Penetrating trauma of the face and facial skeleton – a case series of six patients

Aneta Neskoromna-Jędrzejczak¹, Katarzyna Bogusiak¹, Aleksander Przygoński¹, Bogusław Antoszewski²

¹Department of Craniomaxillofacial and Oncological Surgery, Medical University of Łódź, Kopcińskiego 22, 90-153 Łódź, Poland; Head: Aneta Neskoromna-Jędrzejczak
²Department of Plastic, Reconstructive and Aesthetic Surgery, Medical University of Łódź, Kopcińskiego 22, 90-153 Łódź, Poland; Head: Bogusław Antoszewski

ABSTRACT: Penetrating traumas of the facial skeleton are relatively rare; however, they can be dangerous and even life-threatening. The epidemiology of facial skeleton trauma is diverse and depends on the affected region, age, and the kind of foreign body that caused the injury. In Poland, the most common cause of penetrating traumas are accidents and assaults, and only rarely accidents are related to improper use of firecrackers or fireworks.

The aim of this study is to present a literature review and our own experience with penetrating traumas of the face and the facial part of the cranium.

Six cases with severe wounds and fractures of the facial skeleton were treated between the years 2000 and 2012 in our department. The applied treatment methods depended mainly on the general condition of the patients. In all cases, we achieved acceptable functional and aesthetic outcomes.

KEYWORDS: penetrating trauma, maxillofacial trauma

INTRODUCTION

Penetrating traumas of the facial skeleton are not considered to be a frequent condition. The available literature does not provide detailed epidemiological data on penetrating traumas of the face, and it only consists of single case studies or case series. Based on the available literature, craniofacial injuries that penetrate through the orbital cavity into the neurocranium are particularly dangerous in children (1) and adults (2).

Depending on a country, the causes of penetrating traumas are different. In the USA, the majority of penetrating trauma cases are due to gunshot wounds (3), and other causes include suicide attempts, self-mutilation, traffic accidents, and dog bites (3). In Poland, gunshot injuries (including those caused by gunshots and explosions of fireworks) account for a small percentage of (0.62% – 1.5%) facial skeleton trauma cases (4), and the most frequent causes of penetrating traumas are due to traffic accidents, accidents at work, or physical assaults (3) with the use of sharp, narrow, and long objects that easily enter the thin bones of the facial skeleton, and especially of the orbital cavity.

Penetrating traumas of the face and facial skeleton can be divided into low-energy and high-energy traumas (5, 6). Obviously, the bigger the mass and speed of the offending foreign body, the greater is the kinetic energy and the extent of injury in the bones and soft tissues. Bone injuries are characterised by the presence of small and compound fractures. High-energy traumas may be caused by gunshots (small mass and high speed of the bullet contribute to high kinetic energy) or firecracker bursts (associated with high kinetic energy and high temperatures). On the other hand, injuries caused by stabbing with a long, thin, and sharp foreign body are usually low-energy, but they also can cause penetrating wounds, although not as extended as in the case of high-energy traumas.

Based on the available literature, the location of fracture is associated with the type of trauma and the age of patients. For instance, traumas within the orbital cavity are found mostly in children and young people, and sport activity is the most common cause of injuries in this age group, followed by physical assault, traffic accidents, and accidents at work (7). On the other hand, penetrating traumas of the orbital cavity in adults...
are incurred during fights and due to stabbing with a sharp object (2). Suicide attempts with the use of firearms usually lead to traumas in the submandibular area, submental area, and oral cavity (8).

The aim of this study is to present our experience with treatment of patients with penetrating traumas of the facial skeleton. Between the years 2000 and 2012, 2319 people were hospitalized in our department due to traumas of the facial skeleton, including only 6 patients with penetrating traumas. Facial Injury Severity Scale (FISS) was used to evaluate the degree of facial injuries. The parameters comprising FISS are presented in Table I (9).

