nervous exhaustion or reaction which is not unlike that of the first group. It is essential, however, to realize by physical examination that there are real lesions present which are an obvious and sufficient cause of symptoms.

The majority are women whose troubles date from child-bearing, in which the essential event was injury of uterine or vaginal supports, with infection. The end-result is some variety of prolapse, perhaps not severe, together with chronic cervicitis and intractable leucorrhoea. The uterus is usually bulky, due to subinvolution, and is often lying back in the pouch of Douglas. The perineum is deficient and relaxed, allowing protrusion of the vagina on straining. The symptoms are familiar—constant pelvic discomfort and backache, relieved on lying down, worse on standing and for a few days before menstruation. There may be a sensation of prolapse or perineal weakness with weight and aching after any physical effort. Menstruation is excessive, prolonged, and too frequent. Congestive pain may trouble the woman for several days before the period, and at the end of it she will be left in an exhausted condition. There will be scarcely time to recover from one menstruation before the beginning of the pre-menstrual discomfort of the next. The abdomen is loose, tumid, and toneless, sagging forwards and downwards on standing. Flatulent dyspepsia and constipation are the constant associated conditions. The woman is tired and depressed, and unable to respond to external interests, but she differs essentially from the first type we have considered inasmuch as her nervous state is secondary to the organic trouble, and, unless it has been of too long standing, it will clear up rapidly after successful treatment of the organic lesion.

TREATMENT BY RADIUM

The treatment usually offers little difficulty. It is seldom possible to cure these patients except by operation, and in most cases the operation must be radical. The large group of patients suffering from long-standing menstrual malaise, pain, excess, and frequency, must have menstruation finally arrested if they are to improve. Drugs, rest, douches, and tampons are of little, if any, real use. The constant application of one treatment or another produces a kind of devotion to the pelvic organs which serves only to fix the attention thereon. The patients cannot be well so long as the pelvis attracts any attention whatever, and therefore if the menstrual trouble cannot be entirely cured the function must be arrested. Where there is nothing more than a bulky, probably sub-involutus, uterus, without prolapse or salpingitis, and the patient is over 40, a good treatment is by radium; but I am opposed to radium in younger women, and if there are the associated conditions of prolapse, old tubal adhesions, or fibroids.

OPERATIVE TREATMENT.

For these latter patients, and they are the common group showing the brunt of child-bearing, I believe that only hysterectomy, combined if necessary with repair of prolapse, will effect a certain cure. Where the patient is past 40 years a radical operation is not objectionable, but there is a certain amount of reluctance to perform hysterectomy between 30 and 40, especially if the woman still has a desire for children. Nevertheless, should the symptoms be sufficiently distressing to force the patient to be willing to have the uterus removed, and should there be accompanying objective signs of anaemia and loss of weight and muscle tone to support the story of subjective symptoms, I believe the surgeon is entirely justified in doing a radical operation. I do not remember regretting having been too radical in the treatment of these patients, but I have more than once regretted time wasted on ineffective medical treatment, or an operation

not sufficiently extensive to cure all pelvic symptoms. Such an operation must include at least a total hysterectomy, for leucorrhoea is a constant feature of chronic pelvic symptoms, and if the cervix is left *in situ*, maintaining the discharge which has been so obvious a source of discomfort, the patient will still complain that she is not cured.

Gynaecological surgeons have a considerable advantage over those operating in other parts of the body, inasmuch as their field is not a vital essential to life. We can be radical in our methods without causing a disabling mutilation. The results of the post-operative menopause after 40 years have been greatly exaggerated, and are not comparable to the previous symptomatic distress for which the operation was done. Retention of some ovarian tissue is usually possible, and though it may not persist for long as a useful organ, yet it often affords the patient a certain sense of satisfaction that she has not entirely lost her essential sex organs.

In conclusion, I would repeat that diagnosis of the cause of chronic pelvic symptoms is of so great importance because the treatments are opposite. Where the origin lies in the nervous or temperamental system, operation is likely to be a disaster, but where the trouble springs from actual pelvic lesions then the only hope lies in radical surgery.

OLEOTHORAX, WITH OBSERVATIONS ON TWENTY CASES

BY

NORMAN M. MUNRO, M.D.

