



Use of the serratus anterior muscle flap for reconstruction of an anterior cranial fossa after a gunshot wound

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To the Editors,

The serratus anterior flap (SA flap) is widely used in plastic surgery. Gunshot wounds to the head are usually fatal. However, there are rare cases where extensive defects need to be covered if the patient survives. Covering a defect in the anterior cranial fossa (ACF) presents a particular challenge. Such injuries can lead to severe complications, including cerebrospinal fluid (CSF) leaks and meningitis. Because of the severity of this type of injury and the fact that most patients do not survive, few studies address this topic or offer possible solutions. We would like to present a technical solution for covering the defect in the ACF using the SA flap.

On May 1, 2024, a 20-year-old man was found unconscious by his grandmother with a gunshot wound to the head. Computed tomography (CT) scan showed devastating facial skeletal injury, bilateral contusions of the frontal lobes, a splinter fracture of the frontal bone, and a high frontal gunshot wound (Fig. 1A).

Initially, a tamponade was inserted; then the neurosurgeon performed a decompressive bifrontal craniotomy, and individual bone fragments were removed. Revision, aspiration, removal of fascia from the thigh, and reconstruction of the base between the tamponade and the dura mater, as well as dural plasty of the dura mater with periosteum, were performed. The following day, treatment of the jaw fracture

with a plate screw splint was performed by stomatosurgeon. The surrounding soft tissues of the hard palate were lacerated but showed no signs of significant bleeding. Subsequently, a multidisciplinary consultation was performed due to persistent CSF leakage from the nasal cavity. It was necessary to use a flap that would sufficiently heal the incriminated cavity. After consideration by the multidisciplinary team, the plastic surgeon suggested covering the defect with SA flap.

The procedure was carried out as a concurrent collaboration between a neurosurgeon and a plastic surgeon. The neurosurgeon first removed the necrotic parts of the frontal lobe protruding into the nasal cavity and prepared the area for the flap (Fig. 1B, C), while the plastic surgeon simultaneously prepared the flap (Fig. 1D, E). Although the longest possible thoracodorsal pedicle was harvested, it was insufficient because of the depth and location of the defect, and therefore it had to be extended with a venous graft (Fig. 1F). The flap size was adjusted to match the defect in the ACF (5 × 4 cm). The great saphenous vein from the right lower limb (length 12 cm) was used as a graft, and a microanastomosis of the loop was performed (Fig. 1G). A free musculocutaneous flap was transferred using a microsurgical technique to the superficial temporal artery and vein (Fig. 1H). The flap was carefully inset in the defect. The final suture, hidden within the hair-bearing part of the scalp, and the overall appearance after surgery gave no indication of severe trauma or the demanding

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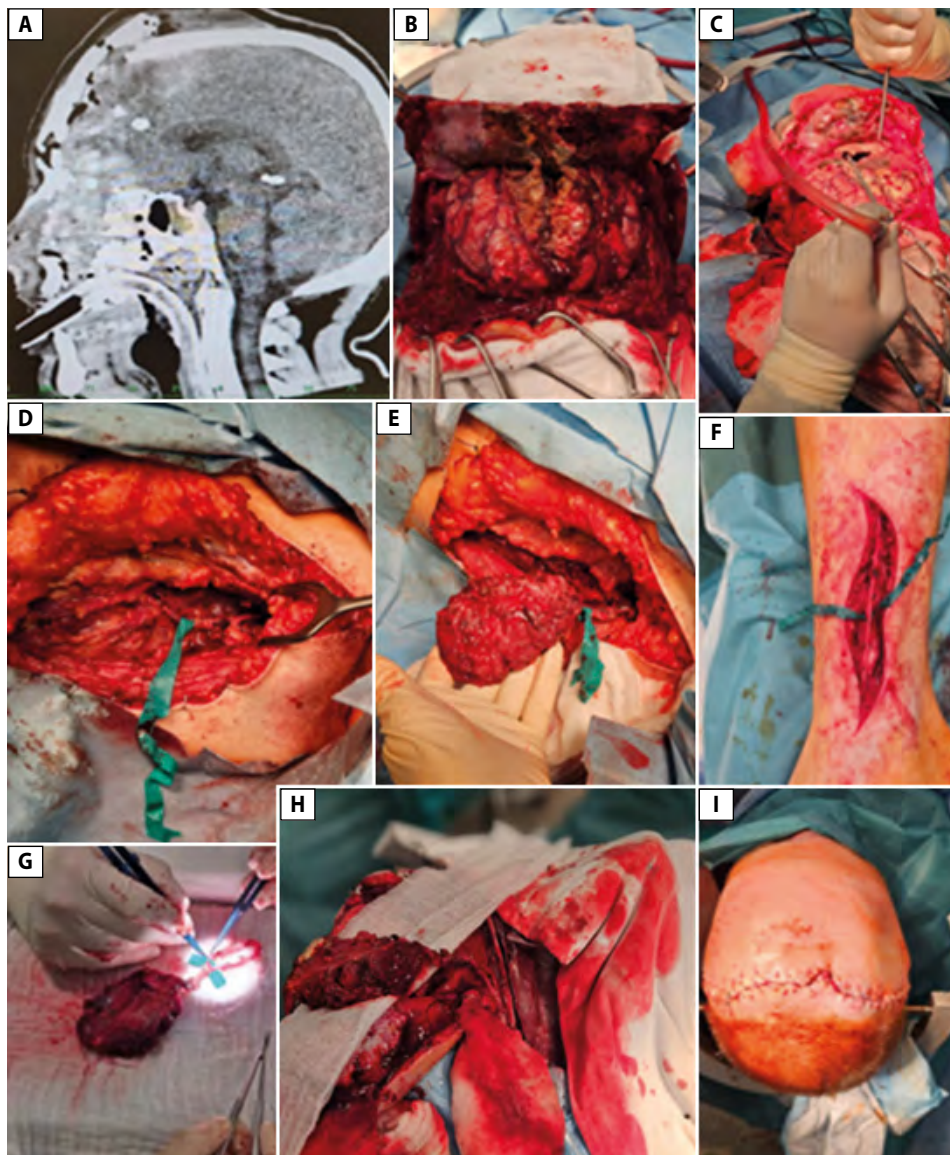