**CASE 1**

After performing diagnostic imaging and excluding coexisting injuries, a 50-year-old patient (D.K) with a pickaxe stab in the subtemporal area, between the zygomatic arch and the right orbital cavity, was transferred in a good condition to the department of craniofacial surgery for further treatment (Fig. 1). On admission, the patient was in a good condition, remained conscious and in good logical and verbal contact (GCS – 15 points), circulatory and respiratorily competent, with pulse equaling 100 bpm (regular and symmetrical) and was well palpable on the circumference, BP was 95/60 mm Hg, and oxygen saturation was 90%. The patient did not have any chronic diseases before the accident. On the physical examination, the patient did not have limb paralysis, meningeal symptoms or other neurological symptoms, rhinorrhea, or bleeding on the wall of the pharynx. There was a pickaxe that was stabbed in the facial skeleton, with the blade stuck in the right subtemporal area, penetrating through the zygomatic, buccal, and subnasal area on the right side. The pickaxe reached the left buccal area, causing embossing and tension of buccal soft tissues, tension of the skin in that area, and a small bleeding from the post-traumatic wound. The pickaxe was causing lockjaw and gradual loss of vision in the right eye. On FISS, the injuries were assessed as 6 points. Before surgery, the patient was consulted with ophthalmologists who diagnosed post-traumatic blindness in the right eye, lack of light perception, wide pupil without reaction to light, and immobile eyeball due to the presence of a foreign body. CT of the head and facial skeleton, with 3D reconstructions, revealed a large, metal foreign body. Numerous artifacts were seen on the CT scans that were caused by the presence of a massive metallic foreign body, which considerably impaired the evaluation of the brain and fractures within the facial skeleton. Therefore, only a partial evaluation of the brain was possible, but intracranial bleeding was excluded (Fig. 2). The patient underwent emergency surgery that was preceded by tracheostomy under local anaesthesia. Then, under general anaesthesia, the posttraumatic wound around the stuck blade was surgically widened and the pickaxe was removed. No bleeding from large or medium blood vessels was observed. The blade of the pickaxe in the right subtemporal area passed through the right maxillary sinus, subnasal area, and then penetrat-

<table>
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<tr>
<th>PARAMETER</th>
<th>FINDING</th>
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<tr>
<td>facial laceration</td>
<td>≤ 10 cm</td>
<td>0</td>
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<tr>
<td></td>
<td>&gt;10 cm</td>
<td>1</td>
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<tr>
<td>fracture of the orbital roof or rim</td>
<td>present</td>
<td>1</td>
</tr>
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<td>fracture into frontal sinus or bone</td>
<td>non-displaced</td>
<td>1</td>
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<tr>
<td></td>
<td>displaced</td>
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<td>dento-alveolar injury of the maxilla</td>
<td>present</td>
<td>1</td>
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<td>Le Fort fracture</td>
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<td>Le Fort III</td>
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<tr>
<td>naso-orbital-ethmoid (NOE) fractures</td>
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<td>zygomatico-maxillary complex (ZMC) fracture</td>
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<td>nasal fracture (alone)</td>
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<td>1</td>
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<tr>
<td>dento-alveolar injury of mandible</td>
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<tr>
<td>fracture of mandibular body, ramus and/or symphysis</td>
<td>2 × number of fractures</td>
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<tr>
<td>fracture of mandibular subcondyle, condyle or coronoid process</td>
<td>2 × number of fractures</td>
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**Fig. 1.** Patient D.K. with a wound in the subtemporal area between the zygomatic arch and the right orbital cavity.
ed the lumen of the left maxillary sinus, fracturing its lateral wall and finally reaching the soft tissues of the left cheek. During the procedure, the patient was diagnosed with fracture of the lateral wall of the right orbital cavity with a 2-cm intermediate splinter, fracture of the lower wall of the right orbital cavity and zygomatic arch on the right side, defect on the orbital floor (5 mm from the anterior edge to orbital cone), and fracture of the anterior wall of the right maxillary sinus. After clearing all bone splinters from the wound, bone fragments were repositioned and immobilized with plates and screws, enabling reconstruction of the lateral and the lower edge of the right orbital cavity. The orbital wall was reconstructed with a titanium mesh. Hemostasis was achieved after electrocoagulation of small vessels. The post-operative wound was sutured in layers. Due to infection within the post-operative wound related to contamination of the foreign body, during the procedure, the operating team decided that a 2-stage surgery should be performed, and reconstruction of the zygomatic arch and maxillary bone was delayed. The patient received antibiotics (ceftazidime, 1g once every 8 hours for 6 days) in the intensive care unit (ICU), where he was transferred immediately after surgery. In the ICU, the patient was fed through a naso-gastric tube and was sedated with continuous intravenous infusion of fentanyl (100µg/hour), midazolam (2mg/hour), and thiopental (2mg/hour). Dexamethasone was given at an initial dose of 24mg per day, and then was continued at decreasing doses for 7 days. Post-operative dressing changes were performed every day. Based on wound swab culture results, ceftazidime was changed to oral perfloxacin (400mg every 12 hours) for 9 days. Due to a satisfactory esthetic effect, the patient resigned from the second stage of management. The patient was hospitalized for 15 days (Fig. 3). The sutures were removed before discharge. We obtained a very good functional outcome with regression of blindness in the right eye (acuity and field of vision as before the injury, without diplopia) and normal jaw opening.

