



Case #41

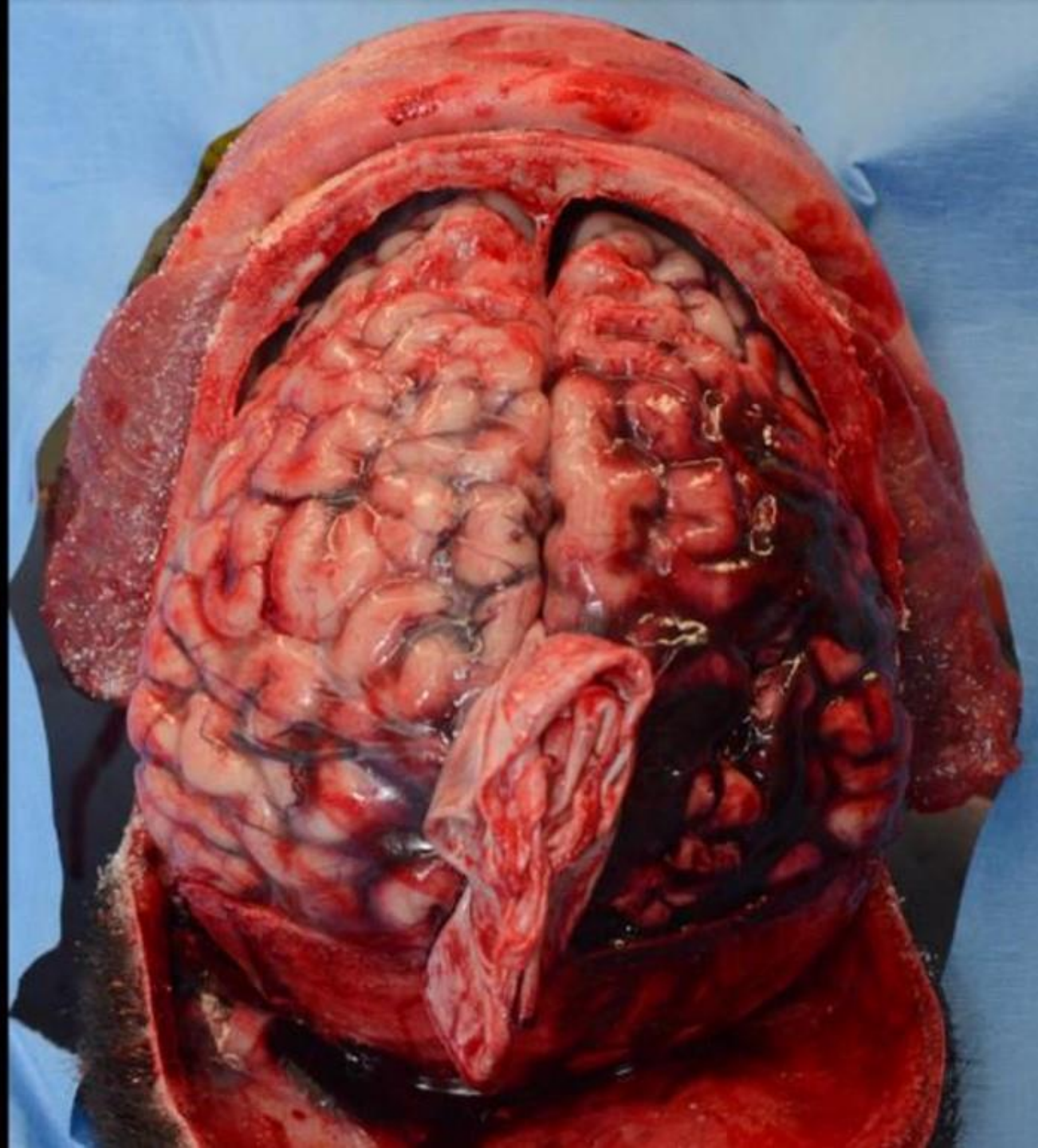
