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An Anesthetic Technique Utilizing Innovar, Fentanyl, and Methohexital Sodium for Outpatient Oral Surgery

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AN ANESTHETIC TECHNIQUE UTILIZING INNOVAR, FENTANYL, AND METHOHEXITAL SODIUM FOR OUTPATIENT ORAL SURGERY

by

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of the Requirements for the Degree

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I certify that I have read this thesis and recommend that it be accepted as fulfilling this part of the requirement for the degree of Master of Science.

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NOTICE

The following manuscript was prepared as a partial fulfillment of the requirements for a graduate degree from Loma Linda University Graduate School under the discipline of the School of Dentistry.

While the format in general is governed by the criteria of a conventional Graduate School Thesis, it is in actuality a manuscript which readily is amenable for publication in a scientific journal.

AN ANESTHETIC TECHNIQUE UTILIZING INNOVAR, FENTANYL, AND METHOHEXITAL SODIUM FOR OUTPATIENT ORAL SURGERY

This paper presents a technique in which Innovar, properly used, is shown to be safe for oral surgery outpatients treated in the private office on a routine basis, with rapid postoperative recovery time.

INTRODUCTION

Neuroleptanalgesia is a state of surgical preparedness characterized by profound analgesia and a psychic detachment which leaves the patient awake but indifferent to his surroundings. This state is produced by the administration of the combination of a potent narcotic analgesic and a neuroleptic agent (major tranquilizer) such as Innovar (Berenyi, 1966).

Under neuroleptanalgesia, the patient is not only free from pain and apprehension, but is protected from overreaction to the trauma of the procedure by psychic indifference--his potentially damaging autonomic responses are reduced (Fox, 1966). Also alpha-adrenergic blockade by the neuroleptic agent helps prevent excessive peripheral vascular constriction and so helps maintain adequate tissue perfusion. With Innovar, remarkable cardiovascular stability has been claimed (Dobkin, 1964) and the problem of respiratory depression has been reduced. The antiemetic properties of the neuroleptic agent help protect the patient from nausea and vomiting during and after the operation (Aubry, 1966;

Shephard, 1965). Generally, analgesia extends well into the postoperative period following neuroleptanalgesia (Walker, 1965).

Since their introduction droperidol (Inapsine), a butyrophenone tranquilizer, and fentanyl (Sublimaze), a potent narcotic analgesic, have become popular agents for neuroleptanalgesia (Trahais, 1967).

In a fixed ratio by weight of 50:1 of droperidol to fentanyl, Innovar is claimed to be a particularly useful agent for surgeries involving geriatric patients (Aubry, 1966), poor-risk patients (Keeri-Szanto, 1963) and those with multiple injuries (Spoeril, 1967). Because of its minimal effects on cardiovascular stability it has been found useful for patients with existing or anticipated hemodynamic difficulties (Aubry, 1966; Carigran, 1964).

There have been numerous papers and scientific presentations concerning the use of Innovar for oral surgery procedures, but generally it has been used as part of a balanced anesthesia technique which, for obvious reasons, is administered only in a hospital operating suite.

Newell (1969) presented cases in which an Innovar drip was administered and the respirations were continuously supported by doxapram hydrochloride (Dopram). Kushner (1969) dosed patients on a basis of 1 cc/20 lb of body weight. Two-thirds of this dose was given as a single bolus intravenously and the remaining one-third held in reserve and used only if needed after a minimum of five minutes. It is very interesting that even with this large dose, only three of the fifty patients developed narcotic induced "board chest"--which may decrease pulmonary compliance seriously.

Nyberg (1970) premedicated his patients with 1.5-2.0 cc of Innovar (determined by body weight) and atropine sulfate 0.3-0.4 mg

intramuscularly 45 minutes before surgery. Then on the operating table each patient received 1.00 cc of Innovar/20 lb of body weight. One-fourth the induction dose was given intravenously over 5-10 seconds and the remainder given intravenously over 30-60 seconds if after two minutes the patient showed no untoward reactions from the initial dose and the vital signs remained stable.

Small (1970) states that Innovar is "an outstandingly effective combination." However he feels that its use in outpatient dentistry is severely limited by the side effect of chest wall muscular rigidity which can result in hypoxia.