CASE 2

A 59-year-old patient (D.R) incurred an extensive wound of the facial soft tissues and facial skeleton due to a suicide attempt with a hunting weapon (the rifle was placed in the left submandibular area) (Fig. 4). On admission, the patient was in a critical condition, unconscious and with hemorrhagic shock (GCS – 8 points). The patient was intubated and sedated with thiopental. In the emergency room (ER), the patient suffered a cardiac arrest, and was successfully resuscitated. The examination of the site of injury revealed a vast, slicing wound with uneven and lacerated edges, considerable loss of soft tissues, rupture of the buccal mucous membrane, facial muscles, and blood vessels that were covering the submandibular area, submental area, and the left cheek (FISS – 6 points). CT of the head and facial skeleton revealed a gunshot fracture in the body of the mandible, next to a complex and small splinter fracture in the ramus of the mandible on the left side, with the loss of the mandibular bone in the area from tooth 35 to the angle of the mandible, zygomatic bone fracture, and fracture of the bottom of the left orbital cavity. The patient underwent emergency surgery under general anaesthesia with endotracheal intuba-
tion. During surgery, the gunshot wound was revised, while the bleeding blood vessels were tied off and underpinned, the ruptured submandibular and sublingual salivary glands were removed, and bone splinters were removed from the wound (Fig. 5). Then, the wound was sutured in layers, and reconstruction of the left cheek was performed. During the procedure, the patient received a transfusion of 2 units of RBCC and 2 units of plasma. In the ICU, the patient was sedated with a continuous intravenous infusion of fentanyl (100µg/hour), midazolam (2mg/hour), and thiopental (2mg/hour). The patient received amoxicillin with clavulanic acid (1.2g i.v. every 12 hours) and metronidazole (500mg i.v. every 8 hours). Cleansing of the surgical wound with boric acid and changing of dressing with neomycin-containing ointment was performed every day. The patient was discharged on the 4th day in a good general and local condition.

CASE 4

A 53-year-old patient (H.Z.) was hit by a grinder stone, and as a result, he incurred a penetrating trauma within the area of the middle, the upper facial skeleton, and fractures of the frontal sinus bone on the right side, right orbital cavity, maxillary sinus on the right side, nasal bone, and bone at the basis of the anterior cranial fossa; the right eyeball was damaged (FISS – 11 points). Immediately after the trauma, the condition of the patient was critical. The patient was disorientated and disturbed, with tachycardia (120 bpm) but without respiratory distress (GCS – 12 points).

