plained to the mother, with stress on the possibility later of closure both of the fenestra in the lateral canal and of the newly constituted auditory meatus. It was realized that the degree of hearing to be expected could not be as great as that following fenestration or otosclerosis, in which there is a normal tympanic membrane and auditory canal. The mechanism of hearing in this child's left ear would be by direct impact of sound waves upon that part of the skin graft covering the fenestra in the lateral canal.

Operation was performed on September 4. A post-aural incision, situated far back behind the hair line, was used in order to interfere as little as possible with the skin that was required for the later reconstruction of the pinna. Outwardly the mastoid process appeared fairly normal, but there was no cartilaginous or bony external auditory meatus. After opening the mastoid process the bony external semicircular canal was identified and further exposed. Neither malleus nor incus was seen, but the stapes was present though immobile. A fenestra was made in the bony external semicircular canal, and this was covered with a thin free skin graft. The bony bed on which the graft was to lie was then carefully smoothed by means of a dental polishing burr, and the graft shaped to lie closely over the fenestra in the canal and on the bony bed so prepared.

The new external auditory meatus was then made by removing a circle of skin in the appropriate spot. A large amount of skin was cut away to allow for later contraction. The tissue underlying the skin was completely removed, so that free access was obtained down to the mastoid cavity. Previous experience of rapid closure of these artificial openings led me to line the superior quadrant of the circle with the temporalis fascia swung down on a hinge, and the postero-inferior quadrant with mastoid periosteum swung forward from a hinge on the mastoid tip. Another free skin graft was then cut and the newly constituted auditory meatus lined completely with this. A plastic tube of suitable size, lined outwardly with "tulle gras," was then inserted.

A piece of nylon was placed over the skin graft in the mastoid cavity, and a pack on this, and the post-aural wound was closed completely. There was little constitutional upset after the operation, and one week later the packs and nylon from the mastoid cavity were removed. The tube and tulle gras in the external auditory meatus were left *in situ* for a few more days. The wound healed by first intention.

On September 15 a conversational voice was appreciated in the left ear at a distance of 12 feet (3.7 metres), and this improvement has so far been maintained. The external auditory meatus has contracted considerably, but it is fully lined with skin, and should remain patent without further contracture. To discourage further contracture a small plastic tube is worn in the external meatus. The mastoid cavity is clean, and the skin graft has taken completely.

It has still to be seen whether the fenestra in the external canal will remain patent, and the reconstruction of the pinna has yet to be carried out.

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UNILATERAL AMAUROSIS WITH PARTIAL RECOVERY AFTER USING HEXAMETHONIUM IODIDE

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The methonium compounds have now been in use for some two and a half years in various spheres of general surgery to provide a relatively bloodless operative field and to prevent excessive loss of blood. Several more or less enthusiastic reports have appeared; the possible disadvantages and dangers have been discussed, but so far as we can ascertain no complications have been reported in the literature. The following case is recorded because we feel that there is a reasonable presumption that the use of hexamethonium iodide in an uncomplicated case of radical mastectomy led to a potentially serious vascular complication in the eye.

Case Report

This patient, a woman aged 42, had stage 1 carcinoma of the left breast, with slight exophthalmos, but no other appreciable disease. Her blood pressure was 135/85.

At 9.45 a.m. anaesthesia was induced with thiopentone and gallamine triethiodide by oral endotracheal tube under face-piece. Maintenance was by N_2O , O_2 , and trichlorethylene with intermittent thiopentone. Induction was uneventful. A frozen section was taken. At about 10.30 a.m. hexamethonium iodide, 60 mg., was given and the patient was put in the 15-degrees anti-Trendelenburg position. B.P. fell in four minutes to 75/55, and shortly afterwards slowly rose again. At approximately 10.45 a.m. hexamethonium iodide, 40 mg., was given. B.P. fell to 70/55, but soon returned to 75/55. Bleeding was only moderately reduced. At the end of the operation about 11.45 a.m., the blood pressure was 85/70. No methylamphetamine hydrochloride was given, as it was thought to be unnecessary.

