with a contraselective artificial pneumothorax gives bad late results (Sinding-Larsen, 1937). The basal artificial pneumothorax in these cases should be abandoned previous to the thoracoplasty and the lung allowed to re-expand if possible. Presence of a basal artificial pneumothorax during thoracoplasty has little or no value—it is unnecessary, and represents a potential danger of effusion or empyema. I have no experience of the so-called "extra-pleural pneumolysis (pneumothorax)."

Thoracoplasty versus Plombage

The collapse produced by paraffin packing may be compared to that of the first stage of thoracoplasty with extrafascial apicolysis. The paraffin packing gives an operative mortality of 3 to 5 per cent., while our first-stage thoracoplasty hitherto has 1 to 2 per cent. mortality. The paraffin packing sometimes has severe late complications, one year or more after the operation, with penetration to the cavity and perforation of the skin by fistulae. It may also hinder a further thoracoplasty owing to a fibrotic reaction around the paraffin. The use of paraffin packing, therefore, is not advisable.

Results

The mortality rate within two months of operation has been reduced to approximately 3 per cent. by operation in several stages (see Table III).

Collapse of the cavity and a sputum free from tubercle bacilli have been achieved in about 90 per cent. of the surviving patients. The follow-up examination in some cases is, however, very recent (see Tables II and III).

Of all the cases 90 per cent. had partial thoracoplasty with resection of eight ribs or less. Only 10 per cent. required total thoracoplasty.

In seventeen cases artificial pneumothorax had been induced on the other side, and was present during the thoracoplasty. These patients tolerated the operation surprisingly well, probably owing to a stabilized mediastinum. There were no deaths. In fourteen of the seventeen cases complete collapse of the cavity and a sputum free from tubercle bacilli was achieved. In four cases artificial pneumothorax on the other side was induced after the thoracoplasty.

The operation has also been tried after thoracoplasty performed previously by other methods has failed to produce complete collapse. Complete collapse of the cavity was achieved in fourteen out of sixteen patients who were operated on a second time in this way.

The results of this operation so far indicate that we are moving closer towards our goal—namely: (1) a complete collapse; (2) a selective collapse; (3) a low operative risk.

REFERENCES

- Alexander (1932). *J. thorac. Surg.*, **2**, 1.
 Bull (1930). *Int. Conf. a. Tub.*, Oslo.
 Davies, H. Morriston (1933). *Pulmonary Tuberculosis*, London.
 Edwards, F. Ronald (1937). *Brit. J. Tuberc.*, p. 7.
 Graf (1936). *Der Chirurg.*, **8**, 469.
 Holst, J. (1932). *Acta chir. scand.*, **71**, 396.
 — Semb, and Frimann-Dahl (1935). *Acta chir. scand.*, Suppl.,
 Lauwers (1929). *J. Chir.*, **33**, 483.
 Lilienthal (1937). *J. thorac. Surg.*, **6**, 414.
 Maurer, A. (1935). *Rev. Tuberc.*, **1**, 49.
 Nissen, R. (1931). *Surg. Gynec. Obstet.*, **52**, 732.
 Romanis, W. H. C., and Sellors, T. H. (1935). *Lancet*, **1**, 802.
 Sauerbruch, F. (1930). *Chirurgie der Brustorgane*, Berlin.
 Sinding-Larsen (1937). *The Collapse Treatment of Pulmonary Tuberculosis*. Nationaltrykkeriet, Oslo.

CEREBRAL OEDEMA IN CERTAIN MENTAL DISORDERS

BY

C. LOVELL, M.D., B.S.

Pathologist to Bethlem Royal Hospital

(WITH SPECIAL PLATE)

During an investigation of the static surface tension of the serum in various diseases it was observed that the sera of some cases of mental disease presented certain peculiarities not found in the sera of normal individuals.