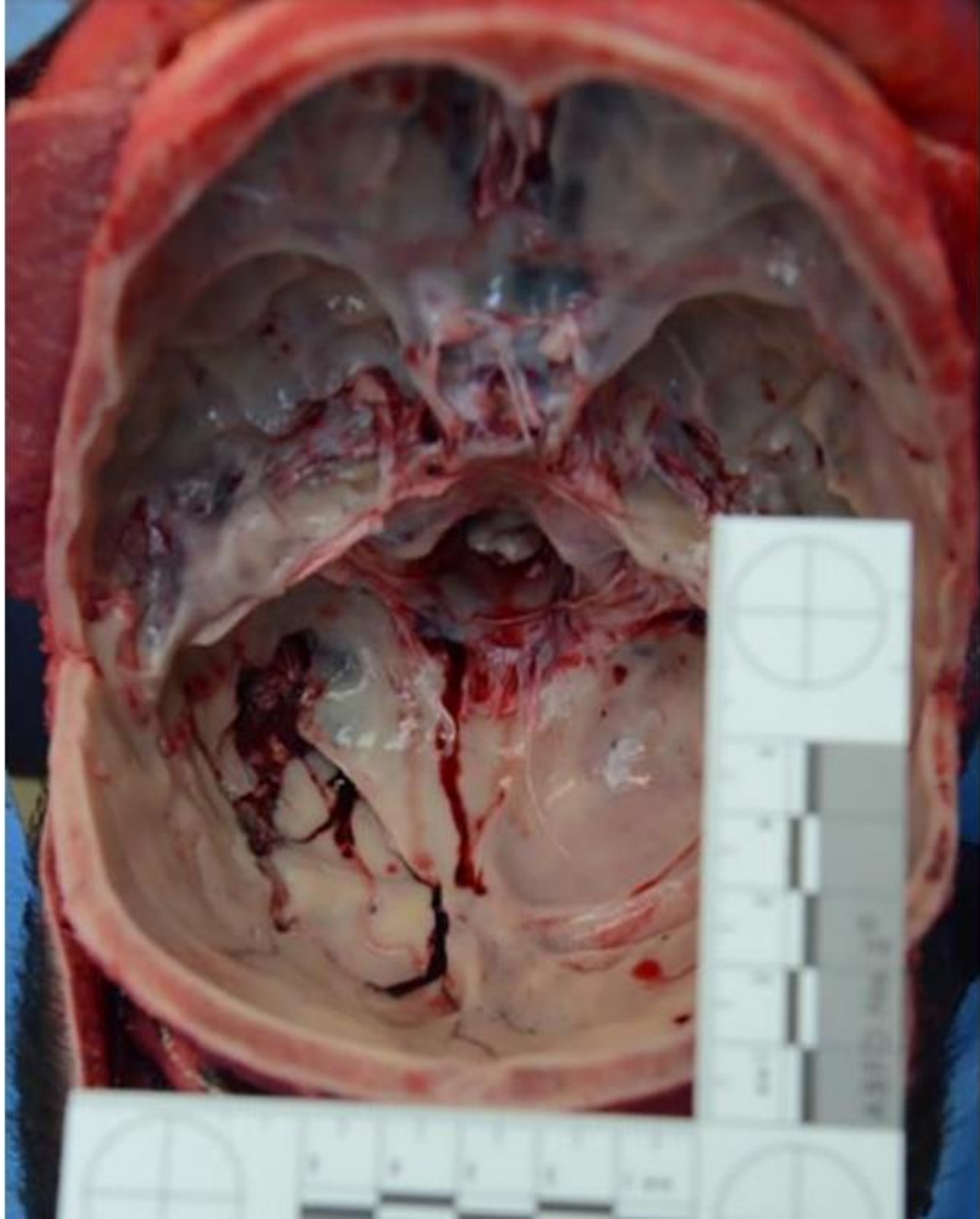
NAME Educational Activities Committee

