INNOVAR* AS AN ADJUNCT TO NITROUS OXIDE, OXYGEN, CURARE ANAESTHESIA

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WITH THE INCREASING concern many anaesthetists are feeling toward the rather routine use of halogenated hydrocarbons, we felt it worthwhile to develop a simple technique to avoid these agents in major surgical procedures. The well recognized use of nitrous oxide (N_2O) plus oxygen (O_2), muscle relaxants and hyperventilation provides adequate operating conditions for certain procedures, i.e. chest work, but is somewhat less than adequate for many other operations when, upon reversal of the relaxant, coughing and straining frequently follows which is not to be desired in abdominal or neurosurgical work. This technique can be improved upon by the intermittent injection of thiopentone and meperidine.

The technique we wish to describe utilizes nitrous oxide to produce amnesia, unconsciousness, and hopefully some analgesia, d-tubocurare for muscular relaxation, fentanyl for analgesia, droperidol for its neuroleptic effects, plus hyperventilation for analgesia and as a potentiating agent. The fentanyl and droperidol were administered in the fixed dose relationship as Innovar (1 ml containing fentanyl 0.05 mg and droperidol 2.5 mg).

One hundred and thirty-six adult patients of both sexes undergoing a wide variety of surgical procedures make up this series.

TECHNIQUE

Patients were premedicated with any standard dose of narcotic plus atropine to reduce fentanyl induced bradycardia. Anaesthesia induction was commenced with intravenous Innovar (1.0–2.0 mls), immediately followed by the usual sleep dose of thiopentone, succinylcholine, O_2 inflation, and endotracheal intubation. Patients were then connected to an Air-Shields "Ventimeter Ventilator" and moderately hyperventilated. A full paralyzing dose of nondepolarizing relaxant was administered and the flow rates of N_2O and O_2 adjusted to provide approximately 60–70 per cent N_2O. Subsequent relaxant doses were governed by the usual clinical signs (wound observation and inflation pressures). Innovar was administered in increments of 0.5–1.0 mls every 35–40 minutes. More frequent Innovar administration was carried out if the usual clinical signs of painful stimuli appeared (sweating, tearing, hypertension, pupil dilation).

With closure of the peritoneum atropine was administered in a dosage of 1.0 to 1.2 mg intravenously. As the last few skin sutures were placed the pharynx was

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gently suctioned and neostigmine was given in divided doses (4.0 to 5.0 mg) intravenously. The N_2O and ventilator were discontinued at the same time and the endotracheal tube cuff deflated.

Usually as the dressings are being applied the patient will obey commands to open the mouth and the endotracheal tube can be removed without coughing or straining. If these steps have been carefully and gently carried out the termination of anaesthesia will be most satisfactory. All the patients in this series were responding and had their endotracheal tubes removed before leaving the Operating Room.

Results

Table I shows the preponderance of females in the series. This reflects our routine experience in a busy general hospital with a large volume of gynaecological surgery. Table II illustrates that most patients were quite fit as scored by the American Society of Anesthesiologists Classification. Table III shows the usual age spread for general surgery and the oldest patient in the group was 88 years.

The site and duration of the operative procedures are shown in Tables IV and

TABLE I

SEX	NUMBER
MALE	37
FEMALE	99

TABLE II

ASA RISK	NUMBER
1	91
2	34
3	9
4	2
5	0

TABLE III

AGE	NUMBER
UNDER 20 YRS	2
20 - 39	50
40 - 59	55
60 - 69	17
70 & OVER	12

TABLE IV

OPERATIVE SITE	NUMBER
NEUROSURGICAL	7
CARDIOVASCULAR	21
THORACIC	4
HEPATO-BILIARY	22
OTHER UPPER ABDOMINAL	14
LOWER ABDOMINAL	64
INVESTIGATIVE	3
OPHTHALMOLOGICAL	1

V. We feel this technique to be of particular benefit in those patients having hepatobiliary and other upper abdominal procedures, where the surgical manipulation alone carries an increased risk of liver damage and post-operative jaundice.

Table VI reflects our feeling that part of the safety of this technique is keeping the dosage of depressant drugs low, so that no respiratory depression is carried over into the post-operative phase.

The recovery room course of 21 patients showed a bradycardia of 60 beats per minute or less. In seven patients no active treatment was undertaken and in fourteen atropine 0.6 mg was given intravenously. In all these patients we were impressed by the fact that the systolic blood pressure was well maintained, in spite of the slowed heart rate. One patient, having received a total of 2.0 mgm of Innovar pre-operatively, complained of an intensely itchy nose and made purposeless movements of her arms lasting about one hour. There appeared to be no relationship between the site of surgery and the occurrence of bradycardia (9 cases in lower abdominal, 10 in upper abdominal, and 3 in peripheral operative procedures).