If a normal serum be divided into two parts, and one part be heated to 56° C. for thirty minutes and cooled to room temperature, and the two specimens be set up in capillary tubes of approximately the same diameter, the surface tension-reducing substances present accumulate at the concave meniscus, so that at the end of three hours no further change can be detected in the next half-hour and the results are then comparable. If the value of the surface tension at this point be worked out there is an average difference of 4.5 dynes per cm. between the normal unheated and the heated specimens. These results can be reduced to terms of a standard tube of diameter 0.075 cm. This standard has been chosen so as to divide the instrumental error equally between the two stages of the measurement (Lovell, 1922-3). I have occasionally seen variations in persons apparently healthy, but I have never observed an abnormal serum among university students and schoolboys who were undoubtedly fit, the specimens being taken during the day from 10 a.m. to 6 p.m.

It was discovered in 1923 that a large group of anxiety cases showed no difference between the surface tension readings of the unheated and the heated specimens. The mechanism of this was not clear at the time, but the method was of some use in differentiating between the katatonic stage of dementia praecox and the similar stage of acute confusional cases.

About this time we examined the organs in a case of extreme anxiety, in which the serum had shown the abnormal surface tension condition. The patient had died of pancreatitis with haemorrhage. We cut sections of all available pancreases in the museum and divided them into the normal and the abnormal. We then turned up the old case-books and found that in every case in which there was an abnormal pancreas anxiety had been a prominent feature. But as most of these patients had died of some inflammatory disease one was not justified in assuming that the pancreatic changes were directly connected with the mental condition. Moreover, in the pancreas autolytic changes are so uncertain that it is not possible to draw conclusions from the appearance of the parenchyma. Round-celled infiltration and fibrosis of the interlobular tissue are the only criteria (Lovell, 1923).

A whole series of cases then came to light in which pathological anxiety as a mental symptom was associated with evidence of pancreatic disorder. This was confirmed by the work of Drury and Farran-Ridge (1925) and Mann (1925) on blood-sugar curves. To a series of 120 cases the accepted pancreatic tests were applied by Dr. Macaulay, Mr. Majumdar, and others. The tests used were the Loewi test, the sajodin test, and the estimation of diastase and fat excretion. The results were not always confirmatory. For instance, in the sajodin test the material was sometimes retained in the stomach for a considerable time owing to gastric atony, and the appearance of iodine in the urine was consequently delayed. In the fat-

Thirty-three special hospitals in London are making an appeal for funds on October 12, when, by the sale of emblems, it is hoped to raise more than the £30,000 which these hospitals used to collect on separate flag days during the year. Voluntary help is urgently needed, and any suggestion or offers of service will be welcomed by Lord Luke, chairman of the London Hospitals Collections Central Committee, 36, Kingsway, London, W.C.2.

excretion test not only was the amount of ether-soluble material influenced by the diet, and by liquid paraffin taken in aperients, but different parts of the same specimen gave different results. A general survey of every available type of mental case was then made, and patients showing the abnormal blood fell into three groups: (1) Simple pathological anxiety. (2) Agitated melancholia. (3) Chronic encephalitis.

At this stage we were faced with the same difficulty as in renal disease—the lack of correspondence between the clinical and the pathological grouping. Is there any physical feature common to the three groups? Let us consider the question in its various aspects.

1.—The Pathological Results

Of the last 2,000 patients forty-nine have died and have been examined post mortem. During life the serum was normal in nineteen. Post mortem the pancreas was normal in seventeen; abnormal in two. The serum was abnormal in twenty-nine. The pancreas was abnormal in twenty-four. No abnormality could be found in the remaining five. In one case the specimens were lost. The changes both in the ducts and in the interlobular tissue are often patchy in distribution (see Plate, Fig. 2).

2.—The Noguchi Test in the Cerebrospinal Fluid During Life

	No. of Cases	Noguchi-positive	Noguchi-±	Noguchi-negative
Sera abnormal	39	34	2	3
Sera abnormal but within limits of instrumental error ..	7	6	0	1
Sera normal	29	11	5	13

It is, however, recognized that the protein of the cerebrospinal fluid is variable, and that a positive Noguchi reaction is given in many conditions.

