there was a physical basis for her troubles. He had been averse to performing a mastoid operation, as the end-result might be a painful scar.

**Case in which Cold Caloric Stimulation of Canals produces Nystagmus of the Ocular Type.**—W. M. MOLLISON, M.Ch.

Patient, male, aged 49, complains of tinnitus and vertigo of twelve months' duration.

*Condition on examination.*—Membranes normal. Deaf in right ear, normal hearing in left ear. Cold caloric stimulation, right or left, produces nystagmus of ocular type on looking to the contra-lateral side only.

Central nervous system normal. Wassermann reaction negative.

DISCUSSION.

Mr. HAROLD KISCH suggested that the eye movements in this case might be congenital.

Mr. HUGH JONES pointed out that as the patient sat in the next room, without any experimental stimulation of the labyrinths, one could note a definite horizontal jerking of the eyes, to both right and left, while there was no " ocular " or " pendulum " nystagmus present —either horizontal or rotatory.

The PRESIDENT said that the only case he could recall in which there was ocular nystagmus was a spontaneous nystagmus in an albino. By caloric tests one could elicit both a vestibular and a static disturbance as well. In the present case, apparently, it was the ocular type of oscillatory movement which was elicited by the vestibular test.

# ABSTRACTS

## EAR

*Concerning the Normal Function of the Vestibular Apparatus.* O. H. MOWRER. (*Annals of O.R.L.*, Vol. XLI, No. 2, June, 1932.)

" Investigators of the vestibular eye reflexes have usually employed either galvanic, caloric, rotational . . . or some other artificial form of stimulation, and the responses obtained have been correspondingly artificial, and not indicative of the real purpose of the underlying mechanism. A far more promising approach to the problem seems to lie in the study of these reflexes as they occur during normal bodily activity."

With this object in view, the author has studied, by means of cinematograph pictures, the movements of the eye and head occurring when a patient alters his vision from a point forty-five degrees to the left to one forty-five degrees to the right, and *vice versa*. He found that the time required for the eyes to change the position from one point to the other was rather less than two-sixteenths of a second while, on the other hand, the time occupied for the head to make a similar movement was five-sixteenths of a second.

In order that this delayed movement of the head should not carry the eyes beyond the desired point of fixation, it is apparent that (if movement be clockwise) the left horizontal rectus muscle of each eye must contract somewhat, and the right horizontal rectus muscle relax correspondingly. This is precisely the change occurring in the rotation test.

From these facts, the author suggests that the normal physiological function of the various vestibulo-ocular reflexes is to prevent the eyes from moving with the head, and assist them in maintaining whatever point of fixation may have been selected previously, and that such responses are highly useful under ordinary conditions of life.

The paper is illustrated with enlargements of cinematograph films taken during these experiments.

E. J. GILROY GLASS.

*The Operative Treatment of Otosclerotic Deafness.* MAURICE SOURDILLE. (*Revue de Laryngologie, etc.* September, 1932. (Special Supplement.))

This article is truly a monument of painstaking industry and perseverance in the face of the numerous and formidable difficulties which all otologists recognise as inherent in the operative treatment of otosclerosis. The history of previous attempts in this direction is uniformly that of high hopes, to be followed by disappointment and disillusion. The writer is modest in his claims to having attained a certain measure of success. He mentions 150 cases on which he has operated, but he does not give a full statistical statement of his results, for which he considers the time is not yet ripe; though he promises to supply such a statement at a future date. He tells us that in his best cases the improvement in the patient's hearing has been tenfold (e.g. from 1 to 10 metres for the conversational voice). He has been practising, and gradually perfecting the operation for the past six years.

Apart from the question of the degree of success he has attained in the main object of the operation, viz. the improvement of the patient's hearing, the evolution of the technique of the operation must be regarded as a triumph of persevering ingenuity, resource,

and manipulative skill. It would, of course, be necessary for anyone intending to embark on this highly specialised branch of surgery to study closely Prof. Sourdille's description of his operation in all its details. The article occupies thirty-nine pages of the "Revue", and the same issue of the magazine contains a full translation of the text into English. The latter should be used with care, as it is not entirely reliable, and might give a wrong impression of some of the important details. To avoid this, a close comparison with the original French is necessary.