TABLE V

OPERATION DURATION	NUMBER
UP TO 59 MINUTES	28
60 - 119	83
120 - 179	16
180 +	9

TABLE VI

INNOVAR (mls.)	NUMBER
A. INITIAL - UP TO 1.0	1
1.0 - 2.0	133
GREATER THAN 2.0	2
B. MAINTENANCE LESS THAN 2.0	64
2.0 - 4.0	70
GREATER THAN 4.0	2

Twenty-eight patients presented with what we considered to be relative or absolute contraindications to the use of a halogenated hydrocarbon anaesthetic agent. These included eleven patients with clinical jaundice or altered liver function tests; fourteen patients who had received a recent halogenated anaesthetic; and three patients who recently had infectious hepatitis or an exposure to infectious hepatitis.

Complications

There were three post-operative deaths in this series. One patient died ten days following operation with pulmonary embolism and septic shock. One patient on the third post-operative day suddenly was stricken with chest pain of acute coronary artery occlusion and died in heart failure 48 hours later. The third death was a 55-year-old male with known carcinoma of the larynx. He presented for spinal cord decompression following the acute onset of paraplegia. Jaundice and fever developed five days post-operative and at autopsy on the 18th post-operative day the liver showed cirrhosis with focal necrosis and metastatic tumour.

Three other patients developed post-operative deep vein thrombosis. One patient made the observation that she felt she knew the operation had started and could "feel" the incision. She experienced no pain and was certainly not distressed by the memory. She was an ill 56-year-old woman undergoing an emergency bowel resection for obstruction. During the ninety minute procedure she received 1.0 ml Innovar initially and 1.0 ml during the operation.

Discussion

Several areas of the technique are worthy of brief discussion. We felt that at the concentration of N_2O we were using (60–70 per cent) there was some doubt that amnesia and analgesia would be sufficient to prevent recall of the surgical experience. Rosen[1] found marked variation in concentration of N_2O required to prevent recall of auditory stimuli. Even with 70 per cent N_2O some patients would still obey commands. McIntyre[2] found that with about 70 per cent N_2O patients hyperventilated and relaxed had no recall. Hutchison[3] in a large series using a similar technique found a 1.2 per cent incidence of awareness. This author lists the possible causes of awareness during anaesthesia as, (a) inadvertent reduction of N_2O in the inspired mixture, (b) patient resistance to N_2O, as seen in tolerance to alcohol and other central nervous system depressants, (c) inadequate supplementation of N_2O, (d) hypoventilation – recognizing the hypnotic effects of a low $Paco_2$, (e) antianalgesic effect of thiopentone.

There also appears to be a good deal of doubt as to whether d-tubocurare exerts a depressant effect on the central nervous system. Cohen[4] and Smith[5] present evidence against central effects, while Hersey[6] presents experimental evidence of respiratory depression independent of myoneural blockade using a cross circulation technique in dogs.

Hyperventilation would appear to be useful in this technique as the analgesia produced is probably secondary to cerebral effects of an elevated pH and hypocarbia.[7]

Several of our patients exhibited liver disease with jaundice, while some had biochemical alterations of liver function only. Innovar would appear to be a safe agent to use in these individuals. Little or no alteration in liver function by Innovar was found by several authors.[8,9]

Summary

We have described what appears to us a most satisfactory anaesthetic technique for major surgery. We use it particularly in patients with whom prudence dictated it would be wise to avoid halogenated hydrocarbons, such as (a) intra-abdominal procedures where surgical manipulation may result in liver function abnormalities (i.e. biliary tract surgery), (b) for repeat anaesthetics in patients who recently had halogenated hydrocarbon, (c) for patients jaundiced or with altered liver function tests, (d) for patients with a history of unexplained fever or jaundice following a previous anaesthetic, and (e) for patients who may have been exposed to infectious hepatitis.

We feel meticulous attention to detail is most important to keep Innovar dosage low and thus avoid any post-operative respiratory depression.

Résumé

Nous avons décrit ce qui nous semble une technique anesthésique très satisfaisante pour la chirurgie majeure. Nous l'avons utilisée surtout chez les malades

pour qui la prudence incitait à éviter les hydrocarbures halogénés, (a) les interventions abdominales où les manoeuvres chirurgicales pouvaient produire des troubles de la fonction du foie (c'est-à-dire la chirurgie des voies biliaires), (b) pour des anesthésies répétées chez des malades qui ont reçu récemment des hydrocarbures halogénés, (c) pour des malades ictériques ou ayant un trouble des épreuves de la fonction hépatique, (d) pour les malades présentant une histoire de fièvre ou d'ictère inexpliqués à la suite d'une anesthésie antérieure, et (e) pour des malades qui ont été exposés à l'hépatite infectieuse.

Nous croyons qu'il est très important de maintenir un faible dosage d'Innovar et ainsi d'éviter toute dépression respiratoire post-opératoire.

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