Shortly after recovering consciousness the patient stated that she could not see with her left eye. On ocular examination a few hours later neither eye showed any abnormality of the conjunctiva, cornea, or of ocular movements, and the right eye was found to be normal in all other respects, with a full field of vision to confrontation tests. The right pupil failed, however, to react to consensual stimuli. The left pupil reacted briskly to consensual stimuli and normally on accommodation, but reacted minimally to direct light. In the left fundus the disk was normal, the arteries and veins were of normal calibre and equal to those in the right eye. Circulation appeared to be normal as judged by the appearance of first venous and then arterial pulsation on applying increasing external pressure to the globe, there was no evidence of any embolus in the arterial branches, which were followed out to the periphery of the fundus, and the macular area appeared normal. The ocular tension was normal, and vision was reduced to perception of light in the central area of the visual field. No local treatment such as paracentesis was thought advisable or necessary, but the patient was put on tolazoline hydrochloride, 25 mg. four times daily. This was continued for a week.

On the following day the left vision had improved to perception of light over the whole visual field, while the patient

There are 727 doctors in Bolivia, mostly concentrated in towns, and two-thirds of the three million inhabitants live in the country (*Presse Médicale*, October 4). As there is little hospital accommodation in the country (about 1.5 beds per 1,000 of the population) many infectious diseases have to be treated at home. There is also a shortage of maternity beds. The State has only 362, and private hospitals devote half their total of 1,061 to maternity cases. Several hospitals are being built; at La Paz there is to be one for children, with 200 beds, and another for tuberculous patients.

could count fingers in the central area. The left fundus now showed a circular area of "oedema"—coagulation necrosis of the retina—covering an area some five disk diameters in width centred on the disk. This involved the macula, but no cherry-red spot was present. This was due to there being a small cilio-retinal artery supplying the macular area—the presence of which accounts for the survival of central vision from the beginning. In the next week the "oedema" of the retina gradually subsided, and as it did so the visual field gradually opened up; at the end of this time the patient could read the small print in a newspaper with her left eye. Thirty days after operation the left fundus showed generalized pallor of the optic disk and attenuation of the retinal arteries, the background of the fundus and the macular area appearing normal, the picture being typical of the late result of occlusion of the central retinal artery. At this time a full ocular examination was made. The right eye was found to be emmetropic, with vision 6/5 and a full peripheral field of vision. The left eye was also emmetropic, with vision 6/6. The left visual field was irregularly contracted, its periphery to a 1/330 white object varying between 30 and 50 degrees from the fixation point, while within this periphery there existed small blind islands.

The patient's recovery from the radical mastectomy operation was uneventful and serial blood pressures were not taken after her return to bed, as this was not thought to be necessary, but there was no suggestion of a falling off in blood pressure nor of circulatory insufficiency. On direct questioning she stated that she had had no previous eye trouble, and had never worn glasses, and there was no history of attacks of misty vision such as might suggest antecedent episodes of retinal angiospasm.

Discussion

It is clear from the clinical evolution of the case that the cause of the visual loss was retinal ischaemia serious enough to account for a severe immediate depression of function, but not prolonged enough to cause complete necrosis of those elements of the retina supplied by its central artery. The possible causes of such interruption of circulation are: thrombosis or embolism of the artery (including air embolism); pressure on the eye from without, increasing the intraocular pressure to a point where arterial circulation is mechanically impeded; arterial hypotension so low as not to maintain an adequate blood supply; and arterial spasm.

Thrombosis and embolism can be excluded on the clinical appearance of a re-established normal blood flow within 24 hours of the operation. Air embolism is admittedly a possibility, but there was nothing during the course of the operation to suggest its occurrence, and without postulating a patent interventricular septum it is unlikely that such would pass the sieve of the pulmonary capillaries.

