ANAESTHESIA FOR THERMOCOAGULATION OF THE GLOBUS PALLIDUS

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Thermocoagulation of the globus pallidus is an operation performed for the relief of rigidity and tremor in Parkinson's disease. The technique employed is based on the use of Leksell's stereotaxic apparatus. For the purpose of discussing the anaesthetic requirements the operation may be considered in four stages.

Stage I. Stereotaxic radiological localization of the globus pallidus.

The position of the globus pallidus is calculated from radiographs taken after lumbar air encephalography. For this procedure the patient is placed in the sitting position. A graduated metal frame is secured to the head by three drills penetrating the outer plate of the skull. Air is injected into the ventricular system by lumbar puncture and a lateral radiograph is taken. If this shows satisfactory filling of the ventricles with air, the patient is then placed supine with hanging head, in order to get the air into the region of the posterior commissure. Further lateral and antero-posterior views are taken and from these pictures the surgeon calculates the position of the globus pallidus in relation to the graduations on the metal frame.

Stage II. Craniectomy.

A burrhole over the coronal suture 4 to 5 cm from the midline is enlarged with bone nibblers. This gives access to the globus pallidus in the next stage.

Stage III. Making the lesion.

The globus pallidus is coagulated by heat generated by diathermy. The electrodes are inserted into the brain so that their tips lie in the calculated position. The coagulation is controlled by observing the rise in temperature by means of a thermocouple placed between the diathermy electrodes. The effect of the lesion on the patient is observed while it is being made.

Stage IV. Closure of the wound.

Choice of local or general anaesthesia

It is considered that the third stage of the operation is best carried out on the conscious patient so that the effect of the lesion may be assessed while it is being made. Local analgesia is therefore essential for this stage.

For the first stage of the operation, the absence of tremor and rigidity is considered desirable to ensure satisfactory radiographs. Furthermore this is a lengthy and uncomfortable procedure which, it is felt, few patients would tolerate well under local analgesia. For these reasons general anaesthesia is preferred. In order to eliminate the unpleasant sensation of bone nibbling, general anaesthesia is prolonged to include the second stage. As the patient will be conscious in the later stages the scalp must be infiltrated with local analgesic solution at the sites of fixation of the frame in stage I and in the line of the incision in stage II.

Problems involved

Having decided that general anaesthesia is preferable for the early stages, it is necessary to consider the special problems arising by virtue of the nature of the operation. Firstly, the proximity of X-ray and diathermy apparatus precludes the use of explosive anaesthetic mixtures. Secondly, the use of the sitting position compels the anaesthetist to select drugs with due regard to their possible effect on the patient's blood pressure. Thirdly, the success of the operation depends on rapid return of consciousness and full co-operation. It is important that the patient should be fully co-operative and also free from retching, vomiting and coughing so that the effect of the lesion on voluntary movement, rigidity, tremor and speech may be observed. This is particularly
stressed, for whereas modern anaesthetic tech-
niques render rapid recovery of consciousness
commonplace, seldom is the patient's full co-
operation sought during the immediate post-
anaesthetic period. Finally, drugs such as benz-
hexol (Artane), which are used in the treatment
of Parkinson's disease may possibly modify the
effects of anaesthetic drugs (Dundee, 1958).

ANAESTHETIC REQUIREMENTS

Endotracheal intubation is considered essential
as access to the head is impossible once the
operation has started. Previous experience in
anaesthesia for diagnostic lumbar air encephalo-
graphy has shown that introduction of air into
the ventricular system is a strong stimulus to the
patient, causing a reflex rise of blood pressure,
hyperventilation and even vomiting if anaesthesia
is inadequate. Fairly deep anaesthesia is required
to suppress these reflexes. As local analgesia is
used at the sites of fixation of the frame and in
the area of the craniectomy incision, the greatest
stimuli to the patient occur on introduction of
air, and on movement of the endotracheal tube in
the trachea when moving the patient and during
craniectomy. It is these stimuli that demand the
greatest depth of anaesthesia. The former occurs
early in the operation and presents no problem.
The latter persists until shortly before return of
consciousness is required and by this time, some
two hours after induction of anaesthesia, local
analgesia of the trachea and larynx may have worn
off.