3.—The Post-mortem Appearances of the Brain

No case of simple anxiety has yet come to necropsy at Bethlem Royal Hospital. In cases of agitated melancholia and of encephalitis the brains seem to form a continuous series, from the intense perivascular infiltration of the acute encephalitic to the dilated spaces with oedema of the melancholic. In between is every degree of oedema and infiltration, so that it is often impossible to distinguish between the two conditions.

4.—The Physical Considerations

A difference of 4 or 5 dynes per cm., which takes three hours to develop, is difficult to check by any other method. The work of Schryver (1910) led us to think that changes in viscosity of the serum, such as are known to occur under the action of heat, might be responsible for the alteration in surface tension on heating. A series of determinations of viscosity by Wace seemed to contradict this. Recently Ashby has shown that under the conditions of the experiment viscosity changes have no appreciable effect. The loss of carbon dioxide from the serum may have an effect by causing a redistribution of electrolytes.

A series of osmotic experiments with collodion capsules, carefully paired for equal permeability, showed that in the abnormal serum the osmotic pressure of unheated and

heated portions presents little or no difference; moreover, the electrolyte in passing out of the capsule carries protein with it to a greater extent than in the normal. This action of electrolytes has been known for a long time (Taylor, 1921; Bayliss, 1923).

The depression of the freezing point was investigated by Wehler. The difference of depression between unheated and heated portions of the same serum was, on the average, 0.02 degree in so-called pancreatic cases and 0.03 to 0.05 degree in normal control cases. More recently the electrical conductivity has been investigated, using the apparatus designed by Ashby (1930). The initial experiments confirm these findings. There appears to be a firmer union of electrolyte and protein in the cases with no range of surface tension than in the normal. It will occur at once that herein lies the cause of the positive Noguchi test in the cerebrospinal fluid given by the majority of these cases. Also the slight oedema of the skin noted later may be due to the same cause (Achard, 1924).

Some Italian observers claim that sulphur is to the pancreas as iodine is to the thyroid gland. The daily excretion of sulphur in the urine varies within wide limits in the normal individual. In a series of fifty cases examined by us the total sulphur per diem was diminished in some anxiety cases but not in all. Fifteen cases showed below 2 grammes per diem, and these were all cases of anxiety or encephalitis, excepting one of carcinoma of the liver.

The sugar content of the cerebrospinal fluid, which is raised in encephalitis, and the cerebrospinal fluid chlorides, have not been estimated in sufficient numbers to be worth quoting. Certainly in many pancreatic cases the apparent chloride content is low, whereas it is raised in uraemic cases.

The pressure of cerebrospinal fluid as shown by a manometer is not necessarily raised. It is well known that the intravenous injection of hypertonic solutions will reduce the pressure in the cerebrospinal fluid of acute encephalitis. Experimentally we have tried hypertonic enemata on three cases of the pancreatic type. In each of these the patient was worse after the enema. In one case in which we used an enema of gum saline the patient was definitely more confused for a time after the experiment.

The fat in the faeces was estimated by Cammidge's method, by the Soxhlet method, and by our own method of difference. As mentioned above, the normal figures vary within wide limits, depending on diet, liver activity, medicines, etc. In a series of 200 cases the results are shown in the following table:

Serum	Ether-soluble Fraction of Faeces.	
	Below 20%	Above 20%
Normal	67	17
Abnormal but within limits of instrumental error	32	12
Definitely abnormal	38	34

This test is of some use, however, when dealing with cases in which the serum result is indefinite.

At first sight there is an agreement between the figures of the ether-soluble fraction and the serum figures in 67 + 34—that is, 101 cases only out of 200. But my colleague Mr. Bartlett tells me that statistically there is a contingency coefficient of 0.25, pointing to a definite relation between the two series of measurements.

