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Retrobulbar haematoma in the era of anticoagulants

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ABSTRACT

Aim: The present retrospective study aimed to evaluate the frequency and distribution of retrobulbar haematoma (RBH) among 26 patients (12 male/14 female) who had suffered maxillofacial trauma/surgery, with special focus on anticoagulants, causes of accidents, treatment, and outcome.
Methods: Patient ages ranged from 8 to 94 years, with a mean of 65 years. Among all patients, 43% had received anticoagulant therapy at admission; 92.3% had a previous history of maxillofacial trauma.
Results: The most frequent cause of RBH were falls (65.4%), and three patients experienced RBH postoperatively after treatment using polydioxanone foil. Postoperatively (after RBH relief), 33.3% of the patients reported persistent complete visual loss; of these patients, 29% had received anticoagulation therapy, and the oral anticoagulant intake was not documented in further 29% of the patients.
Conclusion: Awareness of this pathologic process is crucial for preventing permanent loss of vision via early diagnosis and adequate therapy. With increasing age, patients are more likely to receive an anticoagulant, which leads to a higher risk of RBH. Because falling was the most frequent cause of RBH in our patient population and increases in frequency with increasing age, fall prevention is crucial.

Introduction

The orbital compartment syndrome caused by retrobulbar haematoma (RBH) is a serious emergency condition whose treatment often involves more than one discipline. This clinical scenario can have different causes, including retrobulbar anaesthesia, orbital biopsy, trauma (either blunt or in combination with fractures), orbital floor reconstruction, and aesthetic procedures, such as blepharoplasty [1–3].

Anatomically, the postseptal orbit can be divided into three compartments (subperiosteal, intraconal and extraconal space) with a bony surrounding except in the front. In case of bleeding, the pressure in at least one of the compartments will increase, leading to a proptosis of the globe up to the point when the canthal tendons and extraocular muscles will restrict this anterior movement. During this time, the intraorbital and interstitial pressure increases and leads to a decrease of blood flow in the vessels. If the vessels of the optical nerve are affected, a damage to the nerve will occur, and with further increases of orbital pressure, even the retinal vessels can be affected [4]. Therefore, it can be assumed that increase of orbital pressure due to RBH is one of the main reasons of vision- and visual field loss and hence decompression leads to release of orbital pressure and therefore reperfusion. Mechanical damage of the optic nerve due to a lengthening of the nerve (seen by a severe proptosis, when the nerve will be straight and a tenting of the globe visible) [5] as well as direct pressure, can lead to temporary or permanent damage of the nerve fibers, too.

The risk for the development of RBH varies from as low as 0.05% following blepharoplasties [6] to as high as 3.2% following orbital floor reconstruction [7]. Particularly in trauma cases, the patients are usually admitted through the emergency department and may have complex co-morbidities that distract the physicians from examining the eyes. It is essential, however, to diagnose and treat RBH immediately as a delay may result in complete loss of vision. Loss of vision, even in one eye, will have a huge impact on a patient's quality of life. In younger patients, it can drastically influence their daily work situation, and in older patients -who are already at increased risk for fractures because of the decrease in limb coordination- loss of vision in one eye will increase the risk for falls (*e.g.* as a result of stumbling) [8]. In addition, the ability to estimate distances is severely impaired with monocular vision.

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Intake of anticoagulants is another hidden risk factor for the development of RBH, particularly in elderly individuals; all the aforementioned potential causes are more likely to result in RBH if the patient has previously consumed an oral anticoagulant. With the ageing of the population in industrialised countries [8], the number of individuals undergoing oral anticoagulant therapy has increased. In 2017, the United Nations (UN) released a statement saying that "in Europe, 25 per cent of the population is already aged ≥60 years and that proportion is projected to reach 35% in 2050″ [9]. According to the UN, the corresponding numbers for North America are 22% and 28%, respectively [9]. In view of the high incidence of fractures in the elderly population [10], the incidence of RBH is expected to be high as well. Furthermore, new oral anticoagulant drugs (NOACs), introduced over the past decade, have been increasingly used to treat patients [11]. NOACs could be classified as direct thrombin inhibitors (*e.g.* dabigatran) and factor Xa inhibitors (e.g. rivaroxaban, apixaban and edoxaban) [12], and are administered as an alternative to vitamin K antagonists (VAKs) for preventing deep vein thrombosis, pulmonary embolism [13], and stroke in patients with atrial fibrillation [12], all of which can cause severe morbidity and even mortality. These drugs are advantageous in that they obviate routine monitoring and have fewer food and drug interactions than those with VAKs as well as shorter plasma half-life. Although NOACs have been estimated to be effective after 12–24 h, this interval can vary in patients over 75 years, in those who weigh under 60 kg, and in those with renal dysfunction. Pharmacodynamical interactions (*e.g.* with other anticoagulants, nonsteroidal anti-inflammatory drugs, or steroids), although less common, have also been described. Unfortunately, in cases of bleeding, specific antidotes for the NOACs remain currently unknown. Heidbuchel et al. [12] have stated that *time* is the best antidote. The mechanism of VAKs can be reversed using vitamin K, which is a time-consuming process; moreover, fresh-frozen plasma and coagulation factors could restore coagulation much faster. However, coagulation factors and fresh-frozen plasma might be of no use with NOACs because NOACs could block these factors as well.

