

## Section of Surgery

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### Infantile Hemiplegia

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THE condition I propose to discuss is one of spastic hemiparesis coming on in the early months or years of life associated with epilepsy and with behaviour disorder. I am not concerned here with pure infantile hemiplegia unassociated with other physical or mental disturbance.

Some years ago Krynauw (1950<sup>a</sup>), the Johannesburg neurosurgeon, turned his attention to this condition and eventually reported (1950<sup>b</sup>) a series of 12 cases in which he had removed the entire cerebral hemisphere of the side opposite to the hemiplegia. He claimed that no decrease in power or alteration of cortical sensation followed such an operation but that the epilepsy and behaviour disorders were relieved. Further he brought evidence to show that mental improvement, as measured by learning capacity, was increased after the operation. In his opinion the mental changes, temper tantrums or behaviour disorders formed the most important criteria for operative intervention.

After a careful study of Krynauw's work we decided to carry out a series of such operations and it is of the first 18 such cases that I propose to speak.

It was a simple matter to review a long series of patients who had previously passed through our hands and select for admission and further investigation those who presented with hemiplegia, epilepsy and behaviour disorder.

#### METHOD OF INVESTIGATION

A panel or committee of interested persons was chosen so that each aspect of the case could be adequately examined both before and after treatment and, in addition, the panel met to discuss the advisability of operation before such a drastic step was taken.

*The panel.*—The chosen body consisted of the following: neurologist, psychiatrist, psychologist, radiologist, otologist, electrophysiologist and neurosurgeon. Each individual carried out such tests in his particular field as were required to assess the case fully. When the case was completely worked up the panel met and decided whether or not hemispherectomy was justifiable.

*Symptomatology.*—All patients were sufferers from epilepsy either in the form of major or minor seizures, if not of both. Most, in addition, had disturbance of behaviour: in the smaller children taking the form of frequent and severe temper tantrums. In the other cases the behaviour disorder might take the form of smashing up the house or institution or of attacking members of the family or inmates of the asylum. All were mentally retarded and had either fallen by the educational wayside or were being taught in special schools.

*Pre-operative findings.*—Clinically the patients showed a typical infantile hemiplegia, the affected limbs being smaller and shorter than those of the normal side. In older cases contractures had developed and spasticity was more marked than in the younger children in the series. In some cases disorganization of the upper limb had taken place from subluxation of joints. Power was diminished and range and type of movement limited.

Varying degrees of disturbance of cortical sensation were present but these were rarely very marked. Some patients had defects in the field of vision usually of a homonymous hemianopic kind. In the younger children such examinations were difficult to carry out and some uncertainty as to the presence of a hemianopia remained.

Mentally all cases showed some degree of retardation and the highest intelligence quotient in any case was about 70.

*Electroencephalography.*—Many recordings were made from all the patients but the findings were relatively inconclusive.

Radiologically a number of changes were observed. Straight X-rays of the skull usually revealed a hemiatrophy of the vault with thickening of the parietal bone on the side of the hemiatrophy.

*Air studies.*—These usually showed a gross dilatation of the entire lateral ventricle on the affected side, broadening of the third ventricle, a shift of the ventricular system towards the affected hemisphere,

enlargement of cortical air shadows and, in many cases, cyst formation around the line of the Sylvian vessels. Radiographs taken twenty-four hours after the initial air injection were often effective in exposing such cyst formation when it had not been visible in the routine films. \*

The dilatation of the lateral ventricle was variable in extent: some cases showed more evident enlargement in the parieto-occipital region, others in the temporal or frontal horn and the extent of the clinical neurological signs usually fitted in with the encephalographic findings. If, for example, the occipital horn was grossly dilated then a homonymous hemianopia was usually demonstrable. Careful study of the encephalograms sometimes suggested that the caudate nucleus and optic thalamus were unusually small on the affected side.

*Arteriograms.*—These have been performed in a number, although not all, of these cases and have not proved useful in demonstrating changes in the blood vessels of the affected hemisphere, although in cases with well-marked hemiatrophy there may be shift of the anterior cerebral vessels towards the side of the lesion.

*Photography.*—Much work has been done on making careful photographic recordings of the range and degree of movement possible on the hemiplegic side before operation in order to be able accurately to assess any changes due to operation. Cinematography has also been used extensively during operation to aid the verbal description of movements obtained by stimulation of excitable cortex or of the internal capsule after amputating the hemisphere.

*Psychological testing.*—This has been made as exhaustive as possible having regard to the capability and distractibility of the patients so that once again changes after operation may be definite one way or the other.

#### CONFERENCE

Once their data had been collated a meeting of the panel was called so that the case might be discussed in detail, the pros and cons put forward and a decision as to operative interference reached.

#### OPERATION

*Anæsthesia.*—The patients were induced with Pentothal, an endotracheal tube passed with the aid of a relaxant such as Flavedil and the patients maintained on gas, oxygen and repeated small doses of pethidine. In the case of small children gas, oxygen and a trace of ether is probably better.

