have been studied, with particular regard to the incidence of pregnancy and its effect on the tuberculosis.

There were 54 completed pregnancies in 47 patients, who were followed up for at least one year after delivery; 20 pregnancies in a further 18 patients were artificially terminated.

The patients with completed and interrupted pregnancies were each divided into two groups—those with active and those with non-active disease. In each of these groups the results in patients with completed and those with interrupted pregnancies did not differ appreciably at the end of the follow-up period.

Of patients with persistently patent cavities in spite of treatment, seven completed their pregnancies, and of these, six later deteriorated. Of five whose pregnancies were terminated four later deteriorated.

As expected, the birth rate among these patients was very low, being of the order of one-quarter of that for women of the same age groups in the general population.

The initial diagnosis of tuberculosis less than three months after an antecedent pregnancy was not made with greater frequency than could be ascribed to chance.

The findings support the view that pregnancy has no very dramatic effect on the course of pulmonary tuberculosis.

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REFERENCES

- Berg, G. (1941). *Acta tuberc. scand.*, Suppl. 4.
 Brooks, W. D. W. (1940). *J. roy. Inst. Publ. Hlth*, 3, 67.
 Cohen, R. C. (1946). *Brit. J. Tuberc.*, 40, 10.
 Registrar-General's Statistical Review, 1947 (Part II, Civil), H.M.S.O., 1949, London.
 Stewart, C. J., and Simmonds, F. A. H. (1947). *British Medical Journal*, 2, 726.
 Tattersall, W. H. (1947). *Tubercle*, 28, 85, 107.

Irish medical students now approaching the end of their training are hoping that British hospitals will be able to offer them jobs next year, otherwise they may be delayed for some time before they are able to set up in practice on their own. New Irish legislation, expected to come into force next January 1, will require all newly qualified doctors leaving medical school to work in a hospital for a year before their names are entered on the *Irish Medical Register*. This is part of the arrangement with Britain about the new intern year. But between 260 and 270 students are expected to qualify in Dublin next year, and there will be only 200 jobs available for them in Irish hospitals. They understand there will be about 100 jobs available for them in British hospitals. If these jobs do not materialize, however, there is likely to be a waiting-list of medical students who have completed their training but have not qualified for practice. There is an inducement to them to work in Britain. In Irish hospitals the young doctors will be paid £150 for their year's work, plus their keep. In Britain the pay is £375, from which £100 is deducted for keep. Irish hospitals are wondering where they are to get the money to pay these salaries. "The increase in cost cannot be less than £50,000 a year," says Dr. R. A. Stoney, president of the Irish Medical Registration Council, in a paper published in the current *Irish Journal of Medical Science*. "So far there has been no authoritative statement as to where this money is to come from."

VALUE OF PNEUMOENCEPHALOGRAPHY IN DIAGNOSIS OF FITS

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The occurrence of fits in a young and otherwise healthy adult who has no abnormality on clinical examination is fairly frequent in neurological practice among the armed Forces. Once there is convincing clinical evidence that they are genuine epileptic attacks, the further problem arises whether they are idiopathic (constitutional) or symptomatic of some organic lesion of the brain, such as a neoplasm, cicatrix, angiomatous malformation, or the like. Help in deciding this is given by the family and personal history. Useful evidence may also be obtained from examination of the cerebrospinal fluid (C.S.F.), x-ray films of the skull, and electroencephalograms. None of these procedures causes much clinical upset, and, provided facilities are available, they are not time-consuming. They may, however, give equivocal results; if they are negative the clinical setting of the epilepsy may still leave the suspicion of a possible progressive intracranial lesion as a causative factor. In that case it is usual to consider the advisability of doing pneumoencephalograms to see whether there is displacement or distortion of the ventricular system or whether there are abnormalities in the disposition of cortical air. This procedure does temporarily upset patients, and it carries a slight but definite risk. It is pertinent, therefore, to ask how much useful diagnostic information is likely to accrue in the clinical setting mentioned above.

