

## SUBTOTAL HEMISPHERECTOMY

### Report of ten Cases\*

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Dandy (1928) was probably the first to demonstrate the possibility of subtotal hemispherectomy. In 1950 Krynaw published his encouraging results in 12 cases of infantile hemiplegia with epilepsy and behaviour disorders. Since then a number of cases, estimated at more than 300, have been submitted to this operation in different parts of the world, and on the whole Krynaw's original optimistic views have been upheld. Nevertheless the value of subtotal hemispherectomy has not been sufficiently recognised. To-day I will discuss 10 cases on whom, after careful selection I have performed this operation. Fig. I.

#### Pre-operative clinical picture, and selection of patients.

Age was no barrier to selection. The youngest was 5 years and the oldest 25 years. On the other hand hemiplegia must have occurred in early life. (5 months - 10 years).

Presence of 3 conditions in all cases were insisted upon, others have been satisfied with only two of them.

- 1- Hemiplegia.
- 2- Epileptic fits.
- 3- Behaviour and mental disorders.

Hemiplegia in all our cases was marked, usually with deformity of the upper limb. Figs. 2 - 3 -.

The whole limb is smaller than the normal, with the hand held in position of flexion. The side affected was of no importance, as in case 5 there was a right hemiplegia. Obviously the undamaged hemisphere becomes dominant.

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Epileptic fits varied in number from one a month to many in a day, and some of the patients had had status epilepticus. Behaviour disorders varied from case to case, but all of them were incapable of being educated. Only two of these patients (cases 3 & 5) had been able to reach the 2nd. class and no further.

	Sex	Age	Age of onset	Probable Cause	Result of operation	Follow up	Post. op Fits
1	F	18	8 years	Infection	Excellent	2 yrs. 2 mths	Nil
2	M	16	7 years	?	Excellent	2 years	Nil
3	M	9	2 years	Infection	Good	2 years	Nil
4	M	5	7 months	Meningitis	Died	—	—
5	M	15	5 months	Infection	Excellent	1 yrs. 2mths	Nil
6	M	15	9 years	Infection	Good	1 years	Nil
7	F	13	3 years	Infection	Excellent	8 months	Nil
8	F	20	10 years	?	Died	—	—
9	M	25	2 years	Typhoid	Excellent	2 months	2
10	F	9	4 years	Trauma	So far	2 years	Nil

Fig 1

Most of the patients were unmanageable at home, and parents consciously or subconsciously wished them an early demise at the hand of the neurosurgeon. Destructive tendencies, inability to co-operate at home, and rudeness to relatives and strangers were the most frequent complaints of their parents.

The actual cause of brain damage was difficult to ascertain. In 7 cases there was history of fever immediately preceding the onset of hemiplegia. In one case it was typhoid, and another meningitis, but in others the type of infection was not known. In case 4 the operative

findings suggested an absorbed subdural hematoma, which was probably a complication of meningitis. In case one, the middle cerebral artery was exceedingly small, and in case 8 it was calcified.

For selection of cases it was important to demonstrate that the brain on the other side was fairly normal. For this reason all our cases