With direct thrombin inhibitors, dialysis might be an option; however, factor Xa inhibitors strongly bind to plasma, and therefore, dialysis might not be able to reduce plasma levels [12]. It is possible that the use of pro-coagulants, such as tranexamic acid, aminocaproic acid, or desmopressin, effectively reduces plasma levels; however, clinical data concerning NOAC-associated bleeding remain limited [12]. Studies of prothrombin complex concentrates (PCCs) and activated PCCs (aPCCs) indicate limited effectiveness, with aPCC being more effective than PCC alone [14–16], Studies of oral surgery in patients who are undergoing NOAC therapy/receiving anticoagulants have been published; however, research with the focus on RBH in patients with maxillofacial trauma who are undergoing anticoagulant therapy is limited. Therefore, the aim of this study was to evaluate the frequency and distribution of RBH among patients who had suffered maxillofacial trauma/surgery, with special focus on anticoagulants, causes of accidents, treatment, and outcome.

Patients and methods

This retrospective study was conducted according to the principles of the Declaration of Helsinki and was approved by the local ethics committee (Ethical Committee North West/Central Switzerland (EKNZ), Amendment to Ref. Nr. 343/10).

Data were obtained from clinical records (manual and electronic) and radiologic images of 26 patients who were treated for RBH. The following information was documented: diagnosis, localisation of fracture, aetiology, age, sex, vision, red/green recognition, date of accident, surgical intervention, anticoagulant treatment, international normalised ratio (INR), and steroid prescription as well as the intake of antibiotics, hyperosmotic agents (mannitol), and carboanhydrase inhibitors (isocarbamide).

Descriptive statistics comprised frequencies for categorical data and mean, median and range for metric and ordinal variables. P-values corresponded to the (nonparametric) Mann-Whitney *U* test test and the chi-square or exact Fisher test when the expected frequencies in certain cells were <5. All tests were performed at a significance level of $p = 0.05$ and evaluated using the statistical software R 3.1.1. [17].

Results

General data

Overall, 26 patients [male, 12 (46.2%)] were treated at our department for RBH over the last 15 years. Mean age was 65 years (range: 8–94 years); 9 patients (35%) were <60 years, 5 (19%) were between 60 and 80 years, and 12 (46%) were >80 years.

24 patients (92.3%) had previously suffered a maxillofacial trauma. The most frequent cause of RBH was falling (17 patients; 65.4%); in 3 of these cases, the RBH developed only after the surgical intervention to treat the trauma. Other causes include violence (3 patients; 11.5%), surgery, such as blepharoplasty and meningioma resection (2 patients; 7.7%), traffic accidents (2 patients; 7.7%), sports injury (1 patient; 3.8%), and an explosion (1 patient; 3.8%).

In 21 patients (80.8%), RBH was associated with a fracture; in all these cases, the orbit was involved in the fracture. The orbital floor fracture without any other fracture was the most common cause (30.8% of the overall 26). The left side was more frequently affected (61%) than the right side. In one patient, RBH was documented on the left side and 1 year later, another was documented on the right side, whereas in another patient, RBH (caused by an explosion) was simultaneously noted on both sides.

The symptoms most frequently documented in the emergency department were monocular haematoma (20 patients; 76.9%) and exophthalmos (19 patients; 73.1%), followed by ocular motility restriction (13 patients; 50%), hyposphagma (12 patients; 46.2%), lost pupillary light reflex (10 patients; 38.5%), uneven pupils (10 patients; 38.5%), relative afferent pupillary defect (9 patients; 34.6%), red desaturation (7 patients; 26.9%), and double vision (5 patients; 19.2%). Certain criteria could not be tested conclusively because of eyelid swelling, coma, dementia, or insufficient documentation. The intraocular pressure is rarely documented in the emergency department, and therefore, could not be evaluated.

Anticoagulation

The INR or Quick values were available for 69% of the 26 patients. The Quick value, documented at the time of emergency admission, ranged from 17% to 120%. Mean Quick value was 65.8% in patients who received anticoagulation therapy and 88.2% in those who did not.

