PREFRONTAL LEUCOTOMY IN MENTAL DEFECTIVES.*

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SINCE the introduction of prefrontal leucotomy by Moniz in 1936, an ever-increasing number of psychotics have been subjected to this operation. Results have been very satisfactory in certain types of psychosis and psychoneurosis, especially in obsessional tension states, in agitated depression, and in patients with considerable apprehension and anxiety, while less favourable results have been reported in many cases of schizophrenia, hebephrenia, and others. Naturally, with the number of cases operated on, experience has grown, and psychiatrists, neurologists as well as psychologists are nowadays, to some extent, in a position to determine which case is likely to benefit from the operation, and where leucotomy should rather not be resorted to.

It is understandable that, since certain types of brain disorder have responded so well to this operation, one should feel tempted to find out whether other afflictions of the central nervous system might not show good results as well, especially when any other treatment, applied before, had proved ineffective. Ström-Olsen and his co-workers, among their thirty cases, operated on four epileptics with considerable behaviour-disorder, and report much improvement in three cases and slight improvement in the fourth. It would, however, be interesting to hear whether this improvement is still holding good now, nearly five years after the performance of the operations. Thorpe's two cases were delinquents with post-encephalitic disorder of conduct. Freeman and Watts used prefrontal leucotomy in patients who were free from psychosis, suffering from recurrent carcinoma, thalamic syndrome, tabes dorsalis, and trauma to the cauda equina. In all these instances the indication for the operation was relief of pain. Alfred Meyer had the opportunity of investigating the brain of a patient who had been mentally normal but had been suffering from a basal meningioma, and in whom a prefrontal leucotomy had been performed. Although some improvement was noticed in these cases, the results have been far less striking than in psychotics with anxiety or tension states.

At St. Lawrence's Hospital, Caterham, forty-four mental defectives were leucotomized between March, 1944, and December, 1946, the first case by Mr. Crombie, the others by Mr. McKissock or his assistant Mr. McCall. One of the cases must, however, be excluded from this review, as a considerable hydrocephalus of the right lateral ventricle was found during the operation, which had to be abandoned owing to the danger of intracranial haemorrhage.

The ages of the patients, at the time of operation, ranged from 17 to 47

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years, 9 being between 17 and 20, 21 between 21 and 30, 11 between 31 and 40, and 3 between 41 and 47, the average age being 27 years and 9 months.

As to the type of defectives selected, all groups are represented, from feeble-mindedness to lowest grade of idiocy, the overwhelming majority—75 per cent. —being low-grade imbeciles and idiots. Among them were 16 defectives who also suffered from more or less severe epilepsy, and 15 had a superadded psychosis, partly of the paranoid, partly of the schizoid, and partly of the manic-depressive type, with hallucinations, ideas of persecution, and religious insanity ideas. In some of the most intractable cases electric convulsion therapy had been carried out prior to the operation, with either absolutely negative result, or followed by a deterioration of conduct.

It is obvious that no improvement at the intellectual level of these patients was expected, but a change of their behaviour disorder to the better. All these patients, whether feeble-minded, with a remarkably high intelligence-quotient, or low-grade imbeciles and idiots, whether complicated by epilepsy or psychosis or not, displayed more or less the same very severe disorder of conduct. They were restless, excitable, and irritable, had often screaming fits lasting several days and nights, compelling us to keep them secluded, they were destructive to bedding and clothing, wet and dirty, they often had a tendency to self-mutilation, endangering their lives by banging their heads against the walls, or, on the other hand, became so violent that they constituted a permanent menace to the nursing staff or to other patients. In many of them proper control was only possible by either using large amounts of sedatives, or by keeping a nurse permanently at their bedside—so difficult to manage with the present shortage of nurses.

The majority of the operations were performed during 1945 and the first half of 1946. We, therefore, have had the opportunity of observing these patients after their operations for from 1½ to 3 years approximately. I would like to point out here that in compiling records such as this one is easily biased, often quite unconsciously. To avoid this I have interviewed the medical officers in control of these cases, and all the sisters and most of the nurses, who had been in charge of them long before and then after the operations. Only after comparing very carefully their valuable information have we arrived at the conclusions to be recorded now.