The possibility of a cerebral neoplasm presenting as epilepsy in a young adult cannot be ignored. Thus, Penfield and Erickson (1941) tabulated the presumptive causes of epilepsy appearing at different ages, and for the age group 20 to 35 years they put first trauma and then neoplasm. (It is worth noting that neurosyphilis, still often invoked in many standard textbooks, is not considered important, an opinion with which most neurologists practising in this country would agree.) Discussing this table, they wrote: "In young manhood and in middle age the onset of epilepsy without obvious traumatic cause should always suggest an expanding lesion as the most likely cause." They also declared: "In general, all patients whose seizures have come on late in life should come in for study and usually pneumography." Notkin (1931), studying chronic epileptics with mental deterioration, found that only 8 out of 17 cases had normal pneumoencephalograms. Dickerson (1941), on the other hand, found only 7 abnormal encephalograms in 313 studies on epileptics, but he did not state the type of case he was studying. Merritt and Brenner (1944) reported three patients who had pneumoencephalograms done 7, 20, and 30 months respectively after their first fit. All the encephalograms were normal, and no patient had any abnormal physical

signs, yet all three were eventually proved to have a cerebral tumour. A study of pneumoencephalogram findings in cases of patients who present with epilepsy of recent onset and with no abnormal signs in the central nervous system does not seem to have been made. If abnormalities can be found at this stage the procedure should clearly be widely used, even if normal air pictures cannot be taken to exclude neoplasm. The present study was therefore undertaken to provide information on this point.

Material

During the six years 1945-50, 64 patients were subjected to pneumoencephalography at a military hospital for head injuries because of the development of fits. In eight of these the records were unsatisfactory because of insufficient air or because the air had not entered the ventricles. There remained 56 cases which were taken for review here. All but three were males. In every case the evidence that the fits were epileptic in character was satisfactory and none had begun earlier than the age of 18. Only four had convincing clinical abnormalities in the central nervous system. Cases of blunt head injury such as might be sustained by any civilian patient are included, though none of these were recent and none had residual neurological signs at the time of examination. No penetrating brain wounds are included. The material is selected, since cases with changes initially suggesting localized cerebral disease were excluded, but it represents the not uncommon neurological problem of "fits for investigation."

The ages of the patients at the onset of the attacks are given in Table I. The length of time which had elapsed between the occurrence of the first attack and the performance of pneumoencephalography is shown in Table II. The frequency of the attacks is given in Table III.

TABLE I.—*Ages at Onset of Attack*

18-20 years	11 cases	31-35 years	13 cases
21-25	15 ..	36-40	11 ..
26-30	3 ..	Over 40	3 ..

TABLE II.—*Time of Pneumoencephalography Since Onset of First Fit*

One month	7 cases	Three years	5 cases
Three months	10 ..	Five	6 ..
Six	11 ..	Over five years	5 ..
One year	12 ..		

TABLE III.—*Frequency of Attacks*

One attack only	5 cases	Once in six months or more	16 cases
Once a week or more	12 ..	Less than once in six months	3 ..
Once a month or more	18 ..	Unknown	2 ..

There were 39 examples of grand mal, 15 of Jacksonian attacks, 3 of petit mal, and 2 of akinetic attacks. Three patients had two sorts of attacks: 2 had grand mal with petit mal and 1 had Jacksonian attacks with petit mal.

There was no family history of epilepsy in 49 cases, 5 had a positive history, and in 2 there was no information. The previous medical history contained nothing of significance in 40 cases; 12 had had head injuries, but in all except 2 of these the post-traumatic amnesia had been less than 24 hours; one was a professional boxer; one had a history of cerebral thrombophlebitis, one of neurosyphilis which was sero-negative at the time of examination, and one of meningococcal meningitis. There were no abnormal signs in 52 cases, 3 had slight motor changes such as increased reflexes or slight loss of power, and 1 had a hemianaesthesia and hemianopia in addition to slight spastic hemiparesis.

Of the 56 cases, 42 had electroencephalograms done. Twenty of these had normal records, 13 had a bilateral generalized dysrhythmia, in 5 the dysrhythmia was more marked on one side than the other, and 4 showed a definite focal disturbance.

In 41 cases of the series the result of C.S.F. examination was normal. In 2 the protein was over 50 mg. and in 4 between 45 and 50 mg. In 9 the results were not available. Only one of the cases with raised protein showed abnormality of air pictures.

Technique

Pneumoencephalography was done by the lumbar route with the patient in the sitting position in all cases. Thirty-five to 50 ml. of C.S.F. was removed by repeated aspiration, and after each removal air was injected. After a check film with the patient still sitting up, standard views in the brow-up and brow-down positions were taken. Views for third and fourth ventricles, and in most cases laterals and postero-anterior views with the patient erect to outline the roof on the lateral ventricles, were also done.

