It is probable that when the animal swallowed, an associated movement of the vocal cord occurred, for at that moment an impulse would be travelling down the descendens noni, but no means of making this observation satisfactorily could be devised.

Dr. Frazier of Philadelphia,¹ at the request of Dr. Chevalier Jackson, performed an anastomosis between the recurrent laryngeal and the descendens noni in two patients with vocal cord paralysis. The results of these operations were the same as those on the monkeys. Tension returned to the paralysed cord, but no spontaneous movement. Descendens noni-recurrent laryngeal anastomosis is therefore useless for the relief of paralysis of the vocal cord.

III.—ANASTOMOSIS WITH THE PHRENIC.

It appeared that if the vocal cord could be linked up with the muscles of respiration, then a rhythmical impulse rightly timed would pass through the anastomosis and might restore the normal movements of quiet respiration to the cord. In this case, in contrast to the dissociated movement required for the cure of facial palsy, an associated movement with the respiratory muscles would be desirable.

In the third series of experiments, therefore, the recurrent laryngeal was anastomosed to the phrenic to obtain associated movement between the vocal cord and the corresponding half of the diaphragm. In this series six experiments were performed on three baboons, a hussar monkey, and a rhesus. In one baboon, which died at the end of the fourth month, the recurrent laryngeal was implanted into the side of the phrenic, which apparently had only one root coming from the fourth cervical nerve. In another, which died at the end of a month, the recurrent laryngeal was anastomosed end-to-end with the root of the phrenic arising from the fourth cervical nerve. In neither case had any movement been restored to the cord when the animal had to be killed.

There remained, therefore, four effective experiments.

The first experiment was performed on a baboon. The right recurrent laryngeal was anastomosed end-to-end with the phrenic, and, with the object of restoring the movements to the diaphragm, the distal end of the phrenic was united to the central end of the descendens noni, and the distal end of the descendens noni implanted into the side of the hypoglossal. Stimulation of the recurrent laryngeal during the experiment caused abduction of the paralysed cord, and of the phrenic caused contraction of the diaphragm. At the end of two and a half months no movement was observed in the right vocal cord. At the end of four months the vocal cords were observed to move equally during quiet respiration. The adductor spasm caused by partial asphyxiation was followed by abduction of both cords, but the abduction was a little greater on the left (normal) side than the right.

At the end of six months the cords moved symmetrically, but the excursions of the right cord were now wider than those of the left (normal) cord. At this time the left recurrent laryngeal was anastomosed end-to-end with the left phrenic, thus paralysing the left vocal cord, whilst the right continued to act through the right phrenic. At the present time slight abduction can be observed in the left cord, but, probably owing to some injury to the neck during the administration of an anaesthetic, the right cord has again become paralysed.

These two experiments, however, show that anastomosis with the phrenic is capable of reproducing the normal movements of the vocal cords in tranquil respiration.

In a hussar monkey the phrenic was exposed and separated into two bundles, one of which was divided and anastomosed end-to-end with the distal end of the recurrent laryngeal. This animal shows only the slightest movement of abduction after ten months, and even this disappears altogether under a deep anaesthetic. On partial asphyxiation, however, adductor spasm of both cords occurs.

In a rhesus monkey the distal end of the right recurrent laryngeal was implanted into the side of the phrenic. At the end of two months the right cord was still paralysed, but it appeared to have become more tense than immediately after the operation. At the end of three months there was still no spontaneous movement, but on partial asphyxiation the adductor spasm was followed by abduction of both cords which soon ceased in the right. At the end of seven months both cords were observed to be moving during tranquil respiration, but the excursions of the right cord were not so wide as those of the left.

It may be noted that the movement of adduction, induced by partial asphyxiation, reappears before that of abduction, which corresponds to the weaker extensor movement in the limbs. This is in keeping with the disappearance of abduction earlier than adduction in paralysis of the vocal cords, supervening slowly under pathological conditions.

It is shown from these experiments that spontaneous respiratory movements can be restored to the vocal cord by an anastomosis between the recurrent laryngeal and the phrenic. The entire trunk of the phrenic is not necessary, and probably it will be found sufficient to use half the trunk, as in a lateral anastomosis, or one of the roots arising from the cervical nerves.

No case has so far presented itself in which an operation for the relief of a paralysed cord appeared justifiable in the human being, but if such should be undertaken it is suggested that the appropriate operation would be an end-to-side anastomosis between the recurrent laryngeal and the phrenic.

