Alfentanil is a new synthetic narcotic that is characterized by a rapid onset of analgesia and brief duration of action. Anesthetic efficacy, cardiovascular stability, onset and duration of action, and side effects associated with alfentanil as an anesthetic adjunct were evaluated in 52 patients undergoing elective postpartum tubal ligation. Alfentanil provided adequate anesthesia in all patients, with rapid emergence and no major side effects.

Alfentanil is a new narcotic, the action of which is characterized by rapid onset and brief duration. In rats, alfentanil has a potency approximately one-quarter that of fentanyl. Other laboratory studies have shown that the onset of analgesic action of alfentanil is four times more rapid than that of fentanyl. In these studies, the duration of action of alfentanil was one-third that of fentanyl. When analgesic doses (1-6 μg/kg) are given, the peak effect measured both subjectively and by respiratory depression lasts less than 2 minutes, while signs of recovery occur within 5-6 minutes after injection.

Alfentanil also "appears unique among opioids in having a small apparent volume of distribution and low clearance." Because of its short duration of action, speed to peak effect, and limited volume of distribution, alfentanil may be of considerable value for short surgical procedures. Many minor abdominal surgical procedures of short duration cause a great study model. Since these surgical procedures require a potent, yet controllable, agent for rapid recovery. Postpartum tubal ligation, a brief yet potentially painful procedure, was used as our study model. Since these surgical procedures require muscle relaxation, movement could not be used as an indication of inadequate depth of anesthesia. Instead, we utilized cardiovascular parameters as evidence of the effectiveness of alfentanil.

Method
Fifty-two women undergoing postpartum tubal ligations lasting 12-56 minutes (average 25 minutes) took part in the study. They ranged in age from 18 to 55 years and all were ASA class 1 or 2. Informed consent was obtained from each patient before entry into the study.

Premedication consisted of 10-15 mg diazepam and 30 ml milk of magnesia given orally 60-90 minutes prior to induction of anesthesia. When the patients arrived in the operating room, an intravenous catheter was placed in a peripheral vein, and electrodes and a blood pressure cuff were attached. Heart rate and blood pressure measures were recorded before surgery and used as control values. Either 3 mg d-Tubocurarine or 1 mg pancuronium was given as a defasciculating agent. Thiotepal (2-3 mg/kg) and 1.5 mg/kg succinylcholine were given intravenously to facilitate in-
tubation. After intubation 50 µg/kg alfentanil was given intravenously over two minutes. A nitrous oxide/oxygen mixture (70%/30%) was used for maintenance of anesthesia. A 0.2% succinylcholine infusion was given to control muscle tone. In all patients, respiration was controlled by a mechanical ventilator.

Additional doses of alfentanil (10 µg/kg) were given if blood pressure or heart rate exceeded control values by 20%. From the beginning of induction until the initiation of surgical stimulus, blood pressure and heart rate were recorded every minute using a Dinamap® automatic vital sign monitor; thereafter, these variables were recorded every five minutes until the completion of anesthesia.

Postoperatively, time required to awaken after termination of nitrous oxide, time to extubation, and alertness were observed. Criteria for extubation were: adequate respiration, response to verbal stimuli, and a return of muscle tone sufficient to sustain tetanus. Alertness was defined as the point at which the patient was aware of her specific location. Time until first postoperative pain medication also was noted.

Results

Blood pressure and heart rate increased significantly after induction and intubation with thiopental and succinylcholine (P<0.01) (Figure 1). Both measures returned to near control values after the first dose of alfentanil. After the initial administration of 50 µg/kg, 40% of the patients did not require an additional dose, according to the cardiovascular criteria; these patients had an average of 20 minutes of surgery. Thirty-one percent of the patients received one additional dose of 10 µg/kg; these patients had surgeries that lasted an average of 22 minutes. Twenty-nine percent of the patients received a redose on the basis of a grimacing response.

Only 18 patients exceeded their cardiovascular control values by 20% during surgery. Twelve of these exceeded this limit on the heart rate measure alone. One patient exceeded the 20% value in systolic blood pressure, and five patients exceeded the 20% value in diastolic pressure. In a further analysis, 14 of the 52 patients exceeded a 15% increase of any cardiovascular measure. In three patients, heart rate measures exceeded the 15% limit but not 20%. The plot of mean heart rate and systolic and diastolic blood pressures illustrates the narrow range of cardiovascular fluctuation during the maintenance phase (Figure 1).

