ANAESTHESIA AND OPHTHALMOLOGY

BY

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SUMMARY

The element of control in modern anaesthesia is of special value in ophthalmology, where smooth operating conditions and a trouble-free respiratory period are obligatory. While this feature is of value in controlling bleeding, eye movements, and squeezing, the ability to control intra-ocular tension is of special significance. During operation chlorpromazine, promethazine and pethidine have been found valuable. In non-perforating injury treatment is by the use of posture, hexamethonium and sedation. The techniques are described in detail.

Ophthalmology offers to the anaesthetist the opportunity of using special techniques, and unique conditions under which to study and assess their value. It also presents a challenge to provide not only smooth operating conditions but a post-operative period free from restlessness, vomiting, or respiratory upset. Any of these disturbances may lead to irreparable damage to the eye involved, a catastrophe which must not be allowed to occur. It is therefore difficult to understand the comparative lack of interest in this field.

As a result of advances in anaesthesia, an element of control has been brought to the specialty and this has led to important changes in anaesthesia for ophthalmic surgery. Patients are now offered the advantages of general anaesthesia where, in many centres, it would have been refused only a few years ago.

The question of control can be considered during three stages: the pre-operative, the operative and the postoperative.

THE PRE-OPERATIVE STAGE

Control of apprehension.

This should be considered under two headings in adults, according to whether patients are to have the operation performed under local anaesthesia, with or without akinesia induced by d-tubocurarine, or under general anaesthesia.

In the former group barbiturates were used extensively for many years but were unreliable and were frequently associated with spells of delirium and restlessness which made operation difficult.

Not infrequently disaster resulted. In 1955 reports in the literature favoured the use of the "lytic cocktail", consisting of chlorpromazine (Largactil), promethazine (Phenergan) and pethidine. The properties of this combination of drugs were found to be markedly superior to those of the barbiturates but an unpleasant degree of hypotension was frequently observed. The advantages of this technique were impressive and it was introduced to the ophthalmic surgeons at this hospital. Table I gives details of the drugs employed before operation and it is seen that the technique is similar to that reported by Ingram and Davison (1961) with promazine (Sparine) substituted for chlorpromazine.

<table>
<thead>
<tr>
<th>TABLE I</th>
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<tbody>
<tr>
<td>The premedication for patients undergoing cataract surgery to be given 75 to 95 minutes before operation.</td>
</tr>
<tr>
<td>If patient is under 70 years and normotensive</td>
</tr>
<tr>
<td>Promazine</td>
</tr>
<tr>
<td>Pethidine</td>
</tr>
<tr>
<td>If patient is under 70 years and hypertensive or over 70 years and normotensive</td>
</tr>
<tr>
<td>Promazine</td>
</tr>
<tr>
<td>Pethidine</td>
</tr>
<tr>
<td>If patient is over 70 years and hypertensive</td>
</tr>
<tr>
<td>Promazine</td>
</tr>
<tr>
<td>Pethidine</td>
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Using these drugs the patients are well sedated but co-operative and in each case the eye is white and soft. There is minimal bleeding. While the eye is not too soft for operative manipulation, the danger of vitreous loss is greatly reduced. In a
few instances there has been a fall in blood pressure causing discomfort to the patient and alarm to the anaesthetist. It was therefore with great interest that the early reports of the new analgesic phenazocine (Narphen) were read. It is claimed that its potency is ten times that of morphine and that it has less tendency to cause respiratory depression and fall in blood pressure. It is also claimed that other side-effects are minimal. It was decided to replace pethidine with phenazocine in premedication and, during trials, the degree of analgesia and the absence of hypotension have been impressive. Very rarely do these patients react to the injection of local anaesthetic and their postoperative behaviour has been ideal. No restlessness or vomiting has occurred.

Table II shows the scheme of pre-operative medication for all patients undergoing cataract operation under local anaesthesia. The dose of phenazocine is deliberately conservative and if the patient appears to be inadequately sedated on arrival in the operating theatre phenazocine 0.5 to 1 mg is given intravenously. The ward sisters have assisted in the evaluation of this drug by recording the arterial blood pressures and respiratory rates of the patients at 15-minute intervals preoperatively. No falls in blood pressure have been observed and the respiratory rate has never fallen below 14 b.p.m. Instructions are given to inject nalorphine (Lethidrone) 2.5 mg should the respiratory rate fall to 12 b.p.m.

