

## EXOPHTHALMOS\*

A. D. RUEDEMANN, M. D.

### *Bilateral Exophthalmos*

*Malignant exophthalmos:* Malignant exophthalmos and unusual instances of toxic goiter present some of the most serious problems with which the ophthalmologist has to deal in treating diseases of the glandular system. This group of patients requires special consideration and attention, first, because in the true cases, no exophthalmos existed before operation and secondly, because a review of the histories of these patients reveals certain features which make one realize that structures other than the thyroid gland must be involved, although the clinical picture is largely that of hyperthyroidism. The pulse rate may not be extremely high and the loss in weight may not be great. The basal metabolic rate is inconsistent and usually is not so high as would be expected in cases in which a great deal of weight has been lost.

True malignant exophthalmos appears after operation. The patient notices that the eyes are beginning to protrude and this progresses if no treatment is received. When the patients are seen early, the use of thyroid extract up to the point of tolerance often checks the progress of the ocular changes. Large quantities of glandular extract are tolerated well, but the medication must be controlled by repeated estimations of the basal metabolic rate. The edema is that of a severe myxedema, both in the upper and lower lids, and the patients may gain weight. Unless care is exercised, these patients may be thought to have recurrent hyperthyroidism, and a second thyroidectomy may be performed which may result in serious impairment of the general health and may lead to anterior luxation or even to death.

Patients with this disease have terrific venous engorgement; they may have papilledema, and they are extremely uncomfortable because of headaches. One of our patients had associated increased intracranial pressure which persisted for a long time after operation.

“Decapping” of the orbit (Naffziger) is the best approach for the emergency relief of this condition because it corrects the acute condition whereas general treatment can only improve or check it. Deep roentgenotherapy is now being used in the treatment of four patients, and in none of them is the exophthalmos progressing as before.

Further study, adequate treatment, and better selection of cases before operations are performed on the thyroid gland, will reduce the incidence of this condition. However, a number of our patients in whom

\* This is the third of four papers on exophthalmos and protrusion of the eyeball. The final paper will appear in the April issue of the Quarterly.

## EXOPHTHALMOS

this complication developed were studied preoperatively as thoroughly as possible in the light of existing knowledge of thyroid disease. This distressing condition probably results because certain phases of thyroid disease and interglandular relationships are not understood.

*Hypometabolism:* Many patients with hypometabolism suffer from severe ocular disturbances which are not relieved by glasses and hence these individuals go from oculist to oculist seeking relief that can only be supplied by treatment of the general disease. The majority of the patients in this group are between forty and sixty years of age and they usually present themselves because of headaches and fatigue.

The headache is suboccipital in character, but of ocular origin and is due to a weakness of the accommodation-convergence (Moebius' sign). In an attempt to offset the weakness of the eye muscles the patient uses the neck muscles so that pain develops at the site of insertion of the muscles along the superior and inferior nuchal lines on the skull and the sternocleidomastoides at the tip of the mastoid. The pain in the head appears at about 10 o'clock in the morning, from 3 to 4 o'clock in the afternoon, and again after dinner at night. It is usually worse at the end of the week or after an evening of bridge, and it may be worse in midwinter, because of reading with a poor light. The convergence-divergence ratio may drop down as low as 1 to 1, although 3 to 0 is the usual ratio. The rapid muscular fatigue is apparent in other muscles of the body as well, and these patients suffer from chronic general fatigue.

Externally, the outstanding feature in cases of hypothyroidism is edema of the upper and lower lids which is similar to that seen in longstanding cases of toxic goiter, in postoperative exophthalmos, and in some cases of hypertension. The edema is worse in the morning but usually persists throughout the day, and it cannot be reduced by massage or pressure.

The exophthalmos, which may not have been noticed by the patient, may range as high as 25 mm. anteroposteriorly. This type of exophthalmos may be attributed to marked gain in weight and is the result of pseudo or true myxedema. (I have not had an opportunity to examine the tissue in any of these cases, so do not know the histologic picture it presents.) The protrusion is usually bilateral and equal. In my series of cases, the difference between the measurements in the two eyes was not greater than 2 mm. and no instance of unilateral exophthalmos was observed. The protrusion does not retract with treatment and continues to increase slowly unless thyroid extract is administered daily. Usually only small amounts are necessary to keep the metabolic rate at a normal level.

The fissures are normal, rarely being wider than 10 to 11 mm. Certainly they present no diagnostic signs although, with the eye well forward, lateral inspection may reveal a larger stretch of sclera to the external angle. Ptosis and other lid signs are absent, as are muscle palsies. Itching of the lids, smarting and burning with mild photophobia may be present.

