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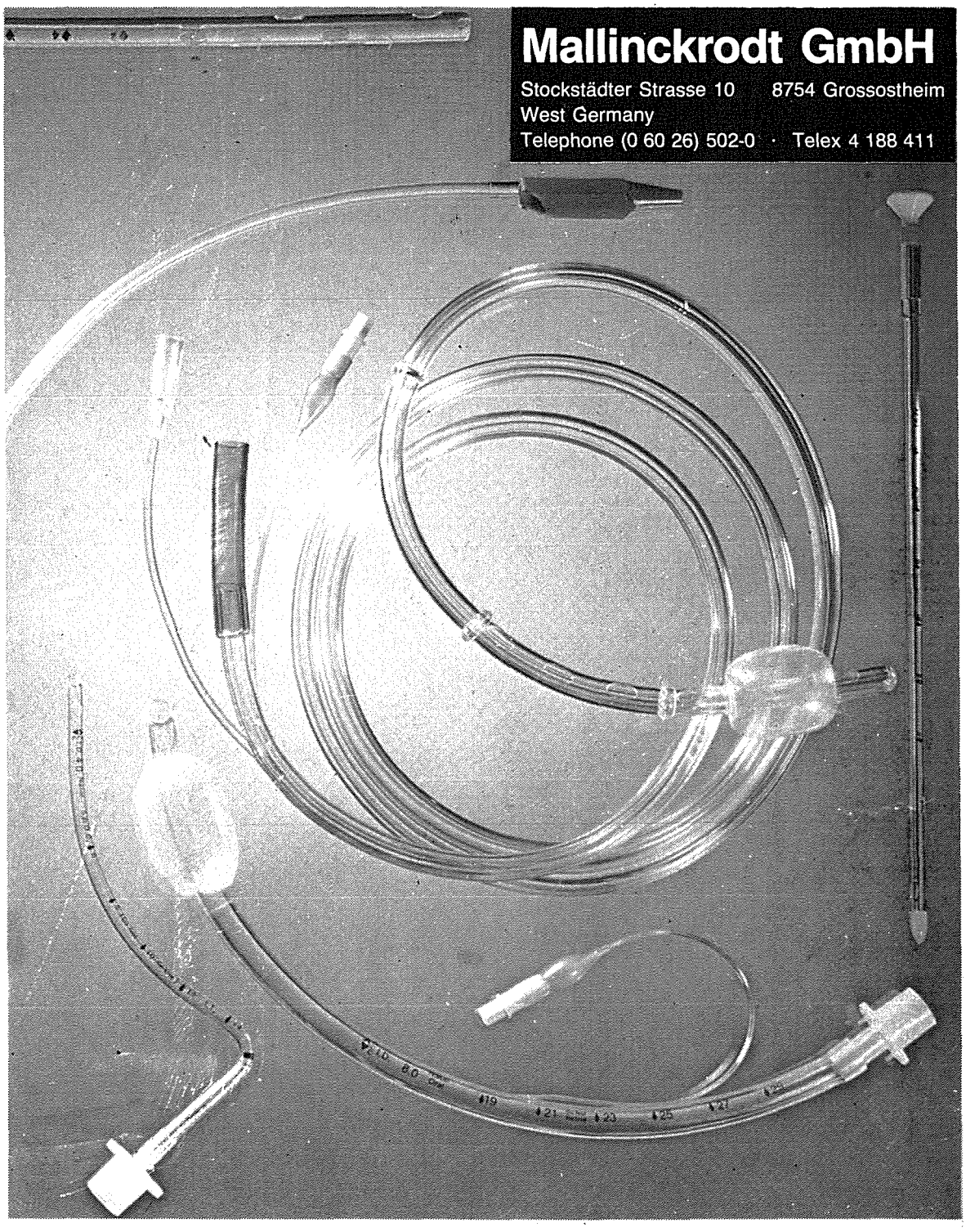

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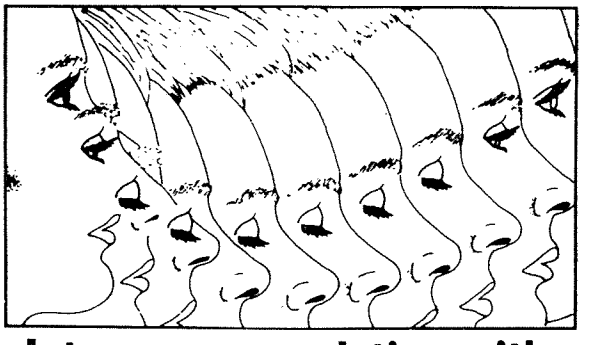

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Spembly medical

FIRST IN CRYOANALGESIA

THE SL2000 Lloyd Neurostat

INTRODUCTION

The SL 2000 Neurostat has been developed by Spembly Medical for a wide variety of applications in Cryoanalgesia. This increasingly important clinical procedure enables many patients experiencing chronic or acute pain to obtain effective, long-term relief. Treatment is performed by using a precise freezing technique to block the relevant peripheral nerves.

THE BENEFITS OF CRYOANALGESIA

- ☐ Long term pain relief
- ☐ Reversible nerve block
- ☐ Post operative pain control with minimum drug usage
- ☐ No neuroma formation
- ☐ Low incidence of neuritis
- ☐ Out patient treatment
- ☐ Treatment can be repeated

THE USE OF CRYOANALGESIA

The SL 2000 Neurostat can be used to produce Cryoanalgesia at many sites, for example:

- ☐ Intercostal blocks
- ☐ Other peripheral nerve blocks (sensory)
- ☐ Nerve blocks for facial pain
- ☐ Sacral foramenal block
- ☐ Facet Rhizolysis
- ☐ Post operative pain relief e.g. post thoracotomy
- ☐ Pituitary ablation
- ☐ Nerve entrapments (sensory)
- ☐ Coccidynia
- ☐ Neuromas

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Editorial

It is indeed our pleasure to write this editorial for the Acta Anaesthesiologica Melitensia: the only regular scientific publication from St Luke's Hospital Medical School since 1982.

The Association of Anaesthetists in Malta has these last 12 months been successful in:

- getting an education team from the World Federation of Societies of Anaesthesia to visit the Island and report on the standard of the local practice of anaesthesia.
- obtaining affiliation with the Association of Anaesthetists of Great Britian and Ireland.
- getting elected as a full member on the European advisory board on Paediatric anaesthesia.

The Association, although not a trade union, has worked unceasingly in the interest of all its members and this united approach has surely been a contributing factor in the success registered so far.

Although research in Malta is limited by lack of facilities and funds the Association has encouraged projects on scoline apnoea (pseudocholinesterase deficiency) and has been offered the excellent laboratory services of the London Post Graduate Medical School for blood studies.

The World wide distribution of this Acta has attracted contribution from Belgian, Spanish, Czechoslovak and South African authors. Its distribution makes the name of Malta beter known and appreciated in scientific circles.

The Association is justly worried about the lack of interest that senior students and young doctors have in the speciality of anaesthesia. Are they afraid of shouldering the heavy responsibilities involved? Is it that such work has poor prospects financially? We are convinced however that this problem has developed because the facilities set up previously for training abroad in Belgium – tailor-made for those students with the U.K. recognition handicap – were not followed up. Hence the current large shortage of Maltese anaesthetists will still be with us for a long time yet.

The art of anaesthesia which this Acta humbly tries to promulgate is best expressed by the citizen of Boston (USA) epitaph on the tomb of V.Y.E. Morton:

Before whom in all time surgery was agony
Since whom science has control of pain.

Dr N. Azzopardi Dr D. Spiteri
Editors

Comparative Study of the New Analgesics Tramadol, Butarphanol, Nalbuphine and Buprenorphine.

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Summary

A comparative study of tramadol, butarphanol, nalbuphine and buprenorphine was performed. The tested drugs were given as post operative analgesics after standard techniques of anaesthesia. All tested drugs were effective for post-operative pain. Buprenorphine and tramadol exhibited a longer duration of analgesia with a lesser incidence of side effects. No significant changes in vital function occured except for one severe episode of ventilatory depression with buprenorphine.

Introduction

Effective control of post operative pain is still one of the most pressing issues in surgery today. Of the millions of people which undergo surgery worldwide, most will experience pain of varying duration and intensity, which in many cases will not be adequately treated. A major objective of research in analgesics has been to find effective alternatives to morphine and meperidine (pethidine) which are free from abuse potential, tolerance, respiratory depression and tendency to cause nausea and vomiting. This goal has as yet only been partially achieved. Major advances have been made in understanding how opiates exercise their effects. There is convincing evidence for the existence of multiple opiate receptors (mu, kappa, sigma and possibly delta) and multiple modes of interaction with each type of receptor.[20,42] Although their physiological function is still obscure their study should lead towards the development of better analgesic drugs.

Methods

The drugs were tested on patients who had undergone cholecystectomy. This choice was made for various reasons: Cholecystectomy is a common operation after which, pain is usually severe and normally treated by opiate drugs. Cholecystectomy pain has been used by various centres as a model for the study of post operative pain. Patients coming for this operation are usually ASA I or II and standard techniques of anaesthesia can be used.