Robert Watson (1970) outlined an excellent technique for outpatients. For neuroleptic analgesia he gave 0.75-1.00 cc Innovar/40 lb of body weight intravenously, local anesthesia and 100 percent O_2 by nasal mask. For neuroleptic anesthesia he used 0.5 cc Innovar/40 lb of body weight intravenously, administered 100 percent O_2 and two minutes later gave intermittent 50 mg doses of methohexital sodium (Brevital) until the lid reflex was lost. At this point, depending upon the type of surgery to be done, either a nasal airway or an endotracheal tube was used.

In both techniques high flows of N_2O (10 ℓ/min) and O_2 (4 ℓ/min) were used. In both techniques, when the surgery was completed the patients were given levallorphan (Lorfan) for narcotic reversal and doxapram hydrochloride to increase rate and depth of respiration and to decrease CNS depression. All patients were able to move from the dental chair in ten minutes and were discharged within one hour.

These techniques, while excellent, do not lend themselves to routine use in the private office. This is especially true in light of

the possible anesthetic problems and the advice of Nyberg (1970) that "Innovar should probably be used only in the hospital where equipment and facilities are available for any postoperative complications, such as respiratory depression, muscle rigidity, and prolonged postoperative sedation . . ."

It was the purpose of this study to develop a technique which would combine the desirable qualities of a neuroleptanalgesic such as Innovar with the requirements of an outpatient oral surgical premedication for safety, rapidity of onset, effectiveness of action, ease of controlling duration, and rapid recovery of the patient postoperatively.

METHODS AND MATERIALS

All patients making appointments with the oral surgery clinic after August 1, 1970, were asked if they wished to be asleep for any extractions. Those who desired this were told to come NPO for 6 hours and to bring a responsible adult to whom we could discharge the patient following surgery. All patients filled out the personal health questionnaire and were asked about areas of concern by the oral surgery resident. A heart and lung evaluation was performed and the blood pressure and pulse rate taken. The patient's physician was consulted in several cases before the procedure was performed. The only patients refused were those whose physical and health status indicated that extractions with or without any type of premedication were contraindicated on an outpatient basis.

Appropriate resuscitative equipment was available. A bag-mask resuscitator connected to an O_2 tank was in each operatory for artificial respiration if needed. A quantiflex anesthesia machine with a

closed circle system was available in the surgical area for use if an emergency arose. In the mobile anesthetic cabinet were endotracheal tubes, airways, a laryngoscope and various emergency and resuscitative drugs.

The contour dental chair was placed in a "cradled" position with the patient's legs slightly lower than his heart. The premedication consisted of Innovar 1.50 cc/150 lb of body weight and atropine 0.4 mg (0.3 mg for ages 7-9 years). For short procedures (less than 30 minutes), fentanyl 1 cc/150 lb of body weight was administered immediately after the Innovar in 15-30 seconds in a D5W drip by means of a 19 or 21 gauge scalp vein needle (Butterfly) in the forearm or hand. For long cases, morphine sulfate 5 mg/150 lb of body weight was used instead of fentanyl, with an additional 5 mg/150 lb of body weight given in three minutes if the vital signs remained stable.

After three minutes the patient's level of sedation was measured by the observer's scale of (1) hysterical, (2) panicky, (3) apprehensive, (4) alert, (5) tranquil, (6) drowsy, and (7) asleep (Elliott, et al., 1969). Those patients who did not fall into the tranquil or drowsy category were given repeated doses of fentanyl 1 cc/150 lb body weight at one minute intervals until they became tranquil or drowsy. Then methohexital sodium 2 cc (10 mg/cc)/150 lb of body weight was administered and a bite block placed in the patient's mouth. Additional 20 mg doses of methohexital sodium were given at 30 second intervals until the patient displayed a minimal to absent lid reflex, delayed response to voice commands, and had intercostal breathing equal to or slightly less than abdominal breathing. When this level was reached, local anesthesia was produced with 2 percent mepivacaine (Carbocaine)

containing 1:20000 levonordefrin (Neo-Cobefrin), a throat pack was placed, and the surgical procedure begun. All patients breathed room air. Additional doses of fentanyl 1 cc/150 lb of body weight or methohexital sodium 20 mg/150 lb of body weight were given as necessary during surgery to maintain the desired level of CNS depression. At the completion of surgery, pressure packs were placed over the extraction sites and the throat pack was removed. The contour chair was moved to the upright position and the patient was observed until he indicated he could walk with assistance. The scalp vein needle was then discontinued if the blood pressure and pulse were within normal limits and the patient was dismissed in the care of a responsible adult.

