Orbital Inflammations Due to Paranasal Sinuses

Toru SEKITANI
Department of Otolaryngology,
Yamaguchi University School of Medicine
(Received May 7, 1975)

As a rule it is a rarity for inflammations of the orbit to arise from the orbit itself, and they originate in the neighbouring structures such as the paranasal sinuses, the teeth and the lacrimal sac, while the metastatic deposition of the infective organisms cannot be excluded. The most usual sourse of orbital inflammations extending from neighbouring regions is paranasal sinuses (the frontal, ethmoidal, sphenoidal and maxillar sinuses). The frequency of paranasal origin in orbital inflammations was studied and described by many authors: Birch-Hirschfeld (1909)[1)], 60 per cent; Bourdon (1922)[1)], 83 per cent; Wallner (1941)[1)], 70 per cent; and Talkovskii (1940)[1)], 39 per cent. In general, paranasal sinus infections extend to the orbit in three ways: 1) It may burst through the patitions separating the sinus and orbit because the bone is always thin and frequently shows natural dehiscences: 2) More commonly it travels directly by the veins as a thrombophlebitis or periphlebitis causing either a subperiosteal infection or a cellulits; 3) A third possibility cannot be ruled out metastatic spread by the blood stream.

The frequency with which the different sinuses casue orbital inflammation has caused some dispute. Birch-Hirschfeld (1909) reported 129 cases in frontal, 89 cases in maxillar, 83 cases in ethomoid, 25 cases in maxillar and 60 cases in pansinuses. Mygind (1920) attributed the highest proportion to the ethmoids, holding that a primary infection in these cells frequently affected the frontal sinus secondary.

We propose now to describe and analyse in great detail our twelve cases and our present analysis of its clinical features is based upon the study, made possible through the courtesy of our colleagues at the Dept. of Ophthalmology and Otolaryngology Yamaguchi University Hospital. These we have examined in course of the last few years.

Case 1. Male, aged 46, was seen on June 17, 1971, with marked swelling on the left sided eye lid and forehead for a month. He had been performed in frontal sinus operation on the left side by external approach thirty years ago. Since then he had his nostrils in good condition until his recent trouble with eye. Visual acuity in both eyes was 20/20. The left eye showed

exophthalmos 16 mm. (right side 14 mm). He complained of double vision and examination showed paralysis of the inferior oblique on the left side. Body temperature was 36.3 C.; white blood count, 6700; X-ray films showed cloudness on the left frontal sinus. In nostrils there was no pus and swelling on the mucous membranes particularly on the left sided middle meatus.

Prof. Kobayashi, chief in the Dept. of Ophthalomology, of our Hospital made a diagnosis of mucocele on the left frontal sinus and asked us to do operation on the left frontal sinus.

On June 22, 1972, external frontal surgery was performed. There was bony defect on the squama on the frontal bone just upwards the supra-orbital margin, which seems to be operation scar performed on 30 years ago. The left frontal sinus was filled with mucous fluid and had swollen mucosa, and the orbital plate on the frontal bone had no defect. The patient was discharged 2 weeks later with no exophthalmos or diplopia.

Case 2. - Female, aged 47, was seen on June 21, 1972, with exophthalmos of the right eye, diplopia, and redness and edema of the upper lid for two months. Prof. Kobayashi, ophthalmologist, saw her and made a diagnosis of right frontal sinusitis and referred to us for her paranasal condition. Her visual acuity on both eyes was 20/13, the right eye showed slight exophthalmos of 16 mm. (left side14 mm.). and diplopia increased in looking up. There was no swelling in the mucosa of the right middle meatus and X-ray films revealed cloudiness of the sinus.

On June 1, 1971 external frontal surgery was performed. There was a bony defect (0.7×0.8 cm.) on the orbital plate just beneath the supra-orbital margin with the squama of the frontal bone in normal. In right frontal sinus we could see purulent fluid and the mucous membrane was swollen after procedure diplopia and exophthalmos on the right eye subsided and seventeen days after operation, she was discharged.

Case 3. - Male aged 13, was seen on June 10, 1971 with pain of the left eye and over flow of tear since one month. Recently he complained of swelling and edema on the left inner canthus which was getting increased and never complained of diplopia and exophthalmos. The visual acuity on both eyes was 20/16 and there was no exophthalmos on both eyes (13 mm). His visual fields were normal. A few days before admission some ophthalmologist made a diagnosis of orbital tumour on the left side and performed on operation without mass into the left orbit. X-ray films showed cloudiness on the left frontal and ethmoid sinuses. The left middle meatus was clear. External frontal and ethmoidal surgery was performed on July 6, 1971.