In 11 patients, the use of a thrombocyte aggregation inhibitor or a coagulation inhibitor was documented; acetylsalicylic acid and phenprocoumon were the ones most commonly used. Mean age of patients who received anticoagulation therapy was 80 years (median 85 years), and that of those who did not receive anticoagulation therapy was 53 years (median 51 years). Fig. 1 presents the list of the anticoagulants used. In 6 patients, anticoagulant intake was not documented.

The time span between emergency admission and surgical discharge could be determined in 19 patients, whereas it could not be determined in 2 patients; the remaining 5 patients received conservative treatment. The time span ranged from 68 to 498 min (mean, 218 min; median, 228 min).

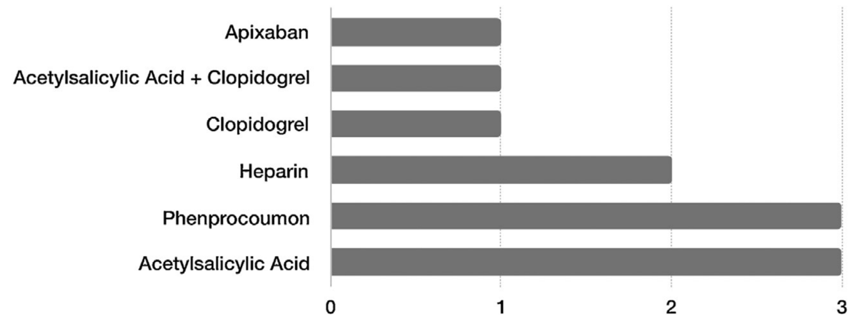

Fig. 1. Anticoagulants and numbers of patients who received anticoagulants.

Treatment

Of the five patients who received conservative treatment, the subjective visual acuity was not impaired at emergency admission in three patients; for the remaining two patients, the respective data were not documented. No persistent complete loss of visual acuity was documented in the three patients whose visual acuity was recorded.

The other 21 patients underwent surgery. A subjective impairment of visual acuity existed before RBH relief in 17 patients (81%), 11 (52.4%) of whom indicated a subjective complete loss of visual acuity before RBH relief. One patient reported no subjective impairment of visual acuity before RBH relief, and in three patients, no data were collected before RBH relief. Of the patients who underwent surgery, 6 (28.6%) had received anticoagulant therapy. After RBH relief, 7 patients (33.3%) showed persistent complete visual loss, whereas in 2 patients (9.5%), no visual acuity was recorded. The duration of the RBH relief surgery depended on whether additional fracture treatment or other surgical treatment (*e.g.* relief of an epidural haematoma) was necessary. The time ranged from 15 to 156 min (mean, 54 min; median, 44 min).

In addition to osteosynthesis material, polydioxanone (PDS) foil (Ethicon, Norderstedt, Germany) was used for fracture reconstruction in five patients, and a titanium mesh was used for the orbital floor reconstruction in four patients. Furthermore, Medpor (porous polyethylene implants, Stryker, Kalamazoo, Michigan, USA) was used in one patient, and a combination of autologous bone and alloplastic material was used in another patient. Among the 21 surgical cases, RBH developed before surgical reconstruction in 8 patients, and after the orbital floor reconstruction in 3 patients; in each of these cases, PDS foil was used (see Fig. 2). Two of these patients had received oral anticoagulants, and one had liver cirrhosis due to high alcohol intake.

Drug therapy consisted of antibiotics, cortisone, and various eye drops and eye ointments during and after surgery. No patient received hyperosmotic agents or carboanhydrase inhibitors to reduce pressure.

Antibiotic therapy was documented in 24 (92.3%) of the 26 patients, with amoxicillin being the most frequently used drug (in 17 patients; 70.8%).

Ophthalmological follow-up examination

In the ophthalmological follow-up examination (n = 18), the most common findings were eye motility restriction (n = 4), followed by relative afferent pupillary defect (n = 3), double images (n = 2), red desaturation (n = 2), and loss of pupillary light reflex (n = 2). Intraocular eye pressure after RBH relief was measured in 13 of the 21 patients who received RBH relief. Mean intraocular pressure of the affected eye was 16.5 mm Hg, and the median was 16 mm Hg (range: 8–26 mm Hg).