Pre-medication consisted of Atropine 0.5-1 mg and Pethidine 50-100mg IM up to 1 hour pre-operatively. Anaesthesia consisted of a thiopentone induction plus suxamethonium for intubation. Pipercuronium or alcuronium were used to maintain relaxation and IPPV with nitrous oxide/oxygen supplemented with Fentanyl 0.1 to 0.15mg, Droperidol 2.5mg. Relaxation was routinely antagonized at the end of the operation by standard doses of neostigmine and atropine.

The analgesics were tested in an open clinical trial. The use of placebo was considered unethical. Pain scoring was on a scale of 4.0-no pain, 1-mild pain, 2-severe pain and 3-intolerable pain. Blood pressure, heart rate and adverse effects were evaluated at regular intervals till 7.00am the next day or till post operative pain subsided.

Tramadol

This drug is derived from cyclohexanol. In experimental animals it is 3-20 times less potent than morphine. It does not depress respiration in normal dosage but tends to raise heart rate and blood pressure slightly. Tramadol has been classified as having a low risk for causing dependence.[21,30] It is effective orally and 1/3 is excreted unchanged in the urine. Tramadol has a half-life of 6 hours.

We have used Tramal 100^{R}, Grubenthal (containing 100mg tramadol hydrochloride) on 33 patients. The first dose was given as soon as verbal contact with the patient was obtained and basal

vital parameters noted. 15 and 30 minutes later further vital measurements were made. A second dose was given if the first injection proved inadequate after a 45 minute interval. After transfer to the ward, further doses of Tramal were given as required after a minimum interval of 4 hours. If pain became severe after 3 hours the patient was taken off the trial.

Results

No correlation was found between duration and quality of analgesia and patient age, weight or duration of operation. Heart rate was depressed to 70% of the previous rate in 14 patients.

Body weight mean 71,3 (range 47-100) kg
Age mean 53,3 (range 22-78) years
Duration of operation mean 63,3 (range 30-215) min
Effective duration of 1st injection 33 patients
mean 5,2(0-14) hours
Effective duration of 2nd injection 31 patients
mean 6,4(0-12) hours

Side effect	1st dose	2nd dose
Drowsiness	1	1
Nausea	1	2
Vomiting	4	2
Other (Dizziness)	1	

Nalbuphine

Nalbuphine is a thebaine derivative acting as a partial antagonist at mu and as agonist at kappa opiate receptors.[1,3,23-26,36,37,41,47] When administered alone there is a ceiling to the respiratory depression induced – but this is equivalent to that produced by 10 to 30 mg Morphine. When Nalbuphine is administered after high doses of other opiates, respiratory depression is antagonised without disturbing the continuity of the analgesia. Cardiovascular parameters remain remarkably stable after Nalbuphine. It is metabolised in the liver but partially excreted unchanged. It is thought to have no abuse potential. In this trial Nubain[R] DuPont (20mg nalbuphine hydrochloride in 2ml) was used on 33 patients. In 20 patients pre-medication was changed to Diazepam 5-10mg and Atropine (Group A). Group B had the usual Pethidine/Atropine. Nubain was given as described for Tramal but the minimum period between injections, in the ward, was reduced to 2 - 3 hours.

Results

No differences were seen between 3 groups. No relation between analgesic effect, patient body weight, age and duration of operation was noted. No adverse changes in vital functions were seen.

Body weight mean 69,9 (range 47-105) kg
Age mean 45.4 (range 28-60) years
Duration of operation mean 61,2 (range 25-125) min
Duration of analgesia after 1st injection
3,4 (0-12) hour
Duration of analgesia after 2nd injection
4,5 (0-12) hours (30 patients)

Side effect	1st injection	2nd dose
Drowsiness	8	22
Nausea	1	0
Vomiting	3	1
Other: Disorientation	1	
Allergic reaction	1	

Buprenorphine

Buprenorphine is another thebaine derivative with mixed agonist/antagonist action. It has a very high affinity but low activity at the mu receptor which is difficult to antagonize by Naloxone. Its analgesic potency is 25-40 times that of Morphine and has a longer duration of action. The respiratory depression of Buprenorphine is widely reported to have a ceiling. Some bradycardia and reduction in blood pressure is seen but is not usually clinically significant. Although no tolerance or dependence has been reported, withdrawal signs can be precipitated in patients chronically on Buprenorphine, if enough Naloxone is given. 55% of oral Buprenorphine becomes available to the tissues.[9] It is metabolised in the liver. 27% appears in the urine unchanged.

In these trials Temgesic[R] Boehringer (containing 0.3mg Buprenorphine in 1ml) was used on 18 patients. Pre-medication, anaesthesia and post operative protocol was as described for Tramadol.

Results

No relation between analgesic effect, body weight and duration of operation was found.

Body weight	mean 71,2 (range 52-90) kg
Age	mean 53 (range 30-68) years
Duration of operation	mean 64 (range 45-105) min
Duration of analgesic effect of 1st injection	7,3 (range 0-13) hours
Duration of analgesic effect of 2nd injection	8,8 (range 0-14) hours

Side effect	1st dose	2nd dose
Drowsiness	6	0
Nausea	1	1
Vomiting	0	2

There was one case of severe respiratory depression which necessitated antagonism by naloxone.

Butarphanol

This is derived from Nalorphine and is 3.5 to 5 times more potent than Morphine. Butarphanol exhibits a ceiling effect as regards respiratory depression but Naloxone is required in higher doses than usual to antagonize such effects. It may raise pulmonary artery pressures and cardiac output in some patients. While it has a marked sedative effect in most patients the risk of dependence seems to be low. Only about 20% of the agent is available to the tissues after oral administration. It is excreted in the urine after hydroxylation. Effective half life is 2,5-3 hours.[14,34,39] For these trials Stadol[R] Bristol or Butarphanol VUFB made in Czechoslovakia were used. Both have 2mg in 1ml. 36 patients were studied in the manner as described for Tramadol.

Results

No difference was found between the 2 preparations. No correlation was found between analgesic effect and body weight, age and duration of operation. No significant vital disturbances occured.

Body weight	mean 68,6 (range 46-95) kg
Age	mean 48,4 (range 26-76) years
Duration of operation	mean 54,4 (range 30-150) min
Duration of effect of 1st injection	mean 3,5 (range 0-14) hours
Duration of effect of 2nd injection	mean 4,5 (range 0-14) hours

Side effect	1st dose	2nd dose
Drowsiness	20	17
Nausea	3	0
Vomiting	5	3
Other: Dizziness	2	
headache	1	
disorientation	1	

Discussion

The attributes of an ideal analgesic may be summarised thus:

1) reliable steady effect
2) minimal disturbance of vital functions
3) no risk for abuse or decreased effectiveness from tolerance
4) simple and safe application.

All the tested drugs were effective in controlling pain after cholecystectomy. The extremes of effectiveness seen with the first dose of each drug i.e. either no effectiveness or prolonged duration of effect, highlights the great variability between patients as regards pain.

Tramadol and Bubprenorphine had a longer lasting analgesic effect and much less sedative effect than Nalbuphine and Butarphanol. Sedation is not an effect without benefit to the patient, especially immediately post operatively. However it becomes progressively less desirable in the subsequent days, as it retards the rehabilitation to normal activity.

Nausea and vomiting occured to a similar extent with all drugs (10-20%).

While a reduction in heart rate is to be expected with the start of analgesia this was actually seen only with Tramadol, so a direct action is postulated. On the other hand Butarphanol was associated with a rise in heart rate.

It is a fact that most physicians underdose when prescribing analgesics. This is mainly done in fear of respiratory depression which occured in one patient after Buprenorphine.