Some four cases of occlusion of the central retinal artery after general anaesthesia have been recorded by Givner and Jaffe (1950), who attributed this complication to pressure on the globe when a patient is in a state of shock and suffering from loss of blood. With a lowered retinal arterial pressure any slight increase in the intraocular tension, the result of the pressure of a facepiece perhaps, might suffice to cut off the vascular circulation more or less completely. In the present case this explanation seems inadequate in view of the apparent survival of the area of retina, including the macula, supplied by the cilio-retinal artery, whose circulation should have been impeded by any external pressure on the globe equally with that of the central retinal artery. For the same reason we do not feel that pure insufficiency of circulation through arterial hypotension is a causative factor; if it were, such a complication should be the almost invariable concomitant of lowering the blood pressure to 70 mm. Hg for an hour or more. Furthermore, it has been calculated by Fritz (1950) that the retinal blood pressure corresponding to the amaurotic threshold is, at a minimum, 7, and at a maximum, 25 mm. Hg. The retinal ganglion and

bipolar cells will almost certainly remain viable, although perhaps temporarily functionless, at the minimum pressure, which will be considerably exceeded if the brachial blood pressure is at 50 mm. Hg.

This leaves, by exclusion, the possibility of spasm of the artery, which we believe to be the causative factor in the case. Spasm of the central retinal artery has often been described; it results usually in temporary obscuration of vision lasting a few seconds to a few minutes; if prolonged enough it may result in blindness. It is on the whole commoner in hypertensive subjects, but the mechanism of its causation is often completely obscure. In the present case what, if any, its relationship to the use of hexamethonium iodide may be it is impossible to say; it may be of significance, however, that this particular patient was to some extent resistant to the hypotensive action of the drug in that her arterial pressure did not fall below 70 mm. Hg; it is conceivable that this resistance is due to peripheral vascular contraction of unknown mechanism in which the retinal artery played so generous a part that its dependent structure, the retina, suffered severely.

Unfortunately we have no definite proof that the blood pressure did not fall to a low level after the patient's return to bed, but she had a competent special nurse and there was no suggestion of further hypotension in the one and a half hours before she recovered consciousness.

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Medical Memoranda

Exogenous Ochronosis

The clinical picture of ochronosis consists of a dark generalized pigmentation of skin and cartilage which is complicated by a marked tendency to osteoarthritis; it may or may not be associated with the excretion of homogentisic acid in the urine. The excretion of homogentisic acid is known as alkaptonuria and, according to Oppenheimer and Kline (1922), was first detected in 1858 by Bodeker. Garrod (1923) states that Virchow (1866) was the first to use the term "ochronosis" to describe the characteristic pigmentation; he used this word because histological sections of the affected tissues were stained yellow or yellowish brown.

It was Albrecht (1902), however, who first suggested that this pigmentation might be associated with alkaptonuria. It was later recognized that osteoarthritis formed the third link to make up the triad of signs in this inborn error of metabolism. It soon became firmly established that the same clinical picture, excepting the excretion of homogentisic acid, could be produced by the application of carbolic acid compresses to ulcerated areas—that is, an exogenous cause (Pick, 1906). A third group, of extreme rarity, is of endogenous origin, and consists of cases associated with the excretion of both alkapton and melanin (Duncan, 1942).

Duncan has stated that up to 1942 just under 200 cases of alkaptonuria had been described in the world literature; this contrasts with only 60 cases of ochronosis, and this discrepancy is due to many alkaptonurics not developing any pigmentation. With regard to the ochronotic cases, by far the greater number were of endogenous origin. According to Beddard and Plumtre (1912), out of 23 cases of ochronosis only 9 were of exogenous origin—that is, due to the application of carbolic acid compresses. Before 1920 it was fashionable to apply these dressings to ulcers, but now this technique has fallen into disuse. The following case is recorded because it was of exogenous origin, which is almost unknown in clinical practice to-day.