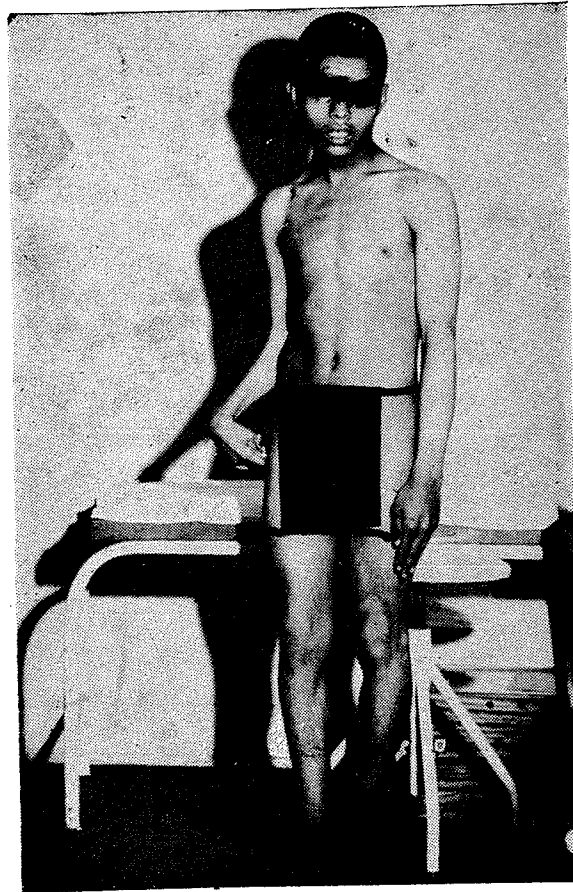


Fig 2

had straight x - rays of skull, pneumoencephalography and electroencephalography. Most of them also had angiography. Straight x - rays of skull often showed that the affected side was smaller than normal, and convolutional markings less.

Pneumoencephalograms show larger ventricle on the affected

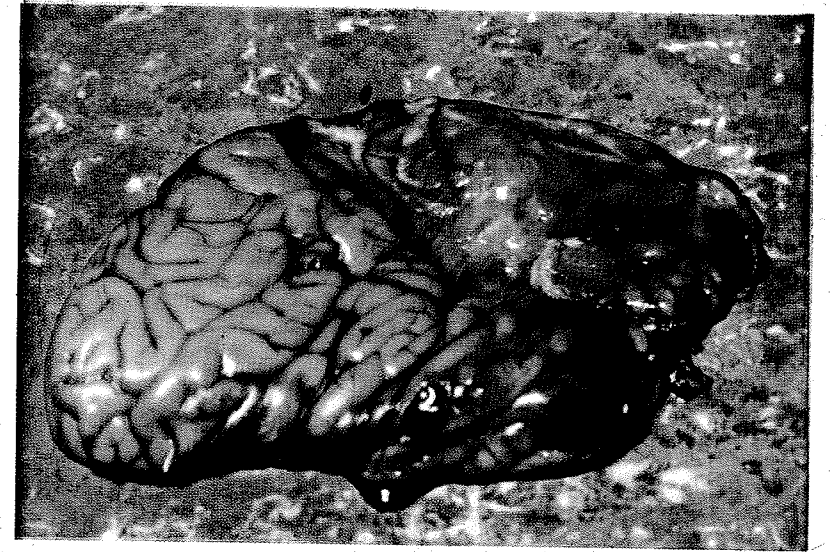


Plate 1) Hemispherectomy specimen; large areas of atrophy and arachnoidal thickening with pools in the frontal lobe can be seen

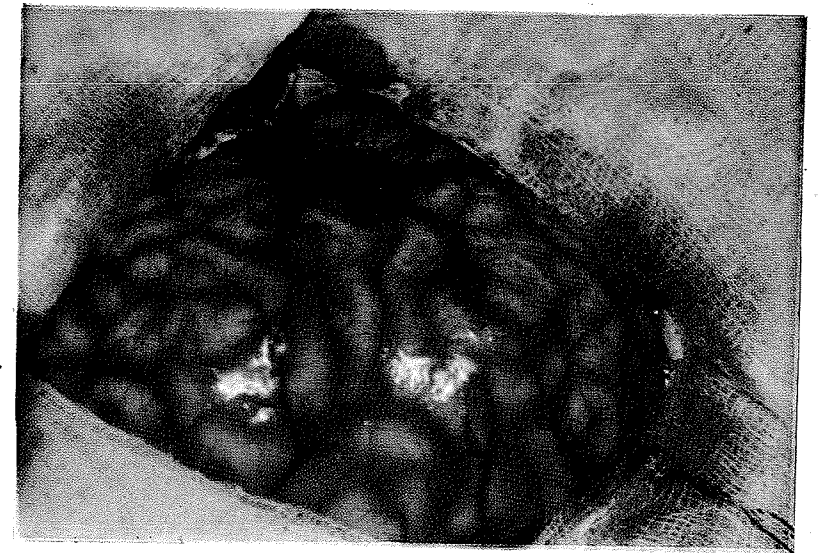


Plate 2) Thickening of arachnoid and brain atrophy

side with slight displacement of ventricle to the same side. Fig. 4.-5. Large subarachnoid pools of porencephalies may be seen. Fig. 6

If both ventricles are large then the case was not considered suitable for operation.

E.E.G. shows predominance of abnormality on the affected side. Fig 7.