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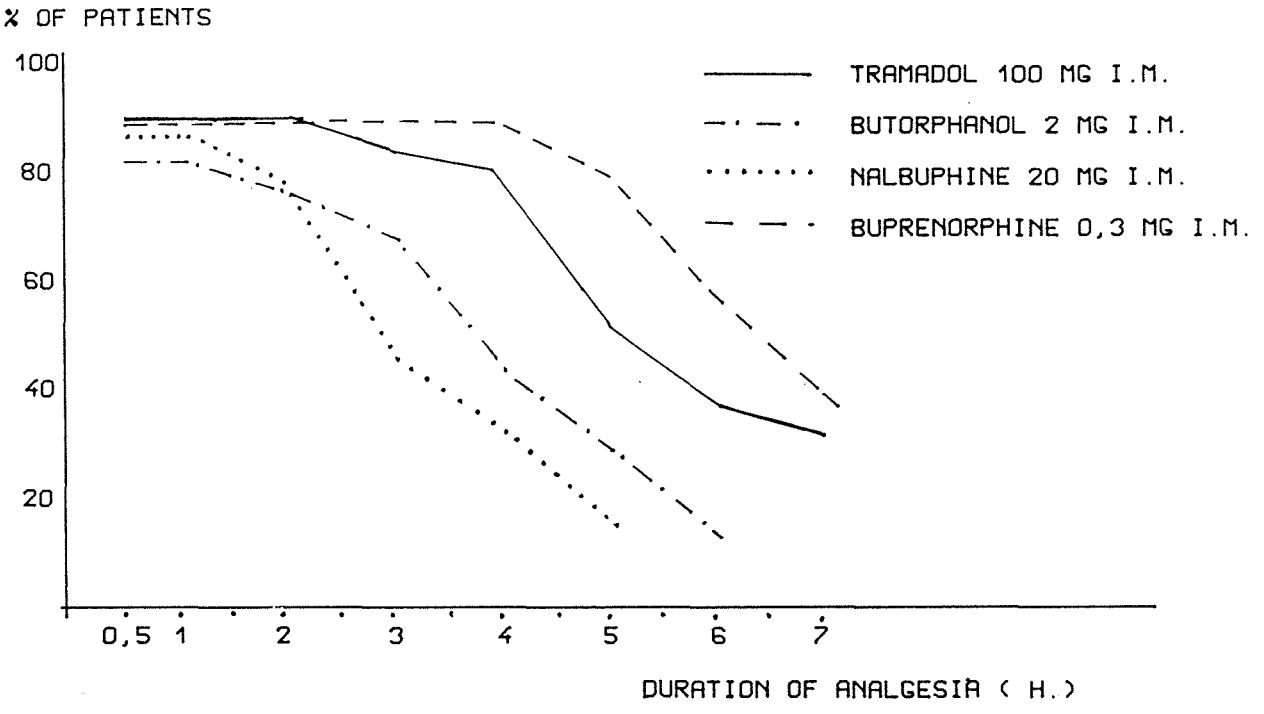
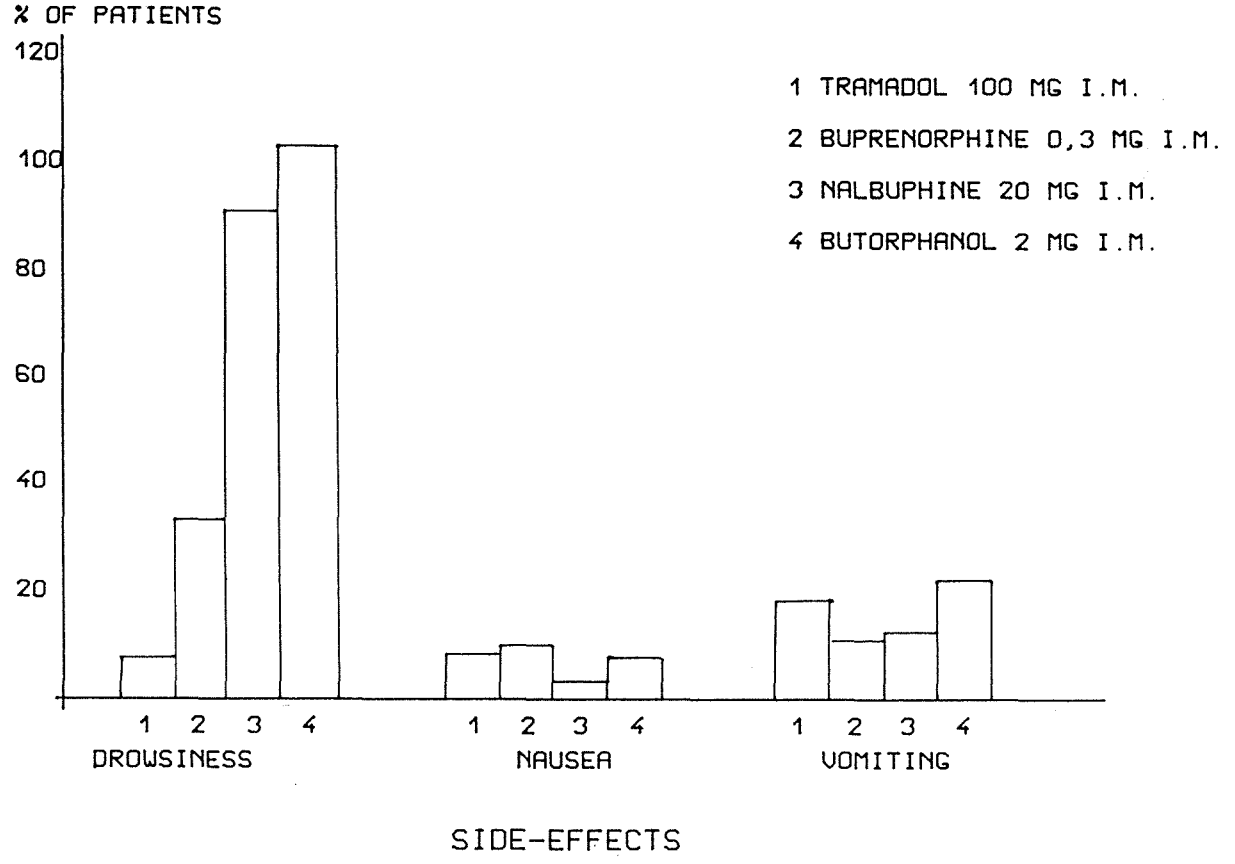

% OF PATIENTS
100
80
60
40
20
TRAMADOL 100 MG I.M.
BUTORPHANOL 2 MG I.M.
NALBUPHINE 20 MG I.M.
BUPRENORPHINE 0,3 MG I.M.
0,5 1 2 3 4 5 6 7
DURATION OF ANALGESIA (H.)


% OF PATIENTS
120
100
80
60
40
20
1 TRAMADOL 100 MG I.M.
2 BUPRENORPHINE 0,3 MG I.M.
3 NALBUPHINE 20 MG I.M.
4 BUTORPHANOL 2 MG I.M.
1 2 3 4
DROWSINESS
1 2 3 4
NAUSEA
1 2 3 4
VOMITING
SIDE-EFFECTS

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Use of Propofol (Diprivan) in Diabetic Patients

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Summary

The use of propofol for the induction of Diabetic patients for relatively short surgical interventions was studied. No remarkable cardiovascular problems were noted. The quick clear headed recovery and the relative absence of nausea and vomiting favoured early resumption of feeding and normal daily routine.

Introduction

The interruption of the daily feeding, energy expenditure and insulin/oral hypoglycaemic agent routine of diabetic patients as caused by surgery should be reduced as much as possible. The use of Propofol with its attendant advantages of quick recovery and absence of nausea and vomiting goes some way in achieving this objective. The doubt however arose if the emulsion vehicle of the drug would in some way interfere with control of blood glucose levels.

Diabetic patients suffer several complications which are of importance to the anaesthetist. Vascular disease affecting the peripheries brings the patient to repeated surgery either for vascular reconstruction or for amputation. Adult onset obese diabetics commonly suffer from ischaemic heart disease and are at real risk of suffering a pre-operative myocardial infarction. Diabetic neuropathy affects both peripheral nerves – which may on occasion present as a chronic pain problem – and the autonomic nervous system with the attendant problems of postural hypotension, disturbances of temperature control and reduced sympathetic 'warning' responses to hypoglycaemia. Diabetic nephropathy will of course require a careful choice of drugs i.e. those heavily dependent on renal excretion should be avoided. The safety of Propofol in the presence of these problems requires attention.

The Hospital Management Committee's approval as well as each patient's verbal consent were obtained. This initial study was made on 25 consecutive diabetic patients scheduled for elective relatively short procedures not involving the abdomen. (These included cataract extractions, debridement of foot gangrene, carpal tunnel release procedures, dilatation and curettage, cystoscopy, excisions of lipomas and lumps in the breast). No other special requirements were chosen for patients to be included in the sample as this study was made to see if any problems would arise in the normal context of a daily surgical list. Pre-medication in most patients included Nitrazepam 5 to 10 mg the night before and Lorazepam 1 to 2 mg on the morning of the operation.

20 were non-insulin dependent and 5 depended on insulin. Those patients which showed uncontrolled blood glucose in the days pre-operatively (the patients hospitalised for lower limb gangrene) were put on a 12 hourly infusion of 5% Dextrose containing plain Insulin according to a scheme often followed in the hospital.

Blood glucose under 200mg%	6 units
over 200	10 units
over 400	20 units

14 were male and 11 were female.

Age groupings:

Under 50	5
Between 50 – 70	17
Over 70	3

If the patient was seen to be anxious on arrival in theatre i.v. Midazolam was titrated to calm him down. Large ante-cubital veins were specially selected to minimise pain on injection which is variably reported to occur. Atropine was given at 0.005mg/kg. Induction was carried out with Propofol at around 10mg/5 seconds using

1.5mg/kg as a guiding dose. Intubation facilitated with Suxamethonium 1mg/kg and Fentanyl up to 0.001 mg was given if necessary. Manually assisted ventilation with nitrous oxide/oxygen and a low concentration of halothane. In 10 patients Pancuronium 0.1mg/kg was used and IPPV with a Manley Pulmovent ventilator. Prostigmine/ Atropine in the standard dose of 2.5mg and 1.2mg respectively were used to reverse relaxation at the end of the procedure. Naloxone or Doxapram were not used to hasten recovery.

Monitoring included an ECG, blood pressure by auscultation and capillary blood glucose sampling by Haemoglucotest test strips every 10 – 15 minutes up to 1 hour post-operatively.

Untoward effects at induction, maintenance and recovery were carefully noted.

Results

No patient complained of pain on injection of Propofol.

1.5mg/kg of Propofol was in the majority of cases enough for a smooth induction. Lorazepam and/or Midazolam may of course have helped in lowering the dose of drug needed. In 4 cases mild muscle 'twitchings' occured at induction mainly in the facial and shoulder muscles and lasting less than a minute. Blood pressure and heart rates did not vary more than +/– 10% from the baseline obtained before induction.

No unexpected problems occured during maintenance. Depth of anaesthesia was to a large extent varied by controlling the concentration of Halothane from 0.3 to 1%.

No patient vomited and only 4 patients complained of nausea. These had had fentanyl supplementation.