Intravenous cannulæ were inserted into each internal saphenous vein to facilitate the giving of intravenous drips and to ensure that blood transfusion could be given without delay if required. Transfusion has not often been required, especially as once the amputation of the hemisphere is about to be commenced, arterial hypotension is induced with C6.

Mid-parietal scalp and bone flaps were turned down separately, the median limb of the scalp flap being kept well to the affected side of the mid-line to avoid bleeding from the unusually large arachnoid villi sometimes encountered close to the superior longitudinal sinus.

The dura mater was next opened in the form of a flap with its base towards the mid-line. Shortly before this stage the depth of anæsthesia was lightened, so that cortical stimulation might be carried out, once the dura was open.

The exposed cortex has shown a variety of abnormalities but by far the most common is an area of cystic degeneration around the Sylvian fissure, involving the temporal lobe extensively and the parietal lobe above in lesser degree. The convolutions around the cystic area are often narrowed, hard and irregular in outline.

A map of the excitable cortex was next made and was found to vary enormously from case to case. The area of stimulation was marked and the response obtained recorded both verbally and by cinematography.

In some cases also electrocortigrams were taken but this was not a routine procedure.

Amputation of the hemisphere—usually after the induction of controlled hypotension—was then performed, the frontal lobe being removed first, followed by the parieto-occipito-temporal lobes in a single mass. The choroid plexus was then excised as leaving it might result in a subsequent hydrocephalus developing. The structures remaining after the amputation were the caudate nucleus, optic thalamus and hippocampus.

At this point, apart from closing dural, bone and scalp flaps the operation was at an end but we have felt it desirable to obtain the maximum of information of physiological interest if the condition of the patient permitted. In certain selected cases, therefore, the surface of the divided internal capsule has been stimulated electrically or a window has been cut in the falx cerebri to expose the medial aspect of the remaining hemisphere for stimulation of excitable cortex here. The results of such stimulation have again been recorded both verbally and by cinematography. Bilateral limb movements have been obtained from stimulating the medial aspect of the sound remaining hemisphere.

Closure of the wound was then required and was done in the usual meticulous neurosurgical manner with a vast number of black silk sutures.

Within a few minutes of the end of the procedure the patients responded verbally or moved in response to painful stimuli or to verbal orders, irrespective of which hemisphere had been removed or the handedness of the individual.

## POST-OPERATION COURSE

There was little of note in the first few post-operative days other than the not inconsiderable rise in temperature which increases nightly for a few days and then gradually diminishes for several more.

Convalescence was otherwise similar to that after any major intracranial operation. Sutures were, of course, removed on the second day when the wound was healed. Patients were got out of bed at the end of a week unless the pyrexia still persisted.

*Complications.*—These have been few but for the earlier cases where it had not been thought necessary to excise the choroid plexus; these were 2 patients who developed a secondary hydrocephalus necessitating subsequent surgical procedures.

*Mortality.*—We have been fortunate in this matter in that there has been no death in the immediate post-operative phase but one patient did succumb three months after operation from an unsuspected low-grade infection producing a unilateral pyocephalus. This patient had suffered both a mild thrombophlebitis of the leg and a urinary infection in the first post-operative weeks and whether the pyocephalus was due to a blood organism or to infection at the time of operation cannot be established.

## RESULTS

The effect of operation has been to eliminate or greatly diminish epilepsy, to remove entirely behaviour disorder, to produce a homonymous hemianopia with splitting of the macula—if such was not present before operation—and to affect power and sensation in minimal degree.

*Deficits.*—It may be considered certain that a homonymous hemianopia will be acquired, if not already present. There will be minimal aggravation of cortical sensory loss as compared with the pre-operative state but this will not be of a degree significant to the patient or even appreciable by him.

There may be slight loss in the ability to use the arm or leg but this is usually more than offset by the decrease in pre-operative spasticity, which is also a usual sequel to hemispherectomy.

*Gains.*—Reduction or elimination of epilepsy. Abolition of temper tantrums (Table I). Lessened distractibility. Capacity to learn is increased or restored if previously lost. In certain of the older patients a definite increase in I.Q.

Decreased spasticity of the affected limbs leading to greater freedom and facility of movement (Table II).

TABLE I  
Epilepsy Temper tantrums

Unchanged .. ..	1	2
Occasional fits { Major	3	1
	Minor	1
No fits .. ..	12	14
Died .. ..	1	1
Total	18	18

TABLE II  
Hemiplegia Mental state

Unchanged ..	12	3
Worse ..	2	1
Improved ..	3	13
Died ..	1	1
	18	18

TABLE III

Patient	Fits	Tantrums	Motor	F-U	General
I M. 4 R.	None	None	Same	3	Developing slowly
II M. 11 L.	Occ. major	None	Worse	2½	Developing slowly
III M. 4 R.	None	None	Better	2½	Developing slowly
IV F. 20 R.	None	None	Better	2½	Considerable improvement
V M. 23 R.	Major and minor	As before	Same	2½	Unchanged
VI M. 4 L.	None	None	Same	2	Developing slowly
VII M. 21 L.	Occ. minor	None	Better	2	Developing slowly
VIII M. 1½ R.	None	None	Same	1½	Too young to say
IX M. 13 R.	None	None	Same	1½	More contented
X M. 12 L.	Occ. major	As before	Worse	1½	Worse
XI M. 17 R.	None	None	Same	1½	Much improved
XII F. 4 L.	None	None	Same	1½	Developing slowly
XIII F. 17 L.	—	—	—	—	Died three months later
XIV M. 26 R.	Occ. major	None	Same	1½	Much improved
XV M. 23 L.	None	None	Same	1½	Much improved
XVI M. 8 L.	None	None	Same	1	No change
XVII F. 9 R.	None	None	Same	1	Developing slowly
XVIII F. 18 R.	None	None	Same	1	Improved