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SPINAL ANAESTHESIA BY STOVAINE.

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In the Church Missionary Society's Hospital in Old Cairo, Egypt, spinal anaesthesia is now used as routine in all suitable operations by all the five surgeons on the staff. A beginning was made about eight years ago, when this method was used in a certain number of picked cases. It took some time for it to become popular with more than one or two of the surgeons, and the Egyptian fellaheen patients were inclined at first to resent this new method, expecting to be given something to inhale, as all their relations and friends had told them was regularly done. Little by little its scope was increased, till by the end of 1924 it was used in every suitable case unless there was some contraindication.

Exact numbers of cases are not available, but they amounted to more than 5,000 down to February, 1925, and at the present time we are doing about 2,400 a year.

Solution Used.

Stovaine is the drug used. Tropacocaine was tried, but did not give quite such good results in our hands. I do not know the reason for this, as Professor Morrison of Birmingham, one of the pioneers in spinal anaesthesia, found it so satisfactory.¹ For some time the ampoules of stovaine billon were used, but later were discarded, chiefly on the ground of expense, and lately we have ampoules put up for us by Messrs. Parke, Davis and Co., as follows: stovaine 0.1 gram, sodium chloride 0.1 gram, sterile distilled water to 1 c.cm. They are sent out to us a thousand at a time, and have proved consistently satisfactory. Their simplicity seems to add to their efficiency.

Type of Case.

The following comparative summary of the last 2,000 cases covers a period of about ten months, and shows how varied are the operations included.

Abdominal sections (including splenectomy, gastro-enterostomy, intestinal anastomosis, appendicectomy, hysterectomy, ovariectomy, etc.)	58
Vaginal and uterine operations (colporrhaphy, perineorrhaphy, curetting, etc.)	121
For inguinal hernia	330
For hydrocele, varicocele, etc.	210
Lithotripsy	51
Suprapubic cystotomy (large stone, prostate, etc.)	43
Nephrectomy	3
For urinary fistula	57
For haemorrhoids	518
For rectal bilharzial papillomata	461
For fistula in ano, ischio-rectal abscess	112
Amputations	8
For injuries and various conditions	30
	2,000

It is only lately that the larger operations in the upper abdomen have been attempted by this method of anaes-

thetia, and they have been attended with great success. In eight cases of splenectomy (very large spleens in Egyptian splenomegaly) it has proved a real boon.

Previous to the use of spinal anaesthesia chloroform was mostly used, as we very seldom use ether for general anaesthesia in this climate. But now we are using very little chloroform, except in small children. Everything up to the costal margin is done with spinal anaesthesia, and many head and neck operations are done under ether by the rectum.

Method of Administration.

The anaesthetic is given in the theatre on the operating table by the surgeon himself. The patient is made to sit up and bend forwards; tincture of iodine is applied over the spines and the right space selected. This varies with the operation. The second lumbar is the most usual, but we go as high as the eleventh dorsal when necessary. The needle is inserted in the middle line, and the experience gained makes it a very easy matter to know exactly the required depth it is necessary to penetrate. If the fluid does not flow briskly the needle is turned round or pushed further or slightly withdrawn to obtain this result, and the syringe is applied. We prefer to allow as little fluid as possible to escape. This has been our practice for about the last thousand cases, with better results. A 2 c.cm. syringe is used and the spinal fluid is allowed to mix with the 1 c.cm. of the fluid in this, and the whole is injected. The whole ampoule is given for an average operation in an adult, and proportional doses for children or weak patients, or very brief operations. On withdrawing the needle a small piece of adhesive plaster is applied to the site of the puncture, and the patient lies down flat. The field of operation is then prepared in the usual manner, and by the time this is done and the surgeon is ready the operation can be commenced. In an operation on the kidney a few minutes lying flat is allowed before the patient is put on his side. The high Trendelenburg position can be safely used by the time the surgeon is ready to begin. The analgesic effect lasts generally forty-five to sixty minutes, which is sufficient for nearly all operations. Operation for double inguinal hernia and double hydrocele in one subject is often done by a quick surgeon under the usual dose. Morphine and atropine are given previously as routine in all big cases—for example, abdominal sections, etc.

