

The Global Lead Advice and Support Service (GLASS) provides information and referrals on lead poisoning and lead contamination prevention and management, with the goal of eliminating lead poisoning globally and protecting the environment from lead.
GLASS is run by The LEAD Group Incorporated ABN 25 819 463 114



Question: What are the lead poisoning risks of a lead pellet, bullet or shot lodged in the body?

*By Elizabeth O'Brien, Manager, Global Lead Advice and Support Service, Australia.
17th March 2002, updated 21st February 2011.*

Answer:

Though there may be instances when the lodged lead foreign body does not entail significant amounts of lead entering the blood stream, the following statement [Reference: North Dakota [USA] Department of Health website - www.health.state.nd.us/ndhd/pubs/prevent/leadpain/leadpain.htm (2002)] found on the web on 28th March 2002 is simply not true:

"Even a lead bullet lodged in someone's leg does not present a blood lead poisoning danger because the lead does not enter the bloodstream."

NB: this website also states "Lead-based paint cannot be absorbed through the skin." This statement is also not true. [Ref: *Skin Absorption of Ionic Lead Compounds* by Florence, Mark; Stauber, Jenny; Dale, Les; Henderson, Dale; Iazard, Beverly; & Belbin, Kerryne, in Journal of the Australasian College of Nutritional & Environmental Medicine, Vol. 15, No. 2, December 1996, pages 11-12 - www.acnem.org/journal/15-2_december_1996/skin_absorption_of_lead.htm] Following a complaint, as at 17th April 2002, the offending factsheet did not appear to be on the website any longer.

A web-published case study in 2001 involving a lead bullet lodged in the left hip joint of a man 15 years earlier, clearly demonstrated that lead was entering the blood stream from the now fragmented bullet - the only identifiable lead source. "His serum lead level was 198 microg/dL (normal range is 0-30 microg/dL), indicating chronic lead poisoning.... The patient was started on chelation therapy, and left-hip synovectomy [removal of all or part of the membrane that lines the joint] and hemiarthroplasty [the replacement of one joint surface with artificial material] were performed. The serum lead level dropped to a normal range within 2 weeks."

The man's doctors recommended that if an x-ray identifies bullet fragments within the cavity of a joint, the patient should be seen immediately by an orthopedic specialist. Both the lead poisoning and the disease of the joint could be prevented by the timely removal of lead particles and devitalized bone tissue. Once the joint and cartilage have been coated

with lead particles from the lead fragments, due to the acidic synovial fluid in the joint, joint replacement and removal of all or part of the membrane that lines the joint are often necessary. All patients whose x-rays identify opaque lead particles lining a joint which contains lead fragments, should have a blood lead test to determine whether they are lead poisoned. [Ref: *Management strategy of a patient with intraarticular bullet, Case of the Week - Discussion, April 23, 2001*, by Joseph DeMartini, Anthony Wilson, Jerry S. Powell, Clermont S. Powell, Harborview Medical Center, Seattle, WA and University of California, Davis, Sacramento, CA (2001) www.ajronline.org/cgi/content/full/176/5/1144]

The Sydney Morning Herald (SMH) reported in 1997 on the first visit by a doctor in 21 years of war to an East Timorese guerilla camp where 10 of the 12 fighters were carrying bullets in their bodies. Faced with the prospect of one of his men not being able to run for 3 months due to a severed tendon if he had the bullet removed from between a main tendon and the bone in his thigh, the commandante instructed the military doctor to leave the bullet there. "The long-term prospect of lead poisoning is set against the short-term risk of capture."

"One [of the guerrillas] had shell fragments in his face, the grey of the metal clearly visible under his gums when he pulls down his lower lip. This man coughed blood and also has leg and hip wounds, the bullets embedded in bone and now grown over, making the impossible to remove. Most of the men have malaria and kidney infections from bad water..."

"A plastic groundsheet is laid out and scrubbed with disinfectant. The doctor, a former military man, administers a local anaesthetic and bends over one of the fighters. He uses a scalpel, clamped in pliers for a better grip, to slice open an old wound and remove a bullet." [Ref: "Agony of East Timor - Secret life of the resistance" by Sydney Morning Herald Special Correspondent, Sept 1997]

There is an historically interesting case of probable lead poisoning of a United States President, Andrew Jackson (1764-1845), due to the same action of synovial fluid on a bullet lodged in his left shoulder from a gunfight in 1813. Jackson also had a bullet lodged in his left lung from a duel in 1806, but when the medical evidence for Jackson's lead (and mercury) poisoning was reviewed in the Journal of the American Medical Association (JAMA) in 1999, the authors noted that:

"The 1813 bullet wound shattered the left shoulder and contact with synovial fluid in joint space is highly likely. Bony sequestrum [dead bone tissue that had become separated from the surrounding healthy bone] implying osteomyelitis [inflammation of the bone marrow and the adjacent bone, was sloughed from this wound in 1814."

The evidence found by the researchers, both from the historical records of symptoms, and hair lead analysis, is consistent with lead poisoning. In 1824, Jackson began to develop rapid progressive dental caries and by 1828, all his teeth had been removed. Jackson wrote often of intestinal complaints after meals - intense abdominal cramping, constipation, nausea, griping and headache. An 1815 hair sample analysed for lead in 1999 showed 105 to 156 ppm (parts per million) lead. By 1829, Jackson's handwriting became almost illegible due to pains in his limbs, particularly his right wrist. Jackson's doctor removed the bullet from his shoulder in 1832.

