Evaluation of Intra Ocular Pressure in Zygomatico Maxillary Complex Fractures

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Received: 10 October 2013 / Accepted: 28 December 2013 / Published online: 10 January 2014
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Abstract

Purpose To study effects of zygomatico maxillary fractures and fracture reduction on intra ocular pressure (IOP). **Materials and methods** IOPs of 20 patients with unilateral zygomatico-maxillary complex (ZMC) fractures (divided into 2 groups of 10 undisplaced, 10 displaced) were measured at various time intervals. The relationship between IOPs between the two groups at various time intervals was recorded and evaluated using independent T-tests.

Results 20 subjects were divided into two equal groups (10 each of displaced and undisplaced fractures). Mean age of patients was 33.8 years with 90 % males and 10 % females. The change in IOP at the time of reporting, after 24 h and 7 days for patients with undisplaced ZMC fractures (Group I) was recorded and was found to be significant. The change in IOP at the time of reporting, before and after surgery, after 24 h and 7 days for patients with displaced ZMC fractures (Group II) was recorded and was also found to be significant. The IOPs of the two groups was compared at various time intervals and was found to be significant. Also, a significant increase in IOP was noted just after fracture reduction, which could be attributed to oculocardiac reflex, which has been proven to cause bradycardia, and in some cases, even death.

Conclusion A cautious eye needs to be kept over IOP while reducing ZMC fractures at regular intervals and the

anaesthetist has to be informed to look for any bradycardia that can occur. Tonometers should be a part of standard armamentarium while reducing and fixing ZMC fractures.

Keywords Intra ocular pressure · Zygomatico maxillary complex fractures · Oculocardiac reflex

Introduction

The zygomatic bone gives prominence to the cheek and takes part in the formation of the orbit and the maxillary sinus. Due to its prominent position in the face the zygoma is frequently subjected to fracture and dislocation. Thus, zygomatic fractures are, next to nasal fractures, the most frequent fractures of the maxillo-facial skeleton [1, 2]. The fracture lines are most frequently located between the zygoma and the adjacent facial bones. However, the separation rarely occurs within the lines of suture and the designation fracture of the zygomatico-maxillary (ZMC) or malar complex is therefore often used [3, 4]. The zygomatic bone will frequently be displaced in the fracture and this displacement may be medial, lateral, posterior or inferior, and the bone may be rotated around a vertical or a longitudinal axis. Infrequently, the zygomatic fracture may be comminuted, or the zygomatic arch may alone be fractured [5–9].

A number of ocular complications are associated with the fractures of the ZMC, namely displacement of the eye, enophthalmos, diplopia, intra-orbital hematoma or edema, and blindness. Blindness may result as a result of increased intra-ocular and intra-orbital pressures, direct injury to the optic nerve or interference with the blood supply of the optic nerve [10].

The wall of the globe is composed of a dense, imperfectly elastic supporting membrane. The anterior part of

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this membrane is transparent—the cornea, the remainder is opaque—the sclera. The anterior part of the sclera is covered by a mucous membrane—the conjunctiva—which is reflected from its surface onto the eyelids. Lining the inner aspect of the sclera are two components—the highly vascular uveal tract, concerned chiefly with the nutrition of the eye, and the retina, a nervous layer concerned with the reception and transformation of light stimuli.

The uveal tract consists of three parts, the two posterior, the choroid and the ciliary body, line the sclera, while the anterior forms a free circular diaphragm, the iris. The anterior chamber is a space filled with fluid—the aqueous humour, and is bounded in front by the cornea, behind by the iris and part of the anterior surface of the lens which is exposed in the pupil. Aqueous humour is an important intraocular fluid responsible for the supply of nutrients to and removal of metabolic wastes from the avascular tissues of the eye. It is also indispensable for the maintenance of the optical properties of the eye. Aqueous humour is constantly being produced in the anterior chamber. However, the mechanism underlying the formation of aqueous humour is still not well understood [11]. There is a circular venous sinus, called canal of Schlemm, which helps in the drainage of aqueous humour. The pressure of the aqueous humour in the anterior chamber is known as intra-ocular pressure. Normal intra-ocular pressure is between 10 and 20 mm Hg [12].

