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HEAD AND NECK

Surgical complications in orbital decompression for Graves' orbitopathy

Complicanze chirurgiche in pazienti sottoposti a decompressione orbitaria per oftalmopatia di Graves

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SUMMARY

The objective of this study is to analyse the complications of orbital decompression in Graves' orbitopathy. The clinical records of 946 patients who had been operated on with orbital decompression for Graves' orbitopathy were reviewed and the intra- and post-operative complications with minimum follow-up of six months were analysed. An extensive review of the literature was carried out to compare results. In the case-series reported here the most frequent complications were: wasting of the temporal region (100%) in patients operated on using a coronal approach; permanent hypoesthesia of V2 (13%) and V1 (8%) in patients operated on with an upper eyelid incision. In only one patient was a total monolateral lesion of V2 reported. The most severe complications consisted in reduction of visual acuity in 5 patients, and CSF leak with cerebral complications in 2 patients, who were operated on with a non-endoscopic endonasal approach. Three patients had intra-operative haemorrhages and 3 patients had post-operative haemorrhages requiring further surgical intervention. The incidence of symptomatic sinusitis/mucoceles was 0.75%. In conclusion, orbital decompression carried out with endoscopic endonasal technique and via transpalpebral accesses appears to be associated with a low incidence of complications. Knowledge of the causes of the possible complications in the different surgical approaches can definitely help to reduce their incidence.

KEY WORDS: Graves' orbitopathy • Orbital decompression • Different approaches • Complications

RIASSUNTO

L'obiettivo di questo studio è analizzare le complicanze della decompressione orbitaria in pazienti affetti da oftalmopatia Basedowiana. Abbiamo analizzato 946 pazienti sottoposti a decompressione orbitaria per orbitopatia di Graves e le complicanze intra- e post-operatorie con un follow-up minimo di 6 mesi. Abbiamo eseguito inoltre un'estesa revisione della letteratura per comparare i risultati. Nel nostro studio le più frequenti complicanze sono state: atrofia della regione temporale (100%) nei pazienti sottoposti a decompressione con approccio coronale; ipoestesia permanente di V2 (13%) e V1 (8%) in pazienti sottoposti a decompressione con approccio transpalpebrale superiore. Un solo paziente ha avuto una lesione totale monolaterale di V2. Le complicanze più gravi sono state la riduzione dell'acuità visiva, che si è verificata in 5 pazienti, e la perdita di liquido cerebrospinale con complicanze cerebrali, verificatesi in 2 pazienti, entrambi operati con approccio endonasale non endoscopico. 3 pazienti hanno avuto un'emorragia intraoperatoria mentre 3 pazienti un'emorragia postoperatoria che ha richiesto un secondo intervento chirurgico. L'incidenza delle sinusiti/mucoceli sintomatici è stata dello 0,75%. In conclusione abbiamo evidenziato come la decompressione orbitaria eseguita con tecnica endoscopica endonasale e con accessi transpalpebrali sia una procedura chirurgica con una bassa incidenza di complicanze. La conoscenza delle cause delle possibili complicanze nei differenti approcci chirurgici può sicuramente aiutare a ridurre la loro incidenza.

PAROLE CHIAVE: *Orbitopatia di Graves • Decompressione orbitaria • Approcci differenti • Complicanze*

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Introduction

Graves' Orbitopathy (GO) is an auto-immune inflammatory disease that causes an increase in the volume of orbital adipose tissue and the extrinsic muscles of the eye. Proportionally to the prevalence of oedema or fibrosis, clinical manifestations of GO are extremely variable. The surgical indication for orbital decompression can thus be attributed to mild aesthetic problems, but also to severe proptosis, subluxation of the ocular globe, corneal exposure, in the presence or absence of diplopia and/or strabismus. Most of the publications available on orbital decompression of GO describe case-studies focusing on patients with differing pathological situations, operated on with different techniques [1]. To further complicate the

situation, surgical techniques are generally not described in detail, and chosen by the surgeon on the basis of his specialisation [2]. In fact, this makes evaluation of surgical complications very difficult.