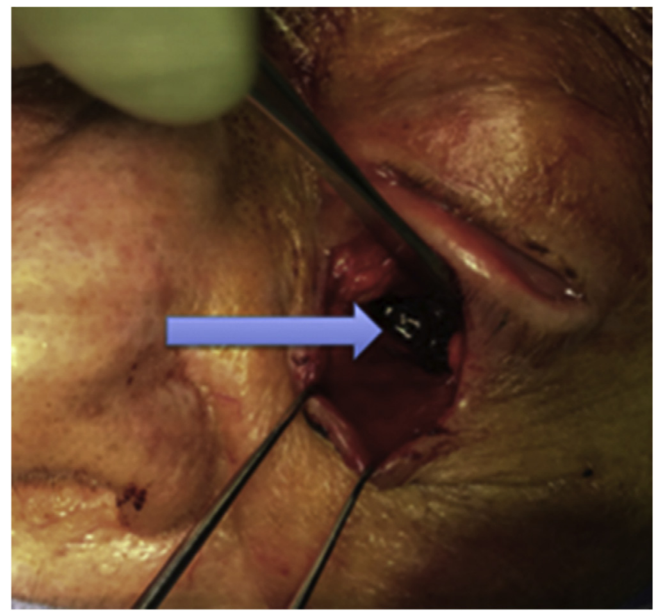

Fig. 2. Retrobulbar haematoma in a case with oral anticoagulants (blue arrow). In this case, the haematoma developed after surgical orbital floor fracture reconstruction using polydioxanone foil.

The following comparisons did not yield significant findings ($p > 0.05$): sex versus fracture, surgery, loss of vision, and anticoagulant therapy. No significant differences were found in comparisons of fracture versus surgery, loss of vision, and anticoagulant therapy. However, RBH was significantly positively associated with the presence of a fracture ($p < 0.001$). With regard to treatment for RBH relief, the number of patients undergoing surgical treatment was significantly higher than conservative treatment ($p < 0.001$), with a significantly higher number of patients reporting no preoperative vision loss ($p < 0.004$). With regard to vision, no significant values were found in relation to anticoagulants.

Discussion

Anticoagulants and thrombocyte aggregation inhibitors, which are more frequently administered to older patients, are of great importance in treating RBH. Drug treatment was documented for approximately 42.3% of the patients in the present study; further, because data for some patients were missing, this percentage may be even higher. Mean age of patients with RBH was 81 years. Among the patients aged >80 years, 58.3% were undergoing anticoagulant or platelet aggregation inhibitor therapy. The drugs used included acetylsalicylic acid, phenprocoumon, heparin, clopidogrel, and apixaban. A tendency towards bleeding is regarded as an additional risk factor for the development of orbital compartment syndrome [18,19]. In a retrospective analysis of RBH, Voss et al. [19] have documented anticoagulation treatment in 7 of 11 patients aged over 60 years. Although NOACs are prescribed increasingly often, in this study, only one patient was noted to be undergoing this therapy. VAKs still play a very important role. The best known is warfarin, which is the most commonly prescribed anticoagulant worldwide and has been available for more than 60 years [20]. Phenprocoumon is popular as well. Pirmohamed et al. [21] have shown that warfarin causes a high rate of adverse effects. Their assessment of different drugs and drug groups has revealed that warfarin led to the third highest rate of hospital admissions. Among other listed drugs that could increase the risk for RBH, only acetylsalicylic acid was found to have a higher incidence for adverse reactions than warfarin [21]. According to another study, there is an increased risk for traumatically acquired RBH (with VAK treatment), even up to 24–48 h after the trauma. Therefore, a strict assessment of visual acuity is essential [22].

In the present study, three patients acquired RBH after orbital floor reconstruction using a PDS foil. RBH is often associated with orbital trauma and accompanied by an orbital floor fracture. Depending on the size of the bony defect, different materials could be used in the orbital floor reconstruction to prevent the re-lowering of the eyeball, possible limitations for the eye motility, double images, or facial asymmetries. In principle, the reconstruction material could be either resorbable or nonresorbable, and either autologous or alloplastic. Established materials include titanium mesh (nonabsorbable), PDS foil, Ethisorb patch (absorbable polydioxanone), Medpore (porous absorbable polyethylene that can also be used in combination with titanium), and autologous bone (*e.g.* from the skull). Careful orbital floor reconstruction and bone continuity restoration typically produce an excellent surgical result, regardless of the materials used for reconstruction [23].