CT revealed a foreign body (fragment of a grinder stone) and complex fractures of the walls in the frontal sinus, maxillary sinus, right orbital cavity, and nasal bone. The patient underwent emergency surgery on the day of the trauma under endotracheal anesthesia. During surgery, the foreign body was removed from the right orbital cavity, numerous bone splinters were removed from the right frontal sinus, orbital cavity, maxillary sinus, part of the nasal bone, and the eyeball (Fig. 7). Bone loss within the wall of the frontal sinus was reconstructed with TachoComb, and tissue loss in the orbital cavity was filled with muscle tissue.
and fatty tissue harvested from the right abdominal region. After rejuvenating edges of the wound and performing hemostasis, the wound was sutured in layers. Frontal tamponades were applied due to nasal bone fractures. During the procedure, the patient received a transfusion of 3 units of RBCC and 3 units of plasma. Directly after the procedure, the patient was transferred to the ICU, where he was started on antibiotics (ceftazidime, 1g once every 8 for 6 days). In the ICU, the patient was fed through a naso-gastric tube and was sedated with continuous intravenous infusion of fentanyl (100µg/hour), midazolam (2mg/hour), and thiopental (2mg/hour).

Postoperative dressing changes were performed every day during hospital stay. The frontal tamponade was removed after 48 hours. After 10 days, the patient was transferred to our department.

The patient was discharged after 38 days of hospitalization in a good condition, with a recommendation of further follow-up on an outpatient basis. He was also recommended to undergo reconstructive procedures in the future.

**CASE 5**

A 55-year-old patient (S.J.) was admitted after incurring a penetrating trauma of the face due to a hit with a chainsaw in the forehead area. Directly after the trauma, the patient was in a critical condition, with tachycardia (over 120 bpm), tachypnea, BP of 80/90 mmHg, and oxygen saturation of 90%. He opened his eyes to pain, used inappropriate verbal responses, and had purposeful movements to painful stimuli (GCS – 10 points). Before the accident, the patient did not have any chronic diseases. The local examination revealed a wound in the forehead area, passing slightly obliquely into the nasal area on the right side, with uneven and lacerated edges (FISS – 6 points). The patient underwent surgery under endotracheal anaesthesia on the day of the accident. During the procedure, the wound and the left frontal sinus were revised. The observed bone loss in the anterior part of the frontal sinus was covered with a polyurethane sheet. Communication with the frontal sinus was through the left nasal duct, and a drain was introduced through this route. The drain was sutured to the left nasal wing. Hemostasis of the vessels was performed. The wound was sutured in layers. The course of treatment was uneventful. The wound was healing and the patient had the drain for 5 days. We administered two antibiotics, lincomamide (600mg i.v. every 8 hours) and metronidazole (500mg i.v. every 8 hours). On the 7th day after surgery, the patient was discharged with a recommendation for further ambulatory care.

