The spectrum of clinical features from lead intoxication includes abdominal colic, weakness, encephalopathy, renal failure, and anemia [9, 16]. The anemia, present in our case 1, has been reported to be associated with an enzyme deficiency (erythrocyte pyrimidine 5'-nucleotidase) and reverses with correction of the plasma lead level [16].

Development of lead intoxication from bullets lodged in soft tissues is very uncommon as the projectiles are surrounded and walled off by a fibrous reaction that renders them inert [17]. In bursal and joint spaces, however, there exists a high risk of poisoning as lead is dissolved.