The following is a brief summary of the chief features of procedure, which has for its object the creation of a permanent opening in the bony wall of the external semicircular canal, and the grafting over it of an epithelialised membrane sufficiently thin and flexible to transmit sound vibrations and, at the same time, to connect this membrane to the membrana tympani in such a manner that the oscillations of the latter are communicated to the graft, and thence to the perilymphatic fluid.

The whole procedure necessitates a series of at least three separate operations, performed at considerable intervals from one another. Supplementary operations may be necessary to correct partial failures occurring in any of these three main operations. Local anæsthesia by infiltration with 1 per cent novocaine with adrenalin is employed throughout. All manipulations within the cavities of the temporal bone are conducted under magnification of the field by a lens or operating microscope. A considerable armamentarium of specially designed delicate instruments is required.

*First operation.* The mastoid process is exposed by retro-auricular incision, flaps are retracted, and the pinna turned forward. The meatal tissues are cut across posteriorly at the junction of the cartilaginous and osseous portions. The skin lining the bony meatus is separated from the bone, with every possible precaution, down to the sulcus tympanicus. Two parallel cuts are made along the length of the skin tube so separated, on the superior and posterior wall respectively, so as to form a flap of meatal skin. The mastoid is opened, and its cells, with their epithelial lining, exenterated. It is necessary to detach the postero-superior insertion of the membrana tympani from Rivini's notch, whilst preserving its continuity with the meatal skin flap. The whole success of the operation depends on this connection being maintained. The flap is displaced forwards, and the bony "bridge" completely removed. No attempt should be made to separate it "en bloc" as this would entail the risk of its being pushed forwards on to the ossicular chain and, perhaps, causing the dislocation of the incus. On removal of the bridge, the chain of ossicles and the interior of the cavity of the tympanum is exposed. In these cases it is often found that,

not only is the stapes fixed in the oval window, but also the whole chain of ossicles is ankylosed and the head of the malleus is " wedged " into the attic by growth of new bone. The head of the malleus is disarticulated from the incus by means of the author's special capsulotomes, and a wire snare is passed over it down to the neck, where it is divided and removed. During this manœuvre the incus is supported in position, by packing above and below with gauze tampons.

The membrano-cutaneous flap previously outlined from the meatal skin is now completely freed, and reflected back over the stump of the malleus and the incus, and its end is laid over the posterior wall of the attic and aditus. It serves three purposes: (1) to shut off completely the tympanic cavity from the mastoid wound. Unless this is done, suppuration in the middle ear almost certainly supervenes, which entails a complete failure of the operation; (2) it provides material for starting the epidermisation of the mastoid cavity; (3) it forms a connecting band between the tympanic membrane and the opening in the labyrinth which is to be made at the third operation. The incus provides a rocking support for the flap, to the nutrition of which it contributes by establishing vascular adhesions with its raw surface. The retro-auricular wound is completely closed, and the mastoid cavity is dressed through the meatal opening. Complete epidermisation of the mastoid cavity requires from five to ten weeks.

*The second operation. " Substitution of the flaps."* After complete healing of the mastoid cavity, it is still necessary to wait " several weeks " before proceeding to the next operation. Novocaine infiltration is carried out as before. The mastoid is then reopened, and the whole of the delicate cicatricial covering of the cavity is raised from the bone, so far as possible in one piece, together with the tail of the cutaneous flap attached to it in front. That part of the cutaneous flap which reaches from the malleus to the wall of the aditus is completely removed, and the cicatricial tissue is slid forward to take its place, and serves both to occlude the tympanic cavity and to establish a new connection between the outer flap and the site of the future labyrinthine fistula.

*The third operation. Trephining the labyrinth.* Novocaine infiltration as before. The mastoid cavity is reopened. The lining membrane is again raised from its bed, whilst carefully preserving its attachment to the incus and reflected tympanic membrane. The opening into the external semi-circular canal is made by scraping through the overlying bone by means of certain special rugines, or " Grattoirs ". It is very important to remove completely all periosteum from the area of bone to be scraped away, so as to prevent formation of callus. The opening should be 4 to 5 mm. long, and 1 mm. wide and should involve the posterior half of the