"The bullet was described as flattened by contusion on bone and hackled on the edge. Jackson reported improved health following the procedure."

A hair sample cut from Jackson's head in 1839 was found to have 68 to 70 ppm lead. The authors suspect that Jackson probably died of chronic renal failure. [Ref: [Andrew Jackson's Exposure To Mercury And Lead - Poisoned President?](#) By Deppisch, Ludwig M; Centeno, Jose A; Gemmel, David J; & Torres, Norca L in JAMA Vol 282 No. 6, pp 569-571 (1999).]

It is interesting to note that another JAMA study had concluded in 1996 that:

"Low level exposure to lead may impair renal function in middle-aged and older men. Longitudinal data suggest an acceleration of age-related impairment of renal function in association with long-term low-level lead exposure." [Ref: [A Longitudinal Study Of Low-Level Lead Exposure And Impairment Of Renal Function - The Normative Aging Study](#) by Kim, Rokho; Rotnitzky, Andrea; Sparrow, David; Weiss, Scott; Wager, Carrie & Hu, Howard, in JAMA Vol 275 No. 15, April 17, (1996).]

Many people seem to have concluded from cases like the two above that only a bullet lodged in the joint cavity is a lead poisoning risk, though the www.shooters.com discussion group entry below adds spinal canal to the list of dangerous places for a bullet to be lodged:-

"About as good an authority as we can find is Colonel La Garde, a U.S. military surgeon from the Sioux Rebellion to the First World War. He illustrates many early twentieth century X-rays of men who functioned relatively happily with Civil War Minié balls, lead shot etc, which had been lodged in flesh or bone for many decades. These are commonly blackened, but not roughened or pitted. He claims that lead poisoning for this reason is almost unknown. It occurs when a bullet is lodged in a joint or the spinal canal, suggesting that only the lubrication sinovial fluid is capable of dissolving lead into the metabolism." [Ref: Ballistics in Scotland, contribution to www.shooters.com made on 4th January 2002]

Not all lead poisoning by lodged ammunition results from the lead being in the joint cavity or the spinal canal. The following abstract notes the sad case of a child lead poisoned by lead shot lodged within the skull.

*"We report the case of a child with retained intracranial **lead** pellets from a gunshot injury, in whom elevated blood **lead** levels were detected approximately 1 year after the injury. No environmental source of **lead** was found, and a twin sister living in the same dwelling had considerably lower **lead** levels. The patient's **lead** levels diminished after each of four courses of chelation, but rebounded each time to potentially toxic levels after termination of therapy. Physicians should be particularly alert in screening for elevated **lead** levels in children with retained bullet fragments. In patients in whom removal of the bullet fragments is impractical, the potential risks of long-term chelation therapy must be weighed against the risks of **lead** toxicity."* [Ref: [Lead poisoning in a child after a gunshot injury](#) by Kikano GE ; Stange KC, [J Fam Pract](#), 34(4):498-500, 502, 504 (1992) Apr]

Lead objects can also cause appendicitis, as shown by the case of a 9 year old boy who developed acute appendicitis 4 days after eating meat of a pheasant killed by shotgun. The

researchers also refer to a 1982 case of a bullet in the appendix and a 1988 case of airgun pellet appendicitis and note that "as many as 500 gun shots have been located in the appendix of patients who routinely consume wild game" and:

"Gunshot wounds to the abdomen may be an indication for appendectomy if the presence of gun shot within the lumen of the bowel is suspected. Although ingested gun shot often does not become symptomatic until long after ingestion despite the presence of multiple pellets in the appendix, acute appendicitis may rapidly ensue if even one pellet becomes lodged in the appendix."

[Ref: *Appendicitis Due to Bird Shot Ingestion: A Case Study* by ANGIE R. LARSEN, M.D. and ROBERT H. BLANTON, M.D. from the website of THE AMERICAN SURGEON www.highbeam.com/doc/1P3-55050726.html]

Finally, the following abstract is about a man whose lead shot was lodged in his stomach and face:

"a case of symptomatic lead toxicity (plumbism) with abdominal colic and hemolytic anemia following a gunshot wound. It is a retrospective case report and the setting is in a teaching hospital in south central Los Angeles. The case report is that of a patient who presented with abdominal pain, generalized weakness, and hypertension following multiple gunshot wounds, 15 years previously. Other causes of abdominal pain and weakness-such as diabetes mellitus, alcohol abuse, pancreatitis, and substance abuse-were ruled out. Interventions included treatment with the newer oral chelating agent, Succimer (2, 3-dimercaptosuccinic acid), and subsequent surgery. The main outcome was the initial reduction in blood lead levels with improvement of symptoms. Because of a recurrent rise in the blood lead levels, the patient was again treated with Succimer and underwent surgery to remove two bullet fragments from the face. We conclude that lead toxicity should be ruled out in patients presenting with abdominal cramps and a history of a gunshot wound. Prompt therapy-including environmental intervention and chelation therapy is mandatory, and surgical intervention may be necessary.

[Ref: *Case Report: GUNSHOT-INDUCED PLUMBISM IN AN ADULT MALE* by Abbasi J. Akhtar, MD; Allen S. Funnye, MD; and Jonathan Akanno, MD, Los Angeles, California, in JOURNAL OF THE NATIONAL MEDICAL ASSOCIATION VOL. 95, NO. 10, OCTOBER 2003 pp 986-990, www.ncbi.nlm.nih.gov/pmc/articles/PMC2594485/pdf/jnma00314-0085.pdf]