Intra-ocular pressure is measured by a method known as tonometry, and the apparatus with which tonometry is performed is known as a tonometer. Two types of tonometry techniques are available—Indentation tonometry, using a Schiötz tonometer, and applanation tonometry, using a Goldman tonometer. The intra-ocular pressure is measured by relating a deformation of the globe to the force responsible for the deformation. There has been a controversy regarding the values of intra-ocular pressure using each type of tonometer. Some studies state that applanation tonometry gives lower intra-ocular pressure values than indentation tonometry [13], whereas others state that indentation tonometry gives lower values than applanation tonometry [14].

The pressure of the contents of the orbit on the orbital walls is known as intra-orbital pressure, or the orbital tension. Normal orbital tension is between 3 and 6 mm Hg [15]. There exists a controversy relating to the relation between the intra-orbital pressure and the intraocular pressure. Some authors report that there is a direct relation between reduction of orbital volume (leading to increased orbital tension) and increase in intra-ocular pressure [16], whereas others claim that changes in orbital compartment pressure may not translate to equivalent changes in intra-ocular pressure [17, 18].

The coats of the eye can withstand fairly high intra-ocular pressures except at the lamina cribrosa, the fenestrated region through which the optic nerve fibres enter the eye. A raised intra-ocular pressure causes mechanical pressure on the lamina cribrosa, altering the capillary blood flow and decreasing the axoplasmic flow in the initial stages. Later, significant backward displacement and compaction of the laminar plates narrows the openings through which the axons pass, directly damaging the nerve fibre bundles, ensuing in blindness [14]. There is a decrease in retinal perfusion in patients once the pressure reaches 80 mm Hg [19]. However, it is not clear what the critical time limit for retinal ischemia is before irreversible damage occurs. Ischemic retinal cells have been documented to have a survival time of 3–5 min in rats and up to 97 min in elderly rhesus monkeys [20].

Because of the relatively confined anatomy of the orbital contents, there is a display of pressure volume dynamics of the enclosed compartment—any increase in orbital volume (like injection of any drug or retro bulbar haemorrhage) causes a corresponding elevation of intra-orbital pressure (where the anatomy of the orbit is not disrupted, as in minimally displaced ZMC fractures). Initially, forward movement of the globe and prolapse of fat lessen this effect, followed by a rapid rise in the pressure once the limit is reached [16, 18, 21]. In addition, a tense orbit may display an increase in the intra-ocular pressure due to loss of elasticity of the cornea [21], which might lead to loss of vision.

In cases where the anatomy of the orbit is disrupted (as in displaced ZMC fractures), the orbital soft tissues tend to herniate into the displaced fragments, acting like a trap-door. Due to the retro-bulbar haemorrhage, the intra-orbital tension tends to rise, thus increasing the intraocular pressure [22].

Though the orbit can withstand trauma to a large extent and no intervention is required if there is no apparent bony injury, immediate treatment is required if there is presence of major hyphemas (blood in the anterior chamber of the eye), acute rise in intra-ocular pressure, retinal detachment and corneal-scleral lacerations [23]. However, according to some authors, there is no significant change in intra ocular pressures before and after reduction of ZMC fractures [24].

Factors that lead to a rise in intra-ocular pressure are—change of position from sitting to supine posture, tobacco smoking, use of caffeine, long term use of corticosteroids, use of general anaesthetics (mainly ketamine and succinyl choline), diabetes mellitus, hypertension, bacterial infections such as leprosy, viral infections such as congenital rubella, mucopolysaccharidosis and Sturge-Weber syndrome, and also, the intra-ocular pressure is higher in the mornings than in the evenings (diurnal variation) [12].

The aim of the present study is to study the effects of zygomatico maxillary fractures and fracture reduction on intra ocular pressure.

Materials and Methods

Twenty patients above the age of 18 years with unilateral ZMC fractures (Henderson's types I, III and IV) were selected serially from those attending the outpatient department of Oral and Maxillofacial Surgery of D.A.V. (c) Dental College and Hospital, Yamuna Nagar. The present study is exempt of the local institutional review board. The patients were divided into two groups with ten patients in each group.

Group I: Minimally displaced ZMC fractures (Henderson's type I) requiring conservative treatment for the same.

Group II: Displaced ZMC fractures (Henderson's types III and IV) requiring surgical intervention.

The patients were clinically and radiologically evaluated. PNS was done in all the cases. CT-scan was advised to the patient wherever necessary, e.g. diplopia or enophthalmos present. Visual acuity, presence of diplopia, infra-orbital paraesthesia, enophthalmos, pupillary reflexes and extra-ocular eye movements were checked and recorded by an ophthalmologist.