ampullary sinus, and the bony canal behind it. If the endolymph cavity should be accidentally opened, almost complete deafness results. A remarkable improvement of the hearing is experienced by the patient as soon as the labyrinth is laid open, and vertigo, generally intense and distressing, but variable in degree and duration is experienced. The amount of immediate improvement in the hearing gives a measure of the permanent benefit to be expected under the most favourable possible conditions of operative success. It is limited by the pre-existing state of the cochlea. The flap of cicatricial tissue is now replaced, covering the opening in the canal. It has to be adjusted carefully, so that the tension on its anterior connections with the incus and tympanic membrane is just sufficient without being excessive. The author states that he finds the improvement of hearing is much less in cases in which the fibrous connection between the tympanic membrane and the labyrinth opening is incomplete ; this he attributes to the communication of sound vibrations from the large surface of the tympanic membrane, through the band, to newly formed membrane covering the window in the canal. Subsequent gradual loss of hearing is to be attributed to bony callus filling up the window. The less fibrous tissue there is in the covering flap, the smaller is the risk of this occurring. The posterior wound is closed, and the cavity is dressed through the meatal wound as before.

It will be gathered from the above description that the various operative procedures employed are of almost inconceivable delicacy and refinement of technique, and that every stage of each operation is hedged about by the menace of irremediable failure should any lapse from ideal perfection of technique occur. In order to carry them through to a successful issue it would seem that the operator would require to be endowed, not merely with extraordinary manipulative skill, but with power to inspire complete confidence in his patients, to such a degree as to render them entirely passive in his hands, even under severe and prolonged strain.

G. WILKINSON.

*Treatment of Otitic Leptomeningitis.* By PHILIP D. KERRISON, M.D. (*Annals of O.R.L.*, vol. xli., No. 3, 1932.)

This paper, which was delivered to the American Otological Society, is a plea for investigation in two directions : (1) Kubie's theory of forced drainage, and (2) direct surgical drainage. It is essentially theoretical and experimental ; no cases having been treated, at least by the author.

According to Kubie, the cerebrospinal fluid is a dialysate, mainly from the choroid plexus, and to a lesser degree from the capillaries of the perineural and perivascular spaces of the central nervous system. If the blood is diluted by the intravenous

injection of a hypotonic solution, the osmotic equilibrium is disturbed, and there is a marked and immediate increase in the production of cerebrospinal fluid. This increase is more marked if diuresis is delayed by the injection of posterior lobe pituitary extract.

Kubie's experiments prove that this outflow of fluid towards the surface of the brain will carry with it the organisms and cells which in purulent meningitis block the smaller perineural and perivascular spaces and, further, that the experiment may be carried out at intervals of only a few weeks without harm to the patient.

In discussing direct surgical drainage, Kerrison regards the cisterns above and below the tentorium and in the neighbourhood of the fissure of Sylvius as not only the most important, but also the most accessible. To drain the former, he suggests obliterating the lateral sinus over a wide area, and making a series of small openings through its inner wall, into the subarachnoid space above and below the line of attachment of the tentorium. Drainage of the fissure of Sylvius is less easy of accomplishment, necessitating a temporal exposure of the surface of the meninges.

Previous attempts at direct drainage have failed, owing to the rapid closure of the openings and the formation of adhesions, but the author considers that by a combination of these two methods a greater hope of success might be anticipated, on the grounds that the increased pressure would overcome these attempts at healing.

In the discussion which followed, Dr. Laurence S. Kubie took part. Whilst holding that the methods of treatment suggested by Kerrison were theoretically correct, he thought there were many difficulties to be faced, not the least of which was the fact that any large opening in the bony coverings of the central nervous system would permit of a partial movement of the whole mass of the brain, which would obstruct any drainage. He did not think that the forced drainage would prevent the rapid formation of adhesions, but in this connection quoted a recent case of meningococcal meningitis (Dr. Leon Cornwall) in which the injection of a small amount of air into the subarachnoid space apparently broke down adhesions to such an extent that there was a discharge of a great deal of pus, and subsequent cure. He mentioned, however, favourable reports which had been received from Retan of Syracuse on the effect of forced drainage (apparently without surgical drainage other than lumbar puncture—E.J.G.G.) in purulent meningitis.

E. J. Gilroy Glass.

## NOSE AND ACCESSORY SINUSES

*Experimental Research on the Pathology of Nasal Tuberculosis.* G. Theissing. (*Z. Laryng.*, 1932, xxiii., pp. 379-94.)