LATE ASSISTANT MEDICAL OFFICER, GROVE PARK HOSPITAL

Ever since Bernou,¹ using large quantities of medicated oil for intrapleural injection, reported in 1922 on his first successful application of oleothorax, this treatment has been gaining prominence, and now claims a definite place in pneumothorax therapy. Following on the recognition of various difficulties and complications of artificial pneumothorax (associated chiefly with pulmonary tuberculosis) the list of indications for oleothorax has increased and the technique has been modified and improved upon. Convincing results from this treatment have been reported on the Continent, chiefly by Kuss,² Weil,³ and Burnand,⁴ and more recently in this country by Chandler,⁵ Gloyne,⁶ and Burrell.⁷ In 1929 Fontaine⁸ published a treatise on oleothorax, with reports on one hundred cases collected from various Continental sanatoriums. For fuller information the reader is referred to this publication and the above-mentioned reports. This paper is only a brief outline of the treatment based on personal observations from a series of twenty cases.

OILS USED AND THEIR PROPERTIES

The choice rests between olive oil and liquid paraffin. Both were employed in the early cases of the series, but on account of the invariable reaction after liquid paraffin I abandoned it in favour of olive oil. Less frequent oil refills are necessary with liquid paraffin because of its slow absorption from the pleural cavity, but this advantage holds only at the beginning of treatment. Both are found to be absorbed at an almost equal rate once the pleural surfaces have become saturated. It is usually advised that for all cases a small quantity of gomenol should be added for its antiseptic properties. Having discovered that gomenol acted as an irritant to a "virgin pleura"—that is, where no effusion has existed—I used it only where antiseptic oil was to replace an effusion. The strength varied according to the degree of purulence of the effusion, with 5 per cent. as the maximum.

METHOD OF PREPARATION

Olive oil of the finest grade was sterilized at a temperature of 105° C. for one and a half hours. Gomenol was added, when required, after sterilization and cooling of the oil, and the mixture was then placed in a cool atmosphere, where it kept well for several weeks. It was occasionally found that gomenol separated out from the mixture in the form of oil droplets, but was easily restored to solution by gentle shaking and reheating. Before use the oil was warmed to body temperature and kept there during the proceedings by means of a water bath. A graduated glass beaker was employed as a container in order to tell the amount at a glance.

PROPERTIES OF ANTISEPTIC OIL

In order to substantiate the claims for oleothorax treatment, numerous investigations have been carried out to determine the bactericidal and other properties of gomenol oil. Chandler and Gloyne⁶ reported on tests performed on rabbits, both normal and those experimentally infected with tuberculosis. In addition to other liquids, gomenol was injected into the pleural sacs of these animals and the results compared; these were rather inconclusive. In determining the bactericidal properties of the oils Tulloch and Ross⁹ found that, while olive oil was lethal to the tubercle bacillus after twenty-four hours' exposure at 37° C., liquid paraffin exerted only an inhibitory action on a culture growth of the same organism. This factor further substantiated my preference for olive oil.

Regarding the properties of gomenol, Clerc of Neuchâtel¹⁰ proved by means of carefully controlled laboratory experiments that it had a specific bactericidal effect on the tubercle bacillus. It inhibited the growth and even killed living bacilli, not only *in vitro*, but also in the organs of tuberculized guinea-pigs. From experience I am inclined to think that such properties of antiseptic oil are maintained *in vivo*. The obvious detoxication and improved general condition of several cases undergoing oleothorax treatment might be thus explained. Also, where oil replaced an effusion rich in tubercle bacilli, any subsequent formation of fluid was always found to be tubercle-free.

INDICATIONS FOR OLEOTHORAX

Tuberculous Empyema

In only a very few cases is gas-replacement of the pus satisfactory treatment. A reaccumulation of pus usually follows, with the harmful effects of toxic absorption and possible waxy disease. Repeated gas-replacements are likely to be complicated by sinuses at the site of aspiration. The surgical measure of draining the pleural cavity by means of resection of part of a rib is, for obvious reasons, not the correct treatment for this variety of empyema. In one case of my series this operation had been performed, with the result that a large discharging sinus occupied the site of the operation wound. No local treatment made any impression on this sinus, and the patient was reduced to a state of chronic invalidism. By rather unorthodox technique oleothorax treatment was applied, various types of plugs being used to retain the oil in the pleural cavity. At the end of nine months the wound had firmly healed and the patient's general condition markedly improved. When seen one year later the patient had returned to light work, a sound scar marking the site of operation.

