Intraspinal Narcotic Anesthesia in Open Heart Surgery

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Intraspinal narcotic anesthesia was performed in 180 open heart surgery patients. 0.1mg/Kg of morphine or 1.5mg/Kg of meperidine was administered as the primary anesthetic in the subarachnoid space using the barbotage technique.

Of the 180 patients scheduled for open heart surgery, morphine was administered to 95 patients, meperidine to 55 and a mixture of morphine and meperidine to 30 patients.

From a clinical point of view, there were no significant cardiovascular problems, however, respiratory depression seemed to be most serious after morphine administration. Mild complications such as pruritus (11.1%), voiding difficulty (10.6%), intraoperative awareness (4.4%) and spinal headache were observed, however these were mild, not major clinical problems and were acceptable. Postoperative analgesic effect and respiratory controllability were excellent.

Key Words: Open heart surgery, spinal anesthesia, narcotics, morphine, meperidine.

INTRODUCTION

Morphine anesthesia for open heart surgery had become very popular since Lowenstein et al. reported that 1.5-3.0 mg/Kg of morphine administered intravenously did not alter the hemodynamics of patients without heart disease. However, morphine anesthesia soon appeared to cause significant disadvantages including intraoperative awareness, histamine reaction, marked increase in intraoperative blood pressure and prolonged postoperative respiratory depression.

This study was primarily undertaken to evaluate

the effects if intraspinal morphine (and/or meperidine) anesthesia and to compare them with the problems resulting from intravenous morphine anesthesia (Lowenstein et al., 1969; Hasbrouck, 1970; Editorial views, 1971; Arens et al., 1972). Behar et al. (1981) reported that intraspinal administration of morphine can induce pain control for as long as 6 to 24 hours. Causins et al. (1979) asserted that the intrathecal route is more effective in producing a higher C.S.F. (Cerebrospinal fluid) morphine concentration than the intravenous route. It has long been thought that the action mechanism of the drug works at the opiate receptors located mainly on the posterior column of the spinal cord. Opiate receptors have been found in the brain of rats by Goldstein et al. (1971). The action mechanism of morphine was more clearly stated by Hughes et al., (1975), who identified morphinomimetics corresponding to these receptors. Thereafter rapid developments in the understanding

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of endorphines enabled clinicians to establish a new concept for pain control. Since 1974 opiate receptors have been found in the spinal cord of vertebrates including human beings by Synder et al. About ten years ago, it was found that intrathecal opioids can produce a strong analgesic effect (Yaksh and Rudy, 1977). Thereafter in 1977, Behar et al. reported the possibility of chronic pain control with a small amount of intraspinal morphine. Meanwhile in 1985 meperidine was practiced as the sole agent for spinal anesthesia (Famewo and Naguib, 1985; Achalovschi et al., 1986). Recently a study to evaluate the effects of meperidine spinal anesthesia on hemodynamics, plasma catecholamine, angiotension I, aldosterone and histamine concentration in eight elderly male patients who underwent transurethral resection of the prostate gland was conducted (Cozian et al., 1986).

In this study intraspinal narcotic anesthesia was attempted using the above information which was obtained from intraspinal narcotic injections and the physiology of total spinal anesthesia (Jeon, 1983). Of the 180 patients scheduled for open heart surgery, morphine was administered to 95 patients (Group 1), meperidine to 55 patients (Group 2) and a mixture of morphine and meperidine to 30 patients (Group 3). A mixture of morphine and meperidine was used to obtain the advantages of rapid onset from meperidine and long duration from morphine.

METHOD

Open heart surgery patients, who were suitable for spinal anesthesia were randomly selected and were premedicated with 0.1 mg/Kg of morphine and 0.05mg/Kg of lorazepam. Spinal tapping using a Whitacre pencil point needle 22 gauge was performed in a sitting position at a level between L2 and L4, and barbotage was repeated three times. 0.1mg/Kg of preservative free morphine or 1.5mg/Kg of preservative free meperidine was administered. After completion of the spinal tap in a sitting position the patient was returned to a supine position and an E.K.G. monitoring device and a sphygmomanometer were put in place. Anesthesia was induced by the intravenous administration of sodium thiopental 5mg/Kg and 1 mg/Kg of succinylcholine, followed by endotracheal intubation. Then pancuronium 0.1 mg/Kg was injected for muscle relaxation, and lorazepam 4-8mg (for adults only) was administered intravenously for the purpose of eliminating intraoperative awareness. Thereafter controlled ventilation was maintained with pure oxygen throughout the opera-

tion and postoperatively as well.