To our knowledge, few publications have reported the rate of complications adequately [3-12]. Leong et al. [12] reported that the global incidence of complications was 9.3%, while the rate of severe complications with long-term sequelae was estimated to be 0.12%. The authors underline that many studies do not mention complications, although this does not necessarily mean that no complications arose. Moreover, Boboridis and Bunce [1] mentioned that it is difficult to reach any safe conclusions regarding the efficacy and possible complications of various techniques. However, it is of fundamental importance to investigate more in depth possible complications, and above all their causes, to further improve surgical techniques and achieve better results.

In this work, the complications that occurred in the case-histories of 946 patients with the use of different surgical techniques are collected and analysed. Furthermore, the causes are critically evaluated and the techniques implemented to reduce the incidence. A careful comparison with data from literature is presented.

Materials and methods

Clinical records of 946 (1762 orbits) of 957 consecutive patients (11 patients lost to follow-up) operated on by a single surgeon from December 1992 to December 2014 were collected. Post-operative data refer to a minimum follow-up period of 6 months. The local research ethics committee approved the study.

The first surgical technique used was the trans-antral infero-medial decompression (TA) according to Walsh and Ogura [13], (21 patients, 39 orbits). Next, the three-wall decompression with coronal approach (C) according to Mourits et al. [14] (21 patients, 38 orbits) was used. Our variation on this technique was the infero-medial approach performed with non-endoscopic trans-nasal access. The combination of the two techniques (TA + C) was carried out in 30 patients (54 orbits).

Since 2000 orbital decompression has been performed on the three walls (lateral, medial and inferior) with or without removal of adipose tissue, adapting the technique to the severity of the proptosis and/or the presence of optic neuropathy and eyes imbalance. Lateral (L) and medial (M) orbital wall surgery was performed as described previously [15 16]. The orbital floor was approached with trans-inferior eyelid access or with the "swinging eyelid" technique [17]. Due to the fact that every complication is correlated to the surgical approach, it is important to know the exact number of each surgical procedures to understand the incidence rate. The lateral orbital wall approach was used 1489 times, medial orbital wall approach 1200 times and infero orbital approach 278 times.

Adipose tissue was removed, but only in combination with decompression of one or more bony walls and almost always with external approaches. In the bilateral forms, both eyes were decompressed during the same operation to better balance the level of decompression between the two sides.

The following were all considered as major complications: death, loss or reduction of visual acuity, cerebrospinal fluid leaks (CSF), central nervous system pathologies, significant bleeding that significantly prolonged the duration of the operation or which rendered a second surgical intervention necessary, permanent impairment of the supraorbital nerve (V1) or the infraorbital nerve (V2) and total palpebral ptosis. Minor complications included injury of the dura mater of the medial and/or anterior cranial fossae, easily controlled bleeding, transient hypo-aesthesia of the forehead (V1) and of the cheek and upper lip (V2), sinusitis, mucocele, corneal lesions, cutaneous palpebral lesions, mild ptosis, wasting of the temporal region, oscillopsia and subcutaneous emphysema.

Possible causes and technical tips are analysed in order to reduce the incidence of single complications.

The problem of post-operative diplopia, considered by some authors to be a common sequela of the decompression operation [18 19], and certainly closely linked to the disease of the extrinsic muscles of the eye [20], was not taken into account.

A systematic review of the literature was performed using large biomedical databases (PubMed and Cochrane) and combining the key words "orbital decompression", "complications", "Graves' disease", "Graves' orbitopathy", "ophthalmopathy" and "thyroid eye disease". We critically analysed and selected 40 of 189 articles that reported the following complications: loss of visual acuity, cerebral complications, haemorrhages and haematomas, hypesthesia and dysesthesia in areas of innervation of the first (V1) and second (V2) branches of the trigeminal nerves, symptomatic sinusitis and mucoceles.

Results

The rates of complications in our patients with the surgical techniques used are shown in Table I.

Death

No death was correlated with the intervention of orbital decompression during the entire period examined.

Loss of visual acuity

We had five patients with mono-lateral loss of visual acuity, three following an endonasal approach, though not

Table I. Surgical complications.