Patients were excluded from the study if they had any other mid face fractures, any previous injury to the orbit or zygoma or both, any medical condition, drugs or habits affecting intra ocular pressure, fractures older than 10 days, any other associated ocular injury or patients who did not report for follow up.

Visual acuity was checked using a Snellen's chart (Eng-chart or an E-chart). The patient was made to sit 10 feet from the chart and asked to read from the chart with each eye separately, keeping the other eye closed. Based upon his ability to read the chart, his visual acuity was noted accordingly.

Diplopia was checked in all the planes i.e. vertical planes (upward and downward), horizontal planes (medial and lateral) and oblique planes by placing a finger in each of the planes and asking the patient to look at it with one eye, keeping the other eye closed, without moving his head. If he saw two fingers in any of the planes, it was noted as presence of diplopia in the respective plane.

Pupillary reflexes were noted by shining a light on the patient's eyes, one eye at a time. Both direct and consensual responses were noted, first for one eye, and then for the other. Any loss of papillary reflex was noted.

Extra-ocular eye movements were checked by asking the patient to look in all the planes i.e. vertical planes

(upward and downward), horizontal planes (medial and lateral) and oblique planes. Failure of movement of the eyeball in any particular plane meant loss of extra-ocular eye movement in the particular plane.

To check the intra-ocular pressure, the patient was made to lie down in a supine position when the patient first reported, and the eye anesthetised with 2 % lignocaine eye drops. Intra-ocular pressure was noted, using indentation tonometry (Schiotz tonometer, Riester, Germany). The tonometer was placed over the cornea of first the eye on the unaffected side, and then on the eye on the affected side (Figs. 1, 2).

Fig. 1 Schiotz tonometer

Fig. 2 Recording the intra ocular pressure

The readings were noted down, and compared with the conversion table supplied alongwith. After noting the readings, Ciprofloxacin eye drops were put into both the eyes.

The procedure was repeated after 24 h and 7 days after the patient reported in group I, and before the induction of general anaesthesia, after the induction of general anaesthesia, immediately after fracture reduction, after the surgery, 24 h and 7 days post operatively in group II.

Visual acuity was also evaluated 24 h and 7 days after the patient reported in group I, and 24 h and 7 days after fracture reduction in group II.

The results were tabulated and statistically evaluated.

Results

Of the 20 patients, 18 were males and 2 were females with the average age of 33.8 years (range 18–70 years). Time from injury until presentation averaged 4 days (range 0–10 days). Visual acuity in the affected eye of 9 out of 10 patients in both groups was 6/6 (Eng-chart) and in 1 patient in both the groups, the visual acuity was 6/9 (Eng-chart). In the unaffected eye, visual acuity in all the patients of both the groups was 6/6 (Eng-chart). At the time of initial presentation 12 patients had infra orbital nerve paraesthesia (5 in Group I, 7 in Group II). Diplopia and enophthalmos was absent in all the patients. All the ZMC fractures were reduced with a Gillie's approach and lift, and were fixed using two point fixation at fronto-zygomatic suture and zygomatic buttress with 2 mm stainless steel or titanium plates under general anaesthesia. In Group I, the mean intra ocular pressures of the affected as well as the unaffected eyes were noted when the patient first reported, 24 h after reporting and 7 days after reporting, and independent T-tests were conducted. It was found that there was a significant difference in the mean intra-ocular pressure of the affected and the unaffected eyes ($P = 0.007$) when the patient first reported. The mean intra ocular pressure tended to reduce in both the eyes 24 h after reporting, which was not significant ($P = 0.127$), and further reduced 7 days after reporting, which was highly significant ($P = 0$) (Fig. 3).

In Group II, the mean intra ocular pressures of the affected as well as the unaffected eyes were noted when the patient first reported, before induction of general anaesthesia, after induction of general anaesthesia, after fracture reduction, after completion of the surgery (while the patient was still under general anaesthesia), 15 min after recovery from general anaesthesia, 24 h after the surgery and 7 days after the surgery, and independent T-tests were conducted. It was noted that there was a highly significant ($P < 0.001$) difference between the affected and the

unaffected eyes when the patients first reported, and remained highly significant before induction of general anaesthesia ($P < 0.001$), after induction of general anaesthesia ($P = 0.001$), after fracture reduction ($P = 0.002$), after completion of the surgery (while the patient was still under general anaesthesia) ($P = 0.002$), 15 min after recovery from general anaesthesia ($P = 0.002$), 24 h after the surgery ($P < 0.001$) and 7 days after the surgery ($P = 0.001$). A highly significant ($P < 0.001$) rise in the intra-ocular pressure was observed in both the eyes immediately after fracture reduction, due to oculocardiac reflex, as discussed later (Fig. 4).