Case provided by:

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Radiologist) of the Armed Forces Medical Examiner System.

The opinions and assertions contained herein are those of the authors and do not reflect those of the Uniformed
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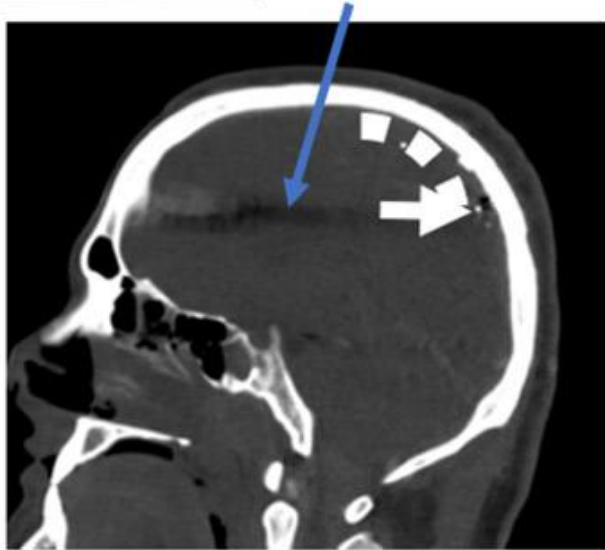
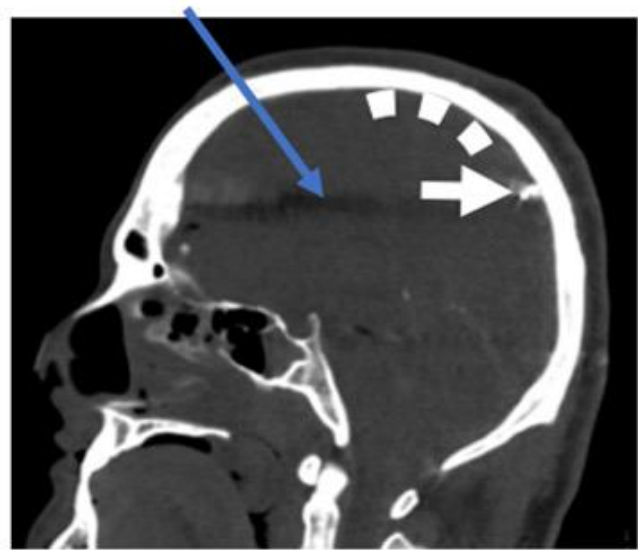
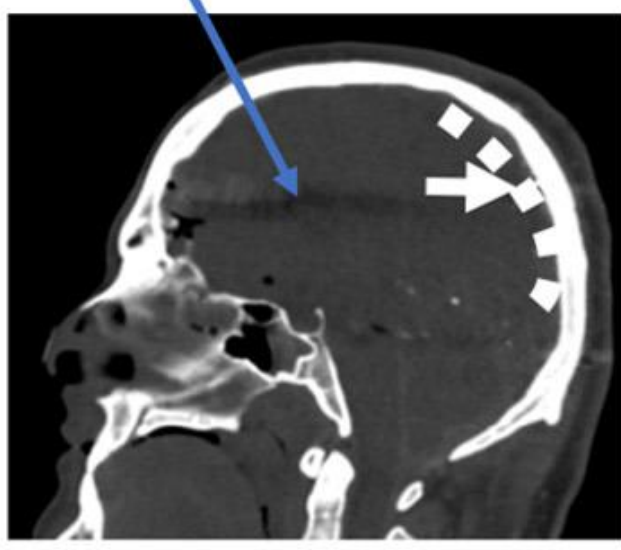
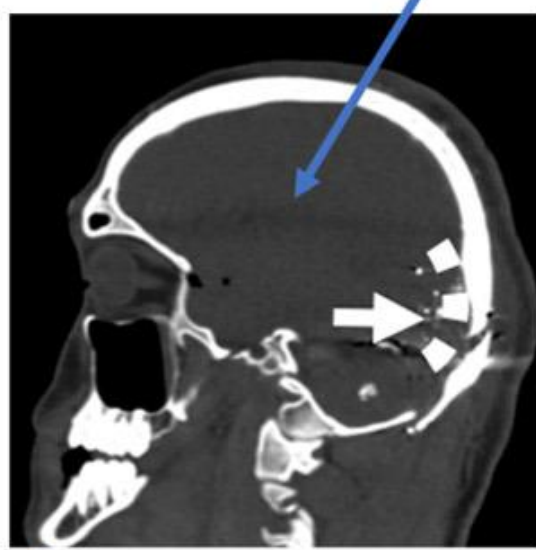
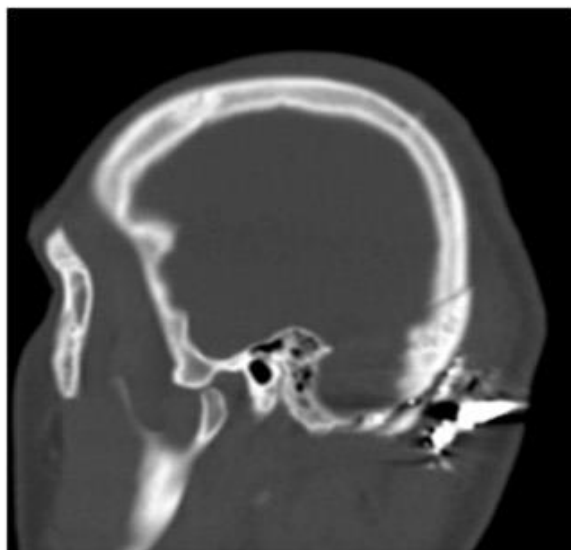
1. The decedent is a young male who was discovered to have a single gunshot wound of the left anterior neck. During autopsy, two bullet fragments were identified: The first in the posterior left side of the neck and the second superficially overlying the right frontal lobe. What would be the best explanation for these findings? (See images 1-3)