The beneficial results which follow oleothorax treatment in tuberculous empyema are probably due to its mechanical and disinfectant modes of action, described originally by Bernou. By reason of its bulk the oil maintains compression of the underlying lung, which invariably is the site of tuberculous infiltration. That pus accumulates rarely, or only in small quantities, after having been

replaced by gomenol oil, goes to prove a satisfactory disinfectant action. My most favourable impressions of oleothorax therapy were got from the results of its application in tuberculous empyema, and I consider it the treatment of choice in suitable cases.

Effusions Complicating Artificial Pneumothorax

In more than half the cases receiving artificial pneumothorax treatment for pulmonary tuberculosis a pleural effusion results, and tends adversely to affect the prognosis. It cannot be said that at the present time satisfactory treatment exists for all cases with this complication, probably because of the various causative factors. A small effusion may become absorbed in course of time, but more often it tends to accumulate and eventually to give rise to pressure symptoms. A gas-replacement may then be quite adequate treatment, but the frequent reaccumulation of fluid necessitates repeated aspirations. In such cases the fluid becomes progressively purulent, and sinus formation at the site of the needle tracts inevitably follows. It is for such a condition that oleothorax treatment has proved beneficial by disinfecting the pleural cavity and preventing further pus formation. In addition, the lung collapse originally produced by the artificial pneumothorax is maintained by the oil. My experience of oleothorax in this condition is limited. The one case in which it was tried could not be regarded as altogether suitable, since tuberculous enteritis had previously existed, and eventually proved fatal.

Pleuro-pulmonary Perforations

Cases have been described in which oleothorax has been the means of closing a broncho-pleural fistula, but, in my opinion, the risk of aspiration of oil into the lung is so great as to make thoracoplasty the treatment of choice. An effusion which follows a pulmonary perforation indicates treatment by oleothorax under conditions similar to those complicating an artificial pneumothorax. In practically all cases the perforation is the result of an active cortical lesion of the lung, and for this reason lung collapse should be maintained. Of four such cases in the series, one had sinuses at the site of previous gas-replacements. These cleared up completely after the second injection of antiseptic oil.

Obliterative Pneumothorax

This is another unfortunate complication of an artificial pneumothorax, and is usually associated with adhesions, the formation of which may or may not have been excited by the presence of fluid. A dry plastic pleurisy commencing at the base is a common cause for re-expansion of the diseased lung and obliteration of the air space. Frequent air refills, even under high pressure, are found to be useless in arresting the obliterative process. Reappearance of symptoms with expansion of the lung will depend on the length of time the lung has been collapsed. Any reactivity in the diseased lung at a future date cannot, however, be dealt with by artificial pneumothorax because of adherent pleura.

To interpose a cushion of oil between the re-expanding lung and chest wall is found to be a very satisfactory method of dealing with this condition. In seven such cases oleothorax successfully arrested the obliterative process, and where the general condition of the patient did not benefit another factor was responsible. One patient died of acute bronchitis. In two cases an unsatisfactory result was obtained because the treatment was late in being applied. It certainly prevented further obliteration of the air space, but not before the lung had expanded sufficiently to cause symptoms. Whenever an obliterative pneumothorax is determined, it seems wise not to delay instituting oleothorax treatment.

Ineffective Artificial Pneumothorax

Insufficient Compression.—Repeated air refills, even under a high positive pressure, do not give the optimum collapse of a lung in which cavities cannot retract, because of the strong fibrous envelope surrounding them. Oil, by reason of its weight and bulk, exerts a greater compression than air on a lung, and this factor is made use of when such a condition arises. For a similar reason, Burrell¹¹ has applied oleothorax treatment in cases of basal bronchiectasis, where a permanent collapse is required. One case coming under this heading was that of an elderly lady who had unilateral pulmonary tuberculosis with cavitation. An artificial pneumothorax was induced and maintained for several months, but the profuse expectoration (T.B. positive) and toxæmic features persisted. X-ray examination revealed a large thick-walled cavity remaining patent in spite of complete collapse of the surrounding lung. Thoracoplasty was considered, but in view of the patient's age oleothorax treatment was applied as a less drastic procedure. When the oil was drained away six months later a skiagram revealed complete collapse of the cavity. This had been suspected clinically from the progressive diminution of sputum (now tubercle-free) and improvement in the patient's general condition.