The blood glucose did show a tendency to rise but this was in keeping with and to the extent usually seen as a normal response to the stress of surgery.

Conclusion

No unexpected untoward events occured in this pilot series and the anticipated advantages of using Propofol in diabetic patients were to a large extent realised. Most patients had their i.v. infusion removed within an hour of the operation as fluids offered were retained. The infusion was kept going in those cases where blood glucose control needed continued attention.

A controlled study using Propofol as the main anaesthetic both for induction and maintenance, and for longer operations, is needed to further elucidate the problems, if any, associated with the use of a fat emulsion during anaesthesia for diabetics.

Anaesthesia for Carotid Endarterectomy

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U.Z. GASTHUISBERG LEUVEN

Introduction

About 120 carotid endarterectomies are performed each year at our hospital. All patients have more than 70% stenosis of one or both internal carotid arteries as shown by Duplex-scan and/or arteriography. Most of the patients suffered previous transient ischemic attacks or reversible ischemic neurologic deficits although some patients are asymptomatic.

It is thought that surgical removal of the stenosis can significantly diminish the risk of stroke.

Two main questions arise when giving anaesthesia for these operations: firstly, can the brain be protected from ischemia by our anaesthetic technique and secondly, how is brain perfusion best monitored during the cross-clamping of the carotid artery?

Anaesthetic technique

Some surgeons prefer to operate under local or loco-regional (interscalene cervical plexus block) anaesthesia, so that the neurologic state can be monitored directly[1].

We believe that this method imposes too much stress on these patients who often have some degree of coronary disease[2]. For this reason all of the carotid operations are performed under general anaesthesia at our hospital. During general anaesthesia one should try to provide sufficient cerebral circulation and oxygenation and to avoid myocardial ischemia. Therefore controlled respiration with sufficient inspiratory oxygen concentration is mandatory. End-tidal pCO_2 is routinely monitored. The patient is kept normocapnic[3] as hypocapnia induces cerebral vasoconstriction and diminishes collateral bloodflow. Hypercapnia results in cerebral vasodilatation and can thereby cause deviation of bloodflow from the ischemic to the vasodilated region of the brain.

Throughout the operation blood pressure should be very stable and kept at or slightly above the patient's normal blood pressure level to assure collateral circulation through the heterolateral carotid artery and vertebral arteries and the circle of Willis[4]. Depending on the patient's heart rate we eventually administer small I.V. boluses of ephedrine or phenylefrine to achieve the required blood pressure. To prevent myocardial ischemia, tachycardia or extreme hypertension should be avoided. Glucose is not given. In the case of cerebral ischemia a glycemia of 150 mg% or more seems to be associated with worse neurologic outcome in experimental animal studies as well as in outcome studies in humans after circulator arrest[5,6,7,8,9].

Pharmacological brain protection

Can we protect the brain during the ischemic epidsode by the anaesthetic used? One might speculate that lowering the functional activity of the brain cells may diminish the need for oxygen, and thus blood flow, to levels sufficient to assure cell integrity. The blood flow level needed is about 12-18 ml/100 gr of tissue/minute.

An alternative explanation for the possible brain protective action of barbiturates is their role as free radical scavengers.

Ca-channel blockers are supposed to have a protective action by preventing Ca-influx at the cellular level or by preventing the postischemic hypoperfusion state. In a lot of animal and human experiments a protective action of barbiturates, isoflurane and Ca-channel blockers is thought to be proven by the amelioration of some biochemical and physiological parameters and more rarely by outcome improvement [10,11,12,13,14].

However when we look at outcome studies in humans a pharmacological brain protective action is far less evident. The Nussmeyer study [15] shows some evidence of some brain protective effect with extremely high doses of barbiturates in patients undergoing cardiac surgery. The high doses of barbiturates are impractical in the setting of carotid artery surgery because of their prolonged action

and the hemodynamic instability they provoke. In a retrospective, non-randomized study, the Mayo Clinic group has shown that in patients anaesthetized with isoflurane, ischemic EEG changes occured significantly less frequently (18%) as in patients anaesthetized with other volatile anaesthetics (26%)[16]. Also, ischemic changes under isoflurane anaesthesia occured at lower cerebral blood flows and the need for a shunt was less frequent (37% vs. 44%) as with other volatile agents. The same group of investigators showed that the critical flow value (the flow value at which ischemic EEG changes occur in 50% of the patients) is 10-12 ml/100 gr/minute in the isoflurane group versus 16-18 ml/100 gr/minute for the other volatile agents.

Monitoring cerebral perfusion

Measuring cerebral blood flow by the radioactive Xenon technique might be considered to be the best way to verify that cerebral perfusion is adequate. However the technique is impractical in the operation room and often not available. The excellent correlation between CBF and EEG activity explains why EEG monitoring is more popular[18].

Measuring the pressure in the distal carotid stump after clamping gives an idea about the collateral circulation. However there is little agreement about which stump pressure is adequate to prevent neurologic deficits. Values from 25 to 70 mmHg have been recommended[19,20].

Bilateral evoked potential monitoring is a reliable method to monitor cerebral perfusion because of the good correlation with EP-latency and amplitude changes[21]. This method is less popular than EEG monitoring but certainly deserves more investigation, because it does not only monitor the cerebral cortex but also deeper brain structures.

The traditional method for detecting cerebral ischemia is the electroencephalogram. When unilateral cerebral ischemia is present a lowering of frequency or voltage attenuation will occur within one minute. EEG changes are evident when CBF drops below 18 to 16 ml/100 gr/min. Irreversible cell damage occurs when CBF falls below 10-12 ml/100 gr/min.[18]. This means that there is a safety margin between EEG changes and cell damage.

The standard 16 channel-EEG has the advantage of detecting regional ischemic events, but is rather impractical in the operation theatre. Also special personnel is required to interpret the formation it generates.

There are a number of simple two or four channel EEG monitors available which are provided with several automatic processing techniques which help the anaesthetist with the interpretation of the data. Regional information is sacrificed, as the monitor only registers the electroencephalographic signals in the region where the electrodes are placed.

Blume found that only major EEG changes (extreme slowing or electroencephalographic silence) were indicative for possible postoperative neurologic deficit[22].

A two channel monitor is perfectly capable of detecting these major changes and thus to identify hemicerebral ischemia. In the same study Blume found that only 9% of the patients with major EEG changes had postoperative neurologic deficit; no patients without EEG changes had postoperative deficits. EEG monitoring can identify those patients in which the cerebral perfusion is at risk during clamping of the carotid artery and those who may benefit from a shunt. A malfunctioning shunt is also readily detected by this monitoring technique. Neurologic deficit can be caused by embolisation phenomena which can occur during the whole perioperative period, and when these involve a sufficiently small region, they can be missed by EEG monitoring. This explains why one sometimes finds patients with post-operative neurologic deficits without evidence of EEG changes during operation.

Experience from the University Hospital Leuven

At our hospital we use a balanced anaesthetic technique based on an etomidate infusion combined with isoflurane inhalation and a low dose of fentanyl as an analgesic.

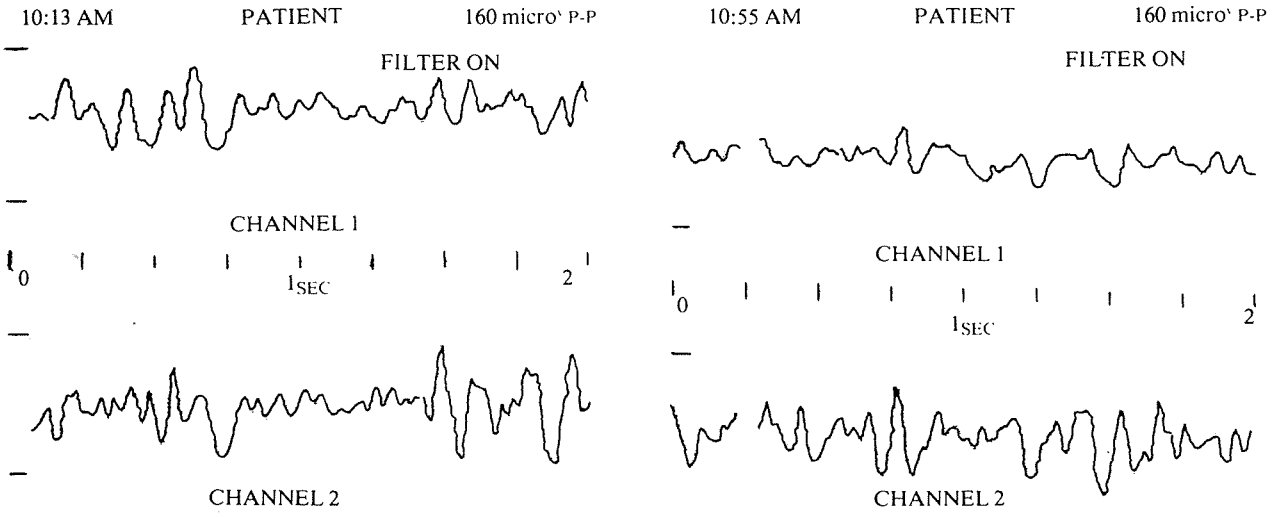
An induction dose of etomidate (0,3 mg/kg) is followed by an infusion at 0,03 mg/kg/min for 27 minutes and is thereafter diminished to 0,01 mg/kg/min. The infusion rate can be altered according to the depth of anaesthesia as measured by the encephalogram. Etomidate lowers the cerebral metabolic rate of oxygen in a similar fashion to the barbiturates. It also provides strikingly stable hemodynamic conditions at induction. A 24 hours cortisol substitution therapy is started immediately after the operation (100 mg of hydrocortisone every 8 hours) because of the cortisol synthesis blocking effect of etomidate.