A possible solution to this problem would be
the use of a short-acting relaxant at the times of
greatest stimulation. As muscular relaxation is not
necessary this technique is considered unjustify-
able A further deciding factor is the difficulty in
predicting the effect of repeated doses of
relaxants on patients who have been taking
benzhexol or similar drugs (Dundee, 1958).

ANAESTHETIC TECHNIQUE

As this is a comparatively new operation which
appears to be gaining in popularity, it is felt that
it is worth while recording in detail the anaes-
thetic technique which has been evolved as a
result of experience in anaesthetizing 54 patients.

It is explained to the patient that he will be
awake for the last part of the operation. Pre-
medication consists of atropine 0.85 mg (1/75
grain) given by intramuscular injection half an
hour before induction of anaesthesia (Brennan,
Hunter and Johnstone, 1957). Anaesthesia is
induced with a sleep dose of thiopentone sodium
followed immediately by suxamethonium 100 mg
intravenously. As soon as muscle twitching has
casted, the lungs are inflated with oxygen and
the trachea and larynx are sprayed with 4 per
cent lignocaine. A wide-bore flexometalllic latex
rubber endotracheal tube is then passed orally
under direct vision. Anaesthesia is maintained
with nitrous oxide (6 l./min) and oxygen
(2 l./min) using a semiclosed system with a
widely open expiratory valve. Pethidine 10 to 20
mg is given intravenously as soon as spontaneous
respiration is established. When time has been
allowed for this to take effect, halothane is added
to the gas mixture, being vaporized from the
trichloroethylene bottle on the standard Boyle's
machine. When the patient is settled in the sitting
position, halothane is withdrawn and reintroduced
only when required to supplement the nitrous
oxide at the times of greatest stimulation.

The scalp is infiltrated with 1 per cent ligno-
caine at the sites of fixation of the frame and the
craniectomy incision. As halothane may sensitize
the heart to adrenaline, this drug is not added
to the lignocaine solution (Raventós, 1956;
Millar, Gilbert and Brindle, 1958).

On completion of stage II anaesthetic gases are
withdrawn. In view of the possible difficulty in
maintaining a clear airway with limited access
to the head, the endotracheal tube is not removed
until consciousness returns. No difficulties other
than transient retching or coughing followed
extubation.

DISCUSSION

In the early cases in this series an attempt was
made to adapt a technique which was at that time
recognized as satisfactory for other neurosurgi-
cal operations. In these, anaesthesia was main-
tained with nitrous oxide and oxygen supple-
mented with pethidine or trichloroethylene. Al-
though it was possible to achieve a rapid return
of consciousness, there followed a period of
drowsiness and poor co-operation which made
assessment of the effect of the lesion difficult.
This technique was therefore abandoned and subsequent observations in this discussion do not refer to these cases.

The problem was to find a technique which would produce adequate depression of the cough reflex and would allow rapid return of consciousness and full co-operation. A powerful, but rapidly eliminated nonexplosive drug was required. As halothane appeared to meet these requirements, it was decided to give it a trial. Halothane has been used for 45 cases and has proved satisfactory.

Although it was thought at first that the action of halothane in lowering the blood pressure might prove dangerous in the sitting position, it has in fact given little trouble in this respect. The transient fall invariably observed on sitting up elderly anaesthetized patients has rapidly corrected itself in all but two of these 45 cases. In each of these, methylamphetamine 5 mg intravenously restored the pressure, with no subsequent fall in spite of the resumed administration of halothane. This compares favourably with the incidence in patients undergoing diagnostic lumbar air encephalography when halothane has not been used. It is considered that this is due, at least in part, to the omission of morphine or similar drugs from the premedication. A small dose of pethidine has been found desirable to combat the tachypnoea sometimes associated with halothane anaesthesia (Kirchner, 1957). Experience has shown that prevention is more effective than the treatment of an established tachypnoea, which may account for the fact that whereas the average dose of pethidine for the whole series was 31 mg, for the last 20 cases it was only 17 mg.