Another indication for hemispherectomy is Sturge-Weber Syndrome. We have not yet had opportunity to operate one of these cases.



Fig 3.

#### **OPERATION.**

Intratracheal general anaesthesia was used in all ten cases, and except for the first three hypothermia was used. A large osteoplastic flap is turned down.

In most of the cases dura is unusually thick, in one case it mea-

sured about 3 mms. with subdural ossification. Surface of the brain is covered with thick whitish arachnoid. See plate.

This is mostly seen over the central portion of the hemisphere. Large subarachnoid pools may be seen. Marked cortical atrophy is usually present, but all parts of hemisphere are not uniformly affected. Again it is the central part, fed by middle cerebral artery which is damaged most, but in one case the part supplied by the Anterior Cerebral artery was grossly damaged.

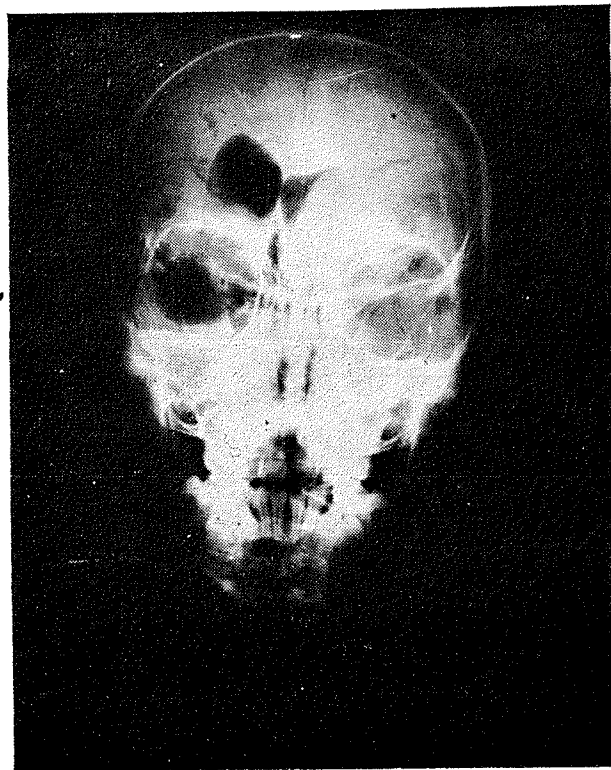


Fig 4.

Brain gyri feel hard to touch as though calcified. One area of the brain that we have observed to be affected in most cases is inferior surface of the temporal lobe. This is thinned out to 2 - 3 mms. See plate.

Could this be a factor in determining behaviour disorders.

To remove the brain we usually start by dealing with the middle cerebral artery. This is easily found by opening the thick arachnoid

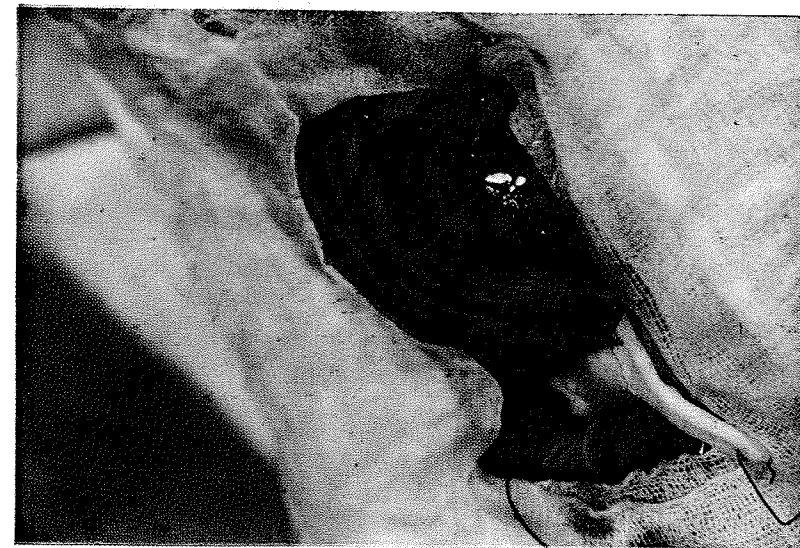


Plate 3) Arachnoid pools over the parietal lobe



Plate 4) Application of clips to the origin of middle cerebral artery

adhesions in the fissure of Sylvius, and after finding branches of the middle cerebral, following them to near the carotid where a silver clip is applied to the middle cerebral artery near its origin. In one case referred above the artery was calcified and we had to crush it first by a pair of artery forceps before applying the clip. Anterior cerebral artery is usually left until we have to remove the frontal lobe. We usually re-