Low dose Fentanyl (3-4 ug/kg) and Isoflurane inhalation are added to blunt over hypertensive responses.

This anaesthetic technique allows prompt postoperative awakening and neurologic evaluation.

Collateral cerebral circulation is evaluated in two ways. First, EEG is continuously followed by a two

FIGURE 1



Asymmetry of the raw EEG after clamping the left carotid artery in a patient with a 75% stenosis on the right side and a filiform stenosis of the left carotid artery.
Stump pressure was 30 mmHg.

FIGURE 2

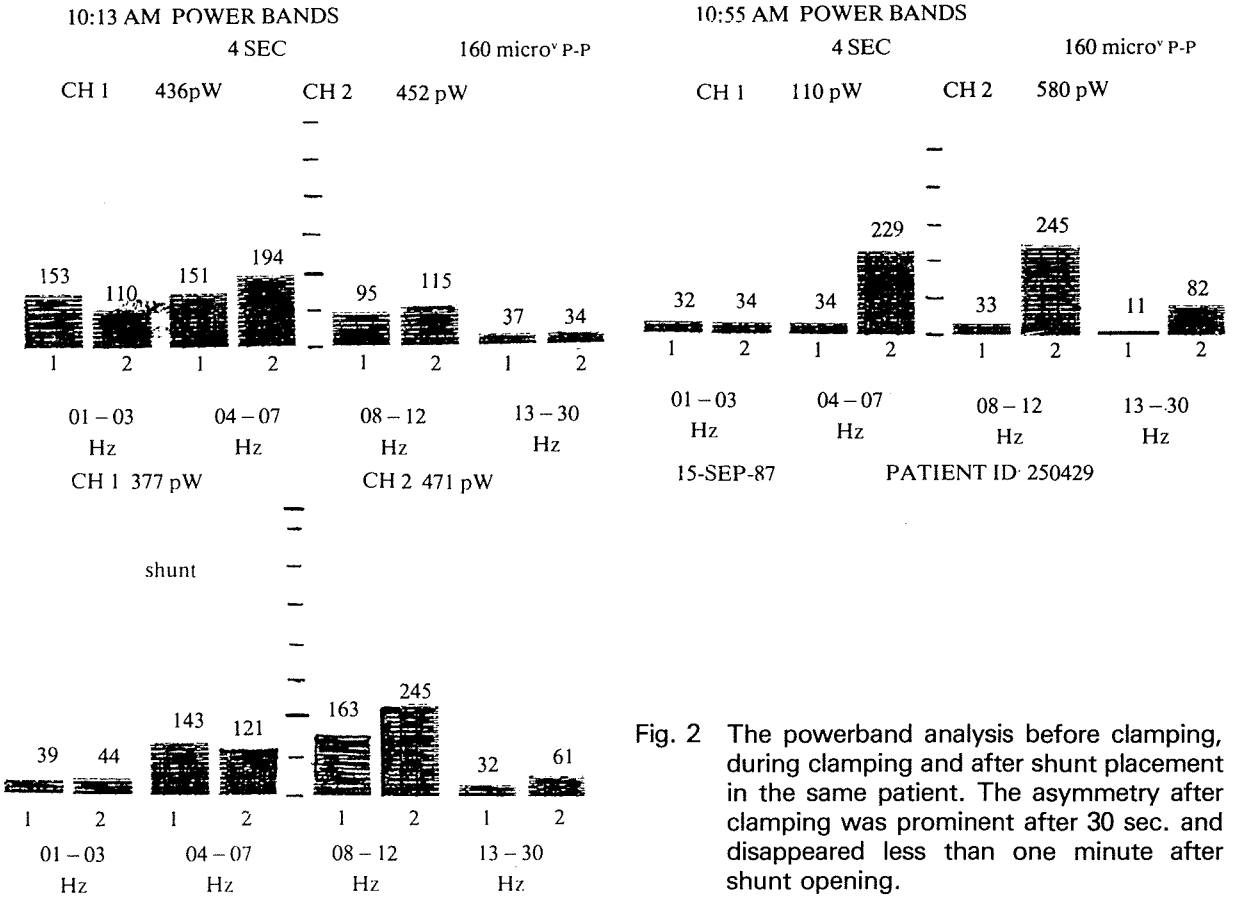


Fig. 2 The powerband analysis before clamping, during clamping and after shunt placement in the same patient. The asymmetry after clamping was prominent after 30 sec. and disappeared less than one minute after shunt opening.

FIGURE 3

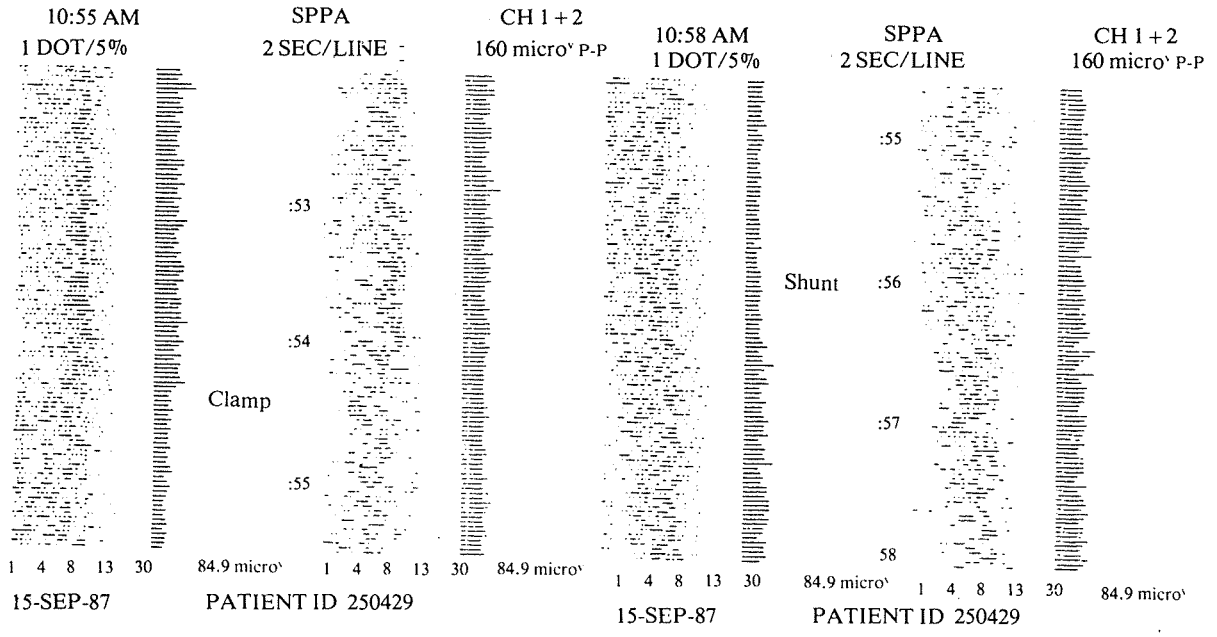


Fig. 3 The same phenomena shown by spectral power percentile array (Sppa). The dominating frequency (8-10 Hz) is lost while the total amplitude diminishes on the left side during clamping.

FIGURE 4

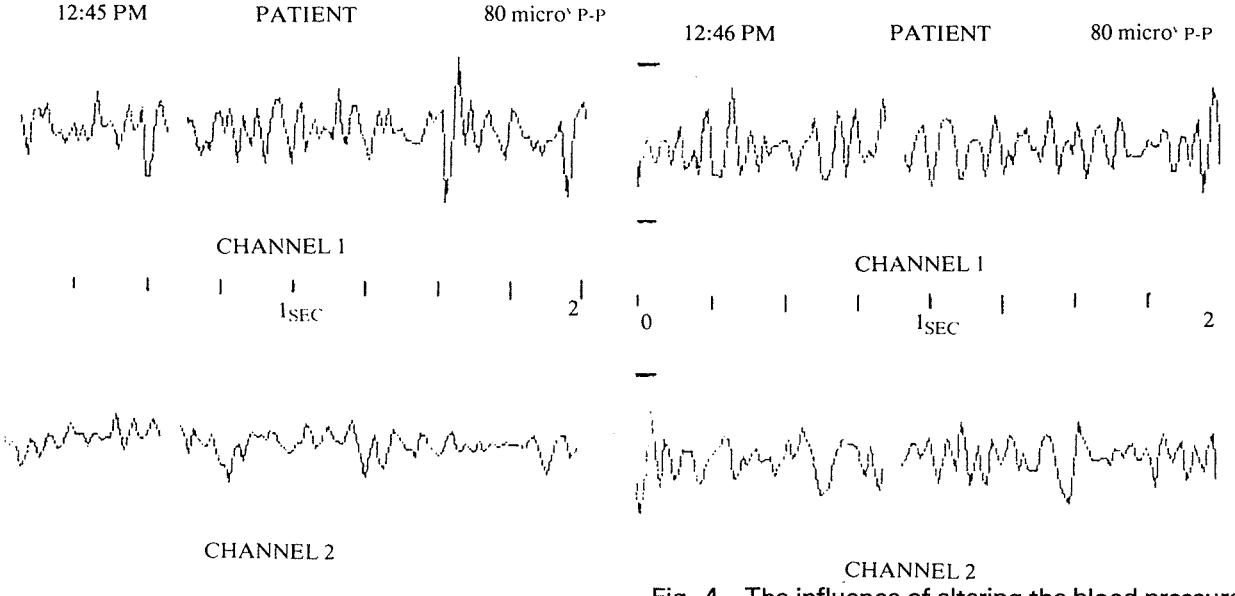


Fig. 4 The influence of altering the blood pressure from 105 to 160 mmHg mean during right carotid artery clamping in another patient. The difference in amplitude disappears.