Complications	Number of patients (Surgical technique)	Rate of complications (Surgical technique)
Death	0	0%
Loss of visual acuity	3 (TA); 2 (L+M)	3.23% (TA); 0.13% (L+M)
CSF leaks	8 (M); 38 (L)	0.67% (M); 2.55% (L)
Pneumocephalus	1 (M)	0.08%(M)
Meningitis	1 (M)	0.08% (M)
Cavernous sinus bleeding	1 (M)	0.08% (M)
Major bleeding	2 (L)	0.13% (L)
Haematoma of the temporal muscle	1 (C)	1.09% (C)
Intraorbital bleeding	3 (M)	0.25% (M)
Epistaxis	1 (M)	0.08% (M)
Hypoesthesia of V1	118 (L)	8% (L)
Hypoesthesia of V2	196 (S); 9 (TA)	13% (S); 9.68% (TA)
Anaesthesia of V2	1 (I)	0.36% (I)
Symptomatic chronic sinusitis	5 (M)	0.42% (M)
Mucocele	4 (M)	0.33% (M)
Corneal ulcers	8 (L)	0.54% (L)
Section of the levator muscle	7 (L)	0.47% (L)
Small areas of burn on the upper eyelid	30 (L)	2.01% (L)
Wasting of the temporal region	51 (C)	100% (C)
Oscillopsia	2 (L)	0.13% (L)
Hyposmia	4 (M)	0.33% (M)
Subcutaneous emphysema	6 (M)	0.5% (M)

TA: transantral. C: coronal. L: lateral wall. M: medial wall. I: inferior wall.

endoscopic, during the first years of our experience. The other two patients had a balanced decompression. One developed ocular keratitis and the other remained without a certain cause. Only partial recovery of visual acuity was seen during follow-up.

Cerebral complications and CSF leaks

We observed one case of meningitis after a CSF leakage not identified and not treated intra-operatively and one case of pneumocephalus. Another eight CSF leaks were identified and managed intra-operatively, without complications. One patient presented a cavernous sinus bleeding and haematoma that was managed post-operatively in a conservative fashion.

We observed 38 cases of mono-lateral lesion of the meninges of the middle or anterior cranial fossa, during lateral approaches with removal of the greater wing of the sphenoid bone. All cases were managed conservatively in 2-3 days, with compressive packing of the eye.

Haemorrhages/haematomas

We had 2 intra-operative major bleedings, during a lateral approach, which complicated the intervention, but both patients recovered without sequelae.

In the postoperative period we had a haematoma of the temporal muscle, after a coronal approach, which required intervention with general anaesthesia. Similarly, three patients were taken back into surgery within 24 hours after first surgery for intraorbital lateral bleeding.

Hypo/anaesthesia of V1, V2 innervation areas

We had 260 cases of mono-lateral hypesthesia of V1 (17.5%) one month after surgery; 118 (8%) continued to report permanent hypesthesia 6 months after surgery.

419 cases operated on externally had mono-lateral hypesthesia of V2 (28%) at one month after surgery; 196 (13%) continued to report permanent hypesthesia 6 months after surgery. We had 9 cases (9.7%) of hypesthesia of V2 in patients operated on with the TA technique. One patient (0.36%) reported the section of V2, with total deficit, during a revision procedure performed on the orbital floor with an inferior eyelid approach.

Symptomatic sinusitis/mucocele

We had 5 patients with persistent post-operative sinusitis (two frontal and three maxillary sinusitis), that were managed successfully with medical therapy. Furthermore, other four patients were operated on for mucocele (two posterior-ethmoidal and two frontal-ethmoidal) 5-8 years after orbital decompression. All these patients were operated on with endoscopic transnasal access.

Palpebral lesions
In 7 patients (0.47%) section of the levator muscle of the upper eyelid occurred with access through the upper eyelid. Six patients had no sequelae because the levator muscle was sutured with absorbable stitches at the end of the surgery. In 1 patient the lesion was not recognised during the intervention, but the patient refused corrective surgery. In 30 patients (2.01%) operated on with a lateral approach, small areas of burn on the skin of the upper eyelid, caused by the drill, occurred.

