Brain abscess related to metal fragments 47 years after head injury

Case report

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The authors report a case of symptomatic brain abscess in a 51-year-old man who presented with personality changes and generalized seizures. He had survived a grenade explosion injury during the Korean War 47 years previously. Computerized tomography scanning revealed multiple conglomerate rim-enhancing lesions and metallic foreign bodies in both frontal areas. The mass was totally removed and Pseudomonas aeruginosa was isolated from microbial cultures.

Retained foreign bodies in the brain, whether bone or metal, should be removed at the time of injury if at all possible. If this cannot be accomplished, patients with such retained foreign bodies should be carefully monitored for life.

KEY WORDS • brain abscess • foreign body • Pseudomonas
Discussion

Literature Review

A brain abscess due to retained foreign bodies, generally bone fragments, usually develops 3 to 5 weeks after a penetrating head injury. In a report on a large series of patients with penetrating craniocerebral injuries sustained during the Vietnam conflict, it was suggested that retained bone fragments should be removed even after a long period of time because infection occurs 10 times more frequently in the presence of such fragments (see also the report by Hammon). A brain abscess is less likely to form around metal fragments, devitalized brain, or other indwelling debris, because the debris clinging to missile fragments is sterilized by the heat of the metal and the track immediately behind such metal fragments tends to seal off.

Fig. 1. Anteroposterior (left) and lateral (right) projection plain radiographs of skull revealing embedded metal fragments (small arrows) in both frontal regions. A round skull defect was also found in the right frontal area (large arrows).

Fig. 2. Left: Unenhanced axial CT scan revealing two metal fragments (curved arrows) embedded in both frontal lobes. An ill-defined mass with surrounding edema in the right inferior frontal lobe and subfalcian herniation were noted. Multiple round low-density areas suggesting small cysts can be seen in the mass. Right: Contrast-enhanced axial CT scan revealing a conglomerate rim-enhancing mass with an ill-defined border. Another metallic foreign body can also be seen (curved arrow) in the inferior medial border of the mass.
Delayed brain abscess

The removal of retained metal shell fragments is not recommended in cases involving deep locations; however, there have been reports, the first in 1954, of delayed brain abscesses associated with metal fragments. The latency period between the time of the penetrating head injury and the formation of brain abscess is several months to 7 years in reported cases. Latency periods of more than several years have rarely been reported. To our knowledge there have been only two cases with latency periods longer than 40 years. Heidrich and Sorgel reported one such case with a latency period of 47 years from an injury sustained during World War I. The other case, reported by Swan, was a delayed brain abscess that occurred some 51 years after a bullet injury sustained in 1919. The latency period in our case was 47 years.

Hypothesis of Formation of Delayed Brain Abscess

The microorganism at the site of injury usually succumbs to the host’s immune response and/or antibiotic therapy. However, if the infection at the site of injury is inadequately managed, the viability of the microorganism is maintained but with decreased virulence. After a certain period, reactivation of infection may occur when the balance between the host’s immunity and the microbial virulence is disturbed. The presence of foreign bodies such as bone or metal fragments could accelerate the dormant and asymptomatic focus even after an extended period. In fact, the virulence and growth of Pseudomonas were enhanced in an in vivo experiment, which involved introducing iron into subcutaneous tissue. This was demonstrated by measuring the increased size of a lesion, formed by a local inoculation with Pseudomonas, after a local injection of 10 μg of Fe+++ In the experimental animal model, Fe+++ appears to enhance virulence by interfering with two nonspecific defense mechanisms. One of these mechanisms involves the denial of iron essential for the in vivo growth of the infecting bacterium by tightly binding Fe+++ to proteins like transferrin and lactoferrin. The other concerns the bactericidal action of the lysosomal cationic proteins of neutrophils, which are neutralized by excess Fe+++. The devitalized tissue around retained foreign bodies is prone to infection, locus minoris resistentiae, and could also play a part in reactivation. However, the exact mechanism of a nidus of infection that remains latent for many years without any clinical symptoms and that subsequently flares up to become an active process leading to brain abscess is still obscure. The reason for the reactivation of the infection in our case is also unknown.

During the Korean War, Gram-positive cocci were the most common microorganisms causing brain abscesses after penetrating head injury, and the combination of Gram-positive cocci and Gram-negative bacilli such as Pseudomonas was common. It is of interest that P. aeruginosa, which may well have contaminated the wound when the injury occurred during the Korean War, was cultured from the specimen obtained.

Clostridium bifermentans was isolated from one patient with delayed brain abscess, which developed 15 years after the Vietnam conflict, and this is the only previous report of this microorganism culture resulting from a delayed brain abscess after penetrating head injury.

Conclusions

Intracranial foreign bodies resulting from penetrating injury should be removed at the time of injury because microorganisms can survive and become reactivated even after long periods of time, regardless of the nature of the fragment. Patients with foreign bodies in the brain introduced by penetrating injury, may develop brain abscesses at any time. If the removal of foreign bodies is not possible after initial injury, these patients should be carefully monitored for life, and any symptoms or signs relating to the injury should be investigated.

References


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