Many questions concerning the pathology of nasal tuberculosis still remain unanswered. e.g. are the lesions always secondary

or sometimes primary? No primary focus may be discoverable clinically, yet *post mortem* tuberculous lesions in the lungs or in the lymphatic system may be found. Is the infection usually endogenous or exogenous, i.e. caused by air-borne organisms? Among the endogenous methods of infection the most important is implantation metastasis by means of infected sputum in advanced phthisis. Blumenfeld demonstrated the interdependence between the different stages of tuberculosis and infection of the upper air-passages. Lupus and lupoid forms of infection occur in the second stage, or stage of generalisation, when the infection spreads mainly by the blood stream and lymphatics. In the third stage, contact infection and intercanalicular spread predominate and this is the stage at which implantation infection of mucous membranes occurs.

The general discussion is followed by a description of animal experiments on rabbits and guinea-pigs. Virulent tubercle bacilli were injected directly into the arterial blood streams (right common carotid), and the author then studied the lesions in the nasal organs which resulted. There are many illustrations in the text. Tuberculous lesions in the middle ear which arise under the same experimental conditions closely resemble those found in the nose, with the one exception that the nasal lesions tend to be more superficial and to show areas of ulceration more often.

Destruction of bone occurs either by an inward spread from the mucous membrane lesions or by an outward extension of primary tuberculous foci which arise in the narrow spaces. In this form of experimental infection, by injection into the arterial blood stream, there is no special tendency to localisation, although the septum appears to be attacked more frequently than other parts of the nasal skeleton.

J. A. KEEN.

*The Use of Glycerine Injections in the Treatment of Congestive Rhinitis.* MANUEL BRUKER. (*Les Annales d'Oto-Laryngologie.* October, 1933.)

The use of sclerosing injections in the treatment of varicose veins also finds an application in the treatment of congestive rhinitis of essential origin. The solution employed is 80 per cent neutral glycerine in distilled water, put up in 3 c.cm. ampoules. The injection is carried out through a wide bore needle fitted to a Luer syringe. After local anæsthesia of the inferior turbinate, the liquid is slowly injected deeply into the mucous membrane from behind forwards. Some pain is produced which lasts a few seconds. This can, however, be avoided by a preliminary injection of novocain or by the use of a more dilute solution of glycerine, 50 or 60 per cent. Following the injection, the nasal fossa is lightly plugged with ribbon gauze

partly to seal the puncture opening made by the wide bore needle, and partly to arrest hæmorrhage. When the operation is completed, the lining membrane of the turbinate looks pale and œdematous and there will be some temporary hydrorrhœa and nasal obstruction. The injection should be repeated between the third and fifth day as the first injection only produces a sensitisation of the tissues. As this sensitisation takes some time to establish itself, there should always be an interval of one to six days between the injections.

M. VLASTO.

## LARYNX

*Benign Tumours of the Trachea and Bronchi.* CHEVALIER JACKSON, and CHEVALIER L. JACKSON (Philadelphia). (*Jour. A.M.A.*, November 19th, 1932.)

Although the literature should be re-classified, twenty-four different varieties of benign tumour have been recognised by the writers. Histologically these growths showed no invading qualities and the clinical course supported the diagnosis of a non-malignant tumour. Any inflammatory condition in the bronchus may be associated with a tumour-like nodule, although growths may occur without conclusive evidence of infection. These growths may be sessile or pedunculated, and may be covered with apparently normal mucous membrane. Ulceration in the inflammatory type seems rare compared with true neoplasms. The usual symptoms are cough, mucoid expectoration, temperature, wheezing heard at the mouth, and hæmoptysis. The secondary effects of bronchial growths are almost always serious; they include dilatation of the bronchus, obstructive atelectasis, bronchiectasis, abscess and, occasionally, empyema. The diagnosis is arrived at from the physical signs, X-ray, and bronchoscopic biopsy. All kinds of benign growths are easily removed by bronchoscopic means under local anæsthesia. Some of these growths, especially papillomata, are prone to recur and repeated removals are necessary. Re-examination within a few weeks of the removal of a benign growth is advisable. Five cases are reported in considerable detail.

The article occupies eleven columns, is illustrated and has a bibliography.

ANGUS A. CAMPBELL.

*Laryngeal Tuberculosis.* R. W. WILKINSON. (*Archives of Otolaryngology*, September, 1932. Vol. xvi., No. 3.)