A test series of ten volunteer prisoner patients who had a past history of drug abuse but had taken no drugs for 24 hrs prior to the procedure was used to monitor the effect of the various drugs on blood gases and, thus, on ventilation. After local infiltration with 3 percent mepivacaine an indwelling 21 gauge scalp vein needle (Butterfly INT) was placed in the radial artery at or just above the wrist. (An informed signed consent was obtained for this procedure from each of the ten volunteers.) The INT tubing was filled with sterile D5W to prevent clotting blood from plugging the needle. The D5W was aspirated from the line before each blood sample was drawn and fresh D5W was used to clear the line until time for the next sample. The samples were taken before drug administration, at the point of deepest sedation (midpoint of the surgery), and postoperatively when the patient indicated he was able to walk. PaO_2, $PaCO_2$ and pH values were determined immediately after drawing the specimens using a Radiograph Copenhagen blood gas analyzer. All ten patients breathed room air. All ten patients had

lead two electrocardiogram tracings taken preoperatively and periodically during the procedure. Tidal volumes were measured at the end of the surgical portion of the procedure using a full face mask and a Wright respirometer in the closed circle system of a Quantiflex anesthesia machine.

RESULTS

Patients participating in the study ranged from 7-100 years of age. The series included several pregnant women and several men who had experienced myocardial infarcts as recently as seven weeks prior to the procedure. Of 800 cases in the study, complete data were recorded for 100 patients who constituted the "series profile"--patients #451-550. The total number of patients providing data for a particular parameter is indicated in each table. The age range and sex of the patients are presented in Table I.

Table I

Patient Characteristics

No. of Patients	Sex		No. of Patients	Age	
	Male	Female		Mean	Range
122	80	42	122	30	7-100
No. of Patients	**Weight**		**No. of Patients**	**Height**	
	Mean	Range		Mean	Range
111	145	54-250	109	67	53-76

Before receiving the premedication all 112 patients evaluated for affect were alert or apprehensive. After the initial dose the effect of the premedication was rated on these patients, and these

ratings are presented in Table II.

Table II

Effect of Premedication

No. of Patients	Level of Sedation			
	Tranquil	Drowsy	Asleep	Alert
112	87	21	0	4

Note that 96 percent of the patients rated were satisfactorily premedicated at the desired levels of tranquil or drowsy, 0 percent of the patients were overdosed or asleep and only 4 percent were still alert. These 4 percent were all alcoholics or hard narcotic addicts and required considerably higher doses to induce tranquility. Table III indicates the total doses used for the given patient population for procedures which consisted of from one to thirty extractions, one to four impactions, tori removal or closed reduction of a fractured mandible.

Although several patients received more than 2.0 cc of Innovar during their procedure, only two patients received more than 2.5 cc of Innovar as an initial dose. Both of these patients received 3.0 cc (3.0 cc/150 lb of body weight). One patient showed depressed respirations but tolerated the dosage, and had a prolonged recovery time. The other patient would breathe only when subjected to painful stimuli. One patient received 4.0 cc over a three-hour period of time. This adult male also required 8 cc of fentanyl and 40 cc of methohexital sodium for a closed reduction of a fractured mandible and one endodontic procedure.

The preoperative and postoperative vital signs were recorded for 100 patients. These data are summarized in Table IV.

Table III

Procedure Dose (Innovar)

No. of Pts.	Mean Dose	Number of Patients Who Received This Dose (cc)								
		0.5	1.0	1.25	1.5	1.75	2.0	2.5	3.0	4.0
567	1.56 cc	8	70	1	354	1	122	7	3	1

Procedure Dose (fentanyl)

No. of Pts.	Mean Dose	Number of Patients Who Received This Dose (cc)								
		0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	>5.0*
499	1.75 cc	22	194	76	121	17	36	5	14	14

*Two patients received a maximum dose of 9.0 cc

Procedure Dose (methohexital sodium 10 mg/cc)

No. of Pts.	Mean Dose	Number of Patients Who Received This Dose (cc)											
		1	2	2.5	3	4	5	6	7	8	9	10	11	12
533	10.52	4	8	1	15	25	58	50	43	39	31	56	14	54