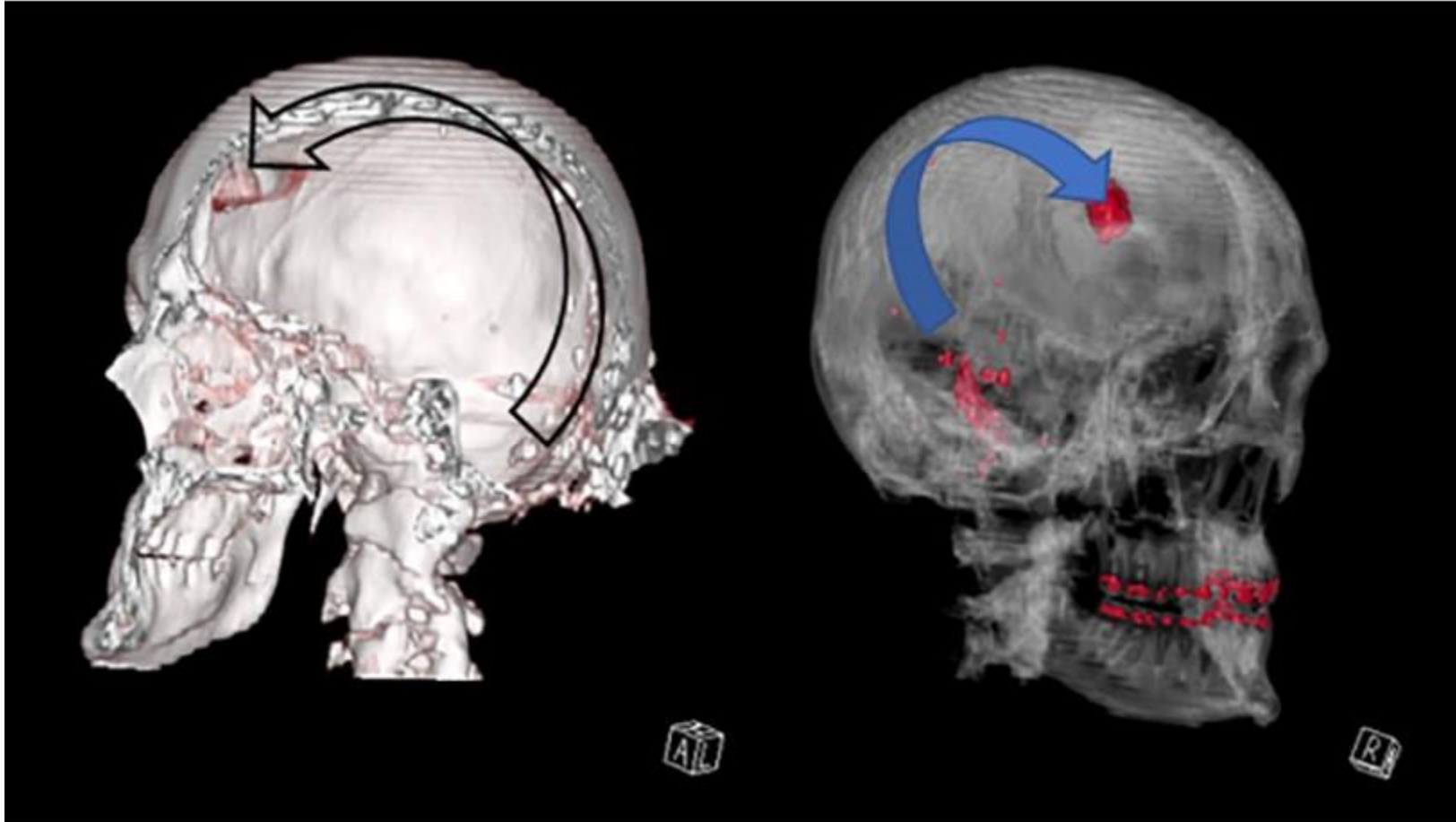
- A second gunshot wound was missed within the decedent's hair
- A single gunshot wound using a Radically Invasive Projectile (RIP)
- A single gunshot wound with a fragment ricocheting off the inner table of the occiput and through the right cerebral hemisphere
- Retained projectile fragment from a previous incident
- A single gunshot wound with fragments traveling in an arc-like fashion along the inner table of the skull