The results have been rather unsatisfactory.

Of the 43 patients under consideration, 5, or 13·15 per cent., died between one day and nearly one year after the performance of the operation, one of a subarachnoid haemorrhage on the day following the operation, another 24 days later of cerebral softening—in this case some degree of hydrocephalus had been found at the operation. The third died after six weeks of toxic myocarditis. One patient suddenly collapsed four months after the operation and died, and the fifth survived nearly a year to die of broncho-pneumonia. Unfortunately permission to carry out a post-mortem examination had not been granted in two of the cases, but I have no doubt that their death, directly or indirectly, resulted from the operation, as all had been rather healthy specimens previously.

In 4 of the remaining 38 cases there was a considerable increase in the fre-

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quency and severity of their epileptic fits. One of them has now frequent *status epilepticus* lasting several days, and practically uncontrollable by our orthodox methods. This patient, though epileptic, had never before been in a *status*. Contrary to the findings of other writers, who reported frequent epileptiform convulsions following the operation, which, however, had ceased some time later, not to reappear again, our 4 cases show a definite and lasting deterioration as far as epilepsy is concerned.

In addition to these 4, 3 more patients who had been free from epilepsy prior to the operation started having fits afterwards, one in the first few hours after the performance of the operation, the second twenty days, the third eight months later. In all these cases an increasing number of fits is reported now. 18·41 per cent. of our cases have, therefore, either become worse or had epileptiform convulsions added to their former cerebral affliction. It goes without saying that these convulsions contribute a great deal to their general physical and mental deterioration.

Considering their behaviour disorder, the results were as follows:

Three patients showed and still show a remarkable improvement. One of them should, at least in my opinion, be excluded from the statistical point of view. She is a medium-grade imbecile, half-Chinese, who, on the whole, had been quiet and well behaved. At times she became restless and noisy, and had screaming fits for no apparent reason. After a day or two she would calm down and be her own self again for a considerable time. In this case some degree of arachnoiditis was found at the operation, and a large amount of fluid released. The following dramatic improvement is, in all probability, due to cessation of intracranial pressure.

The two other cases, however, must be regarded as star successes. One girl, a high-grade imbecile with a superimposed psychosis of the paranoid type, had been emotionally unstable, extremely troublesome and abusive, had screaming fits, and required frequent seclusion. Now, nearly two years after the operation, she works well in the laundry. She is still noisy and troublesome at times, but incomparably better than before.

The other girl, a low-grade imbecile with schizoid mannerisms, emotionally very unstable, used to have outbursts of screaming lasting for several days. She is now quiet and well behaved, and is doing a great deal of useful work in the ward. Since the performance of the operation, nearly three years ago, we have had no trouble at all with her.

Seven of our patients, or 18·41 per cent., can be regarded as slightly or very slightly improved. They are perhaps less noisy, less excitable and less violent; some are still wet and dirty. In some of them nursing and supervision are easier than before, but the change is certainly not striking.

Thirteen of the patients, or 34·19 per cent., are absolutely unchanged, and consume the time of our nursing staff just as much as before.

Twelve, or 31·56 per cent., are worse or much worse. They have deteriorated mentally, if such a thing was still possible, are now filthy in their habits, and are real terrors in the wards. They are spiteful, aggressive, use obscene language, they are exceedingly destructive, and many of them have to be kept under restraint.

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Three other patients, two male and one female, became so much worse after the operation that they had to be certified under the Lunacy Act and sent to mental hospitals. The girl, an epileptic, feeble-minded, with a superimposed psychosis, became hallucinated, saw rats and black men in her room, and was often so aggressive that she was a permanent menace to the other patients as well as to the nurses.

Of the two male patients, one showed a remarkable improvement lasting approximately five months. After that he gradually relapsed to his former condition and eventually became absolutely unmanageable, threatening and dangerous.