Supraclavicular subclavian venipuncture with a 5 cm angiocatheter needle was carried out for central venous pressure monitoring, and an arterial line for mean arterial pressure monitoring was obtained from the radial or femoral artery. A Foley catheter and a rectal thermometer were inserted.

The endotracheal tube was kept in place after surgery and the patient was connected to the MA-1 Bennett respirator for controlled ventilation. Weaning from the ventilator was usually attempted when the patient attained full self respiration without the help of naloxone hydrochloride. A Foley catheter remained in place for 24 to 48 hours to estimate the urine output, and in case of voiding difficulty after removal of the catheter, the patient was catheterized with a Nelaton catheter. Postoperative rounds were made on the first postoperative day and problems relating to anesthesia were checked.

RESULTS

To eliminate intraoperative awareness, lorazepam 0.1mg/Kg or diazepam 0.4mg/Kg was used with lorazepam being preferred. Surgical data is summarized in Table 1.

Cardiovascular dynamics remained stable throughout the intraoperative, recovery and intensive care periods except for the moment of skin incision (Table 2).

Respiratory depression seemed to be most serious between 10 to 14 hours after the intraspinal administration of morphine, and artificial ventilation was continued postoperatively. The mean action of meperidine lasted 3 to 4 hours, and no respiratory problems were observed 4 hours after meperidine administration (Table 3).

Artificial ventilation was required in Group 1 for 19.2 ± 3.2 hours, in Group 2 for 6.1 ± 1.6 hours and in Group 3 for 16.5 ± 3.4 hours.

Respiratory care in the intensive care unit was very effective without any further medication for the synchronization of patient and ventilator because of the prolonged respiratory depression experienced in Groups 1 and 3.

Complications such as respiratory depression, pruritus and urinary retention (in our cases no severe urinary retention could be found, but mild voiding difficulty was observed in some patients) were not problems for the open heart surgery patients (Table 4).

Table 1. Surgical data

Type of Surgery	Group 1 (Mor.)	Group 2 (Mep.)	Group 3 (Mor.+Mep.)
MVR	50	1	12
AVR	20	2	13
Total correction of TOF	3	1	3
ASD Closure	11	21	1
VSD Closure	7	27	1
Removal of myxoma	1	0	0
Ventricular myotomy	1	0	0
Other	2	3	0
Total	95	55	30

Mor: Morphine, Mep: Meperidine, MVR: Mitral valve replacement, AVR: Aortic valve replacement, TOF: Tetralogy of Fallot, ASD: Atrial septal defect, VSD: Ventricular septal defect

Table 2. Changes in blood pressure and heart rate during skin incision

	Group 1 (n=95)	Group 2 (n=55)	Group 3 (n=30)
MAP (mmHg): Xi-Xsp	+25	- 9	+3
Heart rate (bpm): Yi-Ysp	+11	-10	+2

bpm: beats per minute, MAP: mean arterial pressure, Xi: mean value of MAP during the skin incision in each Group, Xsp: mean value of MAP after spinal tapping in each Group, Yi: mean value of heart rate during the skin incision of each Group, Ysp: mean value of rate after spinal tapping in each Group, +: increase, -: decrease

Table 3. Duration of anesthesia, pump and artificial ventilation

	Group 1 (n=95)	Group 2 (n=55)	Group 3 (n=30)
Anesthesia (hours)	5.64±0.85	4.27±0.51	5.31±0.65
Pump (minutes)	86.5±21.7	49.2±18.3	75.6±10.1
Artificial ventilation (hours)	17.3± 3.2	6.1± 3.6	16.5± 3.4

Values: mean±SD, Artificial ventilation: including anesthesia time , Pump: extracorporeal circulation

Table 4. Complications

Pruritus	9 (9.5%)	5 (9.1%)	6 (20%)	20 (11.1%)
Voiding difficulty	10 (10.5%)	4 (7.3%)	5 (16.7%)	19 (10.6%)
Myalgia	0	0	0	0
Intraoperative awareness	4 (4.2%)	2 (3.6%)	2 (6.7%)	8 (4.4%)
Vomiting	3 (3.2%)	2 (3.6%)	1 (3.3%)	6 (3.3%)

