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An airgun projectile in the maxillary sinus of an adult: a case report

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58

Abstract

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Gunshots with non-powder weapons are relatively common in children, and most of them occur unintentionally. This paper describes the second known case of an adult male in whom a shot from an airgun resulted in the presence of a projectile within the maxillary sinus. A 47-year-old man was shot inadvertently about 10 years earlier and was asymptomatic at the time of reporting. The presence of a foreign body detected on a routine orthopantomogram was confirmed by a medical interview and a three-dimensional radiological examination. The pellet located in the right maxillary sinus was removed from intraoral access through the anterior wall of the sinus. The course of the surgical procedure was complicated by the projectile dislocation in relation to the position determined by radiological examinations. Postoperative care and a 4-year follow-up period were uneventful. The maxillary sinus may be considered a favorable location for a persistent projectile, which may reside in the maxillofacial region asymptotically for many years. The foreign body may move loosely in the maxillary sinus, which should be taken into account when planning an operation.

Keywords: Case Report; Penetrating Head Injuries; Gunshot Wounds; Foreign Bodies; Maxillary Sinus

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Introduction

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A gunshot wound is a penetrating injury caused by a fired projectile. A non-powder weapon (NPW) is one that fires bullets using compressed gases, springs, or electricity [1]. This group includes airguns that shoot lead projectiles in the form of pellets (Figure 1) and ball bearings (BBs) [1]. An NPW gunshot can result in numerous bodily injuries, including bone fractures, vascular and organ damage, wound infection, and death [2, 3]. In the event of an injury to the face, structures such as eyes, nerves, vessels, muscles, and bones can be damaged, which can result in disability, facial deformities, and cosmetic defects [4, 5].



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Fig. 1. Airgun pellets. AlexanderRahm, CC BY-SA 3.0.

Gunshots with NPWs are relatively common in children. In this age group, 71-99% of them occur unintentionally [2, 3, 6]. Jones et al. report that 46% of NPW shots result in foreign body retention in tissues [3]. The same authors calculated that 39% of gunshots from NPW occurred in the head and neck region, including the sinuses [3]. Typical post-gunshot diagnostics include a physical examination and radiographic imaging, while treatment is mainly based on surgical intervention and antibiotic therapy [7].

117 The paranasal sinuses are pneumatic spaces present in the craniofacial bones. Four
118 groups of paired sinuses are recognized in humans: frontal sinuses, sphenoid
119 sinuses, ethmoid sinuses, and maxillary sinuses [8]. The largest of human paranasal
120 sinuses are the maxillary ones. Maxillary tuberosity is the posterior wall of the
121 maxillary sinus, the orbital floor forms its top, and its bottom consists of the alveolar
122 processes of the maxilla. Through its base, there is a connection between the sinus
123 and the nasal cavity. Through the anterior wall of the maxillary sinus blood vessels
124 and the infraorbital nerve pass [9]. Conditions that may affect the maxillary sinus
125 include odontogenic, acute, and chronic sinusitis, benign and malignant neoplasms,
126 and the presence of foreign bodies [10]. Maxillofacial surgery or otolaryngology
127 procedures performed within the maxillary sinus include, first of all, rinsing the
128 maxillary sinus, functional endoscopic sinus surgery, and Caldwell-Luc surgery
129 [11].
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131 There exist eight known cases of gunshots from non-powder weapons (NPWs) in
132 the literature, resulting in the bullet remaining in the maxillary sinus [12–17]. Only
133 two of these cases concerned a shot adult, a 30-year-old woman, and a 40-year-old
134 man [14, 17]. This paper aims to publish the second description of the diagnosis and
135 removal of an NPW projectile from the maxillary sinus of an adult male [17, 18].
136 The case report was developed according to the CARE Case Report Guidelines, and
137 its layout follows from the CARE checklist [19].
138