If we look at this balance-sheet, we find that a very considerable improvement resulted in 5·26 per cent., a slight or very slight improvement in 18·41 per cent. of the patients. In more than three times their number, however, there was either no improvement at all, or such a deterioration of the disorder of conduct that many have now to be kept under restraint, or require more nursing supervision than before, or had to be sent to mental hospitals.

The question now arises: Should one operate on mental defectives exhibiting disorders of conduct, or not?

Before answering this question, let us compare the positive and negative results in our series of patients.

I have just pointed out that in 5·26 per cent. of our cases a remarkable improvement of the behaviour disorder was achieved through the operation, a slight or very slight improvement in 18·41 per cent. With a bit of good will one might, therefore, say that nearly 24 per cent. of those that survived the operation could be regarded as more or less successful. The rest, however, are an utter failure. It is certainly of interest that the great majority of the patients who benefited from the operation belonged to the higher grade, and possessed some personality.

It must be admitted that many of the patients were very quiet and well-behaved immediately after the operation, some of them, in fact, too quiet for our liking. This state lasted for weeks in some, for months in others, then a gradual return to the former condition was noticeable. Similar observations have been made by other investigators as well.

Many factors may account for this phenomenon. First of all, prefrontal leucotomy is not to be considered a minor operation as suggested by some writers. It is a rather serious, if not to say brutal operation, and the severe upset of the nervous system following it may be regarded as a shock from which some of the patients recover quickly, while others require months to do so. That during the state of this upset the patient remains quiet, and exhibits none or only very few of his disorders, can easily be understood. The return to his former condition may be due to the fact that other paths of association take over the function of those destroyed by the operation, as suggested by Golla and by Cobb. This view is shared by Hutton.

Another very important factor is how the operation has been performed, whether the so-called anterior or posterior cut was made, and whether enough fibres have been severed.

Without wanting to go into anatomical details, I may just mention that in

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cases with little deterioration small incisions may be sufficient, while in those with considerable deterioration an extensive destruction of the thalamofrontal radiation is necessary. The most illustrating and interesting investigations by A. Meyer on ten brains of patients who had undergone prefrontal leucotomy demonstrate very clearly how often this aim of the surgeon is achieved either very unsatisfactorily or not at all. And in the cases of Meyer the surgeon had to deal with brains of psychotics, or even one mentally normal individual, where one must assume the anatomical structures to be normal or near to normal.

Take in contrast the brain of a mental defective, especially of one of low or very low type. These brains are asymmetrical, large parts often atrophied, the convolutions very flat and simple, the arrangement of the blood vessels anomalous—in other words the contours are absolutely inconstant, and the poor surgeon is faced with the more than grave problem of how to find the thalamofrontal radiation. I have no hesitation in stating that in mental defectives of low type this bundle will not be cut properly in nine cases out of ten.

We must further take into consideration the mortality rate, which has decreased from 20 per cent. in Lyerly's series and 10 per cent. in McGregor and Crombie's series to 4·8 per cent. in the cases reported by Dax, 2·5 per cent. in those reported by Frank, and 2 per cent. in those reported by Parker. Our fatality rate was 13·15 per cent. I agree with all previous writers that, no matter which method is applied, fatal haemorrhages are unavoidable. If the brain is approached by the technique of Lyerly, who inserted a lighted speculum into the skull, blood-vessels can be seen and pushed back, but rather extensive dura openings are necessary, and the danger of secondary infection and adhesions with their grave consequences increases. If, on the other hand, the blind technique is used, no matter whether with a leucotome or a brain needle, anterior or posterior cuts, thin-walled cerebral vessels, either a cortical vein or a branch of the anterior or middle meningeal artery will in one or another case be injured, and death will follow either immediately after the operation or many weeks later.