A few patients who are nervous and frightened imagine they feel pain without really doing so, but a few drops of chloroform on a mask make them happy and comfortable. They remain conscious but are contented. I have known a patient who was complaining of pain become quite happy for the whole time with not more than six drops of chloroform. A patient is sometimes surprised to find he can move his legs and yet feel no sensation. Occasionally during the course of an operation the patient feels slight malaise and has a little retching, but a spoonful of brandy, with a little water, by the mouth nearly always settles this rapidly.

There is a wonderful absence of danger with this type of anaesthesia. There has been no fatality which could really be attributed to the stovaine in the whole series of more than 5,000 cases. There was one case, early in the series, where the patient died on the table. The patient was an old man who had a strangulated hernia. He was kept for four days in his village and then brought up a long journey to the hospital, finishing up by travelling by tram and walking in, so that he was in a very poor state. As soon as the stovaine was injected he collapsed and died. We feel that it was the man's condition that killed him, and that it is not fair to attribute it to the anaesthetic.

Advantages.

The advantages are very marked from the point of view of both surgeon and patient.

1. *Saving of Time between Operations.*—This means a great deal in a busy surgical hospital. It would be impossible to get through some of our days with general anaesthesia. We often have twenty to thirty operations in a morning in two or three theatres. It is a great thing for the surgeon not to have that weary waiting between

operations till the patient is sufficiently under, which can scarcely be avoided with general anaesthesia unless there are two anaesthetists. He can literally go straight on from case to case. As soon as one is wheeled out the next comes in and can sit up and have the injection at once.

2. *Saving of Time during Operations.*—One needs to experience this to know it. The relaxation is always equal to, or better than, that which is only sometimes obtained by the very best general anaesthetics. This means much greater ease and rapidity for the surgeon. It is a great time-saver in operations deep in the pelvis, such as Wertheim's hysterectomy. Also in bladder cases, prostatectomy, lithotripsy, and so on, it is a great help to have complete absence of straining.

3. *Saving of Work after Operation.*—The work on the nursing staff in the surgical wards is wonderfully lessened on operating days. The patients come back from the theatre conscious and fit; they have no vomiting or restlessness, and seldom need a nurse to sit by them.

4. *Saving of Staff during and after Operation.*—Not only can the surgeon dispense with an anaesthetist, but in many cases he needs less assistance at the operation owing to the good relaxation. This in addition to the saving of nursing staff in the wards after, as mentioned above.

5. *Avoidance of Troublesome or Serious Symptoms.*—From the patient's point of view there is much in favour of spinal anaesthesia, including avoidance of vomiting and distressing malaise after operation, and absence of shock. In this latter respect undoubtedly many lives are saved every year in patients who would not stand a general anaesthetic, especially in cases such as late strangulated hernia, septic appendicitis, serious injuries necessitating amputation, etc. This is noticeable in such a country as Egypt, where the people are often so late in seeking advice. There is also less risk of chest complications following operation.

Disadvantages.

There is the real disadvantage that a great number of people think they would prefer to be asleep. This is largely a matter of its being the more usual thing. Our patients here now almost all wish for spinal anaesthesia because it is the usual method. We have had many cases, some among our own workers, who have had two operations at different times, one with general anaesthesia and one with spinal, and without exception they all vote for spinal. This is a real test. A certain small number complain of headache for some days after. Our later experience is that this symptom is noticed less and less. It has certainly been less frequent since we have only allowed as little spinal fluid as possible to escape. It is troublesome, but not serious, and at present it is almost negligible in our wards. Considering the small proportion of such cases it is a very slight disadvantage and compares favourably with the symptom of post-anaesthetic vomiting after general anaesthesia.

There is the fact that very occasionally the stovaine fails to act, but these cases are very rare, and chloroform can then always be administered.

Some people have a fear of paralysis or paresis following spinal anaesthesia. I have never seen such a case, and think there is no foundation for such fear. It would be interesting to hear of authentic cases.

It is worthy of a more extended trial by others than the few enthusiasts in favour of it; certainly for foreign hospitals, where the proportion of surgical work to number of staff is so far greater than at home, it is of inestimable value. It is very considerably used in other hospitals in Egypt, as is shown by the report of Mr. Morrison of Alexandria.²

I must acknowledge my gratitude to my colleagues Mr. F. O. Lashbey, Mr. J. E. Bateman, Dr. Towfeek Negibe, and Dr. Andrew Shakhshiri, for allowing me to include their results in this report.

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