139 Case report

140 A 47-year-old man presented to the dental surgery clinic in July 2019 for removal
141 of impacted lower wisdom teeth. The patient was treated for hypertension, diabetes,
142 and a cataract of the left eye. A routine dental panoramic radiograph (DPR) showed
143 a contrasting foreign body in the right maxillary sinus (Figure 2). The anamnesis
144 revealed that the patient was shot in the right cheek with an airgun about 10 years
145 earlier (being around 37 years-old) and that the revealed foreign body is most likely
146 a pellet left over from the shot. The patient stated that he was aware of the presence
147 of the pellet within the tissues, but he was advised so far against surgical interven-
148 tion due to the lack of ailments. During the diagnostic process, any symptoms of the
149 presence of a foreign body, including lead poisoning, were excluded. The
150 examination showed no signs of inflammation nor noticeable scarring of the cheek
151 skin. The oral vestibule mucosa was intact and without signs of inflammation. The
152 lack of symptoms of foreign body presence contributed to the delay of the surgical
153 intervention. Nevertheless, after the clinical examination, presentation of the
154 projectile location, and discussion of the surgical treatment options, the patient was
155 determined to have the projectile removed.

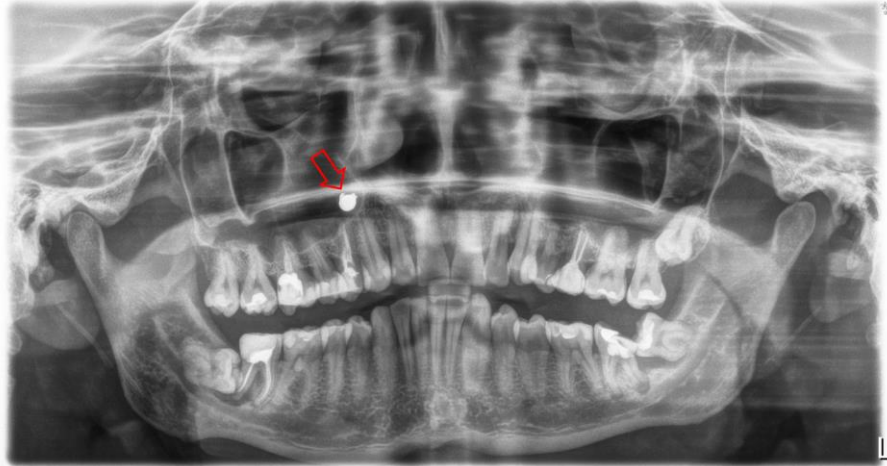


Fig. 2. Orthopantomogram.

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Cone beam computed tomography (CBCT) was performed, which allowed a precise determination of the location of the pellet (Figure 3, A-C). Three-dimensional images suggested that the pellet was embedded in the slightly inflamed mucosa of the maxillary sinus alveolar recess, further motivating the patient to remove the foreign body. Due to CBCT images, the presumed projectile location was established, post-shot anterior sinus wall bone defect was located, and further damage to the adjacent structures was excluded. The pellet was removed as an open surgery procedure through the post-shot bone defect, which required slight enlargement. The procedure was performed under local anesthesia in the reclined patient position. The assumption made based on CBCT that the pellet is surrounded by soft tissues turned out to be wrong. Despite consistent orthopantomogram and tomography images, no lead foreign body was found in the mesial part of the alveolar recess. The pellet was shifted by gravity to the lowest point of the maxillary sinus for the supine head. After intraoperative visual re-localization, the pellet was removed. The operative access was closed in a typical manner and healing was uncomplicated. In accordance with local recommendations, antibiotic prophylaxis was implemented due to surgery on the maxillary sinus via intraoral access [20].



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Fig. 3. Cone beam computed tomography – an airgun projectile in the right maxillary sinus with thickened mucosa. A – coronal view, B – sagittal view, C – axial view. Planmeca ProMax 3D Mid, “average teeth” protocol (90kVp/17.1mAs/2.8s; ø90mm x 90mm field of view).

The patient summarizes the diagnostic process as quick and non-invasive. He perceived the foreign body removal procedure as relatively quick and not burdensome. The patient did not experience any excessive discomfort during the healing process, which he describes as good and quick. After healing, he did not experience any discomfort from the operated area, and he considers his decision to have the pellet removed as correct. The uneventful follow-up period was over 4 years until the manuscript for this report was accomplished in December 2023.