In this carefully arranged paper, with quotations from many sources and a personal record of forty-five cases, the writer reviews

the present knowledge of laryngeal tuberculosis and summarises his conclusions as follows :—

1. The treatment of laryngeal tuberculosis offers encouraging results in many or most early cases.

2. It should be brought to the attention of the general practitioner that every patient with pulmonary tuberculosis should have a laryngeal examination at frequent intervals ; one should not wait for laryngeal symptoms.

3. The treatment is best carried out in a sanatorium where the pulmonary and laryngeal condition may be under careful surveillance.

4. The most effective treatment to-day is electro-cauterisation, vocal rest, and sunlight or modified sunlight.

Of the forty-five cases, twelve were found to be suitable for cauterisation, with a good result in seven cases.

Cauterisation has proved the best single method of treatment known to-day for laryngeal tuberculosis. Vocal rest is of supreme importance, and heliotherapy is very effective if carried out under careful supervision.

DOUGLAS GUTHRIE.

## TONSIL AND PHARYNX

*Total Tonsillectomy by the " Scissors " Method.* DUTHEILLET DE LAMOTHE. (*Les Annales d'Oto-Laryngologie*, November, 1932.)

Pre-operative treatment is carried out for eight days. It consists in " disinfecting the nose and pharynx " with insufflations of argyrol, gargles and antiseptic paints. To diminish hæmorrhage, the patients are given maximal doses of chloro-calcium. The instruments employed are similar in principle to those in current use. The blunt pointed scissors are, however, peculiar in the respect that their cutting edge is both external and internal.

The operation is carried out under general anæsthesia. The adult patient is strapped in a chair, and the child is restrained on the lap of an assistant. The procedure of disengaging the tonsil from its fossa is described and the final delivery is effected with the cold wire snare.

M. VLASTO.

*The Treatment of Enlarged Tonsils in Children.* T. B. LAYTON. (*Lancet*, 1933, i., 511.)

After giving a history of tonsillectomy, the reasons for operation, and some remarks upon the tonsils as a source of sepsis, the writer concludes that size is no indication for removing tonsils to-day. The great indication is the history of recurring follicular tonsillitis, and this is even more important than any appearance of the tonsil.

# Œsophagus and Endoscopy

Since children do not get follicular tonsillitis in the earlier years of life, operation should not be done on a child up to five, six, seven and eight unless the need for it is absolutely proved. Layton thinks the best results come after the age of twelve, and believes that there is as yet no local treatment of the tonsils that can compare with operative surgery.

MACLEOD YEARSLEY.

## ŒSOPHAGUS AND ENDOSCOPY

*The Management of Perforations of the Cervical Œsophagus.* CLYDE A. HEATLY and HERMANN E. PEARCE, Junr. (*Annals of O.R.L.*, vol. xli., No. 4, 1932.)

Four types of perforation of the cervical œsophagus are recognised. In the first, perforation occurs slowly by erosion, as from sharp particles of bone which have been lodged for several days. The infection is commonly walled off and not infrequently drains spontaneously at the time of removal of the foreign body.

The second type is described as " the minute type", as in the case of pins or needles. The progress of infection is insidious and a small abscess forms, which may evacuate itself spontaneously or may suddenly invade the mediastinum.

A third type is perforation of the posterior wall, with immediate infection of the retro-visceral space, and spread to the mediastinum.

The fourth type may be considered gross, immediate perforation, such as might result from a false passage during instrumentation, or removal of a sharp foreign body. Symptoms are pronounced and serious, shock is marked, emphysema develops with astonishing rapidity.

The following indications for external drainage are submitted :—

1. Cases presenting definite evidence of localised abscess in the neck.

2. All cases in which gross perforation is known to have occurred as the result of faulty instrumentation.

3. Cases presenting X-ray evidence of a foreign body outside the lumen in the peri-œsophageal tissues.

4. Cases in which perforation of the posterior œsophageal wall can be established by endoscopic or X-ray study.

5. Cases presenting emphysema in association with rising fever and leucocytosis.

6. Any case when, in the presence of a known or suspected perforation, any reasonable doubt arises as to the safety of the patient.

Briefly, the operation advised is an exposure of the œsophagus at a level of the lower third of the sterno-mastoid muscle. The

thyroid is retracted medially and the space between the œsophagus and the prevertebral fascia is opened up, and packed with gauze.

The paper is well illustrated and a series of eight cases are described.