Holtmann et al. [24] studying >500 patients with orbital floor fracture, have recommended the use of PDS foils and, only for severe defects, the use of titanium mesh. In patients undergoing anticoagulant therapy, this recommendation requires careful consideration. Even during the use of a perforated PDS foil, the holes could easily be covered with small blood clots, and a titanium mesh might enable better drainage to the sinus. Therefore, delaying the surgical orbital floor reconstruction until a low anticoagulant level has been achieved in blood plasma is certainly recommended. To achieve this, however, the anticoagulant intake has to be stopped or bridged, which is not advisable in some patients. Although performing a surgical intervention on a patient receiving anticoagulation therapy obviously increases the risk of bleeding, interrupting anticoagulation can increase the risk for thromboembolic events. Rates of up to 0.3% (for warfarin-treated patients) and 0.4% (for rivaroxaban treated patients) for such events have been reported [25]. Independently of the cause of RBH, if the patient is undergoing anticoagulant therapy, particularly NOACs, the surgeon should determine whether a *simple* lateral canthotomy or an inferior cantholysis is sufficient, or depending on the location of the haematoma, whether a lateral anterior orbitotomy or orbital floor removal using a drain is required to guarantee the best possible drainage (see Figs. 3 and 4).

Obviously, the more invasive procedures usually necessitate secondary reconstruction, which can be performed under strict monitoring.

With regard to the age distribution of patients in the present study, the spectrum from 8 to 94 years is noticeably large. Elderly individuals accounted for the majority of cases, with 65.4% of the patients aged >65 years and 46% aged >80 years. Falling accounted for approximately 54% of cases of RBH. Moreover, among the patients aged >80 years, falling accounted for 75% of cases.

Falling as a cause of maxillofacial trauma has special significance in old age. In 31% of cases, the cause of a fall is an environmental accident [26]. Facial injuries caused by trauma in patients aged >65 years have special characteristics with regard to fracture patterns and localisation, atrophy with decrease in bone quality and quantity, concomitant injuries, pre-existing comorbid conditions, and physical and psychological functional impairment [27]. The annual probability of falls in older people is 30%–60%; 10%–20% of these falls cause injuries, necessitate hospitalisation, or result in death. Most falls are associated with identifiable risk factors, such as muscle weakness, gait disorder, and balance disorder. Evidence suggests that various programmes could reduce the risk of falls in old age [26].

In our study population, falls were the most common cause of RBHs. The cause of the RBH and the distribution of age and sex seem to differ among studies, depending on the country and living conditions. According to a review in Taiwan by Chen et al. [28] the cause of RBH in orbital fractures was road accidents in 87.5% of cases. Mean age was 24.5 years, and the sex was chiefly male (87.5%). However, these percentage values should be viewed with caution because the number of cases studied was low (8 RBHs). Fattahi et al. [29] have studied 50 cases of RBH resulting from orbital trauma. Of these patients, 66% were male, median age was 47.8 years, and the RBHs were caused primarily by falls (36%), violence (32%), and traffic accidents (28%). In our retrospective analysis, 46.2% were male, mean age was 65 years (median 73 years), and RBH was caused by the fall in 54% of cases. As already known, most RBHs occur after trauma or as a postoperative complication. The incidence of RBH after maxillofacial trauma is low, the correlation between RBH and blindness is strong (up to 52%) [30]. Fattahi et al. [29]. have retrospectively assessed 1386 patients with orbital trauma; of these, 50 patients had RBH and 2 patients lost vision. The incidence of RBH was 3.6%, and the incidence of permanent blindness in cases of orbital trauma was 0.14% [29]. For patients with a high risk for falling, the surgeon must determine whether NOACs or VAKs would be more suitable. Patients undergoing VAK therapy must be continuously monitored; the effects of VAKs could be more easily reversed in a trauma setting.

Patients undergoing conventional anticoagulant or NOAC therapy must undergo extremely careful examination after a trauma. Although no clinical symptoms of RBH are observed during the admission of the patients into the emergency department, RBH can occur hours after the trauma. Some patients -for example, in cases of alcohol abuse, drug abuse, intoxication, coma, mental illness, or noncompliance- cannot be adequately examined. Even in compliant patients, the eye examination could be extremely difficult because of severely swollen eyelids or medication. Pupil examination can also yield misleading findings in patients receiving pain therapy using opiates, those with traumatic mydriasis, those who have consumed paralysing agents, or, as aforementioned, cases of alcohol or drug abuse. In cases of relative afferent pupillary defect, optic nerve function is impaired. In such cases, only a rapid direct and indirect response to light stimuli (the swinging flashlight test) in round and concentric pupils is considered reliable to rule out an immediately treatable visual impairment injury [31,32].