Clinical Considerations

There are three factors in the production of mental disorder: heredity, mental stress, and physical disease. One or more of these factors are always present, generally two of them. Normal individuals mostly experience similar mental stresses, but are able to deal with them as long as they are in good bodily health.

There are many physical conditions associated with anxiety, such as renal disease, arteriosclerosis, hyperthyroidism, gall-stones, meningitis, hyperglycaemia, and carcinoma. The "pancreatic" anxiety cases present certain peculiar features. The anxiety must be pathological. There is generally a history of intestinal infection or gastric influenza preceding the development of the anxiety, and frequently a history of diabetes in the family, but only four patients in the last 2,000 have had glycosuria themselves. Conjunctival jaundice is usually present. An oedematous condition of the skin is the rule, and the first sign of improvement is an alteration in the texture of the skin, which becomes less tense. The patients are very intelligent and generally good at mathematics. They have insight into their condition, and are often very angry with themselves and realize the absurdity of their fears.

The dividing line between simple anxiety and agitated melancholia is not defined. The agitated melancholic is more liable to pigmentation (Opie, 1910), which may be marked. A lymphocytosis is frequent. In one series of fifty-nine cases with a lymphocytosis seven agglutinated some organism from the faeces. In another series of ninety cases Dr. W. Page of Sydney found an agglutination of *B. proteus* in three.

The encephalitics are of two types. Those met with in practice generally show some disturbance of movement, either a pronounced paralysis or some loss of muscular control. Institutional cases usually reveal disorders of conduct, and are found among the "schizophrenics." They may show a coarse tremor or ocular paresis, which may be transient and may lead to their recognition. They may be katatonic or hypomanic, and may ultimately present the Parkinsonian picture. Like the more acute cases, they can be roused from their lethargy for a short time.

Course of the Disease

Many of these cases have been followed up for as long as fifteen years. The progress of the simple anxiety case and the agitated melancholic will depend, so far as the physical factor is concerned, on the extent of the damage. This is well shown in the photographs (Figs. 6 and 7, Special Plate).

ILLUSTRATIVE CASES

Case 1.—A draughtsman, aged 19, developed an anxiety about his work. He was fearful that his drawings would be soiled. He was the last out of the office at night, and was waiting in the morning for the office to open. In the hospital he could always be found washing his hands, and he would stand aside when the patients went in to meals to avoid contamination. He was found to be a pancreatic case, and was put on treatment. Three nights later he woke up calling for help. He said he felt something give way inside him. From that time he improved; he was normal in a week and back at work in a month. He had no more treatment, and has felt no undue anxiety since this illness ten years ago. Probably this was a case of pancreatic calculus or inspissation.

Case 2.—A middle-aged Canadian storekeeper. In the middle of the night he would wake, wondering whether he had closed the shop: he would then dress, go downstairs,

take down the shutters, put out his stock and turn on the light, and then put it all away again. He recovered and has had no recurrence.

Case 3.—This patient was a young man, married happily and holding a responsible post in the City. His only anxiety was that he might forget how to manage his tie when he dressed in the morning. He sometimes became so exhausted by his struggle with the tie that he had to lie down and rest while dressing. He refused to let his wife tie it or to use a ready-made tie, but persisted with the struggle. He then developed extensive furunculosis. Under treatment he apparently recovered. Two years later he wrote that he had furunculosis again, and a short course of treatment put him right. He has been well for three years now.

Case 4.—An intelligent man of about 35. Thirty years before he had stolen a few pence from his mother, who had then died before the child could confess his fault. He buried the pence in the street, and for thirty years had been unable to pass down that street. He showed anxiety on every subject, and used to get his family out of the house on any pretext, so that he could wash up the tea-things two or three times. He would take a railway ticket and explain to the booking clerk that he could not remember having asked for it. He was then covered with confusion lest the clerk should think him mad. Under treatment he became normal, but relapsed several times. Here, in addition to the pancreatic condition, we have the habit of thirty years. I have been in touch with him for fifteen years. He is blessed with a happy family and a sense of humour; his anxieties have lost their sting and have become a source of household merriment, in which the patient joins.