(Continued) Number of Patients Who Received This Dose (cc)													
13	14	15	16	17	18	19	20	21	22	23	24	25	>26*
9	18	17	8	7	17	4	24	1	5	1	4	3	17

*Two patients received a maximum dose of 40 cc

Table IV

Vital Signs (Means) of 100 Patients

Vital Signs	Systolic B.P.	Diastolic B.P.	Pulse Rate
Preoperative	124 ± 1.86	68.4 ± 0.97	77.8 ± 1.38
Postoperative	121 ± 1.81	67.7 ± 0.91	78.5 ± 0.84

Even though several patients did have a blood pressure elevation or drop of twenty mm Hg, only three patients experienced postoperative orthostatic hypotension. One fainted upon standing, and the other two had a blood pressure drop upon sitting upright in the chair.

The ten patients who were used to monitor the effect of the drugs on blood gases all exhibited a PaO_2 of 60 mm Hg or above at the point of deepest sedation which was also the midpoint of the surgical procedure. Table V contains a summary of these data for the ten patients.

The values for arterial blood gases drawn at the deepest level of sedation are presented in Figure 1. Review of these data indicates that the PaO_2 values are subnormal, but the values for the $PaCO_2$ are only slightly increased. Additionally electrocardiograms from all patients were within normal limits. The 40-year-old patient had one premature ventricular contraction on the midpoint tracing which was not considered significant.

The tidal volumes measured at the end of the surgical portion of the procedure are given in Table VI. The side effects and anesthetic complications of this technique are tabulated in Table VII.

Table V

Blood Gas Values of Ten Patients

Patient Number	Age	Time of Sample		
		Before Drug Administration	Procedure Midpoint	Patient Ambulatory
		Arterial PO_2		
1	32	78	66	77
2	21	105	84	92
3	23	102	60	88
4	25	80	66	100
5	24	94	65	92
6	19	90	74	93
7	40	100	84	98
8	27	80	76	78
9	26	74	60	86
10	25	70	60	83
Mean		87.3 ± 4.74	69.5 ± 5.17	88.7 ± 7.72
		Arterial PCO_2		
1		27	36	35
2		36	36	41
3		26	30	37
4		38	45	42
5		30	36	30
6		30	34	34
7		30	33	31
8		36	38	39
9		35	40	39
10		34	36	32
Mean		32.2 ± 1.24	36.4 ± 1.20	36.0 ± 1.24
		Arterial pH		
1		7.52	7.47	7.48
2		7.36	7.34	7.33
3		7.45	7.38	7.38
4		7.36	7.35	7.35
5		7.52	7.51	7.52
6		7.46	7.45	7.46
7		7.36	7.36	7.39
8		7.44	7.42	7.47
9		7.50	7.42	7.47
10		7.42	7.42	7.42
Mean		7.44 ± 0.021	7.44 ± 0.016	7.43 ± 0.036