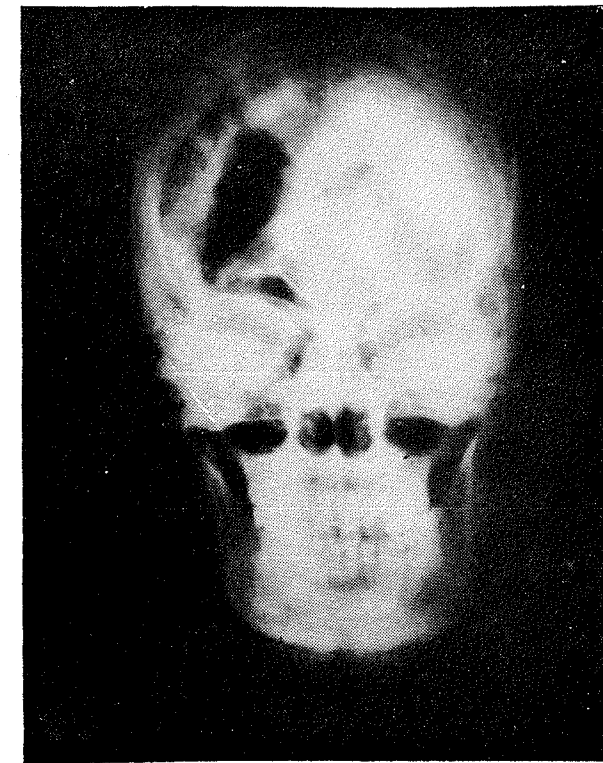


Fig 5.

move the lobes in the following order, Parietal, temporal, frontal and occipital. (In one case we removed the hemisphere in one piece. It makes a nice specimen but I have no recommendation for this method. See plate.)

We make a vertical incision along the Fissure of Rolando, down into the Ventricle. We think that opening the ventricle not only gives more room, but also it is easier to safeguard basal nuclei. We take



care to plug Foramen of Monroe with a patty so that blood does not go into the 3rd. ventricle. I think this is the most important part of the operation, as it makes a great deal of difference to convalescence.

Veins draining to sinuses are better coagulated near the cortex, if brain is pushed down too much they tear at their entrance to the sinus and then bleeding has to be controlled with gelfoam etc.

The area removed is the whole of hemisphere except for basal ganglia. We remove the cortex of insula, and often a part of Caudate nucleus.

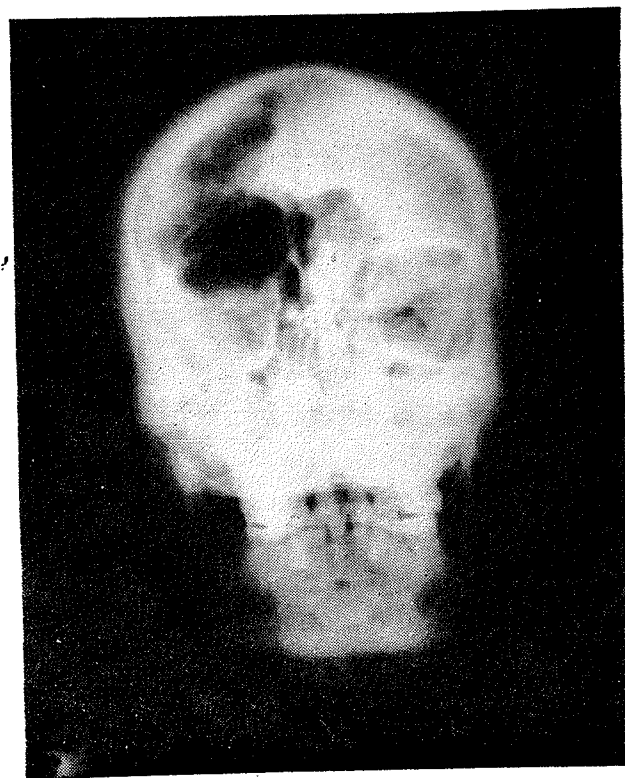


Fig 6.

