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## Airgun Pellet in Soft Tissue, Extra-Articular, May Create Long-Term Joint Morbidity: Case Report and Literature Review

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**Abstract- Introduction:** Pellet gunshot injuries occur quite frequently, especially among teenagers. Although conservative approaches to treatment are broadly accepted, such measures should account for any potential ramifications for the surrounding organs or other structures. Migration, infection, and limitation of proper functioning are hazards that should be weighed when evaluating the need for further steps.

**Case presentation:** We report the case of a 25-year-old male, presented to our emergency department a few hours after incurring an airgun shot in the region of his right knee. Clinical examinations and a radiological assessment revealed the pellet to have struck in an extra-articular location, and indicated that the patient would be able to tolerate the injury with mild painkillers. However, after a few weeks the patient was experiencing limitations in joint movement, though the location of the pellet had not changed. This prompted major concern about the correct clinical pathway to follow in such cases – especially for patients who are athletes.

**Keywords:** *pellet, gunshot, extra articular, soft tissue, injury.*

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# Airgun Pellet in Soft Tissue, Extra-Articular, May Create Long-Term Joint Morbidity: Case Report and Literature Review

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**Conclusion:** Injury management for small pellet gunshots should not be as generalised as it is in the conservative approach. More individualised decision-making is required.

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## I. INTRODUCTION

Management of foreign bodies secondary to a gunshot wound – especially those involving airgun pellets – are well accepted worldwide, particularly if asymptomatic. Symptomatic incidences require medical intervention.

Owing to the limited effects of airgun pellets on patients, many surgeons will not intervene as a general rule. However, this general rule may lead to patient dissatisfaction with the plan of care.

Other challenges, potentially including exposure of the managing team to legal action, may be encountered if loss or limitation of function of some organs is incurred as a secondary complication of inflammation, migration, or fibrosis of nearby structures.

## II. CASE PRESENTATION

A 25-year-old male was presented to our emergency department after trauma had been inflicted

to the lateral side of the patient's right knee. This was caused by an airgun pellet fired from a distance of 30 metres a few hours prior to presentation, with an entry wound only.

The general clinical examination was unremarkable. The local examination showed a small entry wound from the pellet, with no exit wound. There were no signs of underlying haematoma, significant skin loss, active oozing, or limitation of knee joint movement; the pellet was not palpable; and the patient was able to move his limb and his knee joint, with some pain at the injury site. An X-ray showed the pellet, in one complete piece, on the lateral side of the right knee joint (extra-articular), and showed no fracture, neurovascular injury, or other complications. The patient's wound was irrigated and cleaned, prophylactic antibiotics were given and tetanus immunoglobulin was administered. The patient was then discharged with painkillers and standard instructions.

This patient presented to the outpatient clinic after two weeks with some movement limitation of the right knee joint, caused by mild to moderate pain. A CT scan showed the pellet in the same location on the lateral side of the knee joint, extra-articular. There were no signs of inflammatory reaction around the pellet. The patient was demanding removal of the pellet.

This demand was taken under consideration by the medical team, bearing in mind legal action that might arise as a result of patient dissatisfaction.

## III. DISCUSSION

Approximately two- to 2.5-million non-powder firearms are sold annually, and approximately 12.9 people per population of 100,000 are treated each year for injuries that result from such weapons in hospital emergency departments across the United States(1). Airguns are non-powder firearms that use compressed air or another form of compressed gas to propel a projectile such as a pellet.

They are widely regarded more as toys than as tools or weapons. Each year, more than 30,000 air weapon injuries are reported in the United States(2).

The spectrum of airgun injuries ranges from local skin damage to severe chest, abdominal, cerebral, and vascular injury. Soft-tissue injuries are most common, but injuries to the head, chest, neck, and

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abdomen are not infrequent. Airgun injuries can be disabling or even fatal. Shaw and Galbraith reported two deaths from penetrating cranial injuries(1).

The spectrum of air gun injuries ranges from local skin injury to severe chest, abdomen, cerebral, and vascular injury. Soft tissue injuries are the most common type of injury, but injuries to head, chest, neck, and abdomen were not infrequent, either. 6 Air gun injuries can cause disabling and fatal injuries. Shaw and Galbraith<sup>7</sup> reported 2 deaths from penetrating cranial injuries. Air guns, modern or traditional models, are powerful weapons that are capable of causing serious or life threatening injuries, although modern ones are low powered due to safety concerns and legal restrictions. The critical velocity required for penetration of human skin by an air rifle pellet is around 125 feet per second to 230ft/s (38 miles per second to 70m/s). A high-energy missile can be defined as an object travelling at a speed in excess of 2,000ft/s. Low-energy missile injuries occur at velocities below 1,500ft/s(3).

Direct effects on tissues, such as laceration and crushing, occur within the missile tract, rather than occurring as effects resultant from temporary cavitation. Airgun injuries may not always be immediately apparent. Patients may be unaware of having been shot, and the entry wound is often very small: thus, serious injuries may be missed completely(4).

People who are unclear in their management plan will require the coordination of multiple surgical disciplines in order to optimise the prospective functional and aesthetic consequences(5). Definitive management of patients with airgun wounds remains controversial, in terms of the reconstruction of bone and soft-tissue defects(6).

Most low-velocity gunshot wounds may be safely treated non-operatively, with simple local wound care (superficial irrigation and careful cleaning followed by a dressing, with or without antibiotics) and outpatient management(7). These 'minor wounds' include low-energy uncontaminated injuries of the skin, subcutaneous tissue, and muscle, and also fractures that do not require operative stabilization. Tetanus prophylaxis with a reinforcing booster of 0.5mL of tetanus toxoid is indicated for all gunshot wound patients who are not completely immunised (fewer than three immunisations) or who have uncertain immunisation histories(8).

Many airgun pellets are made of lead, which creates major safety concerns. As there is no level of lead exposure that is currently considered safe, the effects of an airgun wound on blood lead levels and on related symptoms are a serious consideration, even when there are few fragments, the wound is extra-articular, or the existing blood lead levels are low(9).

The literature contains few case reports of patients who have presented clinical signs of lead poisoning caused by airgun wounds. Blood lead levels

are not routinely monitored, but the few studies that have been proposed to investigate it have shown increases in blood lead levels(10-13).

There are clinical manifestations within a number of systems. These include anaemia, basophilic stippling, and porphyria within the haematological system(14); anorexia, vomiting, constipation, abdominal pain, and cramps within the digestive system; arterial hypertension within the cardiovascular system; and peripheral neuropathy or encephalopathy within the neurological system. Complications such as these may lead to death (15, 16).

#### IV. CONCLUSION

At present, clinical pathways do not adequately accommodate the short- and long-term consequences of trauma inflicted by airgun pellets. The lack of research conducted in this area to date may result in patients receiving suboptimal care, and may expose managing teams to complaints from patients.

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