Corneal ulcers
We had some cases of corneal de-epithelisation and 8 cases (0.54%) of corneal ulcer caused by intra-operative manoeuvres, all during an external approach; all these resolved successfully with medical treatment.

Wasting of the temporal region
21 patients (100%) operated on with a coronal approach manifested hollowing, of various degrees, of the temporal region. These patients complained of mild disorders with mastication, but no aesthetic damage.

Oscillopsia
2 patients (0.13%) operated on with lateral approach, including complete removal of the greater wing of the sphenoid bone, manifested oscillopsia during mastication. The disorder was well tolerated and the patients refused corrective surgery.

Hyposmia
4 patients (0.33%) operated on with an endonasal approach complained of hyposmia.

Subcutaneous emphysema
6 patients (0.5%) operated on with endo-nasal approach presented inferior palpebral emphysema in the post-operative period, after having violently blown their noses. All these cases resolved spontaneously.

Discussion

Many works reporting the results of decompression intervention are available in the literature, although in general these describe small groups of patients often presenting varying clinical situations. Moreover, orbital decompression is performed with different techniques, depending more on the specialisation and experience of the surgeon than on ocular muscle impairment. Since the typology of complications is closely associated with the technique utilised, we wished to carry out an accurate analysis of the complications arising in our patients, in view of the fact that we used all the approaches described with the exception of Olivari's technique [21], despite the removal of adipose tissue being an integral part of many of our interventions. Leong et al. [12] reported that of 4176 decompressed orbits, the incidence of complications was 9.3%. We feel that, rather than making a simple evaluation, it is important to distinguish between major and minor complications and to try to understand the causes. Leong refers that no death occurred as a consequence of orbital decompression, but in the medical literature 2 deaths have been described following post-operative complications with the TA and infero-medial transpalpebral technique [8 22].
The worst ocular complication is total or partial loss of visual acuity. In our case-series, there were had 5 cases. Three were at the beginning of our experience with a non-endoscopic endonasal approaches. In the first case (TA technique), it was most likely that traction maneuvers on adipose tissue, which was very fibrotic, were performed to increase decompression, causing severe damage, more probably on a vascular basis, of the optic nerve. In the other 2 patients, bone fragments (anterior section of the lateral wall of the sphenoid sinus in one case and a small fragment of lamina papyracea in the other) directly or indirectly compressed the nerve: with endoscopic techniques, this complication may easily be avoided. Another patient developed ocular keratitis after balanced decompression. The last patient had total loss of visual acuity after balanced decompression partially recovered after steroid therapy. The cause of the visual loss was not identified because postoperative MRI and CT scan were negative. In the literature, 2 cases of monolateral blindness [23] and 2 cases of visual loss [3] have been reported, all of whom were operated on with infero-medial decompression. Warren et al. [24] reported 5 patients who developed postoperative panophthalmitis and progressed to blindness. Jernfors et al.[10] reported one bilateral and one monolateral postoperative blindness in patients operated on due to progressive optic neuropathy.
We report 1 case of meningitis and 1 of pneumocephalus due to incorrect closure of CSF leaks in patients operated on with a non-endoscopic endonasal approach. Subsequently, 8 other CSF leaks were closed with a middle turbinate mucoperiosteal flap. There are 28 other cases reported in the literature of CSF leaks and other major cerebral complications (Table II). Although in some cases spontaneous closure of the fistulas is described, we strongly recommend performing skull base reconstruction. On the opposite side, small lesions of the meninges of the anterior and middle cranial fossa with CSF tears (through lateral access) usually represent a minor concern which does not require any skull base reconstruction. We found 5 similar cases in the literature [7 25 26]. In our experience, in the case of lesions of less than 2-3 mm, maintenance of drainage without suction and moderate compressive eye-packing resolve the leaks in a few days.
We had 2 major bleedings, during lateral approaches, which were managed intra-operatively. One patient who was operated on with a coronal approach presented bleed-

Table II. Cerebral complications and treatment after orbital decompression reported in literature.