In 51 cases the air pictures were normal, 3 were abnormal, and in 2 there was a doubtful abnormality. In these two there was a difference of opinion between radiologists and neurologists. In each case the former considered the pictures within the range of normal, whereas the latter thought they showed a recognizable local abnormality. Details of these last five cases are given because they illustrate the diagnostic problems.

Case Reports

Case 1.—A young man aged 20 had sustained a head injury six years previously, with fracture of the right frontal bone and a post-traumatic amnesia of one week. He had made an uneventful recovery. Three months before admission he had begun with grand mal attacks, of which he had four in all. Physical examination was negative, and there was no family history of epilepsy. C.S.F. was normal. Straight x-ray films of the skull also showed no abnormality. The electroencephalogram revealed some slowing in the right frontal region. The pneumoencephalogram showed slight indentation in the roof of the anterior horn of the right ventricle. In view of the normal C.S.F. and the history of head injury the most probable diagnosis in this case was considered to be traumatic epilepsy.

Case 2.—A man aged 33 began with grand mal attacks one year before he was seen. These had continued with a frequency of one a month. There was no previous relevant medical history, and abnormal signs were absent. The family was free from epilepsy. X-ray films of the skull showed an island of denser bone in the right frontal region, but no other abnormality. C.S.F. was normal and the blood W.R. negative. A pneumoencephalogram showed some degree of dilatation of the lateral ventricles which was quite symmetrical.

Case 3.—A man aged 21 began six months previous to admission with grand mal attacks, of which he had two. There was no previous medical history or any relevant family history. Examination, however, showed mild weakness and slight smallness of the right side of the body, with sensory loss and a right homonymous hemianopia. The electroencephalogram showed a persistent depression of the dominant frequency throughout the left hemisphere. C.S.F. was normal. Air pictures revealed a large porencephalic cyst in the left parieto-occipital region communicating freely with the ventricle.

Case 4.—A previously healthy man aged 26 suddenly had a right-sided sensory seizure one evening. This occurred some four weeks before admission to the head injuries hospital. He had a history of a blow on the face some weeks before the fit, but had had no loss of consciousness at this time. Within three weeks of his first fit he had several others, and after the third had some right-sided facial weakness with minimal weakness of the right hand also, and a doubtful right extensor plantar response. C.S.F. showed 50 mg. of protein, but no other abnormality. These signs had persisted for a month when he had his pneumoencephalogram done. This did not show any displacement

or distortion of the ventricular system, which was well filled, but the left temporal horn seemed flatter than the right. The significance of this was disputed, but the finding, combined with his slight right-sided signs, led to ventriculography, in which the change in the left temporal horn was again seen. Brain biopsy was done in the temporal region, but only normal brain was recognized. After this his signs slowly receded. Some months later he had had no further fits, but still had a slight facial weakness. The most probable diagnosis clinically was thought to be an infiltrating glioma. No further follow-up was possible.

Case 5.—During a period of 24 hours a man aged 26 had a series of attacks of unheralded loss of consciousness, with convulsions beginning in the left arm and rapidly becoming generalized. Before the fits he had noticed no disability; after them he was aware of some fumbling in the use of the left hand, and examination showed slight but undoubted weakness of the left limbs. C.S.F. and skull examinations were normal. Pneumoencephalograms were done within a month of the seizures. The right lateral ventricle was slightly larger than the left, and there was a depression in the roof of the anterior part. The significance of these findings was disputed. Nevertheless, as his physical signs steadily increased and his state of responsiveness deteriorated, ventriculograms followed by craniotomy were done about three weeks later. The ventriculograms showed a slight filling defect of the right anterior horn, and at operation an infiltrating glioma of the corpus callosum involving both frontal poles, right more than left, was revealed.

Discussion

The interpretation of air pictures with minor degrees of abnormality is often difficult, and it is not uncommon to review pictures in the light of subsequent clinical events and see abnormalities which were missed at the time. In all the cases recorded here an opinion was given independently both by neurologists and by radiologists.