E. J. GILROY GLASS.

*Impermeable Stricture of the Œsophagus, relieved by Retrograde Bouginage, with the aid of a Cystoscope inserted through a Gastrostomy.* SAMUEL IGLAUER. (*Annals of O.R.L.*, vol. xli., No. 4, 1932.)

The author points out that retrograde œsophagoscopy in cases of impermeable stricture is not always easy to accomplish, as the gastrostomy may be poorly placed and folds of the gastric mucous membrane may get in the way. In such cases, the use of a cystoscope is advised, not only to pass a catheter up the œsophagus, but also in order that lesions of the stomach itself, such as lye burns, may be demonstrated.

A case is described in which the passage of a ureteric catheter was sufficient to relieve the stricture, after which dilatation proved comparatively easy.

Following this, the method was used in three other cases, aged four, three, and two years and, in all of these, the catheter was passed into the pharynx with great ease.

E. J. GILROY GLASS.

## MISCELLANEOUS

*Facial Palsy and Infection with Zoster Virus.* R. S. AITKEN and R. T. BRAIN. (*Lancet*, 1933, i. 509.)

The writers, after noting that it is twenty-six years since Ramsay Hunt wrote on "Herpetic Inflammations of the Geniculate Ganglion," point out that Zoster may be regarded as an infection with a specific virus, which leaves evidence of itself, after the illness is over, in the form of antibodies in the serum, and if any cases of Bell's palsy are due to this virus the complement-fixation should reveal evidence of this." The result of their research may be summarised thus :— 1. The sera of nine cases of Bell's palsy with zoster-like eruptions in the areas of sensory supply of the geniculate ganglion have been found to contain antibodies to zoster virus, demonstrable by complement-fixation. There is serological evidence supporting Ramsay Hunt's clinical explanations of tissue cases which are due to specific zoster infection of the geniculate ganglion. All these cases had aural symptoms. 2. The sera of twenty-two cases of Bell's palsy without zoster-like eruptions (ten of whom had pain in the ear or

mastoid), were found to contain zoster antibodies in four instances only. The evidence thus suggests that the majority of such cases are not due to an infection with zoster virus.

MACLEOD YEARSLEY.

*The Treatment of Diffuse Suppurative Leptomeningitis.* OTTO MAYER. (*Wiener Klin. Wochenschrift.* Nr. 6. Jahr. 40.)

Though Professor Mayer's communication is based upon observations in only three cases, these observations are of such importance that he considers it justifiable to place them on record for the benefit of others. His article is, in fact, a momentous contribution to what has hitherto constituted one of the most baffling problems of surgery and, as such, is more deserving of a literal translation than the rather full abstract which follows.

The cases under consideration are cases of diffuse suppurative meningitis with all the classical clinical evidence of advanced leptomeningitis. The present-day therapy of such cases essentially consists in one of the following procedures :—

1. Radical removal of the primary focus of infection.
2. The removal of spinal fluid by puncture.
3. Intrathecal injection of various disinfectants or sera.
4. Passive congestion by Bier's method.

Experience shows that those cases of meningitis in which the production of spinal fluid remains high, are those which are most likely to recover, even though pleocytosis and increased protein content are present. In cases which do badly we notice that the initial high pressure rapidly diminishes owing to the alteration of the physical characteristics of the fluid which, as a suppurative and fibrinous exudate, tends to clog the ventricles, the basal cisterns and the convexity of the brain, and to form pockets of pus. These observations make lumbar puncture a questionable procedure; it has been found by Schönbaurer that among dogs with artificially induced suppurative meningitis those on which lumbar puncture is done live for a much shorter time than the others.

Lumbar puncture has a therapeutic justification only when it is followed by an ample reproduction of spinal fluid to dilute the intrathecal injection.

By the absorption of the pathological fluid there occurs an hæmatogenous formation of anti-bodies which again reach the spinal fluid by means of the plexus choroidei, the permeability of which is raised by the inflammatory injury. If no new spinal fluid is produced the physiological conditions are upset; the fluid ceases to circulate, the water cushion upon which the brain habitually rests and upon which its normal mobility depends is destroyed, and the absorption of the fluid by the Pacchionian bodies cannot take place. Likewise, the altered conditions prevent the absorption or removal

of the fluid by the perineural sheaths of the spinal nerves. Circulation of the spinal fluid should be not only maintained but also increased in cases of meningitis.