Then there is the definite danger of either increasing the frequency of fits or of creating new epileptics. Dax recorded one patient with convulsions after the operation, Freman and Watts, in their initial reports, 3 among 80 patients, Frank 18 among 200 patients, McKissock 4 among 50 patients. A. Meyer mentions one who had died in *status epilepticus* seventeen months after the operation. In our series of patients 4 out of 38 cases became definitely worse, while 3 more started having fits after the operation. This amounts to 18·41 per cent. And I may be allowed to underline that this was not a transitory phenomenon, but a lasting one, contributing considerably to the deterioration of the patients. Whether the technique used in the operation, or adhesions, or any other damage to the brain were responsible for these convulsions is impossible to state. In the case investigated by Meyer no plausible explanation could be found.

Finally, I have to admit that in many of our cases, in addition to the worsened behaviour disorder, a certain degree of mental deterioration has taken

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place. May I now be allowed to outline in a few words the role played by the frontal lobes as regards intelligence?

Ferrier, as far back as 1878, had already stated that our intellectual power depended greatly on our frontal lobes, a view again expressed by Fulton as lately as 1943. On the other hand, Erickson was of the opinion that the frontal lobes had nothing to do with intelligence. Cobb also denied that they were centres for foresight and imagination. Careful study of leucotomized persons and of the changes in their behaviour disorder, especially, however, anatomical investigations of their brains, have contributed a great deal to establish beyond doubt the immense importance of the frontal lobes. Even if one does not go as far as Rees in identifying them with Freud's super-ego, it is now, thanks to the work of Jacobsen, Freeman and Watts, Le Gros Clark and of A. Meyer the consensus of opinion that memory, imagination, social sense, self-consciousness and future planning, all highly intellectual functions, depend on the integrity of these parts of the brain.

Observations on psychotics after leucotomy have led to varying reports regarding intelligence. Hutton, for example, states that personality changes for the worse are frequent findings, but that changes in the intellect are negligible. Ström-Olsen and his co-workers, on the other hand, report a slight deterioration of the intelligence level, which they attribute to the technique used in some cases. Cuts made too far posteriorly have been made responsible for leading to loss of initiative, and gradually to dementia. Rylander, carrying out mental tests on patients before and after leucotomy, found a decrease in the mean of intelligence quotients of his subjects from 93·97 to 83·75—in other words, a deterioration of approximately 12 per cent. And Freeman and Watts made the remarkable statement that failures after operations were due to incisions in the wrong places, or to the fact that the patient had undergone such a deterioration already that he was acting as if he had no frontal lobes at all.

A decrease in the level of intelligence of 12 per cent. as reported by Rylander may not matter very much in a psychotic with a certain personality and an intelligence quotient of 90 or 100 or even more, but must matter a great deal in a mental defective of low grade whose intelligence quotient may be between 20 and 30, or even lower. He can scarcely afford to lose a single point.

Mental tests on our low-grade defectives have taught us how little social sense, imagination or memory they have, and how they are unable to foresee and to plan. The development of their frontal lobes must, therefore, be exceedingly poor if we agree that those functions are invested in them.

If, through the operation, we decrease further this very low intellectual level, and, at the same time, destroy that small amount of personality which they may have possessed without improving their disorder of conduct, we have done them more harm than good.

Taking into consideration the small percentage of real improvement on the one side, the danger of a fatal outcome, of epilepsy, of a deterioration of the behaviour disorder, and of mental deterioration, in a large percentage of these patients, on the other side, we have come to the decision to abandon this

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operation in our mental defectives, and are of the opinion that, at least in those of low grade, it should definitely not be undertaken.

Only those defectives who possess a higher degree of intelligence as well as a higher standard of personality stand a chance of benefiting by the operation without too great a deterioration of their mental level and their personality. I am in agreement with Frank that, before submitting a mental defective to this operation, a very thorough investigation of the quality of his present and past personality should be made.

May I take this opportunity to thank the superintendent, Dr. Lindsay, who has followed the observations on our patients with very keen interest, for all the encouragement, help, and advice he has given me; further, his deputy, Dr. Firmin, who actually selected most of these patients for the operation and supervised them afterwards, for her permission to publish the findings. Special thanks are due to our staff, male and female, who not only carried out their duties with great devotion, often under considerable duress, but assisted me with great enthusiasm in my investigations resulting in this review.

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