We leave the choroid plexus undamaged, and we believe that its secretion keeps the balance of pressure on the to sides, and a shift of the brain stem is less likely. We have had no trouble with doing this. Care is taken to leave as little of gelfoam or oxycel as possible, but we like to leave a small piece over the formen of Monroe; this we hope does

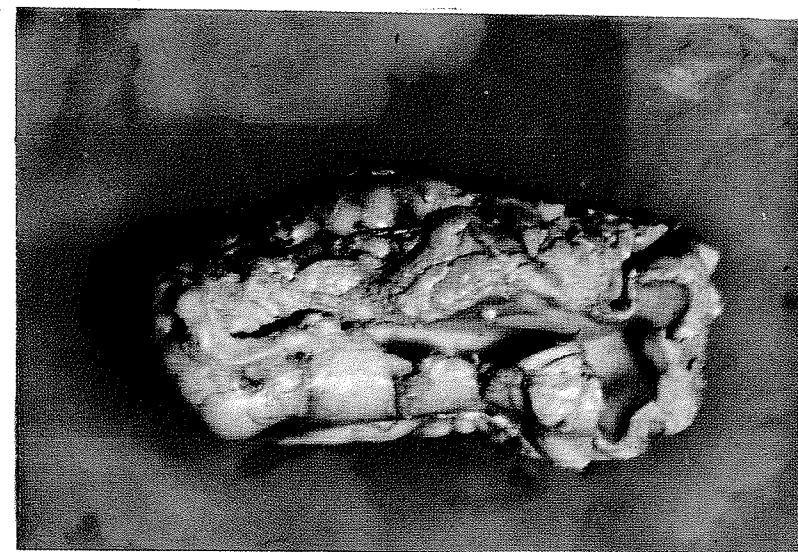


Plate 5) Marked atrophy of the gyri in the inferior surface of temporal lobe

not allow the fluid which may after the operation still contain some blood to reach the 3rd. and 4th. ventricles, and by the time this piece of gel foam is absorbed, fluid is clear.

The cavity is filled as much as possible with saline, and the wound is closed in the usual manner. We have found that if hemostasis is perfect and scalp wound is closed without drainage then post-operative period is smooth and short. In case 10 the frontal lobe looked absolutely normal, and we left part of it. Future will tell us if this was a wise course.

#### Post-operative Complications.

Unfortunately we had two deaths in this series. Both of these I feel were avoidable. One case died from meningococcal meningitis, at the time we had a small epidemic in Teheran, and two other cases

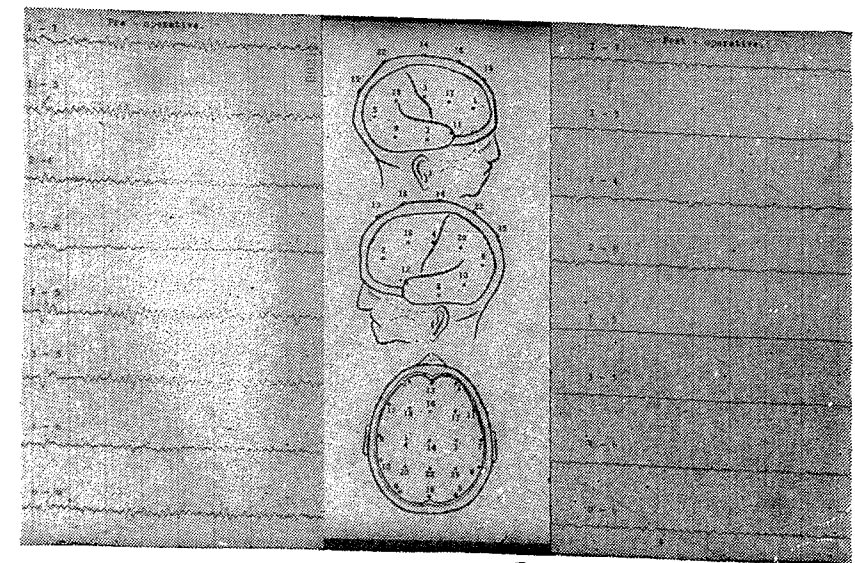


Fig. 7.

in the ward. (The other two fortunately recovered.) The other patient died from a staphylococcal meningitis, two months after the operation. For a time we thought we could save the child, but empyema was formed in the cavity and even removal of the bone flap did not help.