Case 5.—This patient was a man of middle age with agitated melancholia. All lines of treatment were tried without any effect, and he was discharged as a hopeless case. He showed intense pigmentation (Opie, 1910), and may well have been a case of pancreatic cancer.

The Encephalitis Cases

With regard to the encephalitis cases we must recognize two independent phases. The first is the paralytic phase. The muscular wasting, the oedema of the brain, and, I think, the cerebral thromboses prior to organization, can all be influenced by treatment; but when we have done this we have still to deal with the second—the hysterical phase.

As medical men we are seldom able to apply the discipline which so many of these unfortunate people subsequently undergo in the prisons. A group of five encephalitics was selected: in one of these, a case of eight years' duration, the serum was normal, and treatment produced no effect. In two cases the surface tension range of the serum was diminished, and treatment produced improvement only. To a stranger these patients might have appeared normal, but one slowly protruded her tongue at awkward moments, and the other developed a transient lethargy when called upon by her mother to do any work. The remaining two had the abnormal type of serum, and appear to have recovered completely. Subsequently we have found this to be the rule. So long as the serum is abnormal there is some hope of recovery, but when the serum is normal either the case is not a pancreatic case or the damage is permanent.

There are many interesting problems in medicine on which this connexion between the pancreas and low-grade infections seems to throw light, such as the age incidence of vaccinia encephalitis, but they are beyond the scope of this article. The pancreatic case in general does not appear to be allergic; but this condition can be produced by recurrent infection.

Treatment has been by administration of extracts of gastric mucosa, by vaccines in suitable cases, by isotonic

glycerol, by sulphur when this element is deficient, and by calcium salts, according to the laboratory findings and the nature of the case.

Summary

An abnormal condition of the serum is described which, when persistent, is nearly always associated with signs of pancreatic inflammation: this inflammation is generally ascending from the intestine, and is patchy in distribution. Glycosuria is rare. Insulin is ineffective. The altered blood state predisposes to oedema and to low-grade infections.

My thanks are due to Dr. Porter Phillips; to Professor Downs of Alberta, whose work gave us the key to our problems fifteen years ago; to my staff at Bethlem Royal Hospital, who have prepared the sections and photographs; and to all those who have helped by case notes and after-histories, and who are too numerous to mention individually in this article.

REFERENCES

- Achard, C. (1924). *Système Lacunaire*, Paris.
 Ashby, W. R. (1930). *Biochem. J.*, **24**, 1557.
 Bayliss, W. M. (1923). *Interfacial Forces in Physiology*, p. 76, London.
 Drury, K. K., and Farran-Ridge, C. (1925). *J. ment. Sci.*, **71**, 8.
 Lovell, C. (1922-3). *J. Neurol. Psychopath.*, **3**, 123.
 — (1923). *J. ment. Sci.*, **69**, 497.
 Mann, S. A. (1925). *Ibid.*, **71**, 443.
 Opie, E. L. (1910). *Diseases of Pancreas*, p. 371, Philadelphia.
 Schryver, S. B. (1910). *Proc. Roy. Soc. B*, **83**, 96.
 Taylor, W. W. (1921). *Chemistry of Colloids*, London.

NON-SUPPURATIVE INTRACRANIAL COMPLICATIONS OF OTITIS MEDIA*

BY

ADAMS A. McCONNELL, P.R.C.S.I.

Surgeon, Richmond Hospital, Dublin; Honorary Consulting Neurological Surgeon, Royal Victoria Eye and Ear Hospital, Dublin

It is with some diffidence that I present this paper before this Section, but I have been given to understand that an unbiased opinion on the quality of alien coal can be obtained in Newcastle.