Gain in weight and a low metabolic rate, slow pulse, low blood pressure, lassitude, lack of ability to concentrate, and inability to work a whole day comprise the symptoms of hypothyroidism. General improvement may not be associated with local improvement in the eyes, and muscle exercises often are of little avail. Prisms which are used in close work are a necessity for accountants and persons who are using their eyes for close, confining work.

*Hypertension:* A number of our cases of malignant exophthalmos were associated with malignant hypertension, and in these instances, the protrusion was extreme, severe, and uncontrolled by ordinary therapeutic measures. Hypertension *per se* is not usually associated with exophthalmos, but in some instances in which the high blood pressure is of long standing, mainly in malignant hypertension, proptosis is evident. The exophthalmos is bilateral, is not severe, and is associated with edema of the upper and lower lids which is similar to that in patients with hypometabolism.

Associated with the high blood pressure and exophthalmos are vascular changes, rapid pulse, edema of the discs, and a capillary loss in the conjunctival vessels. The patients have headaches on arising in the morning, but these may disappear during the day. Dizziness, nausea, and other symptoms are also present.

The infrequent association of exophthalmos and hypertension makes me feel that the patients in whom both diseases develop will eventually be considered to have a special type of vascular disease. The patients I have observed were never aware of the exophthalmos nor were there any associated signs, such as widening of the fissures or changes in the lids, aside from the persistent edema. No diagnostic value can be attached to the sign of protrusion although it may be 6 to 8 mm. more than a high normal. The exophthalmos persists, although it may vary from 2 to 3 mm. from day to day, but it is slowly progressive. In the patients we have seen, the exophthalmos was not benefited by any treatment prescribed. All the patients died before they experienced any serious difficulty with their eyes.

*Ocular Allergy:* In my experience ocular allergy has produced only one case of exophthalmos. The edema was bilateral and transitory. The patient had a high eosinophil count and a definite history and

## EXOPHTHALMOS

positive reactions to certain allergens. Treatment for the allergic state relieved the ocular edema.

If a patient complains of a sensation of congestion with some local irritation, follicular conjunctivitis, or smarting and burning, the possibility of an allergic basis should be borne in mind and adequate skin tests should be carried out to prove or disprove the diagnosis.

*Venous and arteriovenous angioma:* Venous and arteriovenous angiomas of the brain are rare conditions. Harvey Cushing and Percival Bailey, L. Brock and Cornelius Dyke have discussed this subject and have noted the occurrence of exophthalmos in several cases. The cerebral involvement is not apparent unless roentgen studies, careful examination of the retina, and studies of the visual fields are made. Furthermore, the reflex pathways must be mapped out to elicit localizing signs of vascular involvement. In studying one of these cases of arteriovenous angioma after operation, I was surprised to find a similar modified arrangement in the conjunctival vessels. Other cases of telangiectasia have frequently revealed minute capillary varices or capillary loops of the simplest form of vascular whirls in the conjunctiva. Undoubtedly, disturbance of the vascular system occurs with sufficient frequency to warrant attention.

Ring, in an excellent case report, studied a severe venous aneurysmal disturbance before and after operation, and published the complete findings. Our experience is quite similar to his. The diagnosis is very difficult, and although the process may be localized by means of encephalography and neurologic study, the actual diagnosis is made at the time of the operation.

Brain tumors may produce proptosis by pressure on the venous outflow, which in turn produces orbital edema. This is usually bilateral, although in one well-remembered instance, unilateral edema of the disc and exophthalmos were produced. Bilateral orbital invasion by brain tumors is not unusual, and several such instances have been reported.

Orbital varices, as such, are not encountered frequently enough to warrant more than mention. I have seen two cases which were unilateral and were easily diagnosed.

Study of the eyes, retinae, visual fields, and conjunctival capillaries are indicated in cases of questionable protrusion, for my experience has been that, even with most questions as to localization answered, there is still enough confusion to warrant complete study in each instance.

### DECREASE IN THE SIZE OF THE ORBIT

Any decrease in the size of the orbital cavity results in exophthalmos. The orbital vaults are not often disturbed by bilateral new growths, and increased intracranial pressure never changes the shape of the orbits after calcification has taken place. The shape of the orbit is a protection

against this and unless some bony new growth develops, the orbits are not involved bilaterally.

*Osteitis deformans (Paget's disease):* Patients with Paget's disease are not seen by ophthalmologists often enough for them to present an important diagnostic problem; however, this condition does produce exophthalmos in rare instances. In a series of eleven cases seen at the Cleveland Clinic, protrusion of the eye was present in only one instance, and this resulted from orbital bony invasion, rather than from change in the shape of the orbit.

A more common eye complication in this disease is involvement of the optic nerve because of encroachment on the optic canal. Changes in the skull are clearly shown roentgenographically, and bowing of the legs with changes throughout the bony framework are sufficient to permit diagnosis of the condition. Although diagnosis is easy, treatment is valueless. These patients usually live out their full expectation, but may become blind before death supervenes.