channel EEG recording device: Neurotrac^{R}/(Interspec.). Recording electrodes are preoperatively placed in positions $F_{p1}C_3$, $F_{p1}C_3$, $F_{p2}C_4$ and $F_{p2}C_4$. The device allows for a raw signal display and provides different methods of computer aided analysis of this signal: compressed spectral array, spectral power percentile array, power band analysis and spectral histogram. Examples are shown in figures 1 to 4. Second, the pressure in the carotid artery distal to the clamp (stump pressure) is measured. Before clamping all patients receive 7500 units of heparin. A shunt is used whenever stump pressure is lower than 50 mmHg (transducer placed at head level), except when shunt placement is judged to be too risky for causing embolisation or too difficult technically. In these cases our team relies on EEG analysis alone.

Whenever the EEG shows cerebral ischemia a shunt is placed even when the stump pressure is high.

From March '87 till March '88, 129 carotid endarterectomies were done in this way. In 78 cases stump pressure was more than 50 mmHg and in none of these cases did the EEG change significantly. Of these 78 patients 2 had an early postoperative thrombosis and stroke although immediately postoperatively the neurologic examination was normal. The EEG was asymmetrical at the start of the urgent reoperation. 51 patients had a stump pressure of less than 50 mmHg. In 40 of these cases a shunt was used. In 20 cases EEG did not change during shunt placement and removal and one of these 20 patients had a mild paresis of an arm postoperatively. This paresis was probably due to emboli in a region not detectable by the EEG monitoring used. In the 20 other patients the EEG changed temporarily during shunt placement with rapid normalisation after opening the shunt. One of these patients had a postoperative facialis paresis and one a hemiparesis; both recovered in one week.

In 11 patients with a stump pressure of less than 50 mmHg no shunt was placed, the EEG did not change and none of these patients had postoperative neurologic dificit. All 129 patients survived.

Conclusion

Our anaesthetic technique for carotid endarterectomy proves to be safe as shown by the morbidity and morality figures. The combination of EEG monitoring and stump pressure measurement is in our opinion a helpful method for identifying those patients in whom collateral circulation during clamping is insufficient and who would benefit from a shunt.

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Use of a Peripheral Nerve Stimulator in Regional Anaesthesia. Clinical Evaluation

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Introduction

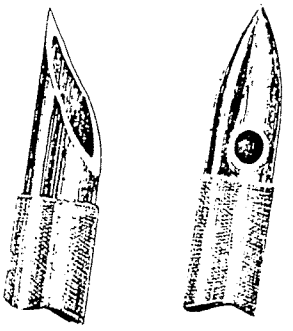
Halsted performed the first dental nerve block in 1884 and the first brachial block (under direct exposure) in the neck in 1889. Hirschel described the first percutaneous brachial plexus block in 1911. It is not easily understood how nowadays regional anaesthesia is not a technique of choice in many centres. Possible reasons may be 1) lack of consistent success 2) the time necessary to perform the block 3) the limited duration of the block 4) fear of complications 5) unfamiliarity with various techniques available.

Successful regional anaesthesia depends on accurate placement of local anaesthetic in close proximity to the nerve trunks. In most peripheral somatic nerve block the eliciting of parasthesia helps in identifying the correct spot for injection. This has led to the dictum 'No parasthesia, no anaesthesia'. This may however cause nerve damage either directly by the needling or during intra-neural injection of anaesthetic agent. Parasthesiae are subjective feelings and uncooperation by the patient may severely sabotage such a technique. Difficulty in identifying landmarks by thick subcutaneous fat may also hamper accurate regional block placement. The use of a nerve stimulator may help overcome these problems. Its use was first described in 1912 by von Perthes. The patient is spared a lot of discomfort as the eliciting of twitching by stimulating a motor nerve requires a lower electrical stimulus than that to cause parasthesiae in a sensory nerve. It also makes cooperation by the patient to a large extent superfluous.

This study was undertaken to confirm these assertions and to note the success rate, the minimum stimulating current needed, the presence of parasthesiae and any complications. No particular selection of blocks was made.

Apparatus

The nerve stimulator used was Neurotrace® (HDC Corporation, Mountain View California USA). It is battery operated (9 volts) and may be re-sterilized by ethylene oxide. Current output ranges from 0.18 to 3 mAmps. Stimulation is for 1ms every second. A green LED flashes with each pulse. A 10ml syringe can be fitted directly to it. If a larger amount of agent is required an extension tubing is recommended to be fitted to the larger syringe to facilitate handling of the needle. The needle is insulated all the way except at the tip. One lead is attached to the hub of the needle and the other (ground) to an ECG electrode placed somewhere distally on the limb to be blocked.



HDC needles come in different sizes:

25G 1½ inches	**22G 3 inches**
23G 1½ inches	**22G 5 inches long**

The first two are 'short level' while the others are 'pencil point' both are rather blunt to reduce risk of nerve damage and to improve the feel of the needle as it crosses various tissue planes.

Method

At the pre-operative visit, the advantages of the technique are explained to the patient and consent obtained. Diazepam 10mg, Meperidine 50mg and Atropine 0.5mg were prescribed as premedication up to 1 hour before surgery.

The local anaesthetic used was Lignocaine 1% or 2% or Mepivacaine 2%. In later cases Bupivacaine 0.5% was used. Adrenaline 1:200 000 was used with each agent.

The block is performed in the induction room with all necessary resuscitation equipment at hand. Monitoring includes ECG and automatic non-invasive BP. An i.v. infusion is set up beforehand as a precaution.

The site and landmarks of the proposed block were identified and marked by skin pencil. Povidone iodine was used to prepare the skin. A skin nick was made by a blood lancet to facilitate the entry of the larger needle and a wheal raised just under the epidermis. The current was set at maximum and moved in the direction of the nerve to be blocked. When a twitch was seen the current was progressively reduced till a good muscle contraction was obtained with the minimum of stimulation. After the obligatory aspiration test, the local agent was injected. Dose was related to age and body weight, number and size of nerves to be blocked and with an eye on the maximum acceptable dose for each agent. After a few minutes the block was tested, patient positioned and sedatives given as necessary.

Results

183 blocks were attempted in 156 patients. Of these 175 were successful (95%). See table for comparison with other authors. The various blocks took from 6 to 20 minutes to perform. Minimal stimulating current was 0.2 mAmps. The operative procedures took betwen 35 minutes to a maximum of 7 hours. Patients ranged from 15 to 70 years and from 35 to 90kg in body weight. 67% were males.

No difference was seen in the success rate between sedated and non-sedated patients. Parasthesiae was elicited in 5 patients. Motor twitches surprised some patients but were not considered painful. The only complication was accidental femoral artery puncture. No neurological sequelae were observed after one year follow up.

Comparison of Different Series of Blocks with Neurostimulation

		Cases	Success Rate(%)
EECKLAERT	Supraclavicular brachial plexus	100	84
YASUDA	Supraclavicular brachial plexus	71	98
SMITH	Interscalene brachial plexus Sciatic/Femoral	60	75
CHAPMAN	Supraclavicular brachial P. Axillary brachial plexus Median/Radial/ Ulnar Nerves Sciatic Anterior/ posterior Femoral Tibial Anterior/ Posterior	68	88
MAGORA	Obturator	14	79
GUARDINI	Sciatic lateral approach	134	95

Discussion

Like Magora, we believe that the best technique for peripheral nerve blocks is the one which ensures easy but accurate placement of the needle with minimal discomfort to the patient and lowest risk of complications. The eight failures resulted despite adequate muscular twitches being obtained.

While it has been said that insulated needles are unnecessary as 30% of the current supplied to a non-insulated needle exists through the tip, recent studies show that the use of such needles may miss the nerve by up to 0.8cm especially in deeply placed blocks where a longer part of the needle is in contact with tissue.

It is probably true to say that the nerve stimulator does not add to the success rate of an anaesthetist experienced in regional anaesthesia, but it is certainly useful to the trainee as an objective method whereby he can gradually gain confidence.

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Constant Pressure in the Non-Dependent Lung for Lung Decortication Surgery

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Summary

In this trial, a modified technique of general anaesthesia using a constant pressure of 3.99 kPa (30 mm mercury or 40.5 cm H_2O) in the non-dependent lung, has been used in eighteen patients requiring Lung Decortication. The haemodynamic response to anaesthesia and surgery was studied.

No significant alteration from the preoperative values of Arterial Blood Pressure (BP), Heart Rate (HR) and Central Venous Pressure (CVP) were noticed.

The surgical technique has been considerably improved by use of this technique with a significant decrease in operating time.