Answer...

E. A single gunshot wound with fragments traveling in an arc-like fashion along the inner table of the skull (30.51% responses)

After perforating the neck, the intact projectile tangentially struck the skull, fragmenting into two pieces and producing a keyhole defect at the base of the occipital bone. The first fragment of the projectile remained extracranial within the deep soft tissues of the left neck, while the second fragment entered the skull, impacted the inner table of the occipital bone, and coursed along the inner table of the skull, leaving an imbedded metal fragment trail that traced the projectile's path. The path extends from the left side of the occiput, coursing superiorly and medially up the occipital bone and crossing the midline (white arrows and boxes, Fig 4). It then continues along the right parietal bone, heading anteriorly, and eventually comes to rest superficially in the right frontal lobe. This type of non-linear track is not uncommon with tangential gunshot wounds of the skull. (Images 4-5)





Other responses:

A. A second gunshot wound was initially missed within the decedent's hair (2.07% responses)

Although a second projectile could justify the discovery of two projectile fragments within the skull, it would have produced a second skull defect and linear track through the brain, which are not seen in this case.

B. A single gunshot wound using a Radically Invasive Projectile (1.88% responses)

Radically invasive projectiles (RIP) will cause a single entrance defect but are designed to splinter into several metallic shards (generally 6 or 8) after soft tissue penetration. Therefore, we would expect smaller size and larger number of projectile fragments than seen in this case, and with a distinct shape present on imaging.

C. A single gunshot wound with a fragment ricocheting off the occiput and through the right cerebral hemisphere (57.63% responses)

When a ballistic fragment enters the cranial cavity, it is often retained. When it passes through brain tissue and strikes the inner table with insufficient kinetic energy to fracture, the fragment can ricochet. The most common ricochet encountered is a deflection that follows a cortical or subcortical path parallel to the internal table, with a ricochet back into the brain at an acute angle occurring less commonly. The linear decreased attenuation, horizontal line seen on the CT imaging (Image 4, blue arrows) is an artifact that occurs when scanning through a large, dense metal object (i.e. the projectile in this case). The reconstruction of the images carries over this artifact as seen on the adjacent sagittal images. No true secondary linear track through the brain was identified on autopsy.

D. Retained projectile from a previous remote injury (7.91% responses)

Surviving a previous GSW to the head is extremely rare with 90% of cases being fatal. Which makes a past injury unlikely but still possible. However, picture 2 shows evidence of recent trauma and bleeding leading to the conclusion that the damage occurred recently.

References:

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doi:10.1007/s10140-020-01766-5
- Bizhan A, Mossop C, Aarabi JA. Surgical management of civilian gunshot wounds to the head. *Handb Clin Neurol.* 2015;127:181-93. doi: 10.1016/B978-0-444-52892-6.00012-X. PMID: 25702217.