Cavernous Sinus Syndrome and Traumatic Carotid-Cavernous Fistula Attributable to a Self-Inflicted BB Gunshot Injury

Marcellino CR, Graffeo CS, Perry A, Wetjen NM, Link MJ
Mayo Clinic, Department of Neurologic Surgery, Rochester, Minnesota

Background
BB guns are a class of gas- or spring-powered projectile weapons whose power and muzzle velocity are often underestimated by casual users and children. Present technology has advanced such that modern BB guns produce high velocity but small caliber ballistic injuries which can penetrate the intracranial space and cause focal central neurologic deficits.

The small size of the projectile simultaneously complicates diagnosis and treatment, particularly if the entry wound is not appreciated by the layperson, resulting in delayed care.

We report a unique case of cavernous sinus syndrome precipitated by a self-inflicted facial BB gunshot injury in a child.

Results
A 9-year-old boy was playing with a BB gun when he accidentally suffered a self-inflicted BB gunshot injury to the face. Family believed that a superficial injury only had been sustained, and medical evaluation was correspondingly delayed more than 9 days. During that time, the patient was unable to completely open his eye and complained of diplopia, eventually prompting ED presentation. At that time, he had progressed to malaise, nausea and vomiting, and a right complete CN III and partial IV nerve palsy, with intact vision, and functioning CN V and VI. The diplopia was secondary to the CN III palsy.

Diagnostic angiography revealed a BB retained in the medial cavernous sinus, as well as a small carotid cavernous fistula probably from disruption of small branches of the inferolateral trunk, which drained into the inferior petrosal sinus and did not require treatment. The BB was in contact with the cavernous segment of the ICA, inducing minimal arterial stenosis. The projectile was confirmed to be ferromagnetic, and so MRI was deferred.

![Figure 1 (a-e)](image)

Figure 1 (a-e). AP and lateral direct and digital subtraction angiography of the right ICA the week following injury with 3-D reconstruction demonstrates localization of the retained BB within the right cavernous sinus, intimately related with the intracavernous segment of the right ICA. DSA images show a small C-C fistula probably from disruption of small branches of the inferolateral trunk.

![Figure 2](image)

Figure 2. Lateral digital subtraction angiography of the right internal carotid artery 5 weeks after injury showing resolution of carotid-cavernous fistula.

Discussion
Modern BB guns can penetrate the cranium and injure skull base structures such as the cavernous sinus, potentially producing severe and highly focal neurological injuries, depending on the trajectory of the pellet. Traumatic vascular injuries causes by BB guns are managed similarly to other missile or penetrating trauma, although little is known about their specific natural history. Other specific management considerations are MRI safety and lead content, which vary significantly from other types of retained projectile injuries, due to differences in composition.

References