Introduction

Lung Decortication is a very common procedure in thoracic surgery, and has been performed for many years with the aim to re-expand collapsed lungs and re-establish normal respiration. This technique is aimed at attaining better conditions for this type of thoracic surgery and, at the same time, to be a safe anaesthetic for these patients.

Patients and methods

Eighteen consecutive patients were admitted to the trial. Etiological factors were a post-traumatic empyema in eight and post tuberculosis empyema in ten. Their ages ranged between 15 and 41 years (mean 30.2 years). Three were females and fifteen males. (Table 1).

Premedication of all 18 patients was Droperidol 5 mg IV (0.05-0.08 mg/kg), 10 minutes prior to induction.

Induction of anaesthesia consisted of Fentanyl 5 micrograms/kg and Thiopentone 3.5 mg/kg.

For intubation (double lumen tube) Suxamethonium Chloride 1.5 mg/kg was used.

Pancuronium Bromide 0.08-0.1 mg/kg was used later and to maintain anaesthesia a mixture of $N_2O:O_2$ 50:50 and Ethrane 0.8% was given.

A standard postero-lateral thoracotomy was performed with the 6th rib being resected. Once the chest was open the pathological lung was connected to a second anaesthetic machine (Picture 1) with constant pressure of 3.99 kPa (30 mm Mercury or 40.5 cm H_2O).

Oxygen flow of 4 L/min was given and pressure was controlled by the expiration valve (Picture 2).

To measure the constant pressure the following apparatus were used:

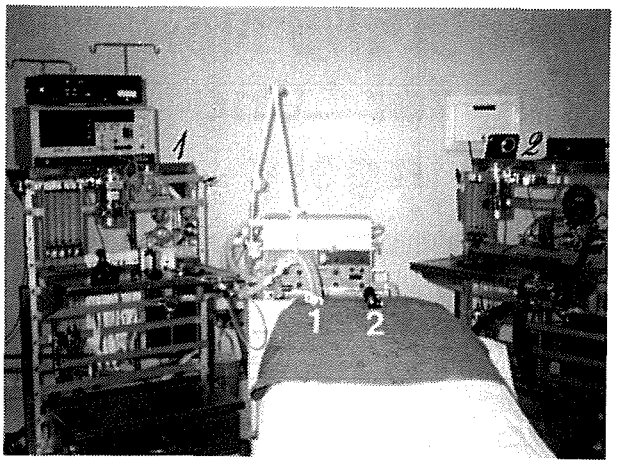
- Aneroid Sphygmomanometer
- An Ohmeda respiration pressure monitor.

The dependent lung was ventilated at a rate of 20 to 25 per minute. Constant pressure was maintained in the non-dependent lung to enable a firm surface to work on as the fibrous tissue was peeled off the lung. The patient's Blood Pressure (BP), Heart Rate (HR) and Central Venous Pressure (CVP) were monitored. Arterial blood gases were checked at 10 minute intervals, but Oxygen saturation was monitored constantly by an Ohmeda Pulse Oximeter. (Figure 1).

Discussion

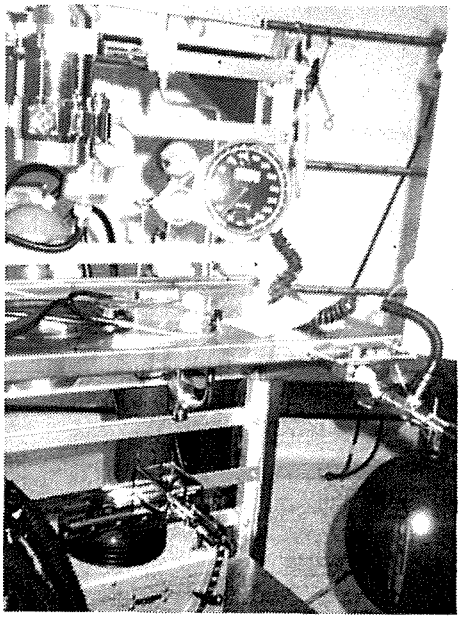
Prior to the use of this modified anaesthetic technique of constant pressure in the non-dependent lung, we performed our standard decortication with a single endotracheal tube.

It was found that it was easier to perform the operation with the lung under some tension. This required the anaesthetist to manually destend lung, while the operation was being performed. It was found that after 3 to 5 minutes of not ventilating, the patient and tension in the dependent lung causes haemodynamic instability, thus necessitating the anaesthetist to initiate ventilation once again.



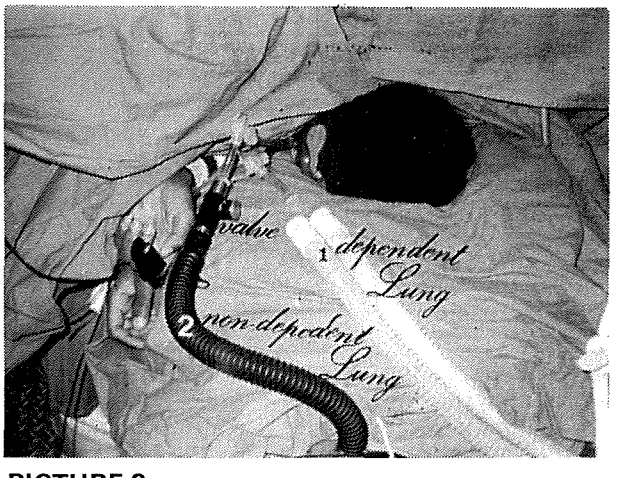
PICTURE 1

Anaesthetic machine 1, supplies ventilator for the dependent lung with N_2O:O_2 50:50% and Ethrane 0.8% Ventilation 20-25 per minute.
Anaesthetic machine 2, supplies non-dependent lung with Oxygen 100%, with constant pressure 3.99 kPa.



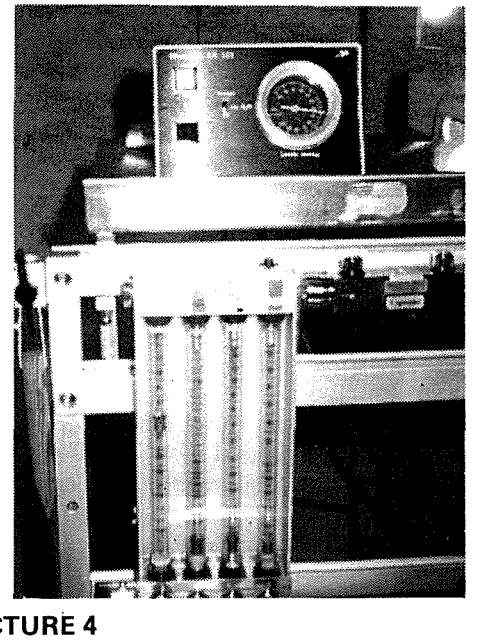
PICTURE 2

Constant pressure in the non-dependent lung 3.99 kPa (30 mm Mercury).



PICTURE 3

Regulation of constant pressure in the non-dependent lung by respiration valve.
1 - Connection for the dependent lung on ventilation.
2 - Connection for the non-dependent lung at the constant pressure of 3.99 kPa regulated by a Heidenbrink valve.



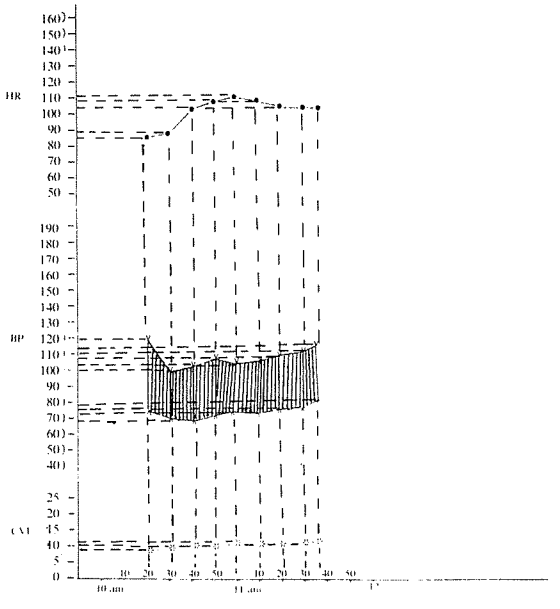
PICTURE 4
Monitoring of constant pressure in the non-dependent lung by an Ohmeda respiration monitor. 40.5 cm H_2O.

TABLE 1

CLASSIFICATION OF PATIENT ACCORDING TO AGES AND SEX			
AGES OF PATIENTS	**MALE**	**FEMALE**	**TOTAL**
15-20	3	0	3
21-25	2	0	2
26-30	6	1	6
31-35	2	1	3
36-40	2	1	3
41-45	1	0	1
TOTAL	15	3	18

FIG 1

MONITORING THE PATIENT DURING SURGERY



Time	pH	pCO_2	pO_2	Tot.CO_2	HCO_3	BXS	Sat.O_2
10:50	7.431	36.3	91.3	22.4	21.3	-0.03	96.2
11:00	7.440	35.0	97.9	24.9	25.3	-0.02	97.9
11:10	7.438	34.2	97.8	24.8	24.0	-0.02	97.4
11:20	7.441	30.4	97.9	22.9	23.1	-0.02	97.8
11:30	7.443	29.8	116.7	20.1	21.0	-0.02	98.0

In cases where there was an airleak from the lung, the distending pressure caused the release of anaesthetic gases into the operative field. This was found not to be a problem, but theoretically could be determental to the surgical staff.