**CASE 6**

A 44-year-old patient (W.B.) was transferred to the ER in a critical condition due to multiple injuries of the craniofacial skeleton that had been caused by a hit with a firecracker in the area of the right eyeball (the patient was leaning over the firecracker when it exploded). In the ER, the patient was confused but able to answer questions, opened eyes to pain, and displayed purposeful responses to pain (GCS – 11). Since the patient was in
post-traumatic shock, anti-shock treatment was implemented. On the local examination, there was a vast wound of the face that involved soft tissues of the cheek, zygomatic area on the right side, eyelids of the right eye, right eyeball, upper lip, skin of the lateral nasal surface on the right side, mucous membrane of the hard palate in the medial line, and the upper gingiva in the area between tooth 11 and tooth 21. It was also revealed that the patient had fracture of the right frontal bone, complex fracture of the bone within the upper and medial facial skeleton with interruption in the palatal suture, and double fracture of the mandibular body. The patient also experienced an injury of the cornea, sclera, and had detached retina in the left eye. The patient had complete blindness of the left eye. Additionally, the patient was also diagnosed with 1° skin burn (<5% of the body surface). The overall FISS score was 12 points. The patient underwent emergency surgery under general anaesthesia. The facial wounds were surgically managed, small bone splinters and foreign bodies were removed, and fractures of the maxilla and the mandible were temporarily managed with the figure-of-8-ligature (ligatures). Drains were inserted in the right maxillary sinus and in both frontal sinuses, and anterior and posterior tamponades were performed. Subsequently, we removed the ruptured right eyeball. Due to exacerbation of symptoms of hemorrhagic shock and worsening of the overall condition, the previously scheduled surgical osteosynthesis of the fractures within the facial skeleton was delayed, and 3 units of RBCC were transfused. Directly after the procedure, the patient was transferred to the ICU, where the patient underwent tracheostomy and was started on mechanical ventilation. The patient was sedated with continuous intravenous infusion of fentanyl (100µg/hour), midazolam (2mg/hour), and thiopeptal (2mg/hour). The patient was treated with ceftazidime (1g every 8 hours for 6 days). During subsequent hospitalization, the overall condition of the patient improved. Then, the patient was transferred to a department of neurosurgery in order to undergo plastic surgery of the anterior cranial fossa because of leakage of cerebrospinal fluid. The procedure was done under general anaesthesia, through bifrontal craniotomy and an intradural approach with cranialization of the frontal sinuses. Reconstruction of the anterior cranial fossa was performed with the use of alloplastic material (codubix). The lacerations of the dura matter were surgically closed and supplied with Tachocomb. The soft tissues above that area were sutured in layers. In the neurosurgical ward, the patient was started on oral pefloxacin (400mg every 12 hours). Only on the 17th day of hospitalization, the overall condition of the patient was stable enough to perform the maxillofacial surgery. During this procedure, osteosynthesis of fractures within the mandibular body was performed, fractures of the lateral and lower rims of the orbital cavities were managed with titanium plates, and reconstruction of the orbital walls with titanium sheet was carried out. Additional orthopedic treatment was also implemented (laboratory rail and flexible elevator). The post-operative course was uneventful. The patient was discharged on the 45th day after the injury in a good condition with recommendations for further ambulatory treatment.

**DISCUSSION**

Currently, there is a growing number of deaths related to traumatic injuries. Based on epidemiological data, trauma is the third commonest cause of death. In Poland, nearly 30,000 people die due to trauma each year, whilst this number in the Netherlands is two times smaller. In contrast, in Hungary and in France this figure can be even higher than in Poland (10). Although there are no detailed epidemiological data concerning the frequency of penetrating trauma within the facial skeleton, many authors emphasize that they are extremely rare. In our experience, they comprise only 0.26% of all facial skeleton trauma cases.

Patients with penetrating trauma of the face are at risk of incurring injury of important anatomical structures of the nervous system, respiratory system, peripheral nervous system, or visual...
and circulatory systems. This can lead to long-term disability or even death due to hemorrhagic shock, damage of cerebral structures, or inflammatory complications. The consequences of penetrating trauma depend on the affected anatomical structures, the scope of penetration, impact and direction of the offending foreign body, and resistance of tissues affected by the trauma. In our experience, trauma with the highest FISS score was caused by a firecracker explosion (12 points), followed by a grinder stone injury (11 points). Apart from extensive facial wounds, these injuries also led to serious damage within more than one anatomic structure in the bones of the frontal sinuses, maxilla, naso–orbito–ethmoidal complex, and mandible.

In the case of head trauma, penetrating foreign bodies lose their energy due to absorption by internal anatomical structures. Trauma within the scope of the facial skeleton may cause dreadfully appearing external injuries; however, because the energy is absorbed by bone structures, post-traumatic injuries cover a much smaller extent than when the traumatic force impacts on the cranial vault.