**TABLE II**

<table>
<thead>
<tr>
<th>Drug</th>
<th>Age and weight</th>
<th>Dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Promazine and promethazine</td>
<td>Under 70 years</td>
<td>50 mg of each</td>
</tr>
<tr>
<td></td>
<td>Over 70 years</td>
<td>40 mg of each</td>
</tr>
<tr>
<td></td>
<td>Over 80 years</td>
<td>30 mg of each</td>
</tr>
<tr>
<td>Phenazocine</td>
<td>Under 70 kg</td>
<td>1.5 mg</td>
</tr>
<tr>
<td></td>
<td>Over 70 kg</td>
<td>2.0 mg</td>
</tr>
</tbody>
</table>

NOTE. Nalorphine 2.5 mg to be given if respiration falls below 12/min.

In August 1962, Bryn Thomas, of Reading, read a paper to the Seventh Congress of the Scandinavian Society of Anaesthetists at Aarhus on the use of phenazocine in ophthalmic surgery. In his technique patients are premedicated with chlorpromazine and promethazine which is given orally 2 hours before operation. Phenazocine is given intravenously when the patient is on the operating table, 5 minutes before the local blockade is performed. Although the techniques differ, Thomas has had similarly satisfactory results and his detailed records of 102 cases of patients ranging in age from 31 to 84 years show that there was no depression of respiratory rate and no change in pulse rate or blood pressure.

For adult patients having general anaesthesia, premedication consists of papaveretum 10 mg, promethazine 25 mg and hyoscine 0.45 mg.

Children form a large proportion of patients and in many cases they pay several visits to the operating theatre. Rectal thiopentone suspension is used for all children under 100 lb. (45 kg) and over this weight papaveretum is used.

**Control of salivation.**

Hyoscine is used for all adults, in doses ranging from 0.3 mg to 0.45 mg. For children up to the age of 12 years 1-hyoscyamine (Bellafoline) is used. Table III gives details of the dosage used. This drug has been in constant use for the past six years and has proved eminently satisfactory. Its onset of action is 15 minutes as compared with 75 minutes required with atropine, and this makes it an ideal drug for use with rectal thiopentone.

**TABLE III**

<table>
<thead>
<tr>
<th>Dose of 1-hyoscyamine (Bellafoline) injected 20 minutes before operation (1 ml=0.5 mg).</th>
</tr>
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<tbody>
<tr>
<td>lb.</td>
</tr>
<tr>
<td>-----------------</td>
</tr>
<tr>
<td>&lt;22</td>
</tr>
<tr>
<td>22-44</td>
</tr>
<tr>
<td>45-66</td>
</tr>
<tr>
<td>&gt;66</td>
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Together they make the timing of premedication more efficient in a long operating list. It is to be hoped that an antisialogogue will be discovered with a shorter duration of action than hyoscine. The dryness of mouth and throat in the postoperative period, lasting several hours, is usually the only unpleasant reminder of a visit to the theatre.

**THE OPERATIVE STAGE**

**Control of squeezing.**

In 1952 Kirby reviewed his experience in nearly 600 cases in which ocular akinesia was produced...
with d-tubocurarine. The selective action of this drug makes it possible, with carefully estimated dosage, to provide relaxation of the palpebral and global muscles whilst preserving the ability of the patient to move the eye on command. In suitable dosage the absence of any respiratory embarrassment, and the relaxed mental state of the patient, associated with slight reduction of intra-ocular tension completes the picture as described by Kirby. This technique is used in the majority of cataract operations performed under local anaesthesia in this hospital.

The patient is premedicated with the combination of drugs already described and, when he is placed on the operating table, oxygen is given according to the method described by Ives (1959). The nozzle of the delivery tube is adjusted so that it is 1 inch above the chin, and directed at the nose. A flow of oxygen of 5 l./min is given with the object of providing a current of air under the sterile drapes. d-Tubocurarine chloride 10 mg is diluted in 10 ml of water and 3 ml is injected slowly into a vein in the back of the hand. After 1 minute a further 3 mg is given and the facial expression and breathing are carefully watched. If the anaesthetist is holding the patient's hand, relaxation of the grip will be observed and is a useful guide. Any alteration in the depth of respiration should be regarded as a warning against further dosage. A dose of 7–9 mg has been found adequate for most patients; 10 mg is given rarely and more is never needed. On the rare occasion when the dose given proves to be excessive, the resultant embarrassed breathing is relieved with a dose of atropine 0.5 mg and neostigmine 0.5 mg. In such cases the small dose of neostigmine does not spoil the akinesia.