The mean intra ocular pressures of the affected eyes for both groups I and II (inter group) were compared when the patient first reported, after 24 h and after 7 days, and

Fig. 3 Mean IOP group I

Fig. 4 Mean IOP group II

independent T-tests were conducted. It was found that although the mean values of the intra ocular pressure of the affected eyes in group II was higher than that in group I, there was no statistically significant difference between group I and group II in the affected eyes when the patient first reported ($P = 0.148$), after 24 h ($P = 0.052$), and after 7 days ($P = 0.901$) (Fig. 5).

Discussion

The present study evaluated the IOP in ZMC fractures. Visual acuity was noted in both the groups at the time of reporting, 24 h after reporting (group I) or after fracture reduction (group II) and 7 days after reporting (group I) or after fracture reduction (group II). No change was seen in the visual acuity of any of the patients. This is in accordance with Zachariades et al. [25] who noted reduced visual acuity in 0.45 % of patients with ZMC fractures. Visual acuity is supposed to be reduced in ZMC fractures due to retrobulbar haemorrhage, which may compress upon the optic nerve, and may even lead to blindness [26].

Diplopia was absent in all the patients. This was not in accordance with Jamal et al. [27], who noted diplopia in 16 % of the cases with ZMC fractures, and the diplopia in 98 % of these patients corrected spontaneously within 3 months. Diplopia occurs when there is fracture of the orbital floor, leading to the downward displacement of the globe, and both the eyes are not in the same plane. The diplopia which occurs is binocular diplopia, where both the eyes are functional but fail to converge on the desired

object, leading to diplopia. In the present study, diplopia was absent as there was no fracture of the orbital floor, and hence, no downward displacement of the eyeball.

Enophthalmos was also absent in all the patients. This is in accordance with the study of Obuekwe et al. [28], who reported a 0.7 % incidence of enophthalmos in patients with ZMC fractures. According to Ellis and Reddy [29], enophthalmos occurs due to an increase in the orbital volume after ZMC fractures, and it has been shown that an increase of orbital volume by 1 cm [3] produces an enophthalmos of 1 mm. In the present study, although there was displacement in group II, enophthalmos was absent, as the medial, superior and inferior walls of the orbit were intact, leading to a non-significant rise in the orbital volume. Any enophthalmos, even if present, would have been so minimal, that it was not perceivable to the naked eye.

Infra orbital paraesthesia was checked through two point discrimination, and was present in 12 (60 %) of the 20 patients (5 in group I, 7 in group II), which was found to be insignificant ($P = 1.00$, Chi square test). This was in accordance with the study of Mosgau et al. [30], who reported a 65 % rate of infra orbital paraesthesia following mid face fractures. Infra orbital paraesthesia occurs either due to direct trauma to the infra orbital nerve or the entrapment of the nerve within the displaced fractured ends, as it exits from the infra orbital foramen. According to Mosgau et al. [30], the paraesthesia reverted back spontaneously in 85 % of the cases within 12 months. This is so because in due course of time, the nerve regenerates itself. Also, during the elevation of the fracture, the entrapped nerve gets relieved and paraesthesia is reversed.

In group I (minimally displaced ZMC fractures requiring conservative treatment), it was found that there was a significant difference in the mean intra-ocular pressure of the affected and the unaffected eyes ($P = 0.007$) when the patient first reported. The mean intra ocular pressure tended to reduce in both the eyes 24 h after reporting, which was not significant ($P = 0.127$), and further reduced 7 days after reporting, which was highly significant ($P = 0$). The higher intra ocular pressure in affected eyes could be due to retro-bulbar haemorrhage, which occurred after the trauma, leading to an increase in the intra ocular pressure. As the haemorrhage resolved in due course of time, the intra ocular pressure tended to return back to normal.

Means of the intra ocular pressures of the affected eyes were noted and post hoc tests were conducted in conservatively treated patients at various time intervals. It was seen that there was no significant difference when the patient first reported and after 24 h of reporting ($P = 1$), and after 24 h and 7 days after the patient reported ($P = 1$). This is so because in group I, there was minimal displacement of the zygomatic bone, leading to an insignificant rise in the intra ocular pressure in the affected eye.