2 of our 18 patients (Table III) have unquestionably suffered as a result of the operation: both of these were errors of judgment on my part. One developed an increase in the hemiplegia which has fortunately been offset by disappearance of a severe behaviour disorder, whilst the other has acquired

an increased speech defect. This latter case should have been subjected only to a local excision of abnormal parietal cortex rather than to total ablation of the hemisphere. These were early mistakes which should not occur again.

*Illustrative case.*—The following is an example of what may be expected of total hemispherectomy in a reasonably intelligent, though sub-normal, infantile hemiplegic.

The patient, a girl aged 20, was fortunate in having an admirable mother who cared so well for her daughter that she was able to do a job of work as a packer in a factory in spite of frequent generalized epilepsy. The patient, if left to herself was dirty, untidy, unable to care for herself properly and would masturbate openly before the family. She was difficult, argumentative and irritable at home. Bereft of her mother's aid she would soon have been admitted to an institution where she would have remained for life.

*Hemispherectomy* produced no change in the spastic paralysis of the hand, but improved the leg to an extent that was proved by the lack of need for constant repairs to the sole of the shoe on the affected side.

*Epilepsy was abolished*; her bad temper disappeared; she became clean in her habits and no longer masturbated publicly. She continued to be employable and wage earning. Later she married and is now able to care adequately for herself, her husband and her flatlet. She is virtually unaware of her hemianopia, a left homonymous defect.

In the younger children much more time must elapse before a true assessment of educational progress can be made, but the opinion of the parents leaves no doubt in our minds that they present far simpler problems in the home than they did before operation. One unfortunate woman indeed has produced a second hemiplegic infant whom she brought to hospital aged 6 months asking for hemispherectomy as it had proved so satisfactory in her elder boy.

The work described here should be regarded as a collective effort on the part of the panel, of which I have been the surgeon. The members of the panel are: Doctors J. A. V. Bates, J. W. D. Bull, E. A. Carmichael, W. A. Cobb, C. V. Jackson, J. McFie, W. Mair and E. S. Slater.

The cinematographic films shown to illustrate movements obtained by cortical and capsular stimulation were taken by Dr. J. A. V. Bates and they represent part of his original research work on this subject.

#### REFERENCES

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## The Management of Tuberculous Bacilluria

By J. COSBIE ROSS, F.R.C.S., Ch.M.

TUBERCULOUS bacilluria may be defined as the finding of the organisms in the urine in the absence of either radiographic or cystoscopic evidence of tuberculosis. This may be somewhat arbitrary, but it is necessary to start from some fixed point. I have deliberately excluded post-operative bacilluria as this presents quite a different problem.

Patients with tuberculous bacilluria fall into three categories:

- (1) Accidental findings during routine microscopic examination of the urine.
- (2) Successful search for organisms in the urine of patients being treated in a sanatorium for phthisis or bone-joint tuberculosis.
- (3) Successful search in the urine of young individuals with minor urinary symptoms.

The third is undoubtedly the most important group.

It is, of course, impossible to consider tuberculous bacilluria except in relation to the main problem of renal tuberculosis. Similarly, renal tuberculosis cannot be considered by itself, but only in relation to tuberculosis regarded as a constitutional disease.

The following observations are the result of investigations carried out by a small group of us at Wrightington Sanatorium, where I have charge of a genito-urinary unit of thirty beds. The classification we use (with minor modifications) is that suggested by Jacobs:

- (1) Early minimal lesion of renal parenchyma.
- (2) Unilateral renal lesion with cystitis and nephrectomy or partial nephrectomy.
- (3) Bilateral renal lesion with cystitis and nephrectomy, or partial nephrectomy, of the worse kidney.
- (4) Cystitis and involvement of the remaining kidney after nephrectomy.
- (5) Major bilateral disease.

For many years it has been recognized that tubercle bacilli may be found in the urines of patients showing neither the symptoms nor other indications of renal tuberculosis. In these patients, however, there is always an active focus of tuberculosis outside the urinary tract. This observation led Wildboltz and others to postulate the passage of tubercle bacilli through a normal kidney. This view is incorrect and the work of Medlar (1932), Band (1948) and others has shown beyond question that the presence of tubercle bacilli in the urine indicates a focal lesion in one or both kidneys, with the proviso that occasionally the tuberculous focus may be in the prostate or seminal vesicles.

In Medlar's classical work, carried out in 1926, 100,000 serial sections were cut from the kidneys