As regards facial injuries caused by sharp objects, they may lead to massive bleeding from damaged blood vessels. It is worth remembering that a foreign body constitutes a certain tampon for the damaged blood vessel, and quite often, the removal of the foreign body leads to a massive bleeding. Penetrating traumas within the facial skeleton may cause physical injuries of the brain, calvarial fracture, fractures within the anterior cranial fossa, and rupture of the dura matter with subsequent rhinorrhea. The complex anatomical structure of the facial skeleton and of the neck, together with the surrounding blood vessels and the nervous system, requires precise, individually planned, and multi-specialist management.

Patients with intracranial pneumatocele and rhinorrhea confirmed on CT require a thorough observation in order to exclude symptoms of increased intracranial pressure. Intracranial hemorrhage poses a direct threat to life and often requires emergency neurosurgery. What is more, the presence of post-traumatic fistula may be associated with infections, which is why patients require wide-spectrum antibiotics.

Some authors emphasize that even in patients admitted in a good condition, who were not diagnosed with post-traumaticic changes in the CNS on initial CT, a follow-up CT scan may reveal such changes in 44% of patients. This confirms the need to perform repeated imaging in order to monitor the dynamics of changes (11, 12).

The majority of our patients had fractures within the upper facial skeleton (4/6 cases) (Table II). Massive lower facial injuries were the least frequent trauma cases, since they were observed only in 2 cases. As regards the discussed cases of penetrating trauma, 3 patients were diagnosed with fractures of the the frontal sinus, and according to the FISS scale, these were qualified as fractures of the upper facial skeleton. These fractures were associated with other injuries within the facial skeleton – fractures of the maxilla (Le Fort II or Le Fort III) and fractures of the walls of the orbital cavity, naso–orbito–ethmoidal complex, anterior cranial fossa, and the body of the mandible. These resulted from high-energy penetrating trauma caused by a grinder stone, chainsaw, or a firecracker. Therefore, the scope of the penetrating injuries within the facial skeleton observed in our patients differs from the typical location of facial traumas that is described in the literature. It is well known that the most frequent location of trauma in the facial skeleton is the nose and the mandible (i.e., areas within the massive middle and lower facial skeleton (13)).

Penetrating traumas are associated with a significant risk of infection due to the mode of injury and the presence of foreign bodies in the wound. Moreover, many authors emphasize that injuries within the frontal sinuses are associated with a particularly high risk of inflammatory complications, and they are frequently associated with other fractures of the facial skeleton (1). In that respect, penetrating trauma within the upper facial skeleton may lead to a situation when an inflammatory condition can expand towards the central nervous system (meningitis and brain abscesses), not to mention cranial cerebral penetrating injuries, when the risk of inflammation is extremely high (14). Due to presence of a foreign body, all injuries of soft tissues are classified as infected wounds (15). Other factors that increase the risk of infection are injuries of the mucous membrane, long surgery times (more than 2 hours), and delayed treatment (when surgery starts after 4 hours since injury) (15). All of the above-presented patients received antibiotics. In those who were not hospitalized in the ICU, we routinely used lincomamide with metronida-
For patients transferred to the intensive medical care unit, antibiotics were implemented in accordance with the policy of the committee for infections in our hospital that is based on the profile of drug resistance and epidemiological data regarding the ICU (ceftazidime or amoxicillin with clavulanic acid, and metronidazole). In the presented group of patients, we did not observe any intracranial inflammatory complications. Except for local and systemic infectious complications (e.g., meningitis, wound infections, intracranial abscesses), other common complications include fluid fistulas, hydrocephalus, epilepsy, and intracranial hematomas (16).

Patients with penetrating injuries may be in various general conditions. Nevertheless, the ‘ABC’ (Airway, Breathing, Circulation) scheme should be performed before transporting the patient and on admission. This procedure should be followed by further diagnostic work-up, including CT and, if necessary, angiography (in the case of penetrating injuries reaching the central nervous system in order to exclude possible vascular abnormalities and injuries). Preoperative angiography is recommended only for patients in a stable general and neurological condition (16). It was observed that around 30% of patients with penetrating head and brain trauma have complications due to injuries of veins and arteries of the CNS (16). Unfortunately, a short period of preparation often does not allow to perform angiography (17). Full diagnostic work-up can be carried out only when the patient’s condition is stable. In most cases, there is not enough time to perform all diagnostic tests. Also, detailed history can be difficult to obtain. Sometimes, penetrating traumas are caused by small objects that can be neglected by the injured person. Such cases of trauma can be asymptomatic and cause phlegmon after many years (16).