There was bony defect on the left lacrimal bone with intact bony surface on the squama and orbital plate of the frontal bone. There was purulent fluid in the frontal and ethmoidal sinuses wit swelling of the mucous membranes. One week later operation swelling and edema on the onner canthus subsided.

Case 4. - Female, aged 53, was seen August 20, 1971, with deformity on the left sided face (Fig. 1) accompained by marked exophthalmos and diplopia. About thirty years ago she had first noticed slightly diplopia and then complained of exophthalmos on the left eye which was getting increased. The deformity on the left sided face had occured for five years. Visual acuity in the left eye was 20/65 (right eye 20/20). and extreme unilateral exophthalmos of 28 mm. on the left side (right side 15 mm.). was found. There was paralysis of the left medial and inferior rectus muscles. There was a large mass in the nostril so that the inferior and middle turbinates could not be seen. X-ray films showed cloudiness on the frontal ethmoidal and maxillary sinuses on the left side and the inferior orbital margin and the piriform aperture on the left side were gone.

On August 31, 1971, external fronto-ethmoidal and maxillar surgery was done. There was large mucocele on the ethmoidal and maxillar sinuses, which extended to the frontal sinus and nostril on the left side, and the bony wall on the inferior orbital area and lateral wall on the left nostril

Fig. 1

were gone by the mass. One week after procedure external ocular muscle paralysis subsided, though exophthalmos was still seen (Fig. 1).

Case 5. - Female, aged 66, was seen on September 7, 1972, with swelling and edema on the right upper lid and diplopia for four months. She was made a diagnosis of orbital tumour on the right side by Dr. Kondo, Dept. of Ophthlmology of our university who asked us her condition on the nasal sinuses. The visual acuity in the right eye was 20/25 (the left eye 20/30). and there was exophthalmos of the right superior oblique muscle. In nostril there was discharge in the sided middle meatus with swelling on the middle turbinate. X-ray films showed cloudiness of the right frontal sinus.

On September 16, 1971 external frontal surgery was performed. There was bony defect on the orbital plate of the frontal bone just beneath the supra-orbital margin of the right side. The mucous membranes in the frontal sinus was swollen and in the frontal sinus, purulent discharge was seen. Her diplopia and exophthalmos subsided after one week later procedure (Fig. 2).

Case 6. - Male, aged 31, 1972, with swelling and edema on the right lid, and diplopia for four months. He was seen by Dr. Kondo, who made a diagnosis of right orbital tumour and was recommended to examine his paranasal condition by us. Visual acuity of the right eye was 20/65 (left eye 20/20). There was exophthalmos of 18 mm. on the right eye (left eye 15 mm.). and paralysis on the external ocular muscles on the right eye. X-ray films showed cloudiness on the frontal and ethmoidal sinuses of the right side. There was swelling on the middle turbinates on the right side.

Fig. 2

On April 4, 1972, external fronto-ethmoidal surgery was performed.

There was purulent discharge in the frontal and ethmoidal sinuses on the right side with swollen mucous membranes. The supra-orbital margin of the frontal bone was gone. One week after procedure exophthalmos and diplopia subsided.

Case 7. - Female, aged 58, was seen on March 3, 1972, with following episode. On March 1, she had face trauma by a furniture at home. At that time her left frontal area was struck hard and the left upper lid was severely swollen with eye pain. Visual acuity of the left eye was 20/200 (right eye 20/40). Exophthalmos of the left eye was 19 mm. (right eye 13 mm.). Fundus and visual field were normal on examination. There was total external ocular muscles paralysis on the left side. X-ray film showed slight cloudiness on the frontal sinus of the left side and the supra-orbital margin was not seen. Nostrils were clear.

On March 7, 1972, external frontal surgery on the left side was performed on.

In the sinus, blood clot was filled and mucous membrane was thin in normal structure. There was bony defect (0.2×0.3 cm) on the orbital plate of the frontal bone with intact of the squama. It was of importance to note that in the left orbit there was large amount of blood clot which filled until behind the bulbus. It was removed completely. Five days after procedure, paralysis of the external ocural muscles subsided and visual acuity increased to 20/25.

Case 8. - Male, aged 37, was seen November 16, 1971, with exophthalmos on the left side accompained by swelling and edema of the upper lid for a month. Dr. Kobayashi saw him and made a diagnosis of left frontal pyocele and consulted us for him. He had a history of radical operation on the maxillar sinuses ten years ago. Visual acuity in the left eye was 20/25 (right eye 20/13). The left eye showed exophthalmos 17.5 mm (right eye 16 mm). Fundus was clear. There was paresis of the external ocular muscles on the left side. In nostrils the middle meatus on the left side was obstructed with swelling of the middle turbinate. X-ray film showed cloudiness on the frontal and ethmoidal sinuses on the left side.

On November 30, 1971 external frontal and ethmoidal surgery was performed.