If RBH is suspected, assessment must be performed immediately. If CT is immediately available, it is possible to establish the diagnosis (Fig. 5). MRI, particularly ocular dynamic MRI, is not recommended because it is a lengthy procedure [33]. In patients undergoing NOAC therapy, the surgical intervention should be performed with or without radiological imaging. If bleeding occurs behind the eye, the retrobulbar pressure rises to a critical level and must be reduced. Haubner et al. [34] have measured the effect of orbital decompression on intraocular pressure in cadavers. The orbital compartment syndrome (OCS) was artificially generated. The initial pressure ranged between 37 and 80 mm Hg; decompression with lateral canthotomy and inferior cantholysis resulted in an intraocular pressure of <20 mm Hg in seven of eight orbits [34]. In

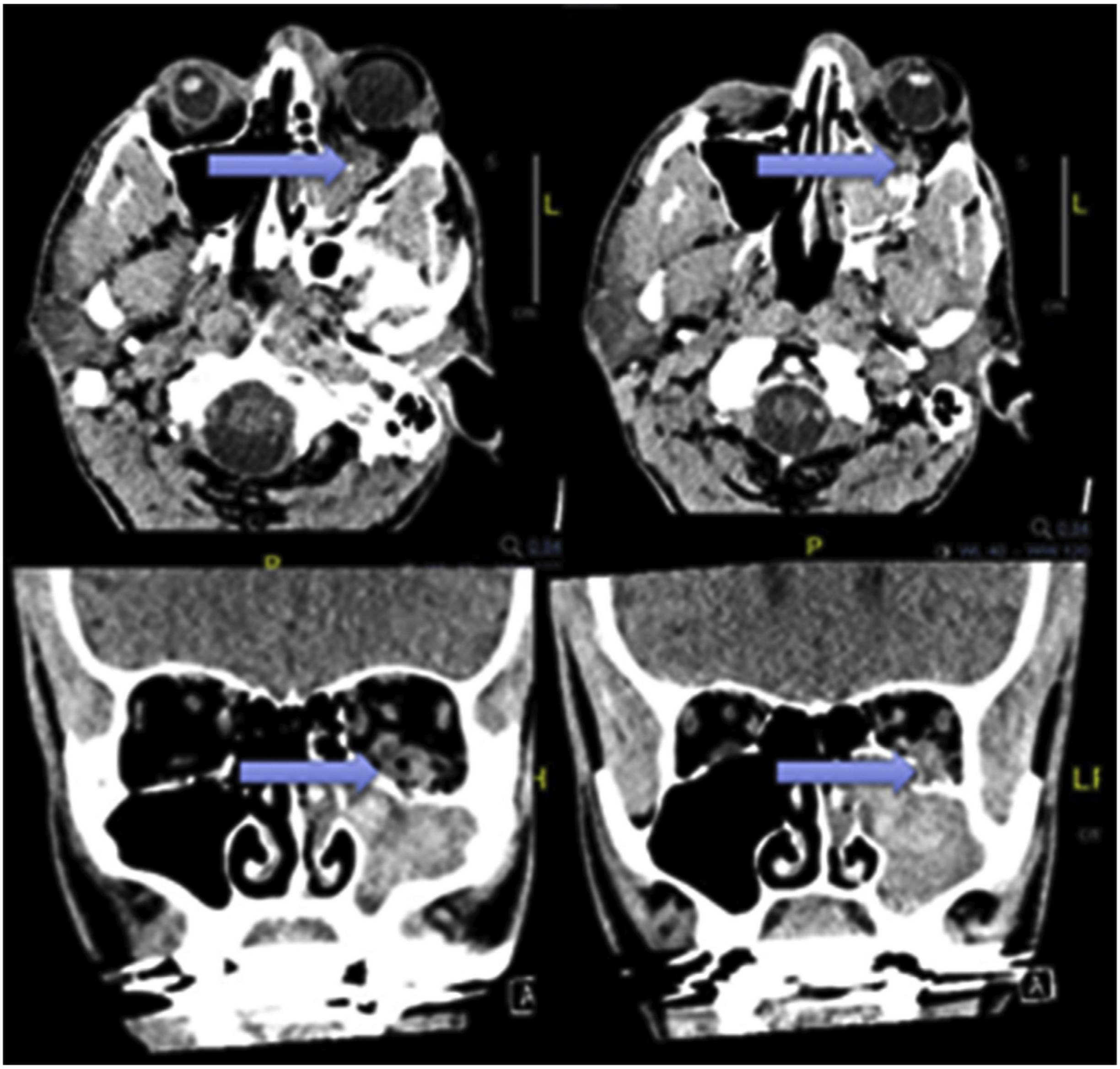

Fig. 3. The patient lost vision in the A&E department after a bicycle accident. The surgery entailed removing part of the orbital floor (blue arrows), and full vision was restored immediately after the surgical intervention. (Computed tomographic scans; Somatom Definition AS + scanner, Siemens, Erlangen, Germany).

another study, Oester et al. [35] have compared two different relief techniques in five cadavers. Both techniques resulted in significant reduction of intraorbital pressure. These studies have shown the effectiveness of lateral canthotomy and inferior cantholysis pressure reduction in cases with no further bleeding (as the study protocol involved cadavers). The situation might be completely different, however, in patients undergoing NOAC therapy: if, for example, the infraorbital artery or another vessel is torn, the vessel must be repaired to effectively stop the bleeding.