*Leontiasis ossea:* A condition comparable with osteitis deformans is leontiasis ossea (Lion face). I have not seen any of these patients, but one case has been reported in which exophthalmos was bilateral. Roentgen examination is necessary for differential diagnosis in diseases affecting the bones of the face, especially of the forehead.

*Acromegaly:* In a review of our cases of acromegaly, exophthalmos was not found in any instance. Ivan Lillie, in reviewing a series of cases, found one instance of exophthalmos. Optic atrophy and other eye signs are more frequent and relative enophthalmos, due to enlarged frontal fossae, is quite frequently seen. In spite of its rarity, acromegaly is a possible cause of exophthalmos, and one case has been reported in which this condition resulted in anterior luxation. The diagnosis is not difficult and roentgenography is a valuable aid. Treatment by removal of the tumor of the pituitary or deep roentgenotherapy may be of considerable benefit to the patient.

*Relaxation of the orbital fascia:* A slight degree of exophthalmos may be produced by relaxation of the orbital fascia and muscle paralysis. The diagnoses in two cases of this type which accompanied thyroid disease were missed at first observation because the picture was obscured by the mental state of the patient in one case, and because of incomplete study in the second.

#### SUMMARY

All cases of bilateral exophthalmos deserve thorough study because the condition offers valuable information as a sign of systemic disease. Exophthalmos of slight degree warrants careful investigation, for its recognition may lead to the diagnosis of an insidious general condition, especially some type of hypometabolism. The main value of such

## EXOPHTHALMOS

study is early diagnosis, for when the protrusion is well advanced, recession is slight or negligible in most instances. This is because the early changes of venous stasis and edema are rapidly replaced by lymphocytic infiltration and fibrosis as the exophthalmos progresses. Each individual case presents a different problem. Although much of the treatment is of little value, some patients are aided tremendously by various measures.

An important problem in exophthalmos is the disturbance of muscle balance and difficulty in use of the eyes for any type of work. Rapid fatigue, pain, photophobia, labyrinthitis, and frequent changes of glasses are all secondary factors.

### UNILATERAL EXOPHTHALMOS

Examination in the presence of unilateral exophthalmos must be thorough and more painstaking than in bilateral exophthalmos because it is much more difficult to make a diagnosis. It is true here, as in bilateral exophthalmos, that the earlier the diagnosis is made, the better the end result.

The history in unilateral exophthalmos is very important, especially in regard to the time of onset, the question of pain, loss of vision, diplopia, elevation of temperature, mental disturbances, and the other symptoms and signs seen in bilateral exophthalmos.

It is well to remember that, although the determination of the degree of exophthalmos is dependent on relative measurements, general statements may be made in regard to the anteroposterior position of the eyes. Fourteen to 20 mm. may be regarded as normal, using a Hertel's exophthalmometer. The difference between measurements of the eyes is usually not sufficient to cause any marked discrepancy and a difference of 2 mm. or less should be disregarded regardless of the instrument or method used. It is in the field of unilateral exophthalmos that measurements are of the utmost importance because they reveal progressive changes which may be compared with a stationary eye. Photographs, inspection, and all other methods of examination are secondary to actual comparative study by measurements.

Unilateral exophthalmos may be due to the following conditions:

#### I. In Children

##### A. Increase in orbital contents

##### 1. Inflammatory

- a. Panophthalmitis
- b. Orbital cellulitis
- c. Pyocele, pyemic abscess
- d. Cavernous sinus thrombosis; lateral sinus thrombosis
- e. Periostitis, osteitis

A. D. RUEDEMANN

- f. Tenonitis:
  - 1. Traumatic
  - 2. Infectious
  - 3. Surgical
- g. Foreign bodies
- 2. Non-inflammatory
  - a. Hemorrhages
  - b. Intermittent (vascular)
  - c. Encephalocele
  - d. Meningocele
  - e. Dermoid cyst, teratoma
  - f. Thyroid disease
  - g. New growths
    - 1. Sarcoma
    - 2. Hemangioma
    - 3. Mucocele
    - 4. Brain tumor
  - h. Congenital malformations

II. In Adults

A. Hemorrhage

- 1. Spontaneous, leukemic
  - a. Sclerotic
  - b. Hypertensive
- 2. Asphyxia
- 3. Scurvy

B. Increase in orbital content

- 1. Inflammatory
  - a. Cavernous sinus thrombosis, lateral sinus thrombosis
  - b. Orbital cellulitis
  - c. Pyocele
  - d. Periostitis
  - e. Tenonitis
    - 1. Serous
    - 2. Purulent
  - f. Panophthalmitis
  - g. Foreign bodies
  - h. Granuloma—actinomycosis, mycelium, blastomycosis
  - i. Hydatid or echinococcus cysts
  - j. Pseudotumors
  - k. Tumors