There was a large defect on the lacrimal bone. In the frontal and ethmoidal sinuses there was purulent discharge with swollen mucous membranes. Seven days after procedure his ophthalmological trouble subsided.

Case 9 - Female, aged 38, was seen January 12, 1972 with ptosis of the upper lid and exophthalmos on the right eye for two months. She was seen by Dr. Kobayashi who recommended to be seen by us for paranasal condition. Visual acuity of the right eye was 20/25, and exophthalmos of 20 mm. on the right eye (left eye 13 mm.) was examined. No external ocular muscle paresis was seen. Fundus and visual field were normal. The nostrils were clear. X-ray films showed cloudiness on the right frontal and ethmoidal sinuses.

On January 18, 1972, external frontal and ethmoidal sinuses surgery was performed.

There was slight swelling on the mucous membrane of the frontal and ethmoidal sinuses. No bony defect was seen on the frontal and lacrimal bones. Two weeks after procedure exophthalmos subsided (Fig 3).

Case 10 - Female, aged 43, was seen June 3, 1971, with exophthalmos, swelling and edema on the right eye for two months. She noticed first slight swelling on the right eye and it has been getting increased. Recently she complained of exophthalmos and diplopia on the right eye. Visual acuity of the right eye was 20/25 (left side 20/20) and exophthalmos of 23 mm. was seen in the right eye (left eye 17 mm.). There was paralysis of external ocular muscles on the right side. Nostrils were clear. X-ray films

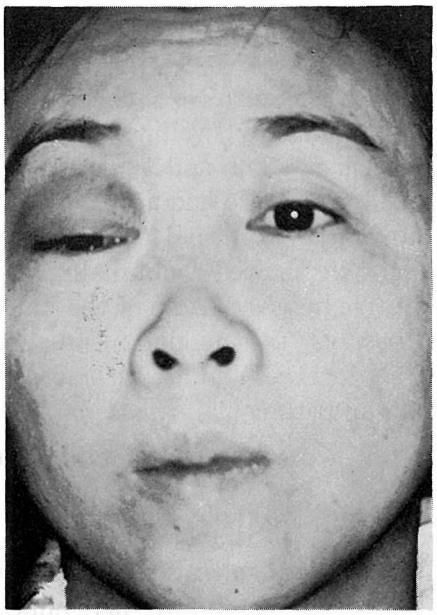

Fig. 3

showed cloudiness on the right frontal sinus with destruction of the supra-orbital margin.

On October 10, 1971 external frontal sinus surgery was performed. There was bony defect on the squama just upwards the supra-orbital margin on the frontal sinus, and in the sinus purulent discharge was seen and the mucous membrane of the sinus was swollen. Seventeen days after procedure unilateral exophthalmos and diplopia subsided.

Case 12 - Male, aged 56, was seen December 9, 1971, with swelling and edema on the right lid and exophthalmos for three weeks. Visual acuity on the right eye was 20/40 (left eye 20/40). Unilateral exophthalmos of 19 mm. (left 15 mm.) was seen. There was paralysis of the right external ocular muscles. X-ray films showed cloudiness on the right frontal sinus. Nostrils were clear.

On January 6, 1972 external frontal surgery was performed. There was no deformity on the frontal bone, and in the sinus no pus was seen. The mucosa slightly swollen. Eight days after procedure his eye trouble was the same as before.

Case 12 - Female, aged 60, was seen Febuarry 24, 1972 with edema and swelling on the left inner canthus for three months. Since ten years she had complained of nasal obstruction. Visual acuity of the left eye was 20/100 (right eye 20/25), no exophthalmos and diplopia were seen. In nostrils there was large nasal polypus on each side. X-ray of films showed cloudiness on the frontal and ethmoidal sinuses.

On March 14, 1972 left external frontal and ethmoidal surgery was performed. There was bony defect on the lacrimal bone, and in the frontal and ethmoidal sinuses purulent discharge was seen. One month after procedure she was discharged from our hospital.

We come, finally, to consider in great detail important clinical aspects of the condition. 1) Topographic anatomy; 2) Classification of clinical features.

1) Topographic anatomy of the orbit and paranasal sinuses.

There is a close relationship between the orbit and the paranasal sinuses. The orbit and the ethmoid cells are separated by the thin paper plate of the ethmoid (the orbital lamina of the ethmoid) which forms the large and more important component, because it is a common route through which sinus infections produce an orbital infections. The medial wall of the orbit is formed above by a part of the orbital process of the frontal bone, which also forms the major portion of the roof of the orbit; the remainder of the medial wall is formed by the lacrimal, ethmoid, and sphenoid bones,

arranged anteroposteriorly in that order. Ethmoid air cells typically invade also the lacrimal bone, and may likewise invade the frontal, or the frontal sinus may extend backwards in the upper portion of the medial wall and in the roof of the orbit. Behind the ethmoid is a portion of the body of the sphenoid bone, where this forms the medial portion of the optic canal.