One means of obtaining an increased secretion of spinal fluid is the intravenous injection of hypertonic saline. The therapeutic benefit of intrathecal injections of urotropin solution is due to this hypertonic effect rather than to a disinfecting influence.

A casual observation which Mayer made on a patient suffering from meningitis confirmed him in a belief, which he had long held, that if the fluid removed by puncture were replaced by air it would not only stimulate the increased secretion of fluid, but would serve also to raise the sunken pressure and to simulate, with air, the water-cushion effect of the absent sub-arachnoid fluid. A girl of 18 had middle-ear cholesteatoma, and an abscess of the temporal lobe which burst into her ventricle with the immediate onset of a high-grade purulent meningitis. In order to determine the site of rupture the abscess cavity was injected with Abrodil (Kraus) in order to take a radiogram. The first exposure, which was taken in the recumbent position, showed the abscess cavity, the fistula, and the ventricle, full of the contrast fluid. As the patient had severe pain whilst lying down, the next exposure was made in the sitting position. This showed the abscess cavity and ventricle to be full of air. In getting up, air had penetrated the open brain-abscess and the fistula. From this moment a very marked flow of spinal fluid came from the brain abscess fistula and the condition of the patient very rapidly improved and subsequently recovered completely. This observation induced Mayer to try the effect of intrathecal (lumbar) injection of air in two other bad cases of meningitis.

In the first case, a child of four years, the meninges became severely involved four days after an operation for acute suppurative mastoiditis. The temperature was 39° C. The pressure of the spinal fluid was considerably raised, the leucocytes were too numerous to count, and the albumin was considerably increased. On the fourth day after the onset of meningitis, 20 c.cm. of the spinal fluid were withdrawn and 10 c.cm. of air injected. On the following days, 30 c.cm. of the fluid were withdrawn and 8 c.cm. of air and 10 c.cm. of a 10 per cent solution of urotropin were injected. As a result, the condition showed marked improvement. Fever abated, vomiting ceased, the pressure of the fluid increased and the fluid became clear. On the fifth day the pleocytosis was 676/3 with a negative Pandy reaction and the general condition was so much improved that puncture was discontinued.

Complete recovery followed.

The second case concerned a girl of six in whom the *lamina cribrosa* was perforated by a slate-pencil which had been driven up through the nose and lodged in the brain. In twenty-four hours

there was a well-developed meningitis, temperature 40° C., pulse 140, cervical rapidity, Kernig's sign, vomiting, pallor with slight cyanosis, and marked shock. Lumbar puncture was carried out 30 hours after the injury. The fluid was under very high pressure and was turbid. The cells were uncountable. The *lamina cribrosa* was exposed by an arched incision (Killian) of the inner angle of the orbit and the pencil was removed. From the following day 30 to 40 c.cm. of the spinal fluid were removed daily and 8 to 10 c.cm. of air with 10 c.cm. of a 10 per cent urotropin solution injected. In six days the child was afebrile and the fluid clear. A frontal lobe abscess developed at the site of injury. This was drained and also healed. In both this and in the first case described, the prognosis was of the most hopeless variety, only one instance of recovery in each case having been reported previously.

Mayer describes his technique as follows :—

The lumbar puncture is carried out with the ordinary trocar, in the sitting position. The fluid is allowed to escape until it only comes in driblets (" tropfenweise "). A 30 c.cm. record syringe which fits the trocar well and contains 10 c.cm. of the 10 per cent urotropin solution and air is now fitted and its contents are injected slowly. Hypertonic saline can also be employed. It is important to use the hypertonic solution in a weak concentration because a strong concentration can induce severe myelitis. As the air is absorbed fairly quickly, the injection must be repeated. The amount to be injected is determined by the amount of fluid withdrawn and by the radiographic controls. It is advised not to allow the pressure in the subarachnoid space to sink too low. On the contrary, it may perhaps be of importance to maintain an increased pressure in this space because, the wider the space is the less is the liability to the walling off of parts of the space or the formation of pockets of pus. The severe headache induced by the withdrawal of fluid is relieved by the injection of air. The unfolding of the gummed up ventricular and subarachnoid spaces (with consequent circulation of the liquid) has been verified by radiographic examination. The general treatment of the patient must be considered. Free administration of fluid is of supreme importance ; if vomiting is present it is given by continuous drop clysma or, eventually, by saline infusion. The toxic influence of the disease on the heart requires attention.

J. B. HORGAN.