## EXOPHTHALMOS

1. Gumma
  2. Tuberculoma
  3. Carcinoma
2. Non-inflammatory:
- a. Air
  - b. Allergic conditions
  - c. Osteomata
  - d. Sarcomata
  - e. Pulsating exophthalmos (may also be inflammatory)
    1. Trauma (77 per cent)
    2. Spontaneous (23 per cent)
  - f. Intracranial aneurysm
  - g. Thyroid disease
- C. Decrease in size of orbit
- a. Trauma
  - b. Hyperostosis, exostosis, sclerosing osteitis.
  - c. Paget's disease
  - d. Invasion from intracranial growths

### INCREASE IN ORBITAL CONTENTS

*Panophthalmitis:* The most common cause of panophthalmitis is injury. Perforating wounds from ulcers, pieces of glass, BB shot, dynamite caps and steel are not uncommon agents. The history is very important although many children do not reveal injuries they sustained while doing something that has been forbidden; therefore a plain roentgenogram of the orbit should be taken.

Non-perforating wounds may so traumatize the eye that a secondary inflammatory process is brought on. These may be due to BB shot and wounds from hard blunt instruments, such as falling against sharp corners of tables, etc.

Panophthalmitis may follow a severe debilitating illness, such as undulant fever, meningitis, scarlet fever, typhoid fever, or whooping cough. In this latter group, the patient may be seriously ill and the eye will degenerate with a severe acute course and will not respond to treatment.

The disease must be differentiated from acute conjunctivitis. In the latter there usually is a purulent discharge and the anterior chamber of the eye is not involved. In panophthalmitis there usually is no discharge, but the anterior or posterior chamber will have a purulent exudate. The eye is severely inflamed, there is some protrusion (2-6 mm. unilaterally), considerable pain, possibly edema, an increase in



temperature of one or two degrees, loss of vision, and eventually degeneration of the globe by perforation of the abscess process or resorption, and then phthisis bulbi. There is a remote danger of intracranial extension of panophthalmitis which will result in meningitis and death.

Treatment consists first of complete bed rest. Supportive measures are administered, heat is applied locally, and general therapy consists of some form of fever therapy. In traumatic cases local surgery is necessary to drain a hypopyon ulcer or to cauterize a corneal ulceration.

*Orbital Cellulitis* may follow panophthalmitis, although inflammation of the orbit may precede degeneration of the globe. Trauma is the most common cause and may be due to injuries by sticks, stones, flying missiles, football, wrestling, boxing, and surgery (enucleation, etc.). The history and roentgen examination are of definite value in establishing the diagnosis.

Cases of non-traumatic cellulitis are those that follow general diseases or a long sickness such as scarlet fever, meningitis, or influenza. This condition may be caused by invasion from the adjacent sinuses. In children up to 7 years of age, the frontal sinuses may be ignored, the antra and anterior ethmoids being the cause of the trouble.

Caries of the petrous bone, extraction of teeth, and periostitis may also be agents in the production of orbital cellulitis. Any acute process around the eye, acute hordeolum, acute dacryocystitis and lid abscess may be factors.

Signs of orbital cellulitis are edema of the lids and conjunctiva, protrusion of the eye, 2 to 10 mm. (usually much greater than in panophthalmitis), and diplopia due to impaired motility. There may be some increase in temperature and increase in the number of white blood cells.

Symptoms are pain on movement of the eye, soreness through the orbit to the side of the head, pain in the head, irritability, some insomnia, lachrymation, photophobia, closure of the lids by pressure edema, and in youngsters when the disease is severe and associated with fever, disorientation may occur.

In association with severe inflammation of the orbit we may have not a meningitis but a meningismus. The number of cells in the spinal fluid is increased but usually there are not as many as in meningitis. The spinal fluid will be free from bacteria and will clear with the diminution of the orbital inflammation.

Treatment consists of complete bed rest, application of heat locally, general supportive measures such as food and liquids, removal of foreign body, and treatment of the sinus infection. In cases of sudden exophthalmos, constant relief of the nasal edema and forced drainage

## EXOPHTHALMOS

may save the orbit from incision. Usually there is no pus in the orbit but if there is any question, a long, large-bore needle may be used to find a pus pocket. Great care is necessary in probing or washing the orbit. The incision may be beneficial, but, in those cases in which the orbit is extremely tense due to inflammatory reaction, this is not a measure to be undertaken offhandedly or unnecessarily.

The prognosis usually is good unless a pyocele develops at which time tissue destruction may be great and panophthalmitis may ensue with meningitis, cavernous sinus thrombosis, and death.

There are many slight orbital invasions which are not serious but it is impossible to differentiate these; hence, each should be treated as a serious involvement.