![Figure 1](image_url)

**Figure 1**
Mean (± S.D.) changes in blood pressure and heart rate during alfentanil anesthesia

<table>
<thead>
<tr>
<th>Number of Patients</th>
<th>52</th>
<th>48</th>
<th>38</th>
<th>25</th>
<th>18</th>
<th>12</th>
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</thead>
</table>

- Systolic
- Diastolic
- Heart Rate
- Dose of Alfentanil

<table>
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<tr>
<th>Blood Pressure and Heart Rate</th>
<th>160</th>
<th>140</th>
<th>120</th>
<th>100</th>
<th>80</th>
<th>60</th>
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<tr>
<th>Dose (µg)</th>
<th>3000</th>
<th>2500</th>
<th>2000</th>
<th>1500</th>
<th>1000</th>
<th>500</th>
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<th>Time (minutes)</th>
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<th>18</th>
<th>24</th>
<th>30</th>
<th>36</th>
<th>42</th>
<th>48</th>
<th>54</th>
<th>60</th>
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<tbody>
<tr>
<td>Post-Admin. of Alfentanil</td>
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<td>Post-Endotracheal Intubation</td>
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<td>Prior to Endotracheal Intubation</td>
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<td>Prior to Thiopental</td>
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<td>Control (Entry into OR)</td>
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Journal of the American Association of Nurse Anesthetists
Cardiovascular measures were stable regardless of the dose of alfentanil (Figure 2). Total dose ranged from 50 to 91 μg/kg. Twenty-four patients received between 50-59 μg/kg, 14 patients between 60-69 μg/kg, seven patients between 70-79 μg/kg, and six patients equal to or greater than 80 μg/kg. Figure 2 depicts mean blood pressure and heart rate as a function of these increasing alfentanil doses. There was no significant difference with increasing dose in any of the cardiovascular measures (P < 0.10).

The median time for eye opening after the termination of nitrous oxide was two minutes. Forty-four patients (85%) had eye-opening times of three minutes or less. The time required before the extubation criteria were met ranged from zero to ten minutes, with a median time of three minutes. Forty-four patients (85%) had times of four minutes or less. The time before the patients became alert ranged from zero to 37 minutes after discontinuation of nitrous oxide. Forty-five patients (87%) had times of eight minutes or less. Increasing the alfentanil dose did not influence significantly the time required to awaken after the termination of nitrous oxide. Time from extubation to first pain medication was an average of 19.5 minutes for 50 patients; two patients required no pain medication postoperatively. Postoperatively, none of the patients had recall of events during surgery.

Thirty-one percent of patients exhibited side effects. Bradycardia was the most common side effect; however, all five patients who exhibited bradycardia had evidence of heart rates below 60 bpm prior to receiving alfentanil. The one incidence of bronchospasm occurred in a patient with a history of asthma, and the single incidence of hypertension occurred in a patient with pregnancy-induced hypertension who was taking hydrochlorothiazide. Two of three patients with evidence of venous irritation had an intravenous catheter in place 24 hours prior to surgery. Two patients vomited postoperatively, one immediately after receiving meperidine intravenously in the recovery room. One patient reported a headache five hours after anesthesia.

**Conclusion**

Alfentanil was an effective anesthetic for this painful surgical procedure. The intermittent stimulus during a tubal ligation was controlled acutely by the rapid onset of alfentanil. This rapid onset of action also was effective in reducing the elevated cardiovascular response to intubation. Cardiovascular stability also was evident with incremental
dosing. We did maintain an artificial limit on the range of parameters (20%), yet expected to see a significant increase in variation with patients requiring multiple doses. However, no significant difference in variation in any of the cardiovascular measures was demonstrated as the dosing frequency and amount increased.

Seventy-three percent of the patients were maintained within a superimposed 15% limit throughout surgery, which further emphasizes the cardiovascular stability of alfentanil. Redosing on the basis of grimacing alone could account for a portion of this overall stability. Regardless, recovery was remarkable even with multiple doses of alfentanil, contrary to the effects of fentanyl. Side effects were of no major concern, and patient acceptance was expressed frequently. Alfentanil appears to be effective as a potent, rapid acting analgesic with extreme cardiovascular stability and unique short duration of action.

REFERENCES


AUTHORS

Beth Rice, CRNA, BSN, graduated from Northwestern State University, Natchitoches, Louisiana, in 1970. She is a 1979 graduate of Harris Hospital School of Nurse Anesthesia, Fort Worth, Texas. She is presently employed as a clinical research anesthetist with The University of Texas Health Science Center-Parkland Memorial Hospital in Dallas, Texas.

A. H. Giesecke, Jr., MD received his medical degree from The University of Texas Medical Branch, 1957. He completed his residency in anesthesiology at Parkland Memorial Hospital. He is now the Jenkins Professor and Chairman of the Department of Anesthesiology at the University of Texas Southwestern Medical School. Diplomate to the American Board of Anesthesiology, and Fellow of the American College of Anesthesiologists.

Rebecca Ferguson, MSII, graduated from the University of Texas at Austin in 1982 with a BA in psychology. She is a student at The University of Texas Health Science Center Southwestern Medical School. She works part time for the Anesthesia Department at Parkland Memorial Hospital, Dallas, Texas.

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