Laxity of Mediastinum.—Cases are met with where an exaggerated pleural elasticity prevents effective pulmonary collapse. Dislocation of the mediastinum follows any attempt at lung compression, even by the introduction of small quantities of air, with a resultant negative intrapleural pressure. Oil, probably in virtue of an irritant action, thickens and increases the rigidity of the pleura. Oleothorax, in such conditions, gives necessary tone to the mediastinum, and so prevents its displacement while the lung is being collapsed. This result was obtained in one of my cases, but the previous dislocation of mediastinum had activated an old focus in the other lung, and rather counteracted the beneficial effects of oleothorax treatment.

To Replace Artificial Pneumothorax

I have seen patients who, when outside hospital control, abandon artificial pneumothorax treatment because of the dread of pain associated with air refills. They are usually of the neurotic type, and it is conceivable that, because of the necessity of less frequent refills with oleothorax, oil might replace air in the treatment of such cases. Provided the treatment was fully established, the same harm would not befall the patient if the oleothorax were to be abandoned, since oil is absorbed much more slowly than air, and the diseased lung would remain longer collapsed.

Where a patient has not the facility for continuing with air refills—for example, on a sea voyage or in an isolated part of the country—it would be justifiable to consider substituting an oleothorax for artificial pneumothorax. Here again the oleothorax must be fully established to be without risk of complications. I have had no experience with this treatment in either of the above types of case.

TECHNIQUE

Syringe.—Various types of apparatus have been devised for introducing oil into the pleural cavity, but in my opinion none of these can claim any advantage over the ordinary Dieulafoy two-way syringe. With this the technique is simple and speedy, especially when an effusion is to be aspirated before injecting the oil. The rubber tubing, usually supplied with a Dieulafoy set, is apt to perish after contact with oil, and also proves unsuitable when the oil is injected under slightly increased pressure. For these reasons I used flexible metal tubing of similar length and size of connexions, and found it very satisfactory.

Needle.—The largest-sized needle supplied with a Dieulafoy set was the one generally employed. The bore is sufficient to allow of a fairly rapid injection of oil, and small enough to make the formation of a pleuro-cutaneous fistula less possible.

Manometer.—In order to measure the pressure of oil in the pleural cavity, different types of oleo-manometers have been used, but none seem to have proved satisfactory. In my opinion, the only important essential for the control of an oleothorax is to know the intrapleural air pressure above the oil. Even when no air is present, as in a complete oil blockage, x-ray and clinical examination will indicate any important change in the intrapleural oil pressure.

Position of Patient.—The most comfortable position for the patient seems to be sitting up in bed, supported in front by a small bed-table. This allows free access to the upper chest for the introduction of the pneumothorax needle, and to the base for the oil needle. When the pneumothorax is partial, a slight change of position may be necessary according to the required sites for needle punctures.

Preliminary Oil Injection.—Where no effusion has previously existed the "virgin pleura" should be tested for its sensitiveness to oil. For this I used an ordinary 10 c.cm. syringe, the needle of which was previously connected with a manometer to make certain that the oil would be injected into the pleural cavity.

Disinfectant Oleothorax.—In all cases where oil was replacing pus, pleural lavage was performed as an intermediary part of the technique. After gas-replacement of the pus, and before the introduction of oil, the pleural cavity was washed out with Jessen's fluid (iodine 1 part, potassium iodide 2 parts, distilled water 40 parts—of this 5 c.cm. is added to one litre of sterile water at 37° C.). This solution is a good solvent for tuberculous pus, and so cleanses the pleural cavity for the reception of antiseptic oil. For pleural lavage the same Dieulafoy syringe and needle was employed.

COURSE OF TREATMENT

Bearing in mind the possibility of a fluid reaction, I never exceeded 300 c.cm. as the amount of the first oil injection. Regarding refills, each case had to be considered separately. The amount given depended largely on the requirements of the case, but rarely exceeded 500 c.cm. The interval between refills was governed by the presence of any reactionary features and general condition of the patient, and varied from one to several weeks.

To determine when an oleothorax is fully established is a matter of judgement in every case. Treatment cannot be regarded as complete without first ascertaining that no serous or purulent fluid is being formed in the pleural cavity. At least three negative punctures, at monthly intervals, are essential before this is certain. In my opinion, a fully established oleothorax should consist, where possible, of a complete oil blockage of the pleural cavity. Any small quantity of air remaining above the oil becomes absorbed, and a cushion of oil is left between the chest wall and compressed lung. The expanding lung forces the oil into the upper part of the pleural cavity, and so the blockage becomes complete. Generally speaking, therefore, the amount of oil to be introduced is that which, when blocking the pleural cavity, will keep the lung in the required state of compression.