Authors	Surgical technique	Number of patients	Number of orbits	Cerebral complications	Treatment
Bailey et al. [28]	3-walls	55	97	2 CSF leaks	1 nasal packing; 1 neurosurg op
De Santo [23]	TA	200	399	4 CSF leaks	No treatment for the leak
Garrity et al. [3]	TA	428	851	15 CSF leaks (4 meningitis, 1 patient died); 1 frontal lobe haematoma	4 second operations
Kashkouli et al. [9]	Transconjunctival approach	1 (case report)		1 subarachnoid haemorrhage and frontal lobe ischemia	No treatment for the leak
Kasperbauer et al. [33]	Medial wall and floor (endoscopic approach)	59	88	2 CSF leaks	2 closed intraop
McCormick et al. [8]	Medial wall and floor (inferomedial approach)	2 (case report)		2 CSF leaks (1 died)	No treatment for the leak
Murchison et al. [34]	Medial wall and floor (transconjunctival approach)	1 (case report)	1	Meningoencephalocele	Resection of the herniated brain tissue and skull-base reconstruction
Nadeau et al. [35]	1 orbit: medial wall 16 orbits: medial and lateral walls 6 orbits: medial wall and floor 50 orbits: medial, lateral and floor	40	73	1 CSF leak	No treatment for the leak
Schaefer et al. [36]	Inferomedial approach	41	72	1 CSF leak	No treatment for the leak
Warren et al. [24]	TA	305	610	1 CSF leak with meningitis	No treatment for the leak

TA: transantral. CSF: cerebrospinal fluid.

Table III. Haemorrhages and haematomas after orbital decompression reported in the literature.

Authors	Surgical technique	Number of patients	Number of orbits	Bleeding
Antisdel et al. [37]	3-walls	50	86	1 epistaxis (second operation)
Eloy et al. [38]	Endoscopic approach	16	27	1 epistaxis
Garrity et al. [3]	TA	428	851	1 frontal lobe haematoma 11 blood transfusions
Jernfors et al. [10]	TA / Transnasal endoscopic approach	78	144	2 epistaxis
Kashkouli et al. [9]	Transconjunctival approach	1 (case report)		1 subarachnoid haemorrhage and frontal lobe ischaemia
Kikkawa et al. [39]	3-walls		9	1 haemorrhage (second operation)
Lund et al. [40]	59 orbits: inferomedial approach	33	59	3 moderate haemorrhages
McCormick et al. [8]	Medial wall and floor (transconjunctival approach)	2 (case report)		1 epistaxis
Metson et al. [19]	8 orbits: lateral wall 33 orbits: medial and lateral walls	26	41	1 epistaxis
Nadeau et al. [35]	1 orbit: medial wall 16 orbits: medial and lateral wall 6 orbits: medial wall and floor 50 orbits: medial, lateral and floor	40	73	1 epistaxis
Olivari [21]	Fat removal	57	108	1 haematoma
Pezato et al. [41]	3-walls	15	17	1 haematoma
Ulualp et al. [30]	Medial wall (endo) and floor (transconjunctival approach)	15	28	1 haematoma
White et al. [42]	Medial (endo) and lateral walls	34	64	2 epistaxis

TA: transantral.

ing in the area of the temporalis muscle (which was sectioned and sutured with this technique). This patient required a revision procedure. Two other patients presented bleeding in the lateral orbit compartment, starting from the adipose tissue. Currently, our strategy is to carefully check bleeding of the adipose tissue that has been re-arranged laterally at the end of the intervention, and we use drainage with suction for 24 hours. More or less severe bleedings have been reported in the literature, described in all surgical approaches, although they are more prevalent in the endonasal approaches (Table III).

In 9 patients operated on with the TA technique, hypoesthesia of V2 occurred. Subsequently, with both endoscopic and non-endoscopic endonasal approaches, we had no more sensitivity disorders of V2 while hypoesthesia of limited areas of the forehead (8%), of the cheek, lip and wing of the nose (13%) were frequent with external access. The cause of impairment of the nerve is associated with drilling of the lower tract of the greater wing of the sphenoid bone, near the inferior orbital fissure, prior to the entrance of V2 in the bony canal of the maxillary bone. Only 1 patient had a monolateral section of V2: this happened during a revision procedure of the orbital floor. In the literature, this complication has been reported to ranges from 0.7% to 32% for V2 and around 5% for V1 (Table IV).