The roof of the orbit is formed largely by the orbital process of the frontal bone, with the lesser wing of the sphenoid contributing a minor portion posteriorly. Anteriorly, the roof presents in its lateral part a slight impression, the fossa for the lacrimal gland, and medially there may be either a more pronounced but much smaller impression, the trochlear fovea, or a small trochlear spine. The medial portion of the roof is favorite route by which mucoceles invade the orbit; it is closely related to ethmoidal cells which may also spread laterally some distance in the roof.

The floor of the orbit slopes up on its medial side to join the medial wall, hence no sharp line can be drawn between these two walls; laterally and posteriorly the inferior orbital fissure may be considered as separating the floor from the lateral wall. The lateral wall of the orbit is the greater wing of the sphenoid bone; anterior to this, at and behind the orbital rim, is the frontal process of the zygomatic; it is along the suture between sphenoid and zygomatic bones that the bone flap is fractured in lateral orbitotomies.

2) Classification of clinical features.

Hubert (1937) studied orbital inflammations due to paranasal sinus infection and classified them clinically into the following five groups.

Group 1. Inflammatory edema of the eyelids, with or without edema of the orbit, most marked near the sinus involved. The infection is limited to the sinuses and there is only inflammatory edema of the lids. The eyeballs movable in all directions and the vision is usually not affected. If the edema extends into the orbital tissue, then there appears a slight exophthalmos and some limitation of the movement of the eyeball.

Group 2. Subperiosteal abscess. There is infection of the bony wall and the periosteum, with a collection of pus between them. There is a circumscribed swelling, which is painful to the touch. The eyeball is displaced and there is interference with its mobility, depending upon the location of the periosteal abscess. The pus may extend into the lids and break through forming a fistula.

Group 3. Orbital abscess. The orbital tissue proper is infected by a direct extension throgh the orbital wall and fascia, or through the venous circulation. Exophthalmos and ehemosis are marked, the eyeball is immobile and there is interferece with vision. The pus may spread to the lid or the

conjunctiva and break through.

Group 4. Orbital cellulitis. Phlebitis of the ophthalmic veins occurs when the infection extends into the orbital tissue through the venous circulation. Prostration and high temperature are prominent features. Extreme exophthalmos, ehemosis, fixation of the eyeball, and disturbance of visin are noted. These cases may not show any macroscopically, but on microscopic examination there is evidence of periphlebitis and scattered areas of necrosis.

Group 5. Cavernous sinus thrombosis. This complication gives essentially the picture of a severe orbital cellulitis as seen in Group 4.

The above mentioned describtion as to the classification of clincal features is a quotation from Smith and Spercer's paper (1948).

The ophthalmological aspects in our cases are given in Table 1. In the twelve cases of orbital inflammations due to paranasal sinusitis in this study we found ten cases of Group 3 and two of Group 2 (Case 1 and 3), and eight cases arising from only the frontal sinus, three arising from the frontal and ethmoidal sinuses (Case 6, 9 and 12) and one from the frontal, ethmoidal and maxillary sinuses (Case 4). Judging from the above mentioned classification we could not find out any cases included in Group 4 and 5. It seems to be a probable reason why there is no case included in Group 4 and 5 in this study that staffs in the Dept. of Ophthalmology and Otolaryngology at our hospital cooperate with each other to prevent delay in carrying out adequate diagnostic and therapeutic measures, while recent improvement in treatments of inflammatory condition, particularly using antibiotics can not be excluded.

Table. 1. Clinical Aspects of Orbital Inflammation due to Paranasal Sinuses.

	Edema of the eye lids	Exophthalmos	Diplopia	Vision	Abscess
1. Male, aged 46.	+	+	−	Normal	+
2. Female — 47.	+	+	+	Abnormal	+
3. Male, — 13.	+	−	−	−	+
4. Female, — 53.	+	+	+	−	+
5. — — 66.	+	+	+	−	+
6. Male, — 31.	+	+	+	−	+
7. Female — 58.	+	+	+	−	+
8. Male, — 37.	+	+	−	−	+
9. Female, — 38.	+	+	+	−	+
10. — — 43.	+	+	+	−	+
11. Male, — 56.	+	+	+	−	+
12. Female — 60.	+	+	+	−	+

SUMMARY

Twelve cases with orbital inflammation due to paranasal sinuses have been reviewed and, topographic anatomy of the orbit and classification of this disease have been discussed.

REFERRENCES

1) Duke-Elder, S.: *Text-book of ophthalmology*. Vol. 5, p. 5422, 1952. Henry Kimpton, London.