When the pleural cavity is of large capacity, or when the collapsed lung is fixed and shows no tendency to expand, an oil blockage is not practicable. The large amount of oil required would give rise to pressure symptoms. In such cases the optimum quantity of oil seems to be that amount which will occupy about two-

thirds of the pleural cavity, stopping short of any pressure features. Air refills can be given above the oil if required.

In course of time the pleura appears to get saturated and ceases to absorb oil, or, if it does, only in very small quantities. The question as to how long after this the oil should be left in the chest cannot at present be satisfactorily answered, in view of this therapy being comparatively recent. When repeated reactions occur with the oil it is advisable to abandon the treatment and empty the pleural cavity. This had to be done in the case previously described under "Compression oleothorax." The patient was elderly and of poor general condition, and these factors probably accounted for the prolonged fever and tendency to fluid formation which accompanied the oleothorax. Fortunately the oil, during its short stay in the pleural cavity, had done what was required of it before having to be aspirated.

It has been shown that oil undergoes no degenerative change in the pleural cavity, even after several years. For this reason, and also because in most cases compression of the diseased lung is desirable, I am of the opinion that the oil should remain in the pleural cavity for at least two or three years. If at the end of this time it is considered advisable to aspirate the oil, expansion of the lung can be controlled by pneumothorax.

As it is less than two years since I first applied oleothorax treatment, I cannot speak from experience of its terminal stage.

My routine management of oleothorax cases was an examination of each one daily for the first week, and then clinical and x-ray examination weekly until the treatment was fully established. After the initial injection of oil, each case was kept on absolute rest for a minimum of four weeks, followed by slowly increased exercise and graded work. On discharge from hospital, patients were instructed to report monthly; any further treatment considered necessary meant their readmission to hospital for a few days. Out-patient treatment of these cases does not seem to be practicable or satisfactory.

COMPLICATIONS

These can be considered more in the nature of reactionary features due to the presence of oil in the pleural cavity. In most of my cases a slight temperature followed the first one or two oil injections, but seldom lasted for longer than forty-eight hours. A more prolonged fever in one case was probably due to the patient's age and poor general condition, and in three other cases to the irritant action of liquid paraffin, since the temperature subsided when olive oil was substituted.

Pleural effusions following the oil injections proved a troublesome complication, and demanded patience until such time as the pleural surfaces became desensitized to the presence of oil. Some could be ascribed to the effect of gomenol on a "virgin pleura," and others to the liquid paraffin employed. In my later cases, where modifications were made regarding the oil used, this complication was not so prominent. All the effusions experienced were of the insidious variety: I never met with the more immediate type described.

A pleuro-cutaneous fistula never complicated any of my cases. Manipulation of the tissues at the site of injection, application of pad and bandage, and the patient being made to lie on the sound side for a few hours after each oil injection—all seemed to prove satisfactory preventive measures.

It is reasonable to suppose that oil in the pleural cavity might cause the patient to experience a sense of "weight in the chest," and also, by depressing the diaphragm, to give rise to gastro-intestinal disturbance. I have heard this put forward as grounds for objection to the treatment, but in my opinion such an objection must be theoretical,

and, from practical experience, is unjustified. None of my patients suffered from any such discomfort, even after their return to work. A few certainly had a mild attack of gastro-enteritis after each oil injection, but this was probably due to the absorption of gomenol, and usually subsided in forty-eight hours.

LIMITATIONS OF OLEOTHORAX

Before a case can be considered suitable for treatment it seems to demand requirements similar to those governing artificial pneumothorax therapy. Thus the condition of the contralateral lung and of other tissues regarding tuberculous involvement has to be considered before instituting treatment. The ideal cases are naturally few, and I was occasionally tempted to overlook quiescent foci in other organs for the sake of determining the more immediate results of this treatment. The outlook for the more advanced case of tuberculosis is so hopeless that the patient's gratification at knowing that some treatment is being attempted seems to justify such liberties with oleothorax.

Of the six fatal cases in the series, five died as a result of either a reactivation of an old focus or an extension of the tuberculous process. None could be directly attributed to the treatment. As mentioned before, the deaths were not unexpected, but each one made me consider how different the result might have been had this treatment been applied earlier. Where a case offers any indication it seems unwise to delay until such time as it proves unsuitable.