The incidence of symptomatic sinusitis is quite low, considering that some patients already present signs of chronic sinusitis at the moment of the orbital decompression. We have had only 4 mucoceles treated surgically. This incidence, however, is likely to be underestimated insomuch as small mucoceles can remain asymptomatic for years and some patients may not refer to our hospital for postoperative sinusitis. Our data is in agreement with those in the medical literature. The incidence of symptomatic sinusitis and mucoceles was low (Table V).

We had 1 case of complete unilateral lesion of the levator palpebrae muscle, not identified during surgery. We advise performing the superior eyelid approach carefully in order to reduce the risk of damaging the levator palpebrae muscle: in the event of partial or complete cut, immediate suturing of the muscle should resolve the problem [15].

Table IV. Hypesthesia and dysesthesia in areas of innervation of V1/V2 after orbital decompression reported in the literature.

Authors	Surgical technique	Number of patients	Number of orbits	Number of transient V1 hypoesthesia	Number of permanent V1 hypoesthesia	Number of transient V2 hypoesthesia	Number of permanent V2 hypoesthesia
Bailey et al. [28]	3-walls	55	97			5 (5%)	
Barkhuysen et al. [43]	3-walls (transconjunctival approach)	7	14			2 (14.3%)	1 (7.1%)
Carrasco et al. [44]	63 orbits: TA 65 orbits: transconjunctival approach	75	128			29 (46%) WO 4 (6.1%) transconj	
De Santo [23]	TA	200	399			200 (50%)	10 (2.5%)
Garrity et al. [3]	TA	428	851			Frequent	23 (2.7%)
Goh et al. [45]	10 orbits: lateral wall 65 orbits: medial and lateral wall 5 orbits: medial wall and floor 2 orbits: lateral wall and floor 69 orbits: medial, lateral and floor	88	151			15 (9.9%)	1 (0.7%)
Jernfors et al. [10]	TA / Transnasal endoscopic approach	78	144				25 (32%)
Kalmann et al. [4]	3-walls (coronal approach)	125	250	Almost all	1 (0.4%)	6 (2.4%)	1 (0.4%)
Kingdom et al. [46]	3-walls	77	114				1 (0.9%)
Liao et al. [47]	Transforniceal	35	62			2 (3.2%)	1 (1.6%)
Lund et al. [40]	35 orbits: Patterson's approach 24 orbits: endoscopic approach	33	59				4 (6.8%)
Maroon et al. [26]	4-walls (ext)	4	7				1 (14.3%)
Michel et al. [48]	Endoscopic approach	78	145				4 (2.8%)
Olivari [21]	Fat removal	57	108	2 (1.9%)	5 (4.6%)		
Sasim et al. [27]	92 orbits: coronal approach 47 orbits: swinging eyelid approach	74	139		5% of the coronal approach		25% of the swinging eyelid approach
Tjon et al. [49]	TA	75					3 (4%)
Warren et al. [24]	TA	305	610			20%	5%

TA: transantral.

Table V. Symptomatic sinusitis and mucoceles after orbital decompression reported in literature.