Fig. 5 Mean IOP affected eye

None of the studies reviewed have reported about the changes in intra ocular pressure in conservatively treated patients.

In group II (displaced ZMC fractures requiring surgical intervention under general anaesthesia), the fractures were repaired with Gillie's temporal approach and lift, and internal fixation of the zygomatico-maxillary buttress and the fronto-zygomatic suture, as and when required. The mean intra ocular pressures of the affected as well as the unaffected eyes was noted when the patient first reported, before induction of general anaesthesia, after induction of general anaesthesia, after fracture reduction, after completion of the surgery (while the patient is still under general anaesthesia), 15 min after recovery from general anaesthesia, 24 h after the surgery and 7 days after the surgery, and independent T-tests were conducted. It was noted that there was a highly significant ($P < 0.001$) difference between the affected and the unaffected eyes when the patients first reported. According to Dongmei et al. [22], in cases where the anatomy of the orbit is disrupted, the orbital soft tissues tend to herniate into the displaced fragments, acting like a trapdoor. Due to the retro-bulbar haemorrhage, the intra-orbital pressure tends to rise, thus increasing the intra-ocular pressure. This led to a significant rise in the intra ocular pressure in the affected eye. The difference between the intra ocular pressures of the affected and the unaffected eyes remained highly significant before induction of general anaesthesia ($P < 0.001$), after induction of general anaesthesia ($P = 0.001$), after fracture reduction ($P = 0.002$), after completion of the surgery (while the patient is still under general anaesthesia) ($P = 0.002$), 15 min after recovery from general anaesthesia ($P = 0.002$), 24 h after the surgery ($P < 0.001$) and 7 days after the surgery ($P = 0.001$). This was not in accordance with the study conducted by Paton et al. [18], who stated that though the intra ocular pressure of the affected eye was greater than that of the unaffected eye, there was no statistical difference between the intra ocular pressures of the affected and the unaffected eyes at any point of time. The variation in the results could be due to the fact that in the study by Paton et al., the type of the ZMC fracture, whether displaced or undisplaced, was not taken into any consideration, whereas in the present study, only ZMC fractures which came under Henderson's type III and IV, with considerable displacement, were treated surgically.

Means of the intra ocular pressures of the affected eyes in group II were noted and post hoc tests were conducted in surgically treated patients at various time intervals. It was seen that no significant change ($P = 1$) was present in the intra-ocular pressure at the time of reporting and before the induction of general anaesthesia. A non significant ($P = 0.723$) reduction in the intra-ocular pressure was

seen, which might be due to the effect of general anaesthetics (nitrous oxide and halothane), which are proven to cause hypotension, as described by Duncalf [31], causing a fall in the intra ocular pressure.

After reduction of the fracture, a highly significant ($P < 0.001$) rise in the intra-ocular pressure was observed in the affected as well as the unaffected eyes. This can be explained by the oculocardiac reflex (OCR) or Aschner phenomenon, which is a physiologic response to physical stimulation of the eye or adnexa [32]. It is a vagally mediated reflex with afferent tracts derived mainly from the ophthalmic division of the trigeminal nerve. Increased stimulation results in decreased activity of the sinoatrial node. In addition to bradycardia, nausea/vomiting, vertigo, syncope, gastric hypermotility, and orbital pain are classic findings. The OCR is quite commonly elicited and has been well documented during ocular surgery. Heart block, junctional rhythms, asystole, and, rarely, death have also been described which is induced by mechanical stimulation of ocular and periocular structures innervated by the ophthalmic division of the trigeminal nerve, and is characterized by bradycardia mediated by vagal stimulation and sympathetic withdrawal. According to Diaz et al. [33], the electric stimulation of the central ends of vagus nerves causes a release of hypertensive substances. Lee et al. [34] stated that systemic hypertension could lead to an increased intra-ocular pressure.

The intra-ocular pressure tended to decrease non significantly in both the eyes when subsequent readings were noted immediately after the surgery (while the patient was still under general anaesthesia) ($P = 1$) 15 min post general anaesthesia ($P = 1$) and 24 h after the surgery ($P = 1$). There was a highly significant reduction ($P < 0.001$) in the intra ocular pressures between 24 h and 7 days after the surgery. These results were similar to that of Paton et al. [18] who reported a similar pattern of change in the intra ocular pressures before, during and after the reduction of ZMC fractures, but were not in accordance with the study of Forrest et al. [15], who found no change in the intra ocular pressure of the affected eye 30 min after the reduction. This might be due to the reason that in the present study, there was no orbital floor fracture, and no orbital graft placement was done, as was done by Forrest et al. [15].