It has been found that d-tubocurarine is superior to other relaxants for use in eye surgery. Gallamine triethiodide and suxamethonium chloride have been given a fair trial but there is with d-tubocurarine much less tendency to bleeding. The writer agrees with others who claim that the use of suxamethonium is followed by a rise in intra-ocular tension. From every point of view d-tubocurarine gives the best results and suxamethonium is used only for the young infant when it is given intramuscularly.

Squeezing is important, not only in relation to the operation, but also as a hazard in the post-operative period. In such cases intramuscular d-tubocurarine has been given every 6 hours and in one patient who found it impossible to speak without screwing up her eyes, a satisfactory cataract operation was achieved on an only eye.

Control of eye movements.

In cases of buphthalmos when performing gonioscopy and goniometry it is essential to have a centrally fixed eye. The patients are usually infants who may require frequent anaesthetics at short intervals and they often have coughs. In these cases the technique employing nitrous oxide and oxygen with a relaxant is ideal. Intramuscular suxamethonium 1 mg/lb. (2.4 mg/kg) body weight gives perfect operating conditions and, as the operations may be of very short duration, it is found more suitable than d-tubocurarine. In such cases the infant always cries lustily before leaving the theatre a few minutes after the end of the operation.

Control of bleeding.

This is achieved by a variety of techniques and by a careful selection of drugs, ranging from a slight tilting of the head of the table in routine anaesthesia to the almost bloodless conditions associated with controlled hypotension.

In squint surgery control of haemorrhage adds considerably to the early cosmetic result and, it is believed, to the end result by preventing fibrosis. This is achieved by raising the head of the table before induction of anaesthesia (thus using the vasodilatation associated with thiopentone to good effect), the choice of d-tubocurarine as a relaxant in doses of 2 mg per stone (1 mg/3 kg) body weight, topical adrenaline immediately the child is asleep, and adequate ventilation throughout the operation.

In cases of dacrocystorrhinostomy, exenteration, and cure of ptosis, a bloodless field is not only of value to the surgeon in reducing operating time but increases the success of the operation. In such cases hexamethonium-induced hypotension has proved satisfactory. When the patient's trachea has been intubated, the head of the table is raised and hexamethonium is given. This order of events is important as it gives ischaemic conditions with very small doses of the ganglion-blocking drug, and at a safe level of systolic blood pressure which is never below 80 mm Hg. Using this technique,
hexamethonium has been given to patients as old as 76 and as young as 1 year.

Controlled hypotension of a special value in the treatment of cases of haemorrhage following non-perforating injuries, frequently resulting in blood-staining of the cornea. The seriousness of this condition and the poor visual results so often obtained in spite of modern therapeutic aids such as acetazolamide, Varidase (suspension of streptokinase and streptodornase), trypsin, and air injections have been emphasized in ophthalmic literature. In 1951 Dr. Louis Werner, being impressed by the bloodless conditions provided by hexamethonium, decided to perform a paracentesis on a man with a primary hyphaema, following injury, under general anaesthesia with controlled hypotension. The complete lack of further bleeding and the ability to maintain a low blood pressure by posture and sedation for five days without a further dose of hexamethonium, was very impressive. Although our technique for treating this condition was thus conceived in 1951, its acceptance was slow. It was not until 1958 that it was tried out in further cases. In the ensuing four years more than fifty cases of secondary haemorrhage following injury have been treated and this technique is now standard practice (Kenny, 1959, 1961).

Control of intra-ocular tension.

In a paper read to the Irish Ophthalmological Society in 1958 (Kenny, 1958) the possibility was referred to of controlling intra-ocular tension by using a ganglion-blocking drug, or the group of drugs known as the “lytic cocktail” believed to act on the diencephalon. This fall in tension was so consistent that I suggested that it might be considered by ophthalmologists as a possible line of treatment in certain cases of glaucoma. The opportunity of using the technique arose in six patients within the following few months but at this stage only in patients in whom the conservative methods of treatment had failed.

Case 1.

A boy of 12 was hit on the eye with a cricket ball. He had a secondary hyphaema five days after the accident with an associated rise in ocular tension. A paracentesis was performed under general anaesthesia with hypotension obtained using hexamethonium. He was nursed in the head-up position for five days sedated with oral chlorpromazine and the blood pressure was thus maintained between 80 and 90 mm Hg without further administration of hexamethonium. He had no further bleeding or rise in tension, the blood clot was completely absorbed and he was discharged from hospital with full vision.

Case 2.