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Discussion

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Airgun injuries to the paranasal sinuses are rare and usually presented in case reports [12–17]. Most of them concern bullets in the maxillary sinuses. Sphenoid and ethmoid sinuses are less frequent localization of persistent NPW pellets [21, 22]. Injuries are usually more severe in children due to their lower bone density [23]. These types of foreign bodies are typically localized during routine post-traumatic diagnostics in hospital emergency departments. Nevertheless, due to the lack of symptoms or slight symptoms after the shot, pellets are sometimes identified on routine radiographs ordered for other indications, which happened in the described case. Conventional (fan beam) computed tomography or CBCT scans are useful in determining the exact position of a pellet before its removal [12, 13, 15].

Despite the poisonous nature of lead, Kühnel et al. state that the main factor in lead poisoning is the location of the projectile, rather than the exposure time [15]. In the case described by these authors, the 50-year presence of a foreign body in the maxillary sinus did not result in lead disease, which was then thoroughly confirmed by laboratory tests [15]. The course of lead poisoning is individual for each patient, whereas children absorb this compound more than adults. Due to the growth process, their tissues are more prone to damage. Whether it is chronic or acute

215 poisoning, the spectrum of symptoms includes various systems, for example,
216 nervous (both central and peripheral), immune, digestive, urogenital, cardiovascular,
217 and hematological disorders, such as anemia [24]. In acute lead poisoning, the most
218 characteristic symptoms are neurological (pain, muscle weakness, paraesthesia),
219 gastrointestinal (nausea and vomiting, defecation disorders, decreased appetite,
220 weight loss, and feeling of metallic taste in the mouth), kidney damage, and
221 hemolytic anemia [25]. In turn, chronic lead poisoning is characterized primarily by
222 disorders of the nervous and digestive systems. The Burton line, a thin blue-violet
223 line along the gums, is typical for chronic lead poisoning and deserves attention as
224 well [26]. In the case described in this report, no such symptoms were noted. The
225 free movement of the foreign body within the maxillary sinus probably minimized
226 the lead absorbance.

227 Surgical removal using the Caldwell-Luc approach is a proven method, which in
228 the described case turned out to be useful due to the persistent defect of the anterior
229 wall of the maxillary sinus [27]. When choosing the Caldwell-Luc approach,
230 bleeding from the posterior superior alveolar artery may be problematic, the course
231 of which should be previously monitored radiologically [28, 29].

232 An alternative to open surgery is endoscopy, which in many situations is preferred
233 because it is less invasive, and therefore the risk of complications is reduced [30].
234 The limitation of endoscopic methods is their lower availability resulting from the
235 higher cost of the procedure. In known cases of NPW gunshots, there were no com-
236 plications associated with the bullet removal from the maxillary sinus [12–16]. In
237 four cases the bullets were removed by Caldwell-Luc surgery, and in two cases by
238 endoscopic antrostomy. Hara et al. reported that both the Caldwell-Luc approach
239 and endoscopic methods are effective and safe [27]. The choice of treatment method
240 depends on the location and the size of the foreign body [27]. Alleged presence of a
241 projectile in the anterior part of the maxillary sinus was the reason for choosing the
242 Caldwell-Luc approach in the case described.
243

244 **Conclusions**

245 The maxillary sinus may be considered a favorable location for a persistent
246 projectile. A lead pellet may reside in the maxillofacial region asymptotically for
247 many years, as in the case under discussion. The foreign body may move loosely in
248 the maxillary sinus, which should be considered when planning a surgery to remove
249 it.
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261 report as all the images were anonymized and no private data were provided
262 allowing the patient's identification.

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Authors contribution:

Author	Contributor role
Turosz Natalia	Conceptualization, investigation, writing—original draft preparation, writing—review and editing
Kamińska Monika	Investigation, resources, writing—original draft preparation
Chęcińska Kamila	Methodology, investigation, resources, writing—original draft preparation
Chęciński Maciej	Conceptualization, methodology, data curation, writing—original draft preparation, writing—review and editing, visualization, supervision, project administration

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