In this series of 56 young adults presenting with epilepsy, only three showed clearly abnormal air pictures. In two further cases there was disputed abnormality. Moreover, a history of severe head injury some years before in one of these five, and the presence of unequivocal abnormal neurological signs in three others, suggested that their epilepsy was symptomatic and that abnormality of air pictures might be found. The main bulk of the cases, however, had no such clinical indication of the possible source of their attacks. None had had attacks until adult life, and in 49 of them there was no family history of epilepsy or related phenomena. They were therefore cases in which, according to Penfield and Erickson (1941) intracranial neoplasm was a likely cause of their attacks. Nevertheless, of the cases in which nothing apart from seizures suggested underlying brain disease, in only one was the air picture abnormal. The type of fit also did not seem to help in indicating when abnormality might be found. Jacksonian attacks suggesting a possible focal lesion were found in 15, but of these, 13 had normal air pictures, and in only 2 was there doubtful abnormality; while each of the 3 in which there were definite abnormalities had generalized grand mal attacks with no focal onset.

Unfortunately these patients were invalided out of the Service and their further history is not available. It is possible that some of them would subsequently have developed clear evidence of gross intracranial disease, as in the cases followed by Merritt and Brenner (1944). Nevertheless, it seems justifiable to conclude that when epilepsy presents in young and otherwise healthy adults with no clinical signs of involvement of the central nervous system, intracranial air studies are not of much diagnostic value. It is important to emphasize that we are speaking of young and healthy adults who showed no abnormality on a searching neurological examination, and to add that there will be some patients within this group

for whom the results of other investigations—in particular, abnormalities of C.S.F. protein, or localized or focal electroencephalographic changes—will still demand air pictures. In general, however, even if we accept the view that intracranial neoplasm is a likely cause for the attacks, the results in this small series suggest that it would be wiser to keep such patients under regular neurological observation and withhold a procedure which carries a slight but definite risk until changes in the clinical picture suggest that it will yield useful information.

It is possible that cerebral angiography may in the future provide a more useful diagnostic guide in this problem—particularly where a focal onset to attacks provides information about which side should be injected. As yet, further experience of its use in the type of case here discussed is required.

Summary

Fifty-six patients who had epilepsy in early adult life were subjected to pneumoencephalography. Four had had abnormal physical signs; three of these had definitely abnormal air pictures, and the fourth a doubtful abnormality. Of the 52 cases with no abnormality on clinical examination, 51 had normal air pictures.

It is suggested that the diagnostic value of pneumoencephalography in young adults with epilepsy as their only abnormality is not great, and that it is better to keep these patients under neurological observation until the emergence of clinical signs indicates the need for air studies.

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REFERENCES

- Dickerson, W. W. (1941). *Amer. J. Psychiat.*, **98**, 102.
Merritt, H. H., and Brenner, C. (1944). *New. Engl. J. Med.*, **230**, 224.
Notkin, J. (1931). *Arch. Neurol. Psychiat.*, **26**, 115.
Penfield, W., and Erickson, T. C. (1941). *Epilepsy and Cerebral Localisation*. Baillière, Tindall & Cox, London.

The means of suicide are changing. The once popular method of poisoning with phosphorus has given way to the use of narcotics. In *Casopis Lekaru Ceskych*, E. Vencovsky and A. Reisich report the first suicidal attempt in Czechoslovakia with "antabuse" (tetraethylthiuramdisulphide) and alcohol in a chronic alcoholic who was being treated at the time with antabuse. The amount of alcohol leading to fatal intoxication varies with the concentration of alcohol, the tolerance of the individual, and the presence of intercurrent or latent diseases. A blood level of approximately 0.6% is generally accepted as fatal. Antabuse is practically a non-toxic substance, and its effect is based on the inhibitory action of complete oxidation of the ingested alcohol. The oxidation is arrested at an intermediate state, when acetylaldehyde is produced. The resulting acetaldehyde leads to a temporary intoxication with very unpleasant signs and symptoms that deter the individual from further alcohol consumption. As the anti-alcoholic action develops only after some days, treatment has to be administered two or three days weekly. Fatal accidents have been seen only in a few cases where contraindications have been disregarded (two cases in Czechoslovakia and seven elsewhere). The intensity of action depends upon the amount of alcohol consumed at one time. The patient under observation, living under great emotional stress during antabuse treatment, attempted suicide by drinking one pint (0.57 l.) of brandy.