The intracranial complications of otitis media may be classified as suppurative and non-suppurative. The pathology of the former is well established, for each stage in the process has been observed post mortem. The pathology of the non-suppurative complications is not so clear, for the operative findings are often inconclusive and necropsies are rare. These non-suppurative complications are of two kinds, one an encephalitic lesion which gives rise to both focal and general symptoms, and the other a derangement of the amount or of the circulation of the cerebrospinal fluid, resulting in the accumulation of the fluid and a rise in the general intracranial pressure.

The Encephalitic Lesion

The encephalitic lesion was postulated by Borries in 1921 and by Symonds in 1927 under the terms "otogenous encephalitis" and "non-purulent encephalitis" respectively. Borries held that the encephalitis was analogous to that which occurs in acute fevers, and that it ran its full course without suppuration. He stated that it was possible to identify the lesion at a post-mortem examination of the rare fatal case. Symonds suggested

that the encephalitis might be the initial stage in the formation of a cerebral abscess.

In general the diagnosis has been made only when recovery followed a negative exploration for cerebral abscess, "the symptoms of abscess without abscess" (Borries). In this condition the cerebrospinal fluid is normal or perhaps blood-stained.

When a patient with otitis media presents symptoms of a focal lesion of the brain, such as aphasia, hemiparesis, or hemiplegia, it is wise to make a diagnosis of an abscess and to act on that diagnosis. Non-purulent encephalitis is rare in comparison with the purulent type. If, however, an abscess be not found, recognition of the possibility of this condition may save further unnecessary exploration, and a decompression operation is indicated in some of these cases of encephalitis just as in some cases of abscess.

Derangements of the Cerebrospinal Fluid

These derangements are of two general types. In the first type an excessive amount of cerebrospinal fluid gives rise to the symptoms and signs of increased intracranial pressure. Symonds described this condition in 1931, and gave to it the name of "otitic hydrocephalus," using the word hydrocephalus as meaning simply an excess of fluid in the skull. By drawing attention to the existence of such cases Symonds rendered a signal service to otology and neurology. Nothing need be added to his description to make these cases recognizable. The outstanding symptoms are intermittent headache and papilloedema. In spite of a high degree of pressure the patient may look remarkably well. There are no localizing signs, a feature which serves to distinguish this condition from that of non-suppurative encephalitis. The fact of greatest importance is that the cerebrospinal fluid is normal and that there is no excess of protein or cells. As there is no obstruction in the pathway of the cerebrospinal fluid the excess of fluid may be withdrawn at any point in that pathway, and of course the easiest point for withdrawal is the lumbar sac. One or several lumbar punctures may be necessary before the amount of fluid remains within normal limits.

The second type of derangement is of the circulation of the cerebrospinal fluid rather than of its amount. At some point in the cerebrospinal fluid pathway an obstruction to the circulation of fluid occurs so that the fluid is held up proximal to the obstruction. If the obstruction be at the outlet from the ventricles an internal hydrocephalus results; if in the cisterns of the posterior fossa, one or more of these cisterns may become distended with retained cerebrospinal fluid. In either case the patient then presents the symptoms of increased intracranial pressure. These collections of fluid localized in the ventricles or in the cisterns of the posterior fossa demand direct removal.

There are therefore two derangements of the cerebrospinal fluid which may arise in the course of otitis media: (1) a general excess of cerebrospinal fluid in which lumbar puncture is safe and curative; (2) a localized collection of cerebrospinal fluid in which lumbar puncture may not be safe and is not curative.

Can these two conditions be distinguished clinically from each other? Cases of both types have symptoms of increased intracranial pressure, but papilloedema is much more common when the fluid is in general excess than when it is localized. Should papilloedema therefore be an indication for lumbar puncture?

* Read in the Section of Oto-rhino-laryngology at the Annual Meeting of the British Medical Association, Belfast, 1937.