The mean intra ocular pressures of the affected eyes for both groups I and II were compared when the patient first reported, after 24 h and after 7 days, and independent T-tests were conducted. It was found that although the mean values of the intra ocular pressure of the affected eyes in group II was higher than that in group I, there was no statistically significant difference between group I and group II in the affected eyes when the patient first reported ($P = 0.148$), after 24 h ($P = 0.052$), and after 7 days

($P = 0.901$). The higher mean value for intra ocular pressure in group II than in group I could be due to retrobulbar haemorrhage in group II due to a higher magnitude of forces causing the fracture, which led to considerable displacement of the zygomatic bone. It was also seen that after 7 days, the means of the intra ocular pressures of the affected eyes in both the groups was comparable. This could be due to the reason that as the retro bulbar haemorrhage resolved, the intra ocular pressures tended to return back to their base values. No study reviewed reported about the comparison of the changes in intra ocular pressure between the conservatively and surgically treated patients at various time intervals.

If the intra ocular pressure is greater than 20 mm Hg in one or both the eyes on more than two occasions, it is termed as ocular hypertension. Ocular hypertension has been recognized as the most important risk factor for the development of glaucoma. According to Dollery et al. [35], increased intra ocular pressure reduces blood flow through both the retinal and the choroidal vessels, which, in due course of time, can lead to blindness.

It was seen that in 4 patients in group II, the intra ocular pressure in the affected eye rose beyond this value, and in 1 patient, it remained above this value even after the surgery, and returned below 20 mm of Hg 15 min after the surgery. The amount of time for which the intra ocular pressure can remain above 20 mm of Hg before causing any visual impairment is not known. So a cautious eye needs to be kept over the intra ocular pressure while reducing zygomatico maxillary complex fractures. Preventive measures for the OCR during elective ocular surgeries have been widely discussed in the literature. Identification of at-risk patients (e.g., children and patients with a history of cardiac disease) and at-risk surgeries is important to prepare surgeons and anesthetists for the occurrence of an OCR. Several factors have been postulated to predispose patients to an OCR included are modern neuromuscular blocking agents without a protective action on the heart, and opioids, in particular fentanyl and alfentanil, which can make the vagal tone the predominant tone.

Beta-adrenergic blockers and calcium channel blockers also may accentuate the reflex. Age is another predisposing factor for the OCR owing to the stronger resting vagal tone in children. Hypoxemia, hypercarbia, and light anesthesia may aid in precipitating the reflex by a mechanism known as *accentuated antagonism*, where a high background sympathetic tone induces exaggerated parasympathetic stimulation. An OCR from cold irrigation solution during ocular surgery also has been reported. In conclusion, careful monitoring and observation of the cardiac rhythm and vital signs, maintaining physiologic oxygenation and ventilation, good communication between the surgeon and the anesthetist, and judicious use of anesthetic medications

implicated in the elicitation of an OCR are of utmost importance in managing these patients. The use of prophylactic preinduction antimuscarinic agents such as atropine or glycopyrrolate is recommended in various procedures. Local anesthetics using the conduction blockade of the trigeminal nerve have been found to be protective against the OCR. Retrobulbar blocks have been proved to prevent elicitation of the reflex during ocular surgery. Local anesthetics are routinely administered to the periorbital tissue during ZMC fracture repair, which may provide a potential benefit in preventing the OCR.

Thus, while reducing ZMC fractures, any movement which is bound to cause immediate bradycardia due to OCR, might lead to an immediate and high amount of increase in the intra ocular pressure.

So, these fractures should be reduced slowly, without putting in any abrupt movements or unnecessary forces so that there is no rapid increase in the intra ocular pressure, which, in turn, could lead to any visual impairment.

Therefore, any significant bradycardia noticed during reduction and fixation of ZMC fractures, as noticed with the help of a cardiac monitor, could lead us to suspect a rise in the intra ocular pressure. As the time for which a high intra ocular pressure can cause visual disturbance is not known, it is vital to lower the intra ocular pressure as early as possible, which can be done by the anaesthetist by controlling the vagal stimulation and the resultant hypertension.

However, a larger sample size and an extensive study are required to substantiate the effect of ZMC fractures and their surgical correction on IOP.

Conflict of interest None.

Ethical Standards This study was approved by ethical committee of Pt. B.D. Sharma University of Health Sciences, Rohtak, India.

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