Transcutaneous transseptal orbital decompression for acute RBH is another treatment option. In contrast to lateral canthotomy and inferior cantholysis, this technique allows drainage of bleeding from the orbital compartment without performing the time-consuming orbital osteotomy. In addition, the lateral canthal ligament, which fixes the eyelid, is not injured in this procedure [36]; however, when it is cut, other bleeding could occur in patients undergoing NOAC therapy, which could worsen the situation.

The earlier that decompression is performed after the onset of symptoms, the better is the prognosis for postoperative vision [7]. To avoid permanent damage, surgery should be performed within 2 h of the injury [37–39]. In addition to immediate patient transport to the emergency department, the time in the clinic until decompression should be as short as possible. In the present study, the time between emergency admission and surgical discharge ranged from 1 h 8 min to 8 h 18 min. Mean value of 3 h 38 min was clearly above the target time of 2 h.

Drug therapy, particularly in conservative procedures, includes 20% mannitol and acetazolamides. These drugs may be contraindicated in connection with hypovolemic shock. High-dose steroids are recommended for the treatment of OCS, but this recommendation is based on a strictly empirical approach to reduce posttraumatic orbital oedema. There are no studies regarding the effectiveness of corticosteroids in OCS [22,32]; moreover, they are associated with an increased rate of mortality in patients with craniocerebral trauma and GCS $\leq$ 14 [40].

Different procedures can help to prevent the occurrence of RBHs. Theses can be divided into preoperative, intraoperative, and postoperative procedures. A possible tendency to bleed should be preoperatively recorded. In addition to VAKs and NOACs, dietary supplements and herbal preparations can influence bleeding. In

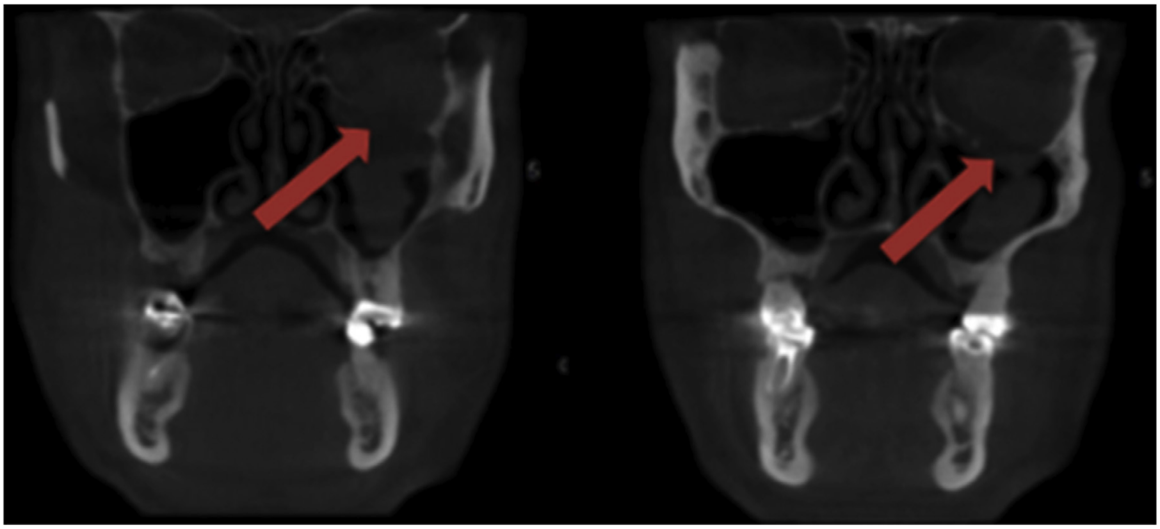

Fig. 4. Cone beam computed tomographic scan of the patient in Fig. 3 showing the orbital floor defect (red arrows) resulting from the removal of orbital floor in surgery to relieve retrobulbar haematoma. (CS 9300, Carestream, Rochester, NY).