Haemodynamic stability using this technique was observed.

It was also possible to shorten the operative time as the lung could be kept distended until the completion of the procedure.

Less damage was caused to the lung by working on a distended lung kept under constant pressure.

In our hands the use of the technique CONSTANT PRESSURE IN THE NON-DEPENDENT LUNG has resulted in an operation that is easier, with less blood loss, requires less operative time and is safe for the patients.

The constant pressure of 3.99 kPa (30 mm Mercury or 40.5 cm H_2O) in the lung is not as high as during a cough when the pressure rises up to 13.3 kPa (100 mm Mercury or 135 cm H_2O) or more.

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ALLOFERIN

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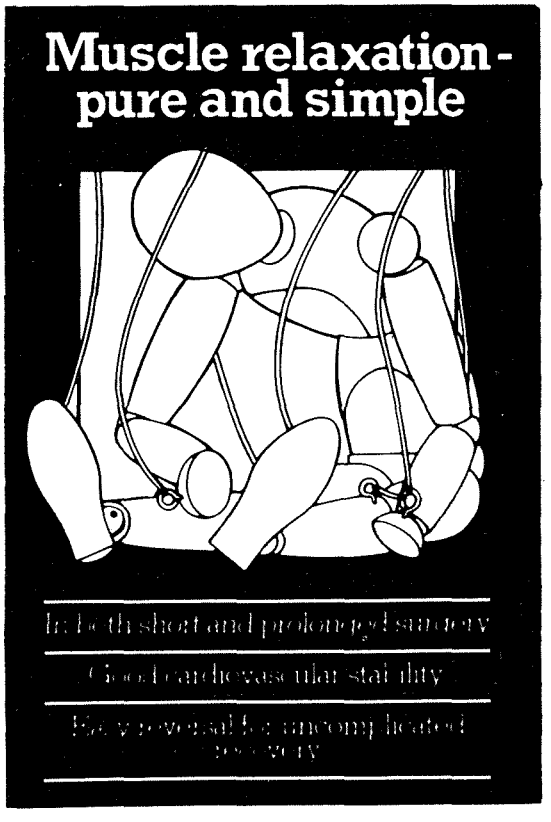

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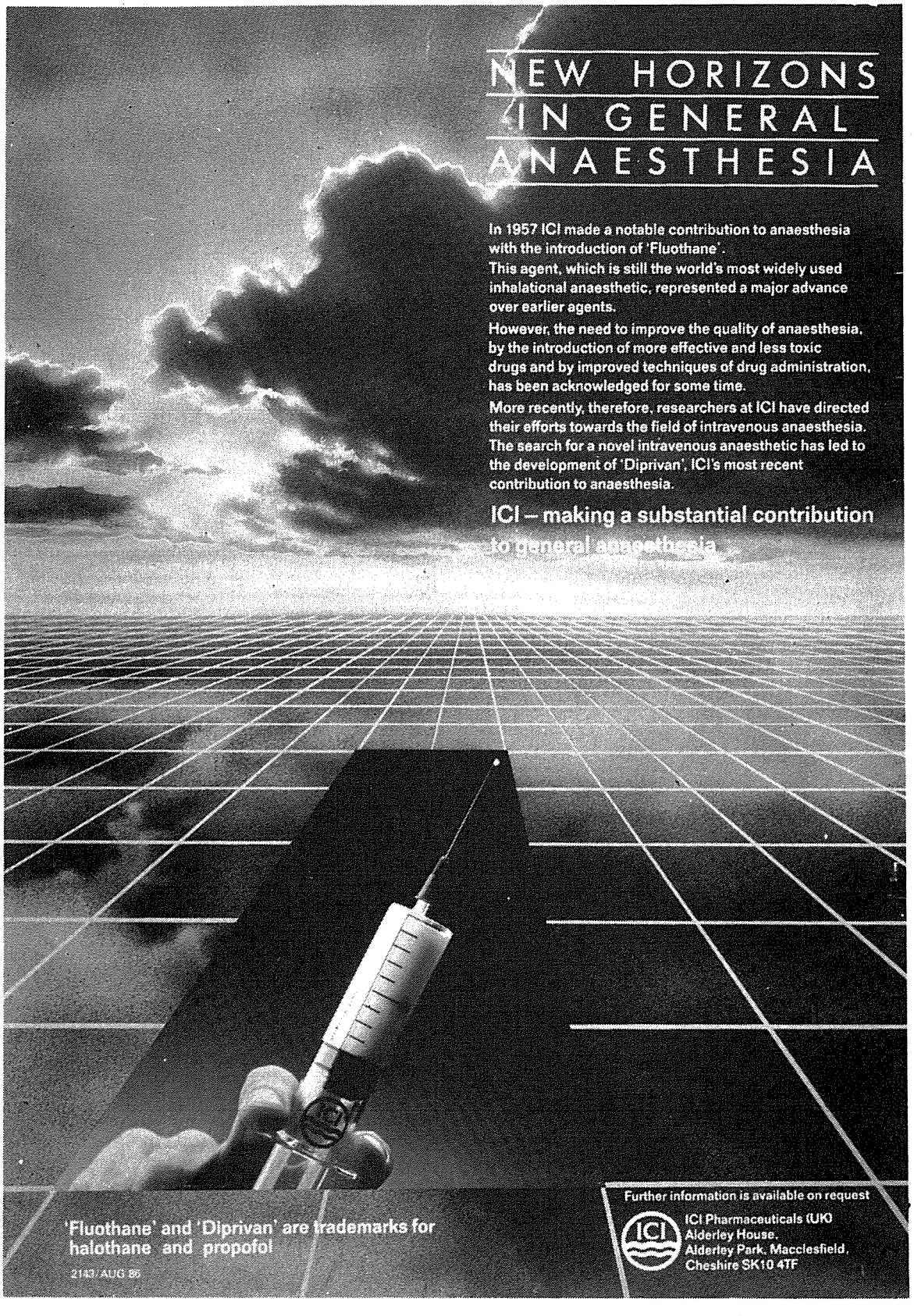

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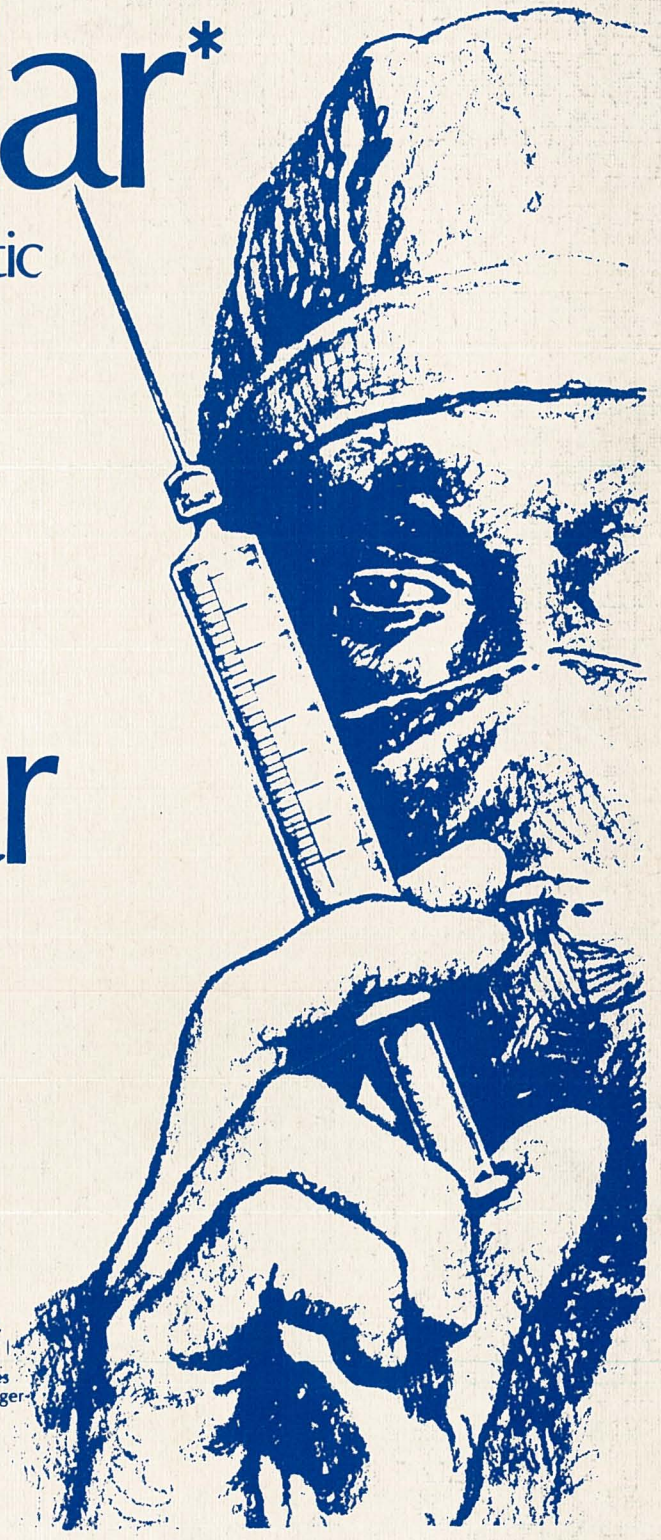

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