Table 5. Drugs

Drug	Dose & Route of administration
Main anesthetics	
preservative free morphine	0.1mg/Kg, intrathecal
preservative meperidine	1.5mg/Kg, intrathecal
Adjuvants	
diazepam	10 to 20mg for adult, intravenous
lorazepam	4-8mg for adult, intravenous
Premedicants	
morphine	0.1mg/Kg, intramural
lorazepam	3-5mg for adult, intramural
glycopyrrolate	0.005mg/Kg, intramural
Induction agents	
sodium thiopental	5mg/Kg, intravenous
succinylcholine	1mg/Kg, intravenous
Muscle relaxant	
pancuronium	0.1mg/Kg, intravenous
Gas	pure oxygen

DISCUSSION

In Group 1 the majority of cases were valvular surgery where a longer operating time is needed, and so, morphine, which has a longer action time, was used. on the contrary septal defect surgeries were primarily selected for Group 2 because the surgical procedure is simpler. Consequently meperidine which has a shorter action time was used.

It is quite interesting to note that although morphine has a long action time, the onset of action is rather slow which may be due to the low lipid solubility of the drug. Meperidine is known to have a more rapid onset of action due to its higher lipid solubility. Taking these factors into consideration, a mixture of morphine and meperidine was used in Group 3. This technique could be very useful in clinical practice particularly for open heart surgery where a lengthy operating time is anticipated. Cardiovascular dynamics appeared to be stable throughout the intra-operative, recovery and intensive care unit periods except for the moment of skin incision as shown on Table 2. A slight in both blood pressure and heart rate during the skin incision was noted when morphine was used. This phenomenon may be due to pain stress while the effect of anesthesia is not deep enough due to the slow onset of morphine's effect.

The rapid onset and long duration effects of the mixture of morphine and meperidine may explain why the blood pressure and heart rate did not rise in Group 3.

Decreased peripheral resistance resulting from a sympathetic blockade by morphine itself and the histamine released by morphine and meperidine cause the blood pressure to decrease at the time of skin incision in Group 3. Accordingly hemodynamic stability may be a merit of intraspinal narcotic anesthesia. The onset of the intraspinal analgesic effect of morphine is 1.3 hours and that of meperidine is 0.4 hours (Allen, 1984). It usually takes about 40 to 50 minutes to prepare a patient for the skin incision and so, the slow onset of morphine's effect as shown in Group 3 was not a real problem.

Some reports suggest that the analgesic effect of intraspinal morphine may be due to a similar as shown in intraspinal regional anesthesia (Bromage et al., 1963; Urban, 1973). But thereafter, intraspinal morphine was thought to bypass the blood brain barrier and act directly on the neuraxis. It is well known that intraspinal morphine produces regional anesthesia in a segmental-block fashion, and accordingly it exerts its most potent action on those segments nearest to where it was administered. Therefore in this study morphine was administered by the barbotage technique and it was expected to reach the brain at the time of administration.

The most serious complication of intraspinal morphine anesthesia is respiratory depression or arrest. Although respiratory depression is a life threatening complication, it is beneficial to postoperative respiratory care in cases of open heart surgery. Especially in cases of valvular replacement surgery in which the extracorporeal circulation time exceeds more than one hour, postoperative respiratory care with a respirator is easier in the state of respiratory arrest. Intraspinal morphine anesthesia requires longer postoperative artificial ventilation as shown on Table 3.

In respiratory care there are problems only in the case of early weaning. In this study, early weaning with the help of naloxone hydrochloride was quite a dangerous approach because of the possibility of respiratory arrest due to the short action duration of the antinarcotics. It is better to wait until the patient has recovered from the narcotics and has attained full self respiration. After identifying these possibilities, the endotracheal tube can be removed. Intraspinal narcotic anesthesia has many benefits in post-operative pain control. In the majority of cases, absolutely no pain killer was used. Postoperative

somnolence is sometimes misunderstood as an unexpected side effect but it is of no problem when the clinician understands exact process. Patients merely felt pruritus when they were asked about it, otherwise, pruritus evoked no discomfort. Voiding difficulty was not a serious problem but it could be completely solved by Nelaton catheterization once or twice with no complaints.

No one complained of intraoperative awareness, and almost all of the patients were comfortable during the surgery and recovery periods.

Considering all of the advantages mentioned above, intraspinal narcotic anesthesia may be an appropriate anesthetic method with clinical application in open heart surgery.

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