Summary of Cases

Case	Indication	Result of Treatment
1	Tuberculous empyema...	Improved; returned to work
2	Tuberculous empyema...	Died; pulmonary tuberculosis
3	Tuberculous empyema...	Much improved; returned to work
4	Tuberculous empyema...	Improved
5	Tuberculous empyema; post-operative sinus	Improved; returned to work
6	Artificial pneumothorax; purulent effusion	Died; generalized tuberculosis
7	Spontaneous pneumothorax; effusion	Died; pulmonary tuberculosis
8	Spontaneous pneumothorax; effusion	Much improved; returned to work
9	Spontaneous pneumothorax; effusion	Died; pulmonary tuberculosis
10	Spontaneous pneumothorax; effusion and sinuses	Much improved; returned to work
11	Obliterative pneumothorax; effusion	Died; acute bronchitis
12	Obliterative pneumothorax; plastic pleurisy	Improved; returned to work
13	Obliterative pneumothorax; adhesions	Improved
14	Obliterative pneumothorax; plastic pleurisy	Stationary
15	Obliterative pneumothorax; effusion	Worse
16	Obliterative pneumothorax; plastic pleurisy	Much improved; returned to work
17	Obliterative pneumothorax; plastic pleurisy	Much improved; returned to work
18	Ineffective artificial pneumothorax; mediastinal laxity	Worse
19	Ineffective artificial pneumothorax; cavitation	Improved
20	Ineffective artificial pneumothorax; cavitation	Died; amyloid disease

CONCLUSIONS

1. Oleothorax is the treatment of choice in suitable cases of tuberculous empyema, and proves an alternative to the more drastic procedure of thoracoplasty in certain conditions complicating a spontaneous or artificial pneumothorax.

2. The technique is simple and speedy with a Dieulafoy two-way syringe and flexible metal attachments.

3. Olive oil is to be preferred to liquid paraffin, because the latter is a pleural irritant.

4. Because of its irritant properties, gomenol should be added to the oil only when an effusion is being replaced, and then in graduated strengths.

5. Discretion regarding the oil used makes complications negligible.

6. Of twenty cases, eight improved sufficiently to allow of their return to work.

I am indebted to Drs. Crowe and Costello for assisting in the treatment; also to Drs. McCartney and Allison for the bacteriological investigations.

REFERENCES

- ¹ Bernou: *Bull. Acad. de Méd.*, 1922, lxxxvii, 457.
- ² Kuss: *Rev. Tuberc.*, 1926, vii, 100; *Arch. Méd.-Chir. Appar. Respir.*, 1926, i, 203.
- ³ Weil: *Bull. Mém. Soc. Méd. Hôp. de Paris*, 1923, xlvii, 1382.
- ⁴ Burnand: *Soc. Méd. Hôp. de Paris*, 1924, xlviii, 1262.
- ⁵ Chandler: *Tubercle*, 1930, xi, 183.
- ⁶ Chandler and Gloyne: *Ibid.*, 1927, viii, 563.
- ⁷ Burrell: *Recent Advances in Pulmonary Tuberculosis*, London, 1929, p. 169.
- ⁸ Fontaine: *L'Oléothorax*, Paris, 1929.
- ⁹ Tulloch and Ross: *Tubercle*, 1926, vii, 265, 321.
- ¹⁰ Clerc: *Rev. Tuberc.*, 1930, xi, 39.
- ¹¹ Burrell: *Modern Technique in Treatment* (Lancet, Ltd., London), 1928, iv, 274.

FULMINATING MENINGOCOCCAL MENINGITIS

RECOVERY FOLLOWING SYSTEMATIC CISTERNAL PUNCTURES AND POLYVALENT SERUM

BY

J. N. C. FORD, M.A., B.M., B.Ch.Oxon.

AND

GEOFFREY SHERA, M.A., M.D.CANTAB.

CONSULTING PATHOLOGIST TO THE EASTBOURNE HOSPITALS AND TO
THE EAST SUSSEX COUNTY COUNCIL

IN COLLABORATION WITH

SIR JAMES PURVES-STEWART, K.C.M.G., C.B.,
M.D., F.R.C.P.

In view of the high mortality rate of fulminating cases of cerebro-spinal fever the following case seems worthy of record.