No sedative or analgesic premedication is given for the following reasons. Such drugs are respiratory depressants and may impair an otherwise smooth transition from suxamethonium apnoea to adequate spontaneous respiration (Stark, 1958). Experience in anaesthesia for other neurosurgical operations has shown that omission of such drugs from the premedication facilitates control of the cough reflex during maintenance of anaesthesia. In addition, these drugs are peripheral vasodilators and interfere with the compensatory mechanisms which maintain blood pressure on change of posture. It is felt that they are better avoided in the premedication when the patient is to be placed in the sitting position. Finally, these patients welcome the operation as a possible means of alleviating a most distressing disability and do not, in the writer’s opinion, require pre-operative sedation.

All the patients received suxamethonium 100 mg to produce relaxation for intubation. A relatively large dose is preferred to give perfect relaxation and to allow ample time for inflation of the lungs with oxygen, local analgesia of the trachea and larynx, intubation and inflation with the nitrous oxide-oxygen mixture before spontaneous respiration returns. These patients were all treated pre-operatively with one or more of the anti-Parkinson drugs, the majority of them receiving benzhexol up to and including the day of operation. No patient has shown an abnormal response to suxamethonium. It is not, therefore, considered that pre-operative treatment with benzhexol is a contra-indication to the use of suxamethonium.

Dundee reports three cases of delayed recovery from anaesthesia in patients with Parkinson’s disease treated with benzhexol (Dundee, 1958). He attributes this to synergism between benzhexol and thiopentone. All the patients in this series received thiopentone for induction of anaesthesia in doses ranging from 100 to 400 mg with an average dose of 280 mg. With one exception all these patients were fully conscious and co-operative within 15 minutes of withdrawal of anaesthesia. The exception was a 51-year-old man who had been treated pre-operatively with benzhexol 30 mg daily. He received thiopentone 200 mg and pethidine 30 mg. Supplementary halothane was necessary throughout the 1½ hours for which general anaesthesia was maintained. Although he regained consciousness 20 minutes after withdrawal of anaesthesia, it was three-quarters of an hour before he was sufficiently co-operative for the surgeon to proceed with the operation.

This delay in recovery might possibly be attributed to synergism between benzhexol and thiopentone but it is felt that a number of other factors should be taken into account. Firstly, the delay in recovery was in co-operation and not in the return of consciousness. Secondly, in the light of more recent experience the dosage of
Pethidine can be considered high. Thirdly, halothane was administered continuously for 1½ hours. It is felt, therefore, that this was a difficult patient who received more than the average amount of drugs for the maintenance of anaesthesia. He might well have shown delay in recovery if thiopentone had not been used. In view of the fact that there was only one case of delayed recovery which is by no means definitely attributable to benzhexol thiopentone synergism, the writer doubts if such synergism occurs and suggests that the cases described by Dundee may possibly be due to a synergism between benzhexol and the morphine given in the premedication similar to that between chlorpromazine and morphine described by Buxton Hopkin (Hopkin and Brown, 1958).

None of these patients vomited in the theatre. Retching and nausea were troublesome in three patients all of whom responded to promethazine 12.5 mg intravenously. Parkinsonian rigidity returned rapidly in all cases before the thermocoagulation. Return of tremor was not constant, but as the surgeon is chiefly interested in rigidity and power, this is not considered a great disadvantage. In recent cases injection of nikethamide 2 ml has been given intravenously in an attempt to restore the tremor. This has met with conspicuous success, which may, however, be coincidental.

SUMMARY
The operation of stereotaxic thermocoagulation of the globus pallidus is described briefly. The anaesthetic requirements are discussed with particular reference to the possible sensitivity of patients with Parkinson's disease to anaesthetic drugs. An anaesthetic technique is outlined which has been evolved over a period of two years during which time the writer anaesthetized 54 patients for this operation.

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