The prognosis in patients with penetrating facial trauma depends on the clinical condition of the patient. The mortality rate in patients with GCS 3–8 ranges between 60 and 90%. For patients with higher GCS (between 9 and 15), the risk of fatal complications is below 10% (18). The prognosis is worse in patients with rhinorrhea who require craniotomy. The use of transcranial approach is correlated with the mortality risk 0 to 6% (19, 20, 21). The risk of rhinorrhea recurrence varies between 5 to 32% (22, 23, 24). Reconstruction of the anterior cranial fossa can be also done with the use of endoscopic approach (25). Endoscopic techniques, in comparison to classical external approaches to cranial fossa, give a better field of view with enhanced illumination and magnification. The positioning of the underlay or overlay grafts is also more accurate (26–31). There are different endoscopic approaches dedicated to access different areas – transfrontal, transcirriform, transplanum, transsellar, transclival, and transpterygoid (32, 33).

As regards craniotomy, both intra- and epidural approach is used. Epidural access often leads to further iatrogenic dam-

age of the dura matter and may result in omission of the original rhinorrhea source. One disadvantage of this approach is a limited view into the anterior cranial base. Indications for the epidural access are limited and include rhinorrhea from a known location and postoperative rhinorrhea in the sellar area (34). Otherwise, intradural approach (preferred option) provides full view of the anterior cranial fossa, i.e., both wings of the sphenoid bone are visible to the anterior clinoid processes, upper orbital floor, and ethmoid wall. Usually, bifrontal craniotomy and craniization of the frontal sinuses is performed in order to prevent the formation of cyst lining and subsequent infections. In the intradural approach, intraoperative administration of mannitol and gravitational effect of the frontal lobes reduce the need for retraction of the frontal lobes and minimize the risk of complications such as hematoma or impaired sense of smell.

There are various methods of surgical closure of lacerations in the dura matter. The simplest method is to sew up the dura matter. As regards reconstruction, different materials can be used, like adipose tissue, muscle, fascia lata, cartilage of the nasal septum, vascularized portion of a epicranial aponeurosis or artificial dura (35). Dura matter lacerations can also be fixed by sewing or fibrin glue. Spongostan and TachoSil can be applied as additional sealing materials. The final choice of material depends on the severity of the defect and the type of trauma. In patients with otorrhea, the choice of surgical approach depends on the source of liquor rhora - the middle or posterior cranial cavity. If the fistula is located in the posterior cranial cavity, surgical treatment with an approach through or behind the mastoid process can be performed. If the laceration of dura matter is located in the middle cranial fossa, an approach above the ear at the level of the middle temporal gyrus is performed, which allows to view the base of the skull.

If dura matter lacerations necessitate surgical treatment, it is preferred to manage that during a single-stage operation together with repositioning of the facial bone fractures and soft tissue wound closure.

**CONCLUSIONS:**

Diagnostic and therapeutic work-up in patients with penetrating trauma within the facial skeleton should include cooperation between specialists in the fields of maxillofacial surgery, ophthalmology, laryngology, neurology, neurosurgery, plastic surgery, and anaesthesiology.

The patient is usually in critical condition and requires immediate implementation of proper diagnostic work-up and management.
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In special circumstances, when there is a strong suspicion that the contaminated foreign body may infect wounds, it is recommended to implement a 2-stage management.

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Corresponding author: Katarzyna Bogusiak, Department of Craniomaxillofacial and Oncological Surgery, Medical University of Lodz, Kopcińskiego 22, 90-153 Łódź, Poland; Phone: +48 42 677 67 88, Email: katarzyna.bogusiak@gmail.com

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