Authors	Surgical technique	Number of patients	Number of orbits	Number of frontal sinusitis	Number of maxillary sinusitis	Number of sinus surgery
Antisdel et al. [37]	3-walls	50	86	1	2	3
Bough et al. [50]	TA	1 (case report)	2		2	2
Cansiz et al. [51]	18 orbits: TA + medial wall (endoscopic approach) 8 orbits: TA + medial wall (endoscopic approach) + lateral wall	19	26		1	1
Carrasco et al. [44]	63 orbits: TA 65 orbits: transconjunctival approach	75	128		10 (6 TA, 4 transconjunctival)	
Eloy et al. [38]	Endoscopic approach	16	27	1		1
Garrity et al. [3]	TA	428	851		18 (not specified what kind of sinusitis)	0
Goh et al. [45]	10 orbits: lateral wall 65 orbits: medial and lateral wall 5 orbits: medial wall and floor 2 orbits: lateral wall and floor 69 orbits: medial, lateral and floor	88	151		3	1
Hanabury et al. [52]	TA	28			4	1
Jernfors et al. [10]	TA / Transnasal endoscopic approach	78	144		14	3
Kasperbauer et al. [33]	Medial wall and floor (endo)	59	88		3 (2 maxillary sinusitis, 1 ethmoid mucocele)	3
Lee [53]	External ethmoidectomy	1 (case report)	1	1		1
Leung et al. [11]	Endoscopic approach	20	29	4	1	3
Lund et al. [40]	35 orbits: Patterson's approach 24 orbits: endoscopic approach	33	59	1	2	2
Mensink et al. [54]	3-walls	1 (case report)	1	1		
Michel et al. [48]	Endoscopic approach	78	145	1	1	
Nadeau et al. [35]	1 orbit: medial wall 16 orbits: medial and lateral wall 6 orbits: medial wall and floor 50 orbits: medial, lateral and floor	40	73		8 (20%, not specified what kind of sinusitis)	4
Remulla et al. [5]	Endoscopic approach	3 (case report)		3		
Rizk et al. [55]	18 orbits: TA + medial wall (endoscopic approach) 2 orbits: medial wall (endoscopic approach)	10	20		1 ethmoid sinusitis	0
Rose et al. [56]	3-walls	6	6		6 Silent Sinus Syndrome	6

TA: transantral

All patients we operated with coronal approach presented hollowing of various degrees in the temporal regions, and temporary disorders of mastication. These complications are also described in coronal approaches and lateral orbitotomies [25 27-29].

With lateral approaches we had some cases of lesions of the cornea. Currently, our strategy is to temporarily close the eyelids during intervention with two 5-0 nylon stitches [15].

With the combined technique of swinging and endonasal endoscopy, a case of entrapment of the medial rectus muscle has also been described. This problem required a secondary procedure [30].

Olivari [31] described several possible complications of transpalpebral lipectomy, but in his vast experience (697 patients) he reported only 3 retro-orbital haematomas which were operated on immediately, 16 cases of paresis

of V1, in some other cases temporary paresis of the supratrochlear nerve, and 2 intra-orbital infections.
With the same technique, Kazim et al. [32] described only 2 cases of myogenic impairment of inferior oblique muscle function.

Conclusions

The incidence of 9.3% of complications reported by Leong et al. [12] is likely to be underestimated since many publications do not report any complications. Furthermore, many surgeons utilise the same surgical technique in all patients and often report data relating to small case-series: this makes it difficult to understand which method is associated with minor complications [1].
From the analysis of our data and of those present in literature, we conclude that the most severe complications, such as diminishing/loss of visual acuity and CSF leaks, are more frequent during trans-maxillary and non-endoscopic endonasal approaches. Certainly, correct closure of accidental CSF leaks has significantly reduced the incidence of severe complications. We do not consider small meningeal lesions caused during external approaches as major complications as the use of drainage without suction and moderate eye-packing for a few days are usually sufficient to resolve this problem. Lesions of V1 and V2 were much more frequent with external access, and therefore maximum attention is required to not traumatise these nerves during surgery. The incidence is likely to be underestimated also for this complication because patients tend not to refer minor complaints unless specifically asked.
Generally speaking, bleedings have a low incidence. For lateral approaches, the use of drainage with suction for 24 hours seems to be very useful in managing mild to moderate bleeding.
Symptomatic sinusitis was not frequently reported, but in the endoscopic approach it is important to perform extensive antrostomy involving the natural ostium, remove the lower two thirds of the middle turbinate and carry out a complete anterior sphenoidotomy to allow adequate ventilation of the sinuses. We advise keeping the anterior one third of the lamina papyracea in place to avoid the risk of frontal sinus dysventilation.
It is also advisable to protect the cornea and conjunctiva during surgery, especially during external approaches, by closing the eyelids with stitches. The introduction of endoscopic endonasal techniques through the medial wall and with superior and inferior eyelid incisions, as used in blepharoplasty, have made this intervention less invasive and have reduced the incidence of complications [15].
It should be noted that most complications represent a minor problem for the patient compared to a pathology with important functional and psychological impairments.

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