HISTORY OF THE CASE

September 11th, 1931.—A strong healthy girl of 22 was watching a tennis match in the morning, though she confessed to having got up feeling "not too fit." In the afternoon she had an attack of shivering, and was brought home and put to bed. At 6 p.m. she complained of feeling feverish, of headache, of pains in the limbs, and of a slight sore throat. She was restless, very flushed, and perspired freely. There were a few small petechial haemorrhages on the trunk and limbs. The fauces were red. The temperature was 106°, and the pulse rapid and full. During the night the patient slept fairly well for some hours, but, about 3 a.m., she became very restless and vomited severely several times. A few hours later she was in a violent delirium, and began to cry out.

September 12th.—The delirium and typical meningeal cry was now accompanied by spasm of the facial muscles, which soon became very pronounced. There was rigidity of the neck, and Kernig's sign was positive. Abdominal reflexes were present at this time; knee-jerks and ankle-jerks were exaggerated; plantar responses were indefinite. The temperature dropped to subnormal during the night, but in the morning rose to 100° (see Chart I). Lumbar puncture put the diagnosis beyond doubt. The spinal fluid was extremely turbid and under high pressure. After centrifuging there was a heavy deposit of pus, with intracellular and extracellular plump Gram-negative diplococci. Pandy's and the Nonne-Apel globulin tests were strongly positive. The total protein was 0.3 per cent. and the cell count 19,360 per c.mm.; the cells were nearly all neutrophils. A count of the organisms showed 144 per 100 fields. Glucose was absent.

By the evening the full picture had developed. There was marked rigidity (though no head retraction) of the neck and back. Violent spasms of all muscles caused constant movements of the limbs and a typical risus sardonius. The meningeal cry was intensified. No strabismus or any cranial nerve paralysis occurred at any

time. The abdominal reflexes were absent, and the knee- and ankle-jerks were present, though no longer exaggerated. The plantar responses remained doubtful, and in fact were never definitely extensor. But Kernig's sign was very marked.

The tongue was dry and furred, but the skin extremely moist. The eruption had developed into quite large purpuric spots all over the trunk and limbs. (A few days later a typical herpes arose on the upper lip.) The spleen was not enlarged, and never became palpable. Vomiting was not repeated after the first night, but the bowels were very constipated and had to be regulated by enemata throughout the illness. The temperature was 101°, and except at the onset was never particularly high. The pulse rate was 115, regular and full, and remained some-

CHART I

what rapid for several weeks (even after the temperature had fallen). There was at no time any evidence of cardiac involvement.

A menstrual period was missed at this acute stage, but the next one appeared as usual the following month. The patient had to be catheterized on two occasions, but thereafter normal control returned. The urine was acid; specific gravity 1022; a fair cloud of albumin was present; and the deposit showed many hyaline casts; there was no haematuria.

Cisternal puncture was performed by Sir James Purves-Stewart under light general anaesthesia, and 40 c.cm. of turbid cerebro-spinal fluid was withdrawn under pressure. Fluid showed 28,160 cells per c.mm., and 136 organisms per 100 fields. Possibly the greater number of cells in the cisternal as compared with the spinal fluid was accounted for by the nearer approach to the maximum local incidence of infection via the cisternal route.

After a slow intracisternal injection of 20 c.cm. of warmed polyvalent anti-meningococcal serum the respirations became very shallow and slow, and finally ceased. Artificial respiration and a hypodermic of camphor restarted the breathing after a few minutes. In addition, 10 c.cm. of the serum was given intravenously to counteract the severe septicaemia. (See table, and notes below.)

On coming round from the anaesthetic, the patient once more became violently restless.

September 13th.—The condition was much the same, there being no change in the physical signs, though the temperature and pulse rate were both down. Cisternal puncture was repeated under general anaesthesia, when 50 c.cm. of cerebro-spinal fluid was obtained, and 20 c.cm. of carefully warmed serum slowly injected. This time there was no mishap, though the respirations became very rapid and shallow; 10 c.cm. of serum was also given intravenously.

The fluid showed increased cellular content, but fewer organisms and more marked phagocytosis; cells 44,800 per c.mm., organisms 128 per 100 fields.

In the evening the patient was rather less violent. Cisternal puncture was repeated, 32 c.cm. of cerebro-spinal fluid being withdrawn; 20 c.cm. of serum was injected, together with 12 c.cm. intravenously. The fluid was now blood-stained and tinged yellow on centrifuging. Glucose was still absent, and the total protein was 0.4 per cent. The cells averaged 28,160 per c.mm. No organisms were visible, and the amount of pus present in deposit was