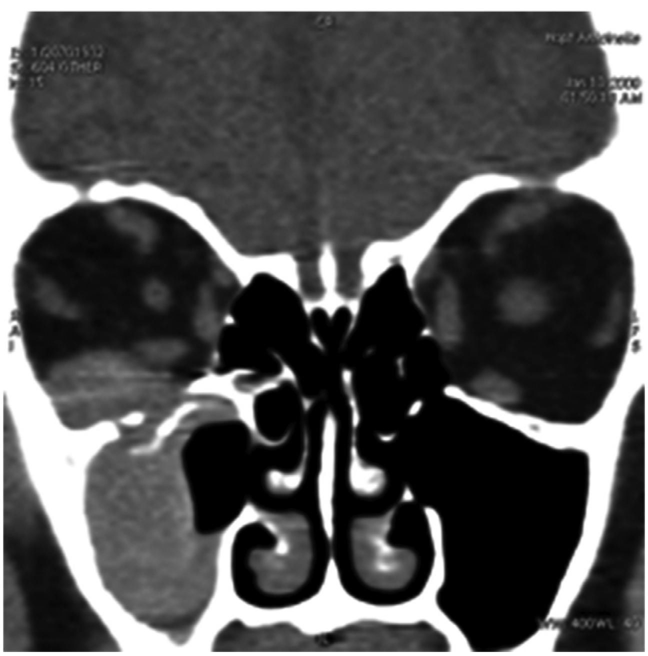

Fig. 5. Retrobulbar haematoma after a surgical intervention using a polydioxanone foil. The patient was undergoing anticoagulant therapy.

patients undergoing anticoagulant therapy, the benefit must be weighed against the risk, or the medication must be changed to another anticoagulant (*e.g.* short-acting heparin, whose action can be reversed using protamine). Hypertension should be preoperatively clarified and stopped. Good haemostasis should be intraoperatively ensured. Sufficient local anaesthesia can reduce the increase in blood pressure caused by pain. Blood pressure should be well monitored both during and after surgery.

The literature describes various risk factors associated with postoperative RBH. These include vascular disease, coagulation disorders, anticoagulation, arterial hypertension, increased physical activity, Valsalva manoeuvres, coughing, and vomiting [6,18,41–43]. If RBH occurs, it should be detected at the earliest after the operation. Therefore, after orbital surgery, the patient must be monitored for visual acuity control and possible signs of RBH, particularly in cases wherein anticoagulant therapy could not be discontinued beforehand. Postoperatively, once the patient is awake, he or she should be instructed to immediately inform the hospital staff in case the patient experiences severe pain in the eye or changes in vision. In case of nausea, antiemetics should be administered; coughing and blowing of the nose, which can cause pressure, should be avoided. According to the study by Fenzl and Golio [44] drainage should be considered for preventing RBH. Drainage is particularly important for cases of three- and four-walled orbital fractures, large blunt trauma, and penetrating trauma as well as for patients undergoing anticoagulant therapy [44]. Chen et al. [28] have described a similar procedure for orbital surgery that involves the use of a butterfly drain in combination with a vacuum blood collection tube. According to the authors, a negative-pressure drainage system should be routinely used in the treatment of orbital fractures to prevent RBH [28]. The use of a butterfly drain with lateral perforations, in combination with a mounted syringe for negative pressure, has been reported in another study as well [45]. We believe that for all patients treated for RBH, particularly those undergoing NOAC therapy, it is essential to perform an appropriate drainage procedure after orbital surgery. The drainage system used — such as the WEB-SIL Easy Flow Drainage system (Websinger, Wolkersdorf, Germany) and the Penrose Drain — is the surgeon's personal choice.

The main limitations of this study are its retrospective character and the rareness of the occurrence of RBH and therefore, a small sample size. Furthermore, since RBH is an acute, very severe circumstance, no equality in cases is seen and some of the usual examinations have to be skipped – due to the nature of the emergency – respectively due to a lack of time.

Conclusions

Blindness is a rare but serious complication in the field of oral and maxillofacial surgery. Among other factors, vision is a decisive criterion for an independent life of every human being. The increasing intake of anticoagulants at an advanced age is considered a predisposing factor for RBHs. Because patients undergoing NOAC therapy do not have to be monitored in the same way as those undergoing VAK therapy, the number of NOAC prescriptions is increasing. Unfortunately, no antidote is available yet. Because the RBH is primarily characterised by a sudden or rapid and painful loss of vision, all patients undergoing anticoagulant therapy, particularly with NOACs, have to be carefully monitored upon their admission to the emergency department and throughout their hospital stay, because the occurrence of RBH could be delayed. The decisive aspect in the management of RBH with possible visual impairment is rapid diagnosis and therapy; the best visual results are achieved using early decompression, and the decompression may need to be more extensive in patients undergoing NOAC therapy than in those undergoing VAK therapy or no anticoagulant therapy.

Therefore, physicians should be aware of the exact anticoagulant that the patient has been prescribed. Treatment options for managing the bleeding in patients who are undergoing NOAC therapy are more limited than that available for managing it in patients who take conventional anticoagulants; moreover, the surgical approach that is chosen might be different.

Disclosures

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Declaration of Competing Interest

The authors declare that they have no competing interests.

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