A man was hit by a golf club in the region of the left eye and, after treatment in a local hospital for two weeks, was admitted to the Eye Hospital with a tension of some 30 mm Hg in the left eye. He was treated with acetazolamide tablets and eserine drops. Later a trephine operation was performed under local anaesthesia and seven weeks after the accident his tension was still high (about 40 mm Hg). After intravenous injection of chlorpromazine, promethazine and pethidine, the tension fell within 10 minutes to 15 mm Hg and the patient became relaxed and slept. During the next two days he was sedated with chlorpromazine and promethazine tablets but, as the tension gradually rose to 30 mm Hg, it was decided to use hexamethonium with the patient nursed in the head-up position. After a small dose of this drug the blood pressure fell to 90 mm Hg and the tension fell to 20 mm Hg. He was nursed in this position for a further six days, chlorpromazine and promethazine tablets being used for sedation. At the end of this period the drug was stopped and the patient was gradually lowered towards the horizontal position. A week later the tension in the injured eye was 26 mm Hg. Four months after discharge from hospital the tension was 22 mm Hg and vision was 6/18. It would appear that normal vasomotor stability was restored through breaking the vicious circle by ganglionic blockage, when conservative treatment had failed.

Since that time a further thirty cases have been treated and the technique employed may be summarized as follows:

When it is required to lower intra-ocular tension during operation without control of bleeding the “lytic cocktail” is used. This contains chlorpromazine 50 mg, promethazine 50 mg and pethidine 50 mg. These drugs are particularly useful in aged patients in whom a fall in arterial blood pressure is undesirable.

In patients with non-perforating injury with secondary hyphaema the treatment is by the use of posture (the sitting position), hexamethonium, and sedation, until the hyphaema has cleared. If the tension is not thus controlled a paracentesis is carried out under general anaesthesia with arterial hypotension, after which the patient is nursed in the head-up position for a further five to six days. During this time sedation is provided by chlorpromazine tablets.

The technical difficulties associated with intravenous therapy in children under 1 year of age, and the possible hazards associated with the lowering of blood pressure in the geriatric class, prompted a trial of urea.
Case 3.
In July 1960 a baby of 3 months, suffering from buphthalmos and aniridia, was examined under general anaesthesia before attempting goniotomy. The complete haze of the cornea, due to an intra-ocular tension of 50 mm Hg in both eyes, precluded operation and it was decided to use urea as a premedicant before a further attempt. A dose of 1.5 g/kg body weight was given through an intragastric tube and within 1 hour the baby, who had cried continuously during its stay in hospital, fell asleep and was obviously free from pain. Three hours later the baby was anaesthetized and the tension was 18 mm Hg in both eyes but when the contact lens was applied the cornea became hazy. Because of the difficulties associated with aniridia, no surgery was undertaken. Some days later intragastric urea was given 5 hours before operation; on this occasion goniotomy was possible and the child is now making excellent progress. This is the only case in which we have used this technique.

Urea was also given by intravenous infusion to several elderly patients as a pre-operative preparation and in all instances the tension fell to normal levels. There was, however, an increased tendency to bleeding, and three patients complained of pain in the limb which was infused. The increased bleeding, and the time factor involved in giving the infusion 3 to 4 hours before operation, precludes its use, except when given by the intragastric route to the very young, when it has obvious technical advantages.

The Postoperative Period
Satisfactory anaesthesia safeguards the patient against postoperative vomiting and restlessness. In corneal graft and cataract surgery such sequelae are likely to spell disaster.

Restlessness is due either to inadequate analgesia or to the use of barbiturates in premedication. The need for adequate analgesia is stressed, as is again the value of phenazocine, in providing not only the value of phenazocine, in providing not only the

References

Anesthésie et Ophtalmologie
Sommare
Le facteur "contrôle" dans l'anesthésie moderne est d'une valeur particulière en ophtalmologie; dans cette spécialisation très particulière, elle aussi, il est indispensable que l'intervention puisse se dérouler sans accoups et qu'il n'y ait pas d'incidents pendant la période respiratoire. Cette condition préalable est surtout importante pour l'arrêt d'hémorragies, pour les mouvements des bulbes et pour les contractions spasmodiques péri-oculaires. On s'est rendu compte que pendant ces interventions chlorpromazine, prométhazine et pethidine rendent de précieux services. Dans les lésions non-perforantes, le traitement consiste en adoption de différents modes de statisme et en administration d'hexaméthonium et de sédatifs. L'auteur décrit la technique en détail.

Narkose und Augenheilkunde
Zusammenfassung