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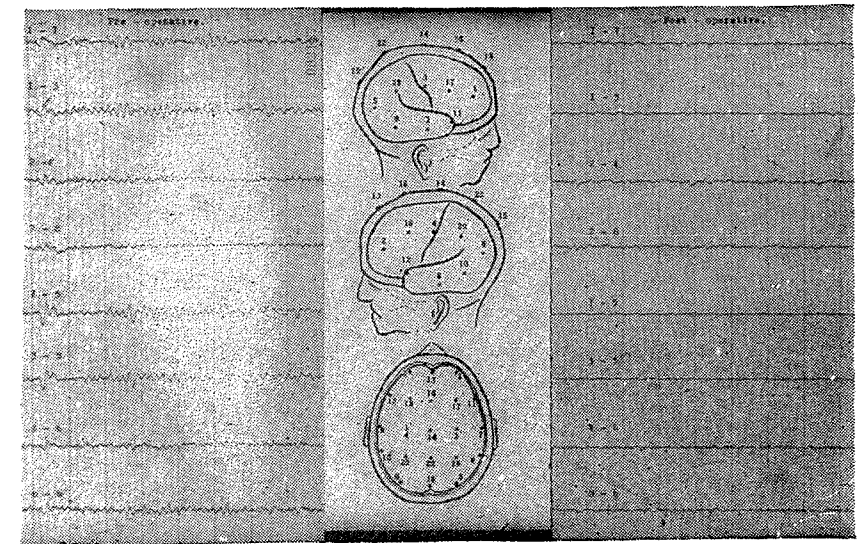


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siness, neck rigidity and Kernig signs. We could find no organism. Case 6 was one of them, and he was steadily going downhill, when we began forced feeding through a nasal stomach tube. He rapidly improved. These cases become so lethargic that feeding may be a great problem. In two cases we had C.S.F. fistula for 2-3 weeks, both these had a scalp drain removed after 24 hours.

#### Results of Operation.

Our cases have not had a long follow-up, and this is also true of other published series. Our longest follow up has been 27 months. Nevertheless we can give an indication of our results so far. All our cases were mentally very much improved. Case one is now a useful member of the family, and looks after the other children. Preoperatively she could not be managed at home or even in the ward, as she was a great nuisance to other patients.

Case two has resumed his studies that had not gone beyond 2nd. class. Case five after one year is now in the 4th. class. At a recent medical meeting when he was shown he complained that he was poor in arithmetic, but otherwise alright at the school. These are some examples, but the number of mentally retarded children from these patients areas of the country, who are brought to us for operation, and praising the results in the operated cases, are the best guides and the best encouragement.

Hemiplegia is not made worse by operation, and walking is usually improved because of reduction of spasticity. In our series only one case so far has had 2 post-operative fits, Case 9. Case 5 who had frequent Jacksonian fits pre-operatively besides his generalised seizures and status epilepticus, now makes this peculiar statement that occasionally has a feeling in his affected hand but there is never any movement. Most of the cases in other series who had post-operative fits, occurred in the first month after the operation.

#### Summary and Conclusion.

10 cases submitted to subtotal hemispherectomy are discussed. In selected group of infantile hemiplegia where epilepsy and behaviour disturbances are present, and investigations prove that the other hemisphere is fairly normal, this operation is of great benefit. Nevertheless long follow-up of these cases is necessary before a final judgement can be passed. Age should be no barrier to selection, as those of 18 - 25 have benefited as much as young children.

#### Résumé et Conclusion.

Dix cas d'hémisphérectomie subtotale sont discutés. Dans un groupe sélectionné d'hémiplégie infantile avec épilepsie et troubles psychiques où les investigations prouvent que l'autre hémisphère est normal, cette opération est de grande utilité. Cependant avant de pouvoir porter un jugement définitif il est nécessaire de pouvoir suivre ces cas pendant une longue durée. Puisque des malades de 18 à 25 ans, ont bénéficié de cette opération que les jeunes enfants, l'âge ne doit pas être considéré comme un critère de sélection.

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