Figure 1. **A.** Computed tomography scan – the gunshot canal starts in the area of the hard palate, where displaced fragments are present. It then continues through the nasal and ethmoid sinuses, which are splintered, extends into the skull base, and ends frontally at the convexity of the skull; **B.** Defect in the anterior cranial fossa around the necrotic zone after the shot; **C.** Prepared area after partial necrectomy of the frontal lobe; **D, E.** Preparation of the thoracodorsal pedicle and SA flap; **F.** Harvested great saphenous vein from lower leg (length 12 cm); **G.** Microanastomosis of a vascular pedicle with the venous graft into the resulting loop; **H.** Resulting microanastomosis of the loop with the superficial temporal artery and vein **I.** Final suture, incision hidden in the hair-bearing part of the scalp

procedure the young patient had undergone (Fig. 11). The postoperative course was without complications, and by the 23rd day after admission the patient could be transferred to another department for further rehabilitation. Bone cement cranioplasty was carried out in November 2024. Surgical repair of the hard palate defect by stomatosurgeon is planned. The patient is blind but can distinguish between light and dark. With the support of his family, he continues his education. As of September 2025, the patient shows no signs of liquorrhea.

Because of severity of such injuries and the low survival rate of these patients, only a limited number of studies have

addressed this topic. Most of the available reports are single case studies. For example, Burks et al. described a case of traumatic CSF leakage caused by a bullet fragment lodged in Rosenmüller's fossa, where an ACF defect following a gunshot wound was successfully treated by endoscopic surgery [1]. Another report on traumatic ACF lesions, including gunshot injuries, emphasizes the importance of surgical management of bone defects and the prevention of complications such as CSF rhinorrhea and meningitis, often using bone grafting [2]. Our case was unique in that the defect was larger and required coverage with more massive tissue. For this reason, the SA

flap was chosen. We decided against using the forearm flap, as it would have provided thinner coverage, and inadequate removal of the skin layer could have led to epidermoid cysts formation, which in this case could have been fatal for the patient. The anterolateral thigh (ALT) flap requires a technically more complex dissection, and in robust patients with excessive subcutaneous fat, its use does not offer an advantage for this indication. The SA flap is frequently used in post-traumatic reconstructions, with studies reporting successful outcomes in 85% of traumatic injury cases [3]. The main advantages of the SA flap are reliable vascular supply and minimal donor-site morbidity [4, 5].

In summary, managing these severe traumas is highly complex and requires a strictly multidisciplinary approach. Even after the initial craniotomy and duraplasty, massive CSF leakage may persist. Because survival in such severe cases is exceptionally rare, clear management strategies for large ACF defects are scarcely described in the literature. Our case demonstrates that large ACF defects can be successfully covered using a SA flap, achieving an excellent outcome.

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Conflicts of interest: None.

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