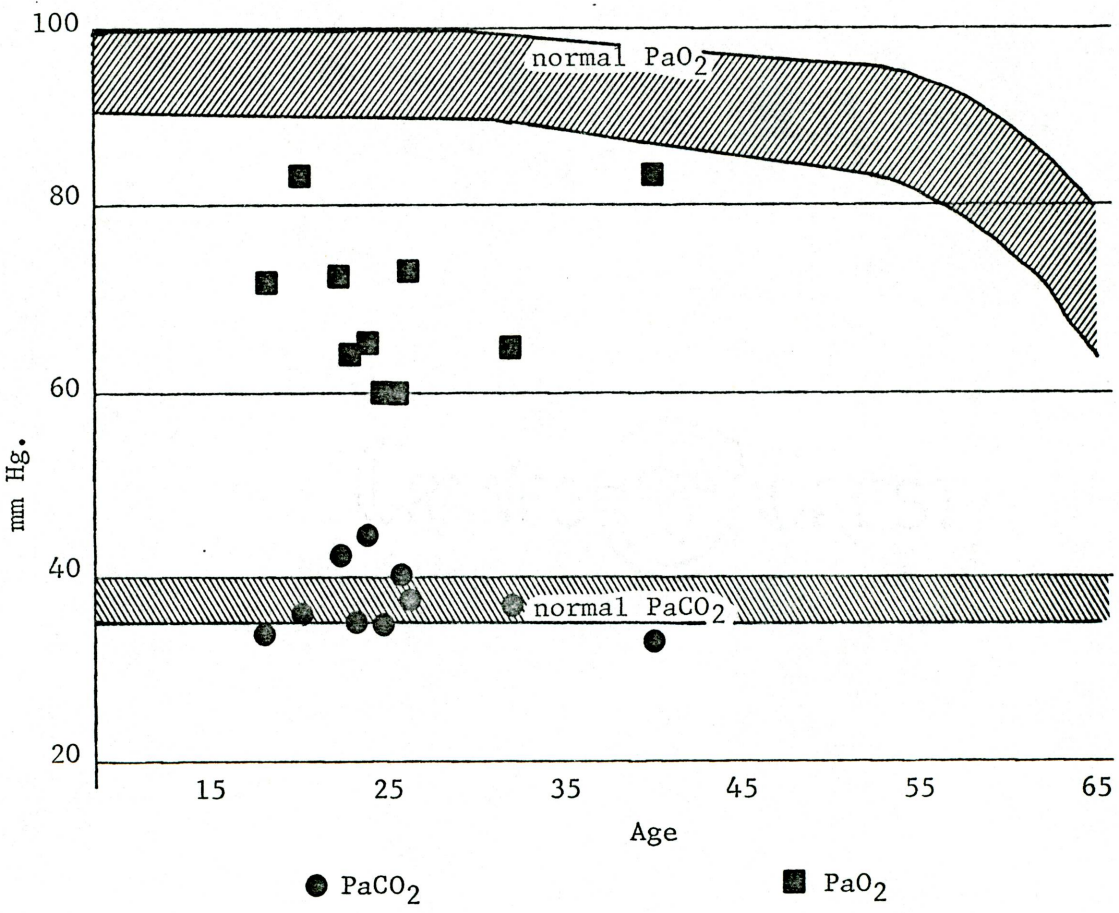

Figure 1. Values for arterial blood gases drawn at procedure midpoint.

Table VI

Tidal Volumes of Ten Patients

Patient Number	Tidal Volume (cc) at End of Surgical Portion of Procedure
1	515
2	335
3	380
4	350
5	360
6	250
7	332
8	375
9	390
10	369
Mean	387 $\pm$ 28.35

Table VII

Anesthetic Complications and Side Effects of 800 Patients

Complication	Number of Patients
Emesis intra or postoperative	0
Nausea intra or postoperative	6
Laryngospasm	0
"Board chest"--muscular rigidity	0
Depressed respiration requiring levallorphan or doxapram	6
Postoperative hypotension	3
Postoperative nervousness (usually on first postoperative day)	5

DISCUSSION

As noted the age, weight and height, and physical condition of the patients varied greatly. The youngest patient in the series was a seven-year-old Caucasian male asthmatic who required a daily dose of steroid. He was treated for a fractured mandible (closed reduction) on an outpatient basis. The oldest patient, a 100-year-old Mexican-American male, had his six maxillary anterior teeth extracted and an immediate maxillary denture inserted. The pregnant women and the poor-risk patients were treated for nonelective problems only.

The procedures also varied in duration from five minutes for a simple extraction to a 4½ hour case on a 22-year-old Caucasian female. She was sedated for a restorative procedure during which the general dentist prepared seven teeth in two quadrants for gold crowns, took impressions, and seated temporaries.

The total amount of medication used seemed to depend on a combination of the patient's physical status, drug history, and the complexity of the surgical procedure. Debilitated patients, patients with minimal alcohol, "pills" and/or caffeine intake, or patients requiring simple extractions received less medication during a procedure than those who were robust and athletic, had a history of drug intake, and/or required a long surgical procedure.

All the "series profile" patients were alert or apprehensive during the dental examination. The effect of the premedication was adequate on all but those who were drug abusers. These and several others in the general study group who were agitated or hysterical during the examination required larger premedication doses. However, each

patient who received 2.5 or 3.0 cc of Innovar in the premedication dose had a prolonged recovery time while almost all of those who received 2.0 cc or less became ambulatory within ten minutes.

Morphine was used in the premedication of longer cases as a matter of convenience as it lasts 1½-2½ hours following intravenous administration and provides profound analgesia with some sedation. Fentanyl administered intravenously gives profound analgesia for only 10-20 minutes. Increments of fentanyl given to a patient who had received morphine provided any additional analgesia required during times of increased painful stimuli, such as the manipulation of a fractured mandible. As fentanyl and methohexital sodium each potentiate the CNS depressant effect of the other, the knowledge of which one to give was obtained mainly by trial and error in observing patient response to each dose. Additional fentanyl was given when a painful stimulus elicited a response. The methohexital sodium was used to maintain a light sleep.

Several patients who had been skin tested and found to be allergic to all local anesthetics were treated by this technique without receiving any mepivacaine. They did require additional fentanyl. Poor-risk cases such as patients with recent myocardial infarcts and aged individuals received methohexital sodium only during the injection of the local anesthetic solution and were awake but sedated for the remainder of the procedure. In several long, poor-risk cases the elimination of methohexital sodium and the reduction of amount of the narcotic doses along with good local anesthesia and premedication with Innovar produced patients who were lightly premedicated yet comfortable and cooperative. No nitrous oxide was used on any patient as adequate analgesia and

sedation were obtained without it.

Atropine (0.4 mg) was given routinely to prevent bradycardia and to dry salivary and bronchial secretions. This dose did not adversely affect patients with asthma or glaucoma, nor did it produce a pulse rate above 120 even in those patients presenting with a rapid pulse.

A review of Table IV indicates that the change in the means of the vital signs was negligible when comparing the postoperative values to the preoperative values. No vital signs were recorded during the surgical portion of the procedures, but the pulse was intermittently palpated on each patient. It remained strong in all except three patients, with no irregularities noted at any time. Eight patients had a systolic pressure drop of twenty mm Hg and three patients had a systolic pressure elevation of twenty mm Hg. The three patients who experienced orthostatic hypotension were successfully treated with ephedrine, 15 mg intravenously and 15 mg intramuscularly.

The blood gas studies show that even though the preoperative and postoperative PaO_2 values were satisfactory, some depression of oxygenation occurred at the point of deepest sedation with patients breathing room air. These midpoint results are in the same range as the PaO_2 values given for patients thirty minutes postoperatively by Nyberg (1970). Since these PaO_2 values are below normal, it is conceivable that hypoxia could develop rapidly if there was a delay in achieving alveolar ventilation in a patient with respiratory distress. We recommend that all patients sedated with this technique receive 100 percent O_2 by nasal mask. One patient with a midpoint room air PaO_2 of 60 mm Hg had a PaO_2 increase to 118 mm Hg after breathing 100 percent

nasal O_2 (4 ℓ/min) for two minutes. The minimally elevated $PaCO_2$ values are more favorable than the $PaCO_2$ values taken 30 minutes post-operatively by Nyberg (1970) for his series.

The tidal volumes obtained at the completion of the surgical portion of the procedure were 25 percent below the 500 cc tidal volume of a normal young adult and may have been lower at the point of deepest sedation. This is a factor in the low PaO_2 midpoint values with patients breathing room air. Administration of 100 percent nasal O_2 should minimize the effect of depressed respirations.

No patients developed muscular rigidity at any time. It would appear that this complication is unlikely at this dose level.

In the early part of the study four patients experienced respiratory depression after administration of 10-20 mg of alphaprodine hydrochloride (Nisentil) as the narcotic in the premedication. The combination of alphaprodine with Innovar and methohexital sodium proved to have a potent respiratory depressant effect and is no longer used with this technique. The other two cases of respiratory depression occurred when fentanyl was given too soon after the second 5 mg of morphine and followed rapidly by 20 mg of methohexital sodium. No serious respiratory depressions have occurred in this series of 800 cases with fentanyl as the only narcotic, although if too much is given or if it is given too rapidly it can produce respiratory depression.

All six patients who had respiratory depression were successfully treated with 1 mg levallorphan intravenously and artificial respiration with a bag-mask resuscitator until they recovered adequate tidal volumes, usually within 30 seconds. With experience it was possible to evaluate the patient who was developing respiratory depression

and to administer the levallorphan before the patient's ventilations became inadequate.

The six patients who developed nausea following administration of Innovar and fentanyl were treated with 0.5 cc to 0.75 cc of droperidol intravenously and experienced relief from their nausea in three to five minutes. No patient vomited either during or after any procedure in the series of 800 cases.

Several patients who did not recover postoperatively at a satisfactory rate were given methylphenidate hydrochloride (Ritalin) 10 mg intravenously and usually an additional 10 mg in 4 minutes. Twenty mg was adequate in each case to decrease CNS depression with the effect that the patient was ambulatory within 5 minutes after the second dose. Methylphenidate must be used with great caution as this CNS stimulant may increase the blood pressure and pulse rate. Patients should not receive methylphenidate unnecessarily nor be dismissed until the vital signs stabilize within acceptable limits.

Doxapram was the drug of choice for patients who remained sedated with minimal tidal volumes. The dosage was 0.5 mg/lb of body weight given intravenously; this was repeated in two minutes if needed to decrease sedation and increase pulmonary ventilation to an acceptable level. In some patients doxapram caused sweating, and some patients also complained of an intense burning sensation in the lungs.

The patients who complained of nervousness usually did so about 4-8 hours postoperatively. This was probably a side effect of the Innovar as their records revealed they had received no methylphenidate or doxapram at the time of surgery. They were treated with oral diazepam (Valium) 5 mg TID for three days with relief in each case.

SUMMARY

The extensive data compiled in a series of 800 cases indicate that the Innovar, fentanyl, methohexital sodium technique is suitable for use on outpatients undergoing extensive oral surgical procedures. Properly administered, this technique allows the patient to be responsive to voice commands. Most patients were unaware of falling asleep or waking up after the procedure. The author has had the privilege of using this technique in a private oral surgery office under private office conditions for one month and considers it to be acceptable to the needs of the oral surgery community. Because of the potency of the drugs and the complications which may develop, these agents should be used only by those individuals who have had adequate training in general anesthesia.

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by

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An Abstract of a Thesis

in Partial Fulfillment of the Requirements

for the Degree Master of Science

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ABSTRACT

A study of 800 patients ranging in age from seven to one hundred years was conducted in the development of an anesthetic technique which combines the desirable qualities of a neuroleptic agent with the requirements of an outpatient oral surgical anesthetic. These requirements included rapidity of onset, effectiveness of action, ease of controlling duration, and rapid postoperative recovery.

Patients who were cleared medically for outpatient procedures were given Innovar 1.5 cc/150 lb of body weight, atropine 0.4 mg, and fentanyl 1.0 cc/150 lb of body weight as an initial dose within 30-45 seconds in a D5W drip by means of a 21 gauge scalp vein needle. On cases lasting over 30 minutes, morphine sulfate 5 mg/150 lb of body weight was given initially instead of the fentanyl and repeated in four minutes.

The patient's level of sedation was measured by an "observer's scale." Doses of fentanyl 1 cc/150 lb of body weight were repeated at one minute intervals until the patient's level of sedation was adequate. Twenty mg doses of methohexital sodium were then administered at 30 second intervals until the patient displayed a minimal lid reflex, delayed response to voice commands, and intercostal breathing approximately equal to abdominal breathing. All patients breathed room air during the procedure and almost all patients received a local anesthetic. The total amount of medications used seemed to depend on a combination of the patient's physical status, drug history, and the

complexity of the surgical procedure.

With this technique 95 percent of the patients became ambulatory within 10 minutes following surgery and could be discharged in the care of a responsible adult.

Ten volunteer prisoner patients were used to monitor the effect of the drugs on blood gas values of the radial artery. All ten patients exhibited a PaO_2 of 60 mm Hg or above at the point of deepest sedation. Electrocardiogram tracings on all ten volunteers were within normal limits. The effect of the anesthetic on the means of their blood pressure and pulse rate was minimal. The mean of their tidal volumes at the end of the surgical procedure was 25 percent below normal values.

A review of the complications in the series of 800 patients includes six patients who experienced depressed respirations requiring treatment with levallorphan or doxapram. Three patients developed postoperative hypotension. No emesis occurred in any patient either during or after the procedure and only six patients experienced nausea. None developed a laryngospasm nor a board chest.

The procedures varied in length from five minutes to 4½ hours. Ninety-six percent of the patients rated preoperatively for affect experienced adequate sedation from the initial premedication. Zero percent were overdosed and the four percent who were inadequately sedated after the initial premedication were all drug abusers.

Because of the subnormal PaO_2 values obtained in the blood gas study it is recommended that all patients receive 100 percent nasal oxygen during the surgical procedure. Because of the potency of the drugs and the complications which may develop, it is also recommended

that these agents should be used only by those individuals who have had adequate training in general anesthesia.