CASE REPORTS

Sustained Hypertension during Innovar and Innovar–N₂O Anesthesia

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Remarkable cardiovascular stability has been attributed to neuroleptanalgesia with a combination of droperidol and fentanyl,¹ available as Innovar. This report describes three cases of unexplained sustained hypertension which occurred during Innovar and Innovar–N₂O anesthesia.

CASE REPORTS

Patient 1. A 42-year-old man was admitted for open reduction of the left ankle, fractured two days previously. On physical examination, the patient's weight was 70 kg, blood pressure 130/80 mm Hg, pulse rate 78 beats/min. Except for the fracture, medical history and physical examination disclosed no abnormalities. Premedication consisted of Demerol, 75 mg and atropine, 0.4 mg, given intramuscularly one hour before surgery.

Prior to induction of anesthesia, blood pressure was 130/80 mm Hg, pulse rate 90 beats/min. After intravenous administration of 3 ml of Innovar, the patient became drowsy and was taken to the operating room. An additional 7 ml of Innovar and 2 ml of fentanyl were given at a rate of 1 ml/min, and the patient became unresponsive. Respiratory rate decreased to 6-8/min. Analysis of arterial blood revealed pH 7.22, Pco₂ 57 mm Hg, and Paco₂ 49 mm Hg. Blood pressure increased slightly, to 140/80 mm Hg, and pulse rate remained unchanged.

An oropharyngeal airway was inserted, and mask inhalation anesthesia with N₂O:O₂ 3:2 l/min in a semiclosed circle system was begun. Respiration was assisted manually, with a minute volume of 6-8 l/min. When the skin incision was made, the blood pressure increased, and in 20 minutes reached 210/120 mm Hg. The pulse rate increased to 100 beats/min and 2 ml of fentanyl were given. At this time, arterial pH was 7.36, Pco₂ 150 mm Hg, and Paco₂ 36 mm Hg. Because of the hypertension a 0.1 per cent trimethaphan camphorsulfonate (Arfonad) drip was started. After approximately 50 mg of Arfonad, the blood pressure fell to 120/80 mm Hg, and the pulse rate rose to 140 beats/min. Arfonad was discontinued and the operation completed. For the one-hour operation, 25 mg of Droperidol and 0.7 mg of fentanyl were administered. The patient be-

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The blood pressure did not exceed 180/100 mm Hg, and she was discharged in good condition on the ninth postoperative day.

**Patient 3.** A healthy, 17-year-old, 59-kg youth, underwent elective rhinoplasty for a traumatic nasal deformity. Preoperatively, the blood pressure was 110/70 mm Hg; pulse rate 80 beats/min. The patient received 1 ml of Innovar intramuscularly as premedication 45 minutes prior to induction of anesthesia. In the operating room, the blood pressure was 110/80 mm Hg; pulse rate 90 beats/min. The head of the operating table was elevated to 30 degrees. Cotton swabs soaked with 15 per cent cocaine were applied to the nasal mucosa. The nose and surrounding tissues were infiltrated with 20 ml of 1 per cent lidocaine containing 150 units of hyaluronidase (Wydase) and 1:100,000 epinephrine.

After induction of anesthesia with 5 ml of Innovar administered over a ten-minute period, the blood pressure rose to 150/80 mm Hg and pulse rate increased to 110 beats/min. The patient was still initiating conversation, and an additional 2 ml of Innovar were given over the next ten minutes. The blood pressure rose to 160/80 mm Hg; the pulse rate rose to 150 beats/min. The patient responded to questions with slurred speech, his respiratory rate slowed to 8/min, and he was instructed to take deep breaths. Prior to the skin incision, an additional 1 ml of Innovar was given. Blood pressure remained at 180/80 mm Hg, pulse rate at 150 beats/min.

Shortly after skin incision, 1 ml of fentanyl was injected. Blood pressure and pulse remained elevated at their previous levels. Analysis of arterial blood showed pH 7.37, Pco₂ 36 mm Hg, Po₂ 70 mm Hg. Throughout the 80 minutes of surgical manipulation, the patient stated that he was comfortable. During the second half of the procedure, the blood pressure stabilized at 140/80 mm Hg; pulse rate at 145 beats/min. A total dose of 20 mg Droperidol and 0.65 mg fentanyl was used.

In the three-hour period in the recovery room, the blood pressure ranged between 150/80 and 140/70 mm Hg, pulse rate between 110 and 100 beats/min. At midnight, ten and a half hours after operation, the blood pressure was 130/80 mm Hg; pulse rate 110 beats/min. The following morning at 8:00 AM, the blood pressure was 120/70 mm Hg; pulse rate 110 beats/min. The patient was discharged from the hospital on the fourth postoperative day.

**DISCUSSION**

Hypertension caused by another neurolept-anesthetic, ketamine, and hypertension caused by a combination of a monoamine oxidase-inhibiting tranquilizer and meperidine have been reported, but we find no reports of severe hypertension with Innovar or Innovar-N₂O. The drug information currently available cautions about hypotension but does not describe hypertension. The pharmacologic mechanisms which might explain sustained hypertension due to Innovar fall into at least two categories: increased release of epinephrine and/or norepinephrine; and decreased tissue reuptake of epinephrine and/or norepinephrine.

Surgical stress, particularly with insufficient analgesia or anesthesia, can initiate release of catecholamines. Indeed, increases in pulse rate and blood pressure are the usual indications for administering additional fentanyl. Once sufficient fentanyl is given, the blood pressure and pulse usually return to normal values. With neuroleptanalgesia the droperidol-induced profound tranquilization might mask the usual expressions of pain or anxiety without inhibiting the catecholamine release. In patients 1 and 2 sufficient Innovar was given to produce unconsciousness and adequate maintenance doses of fentanyl were added. In the third case, in addition to Innovar analgesia, the operative field was swabbed with cocaine and infiltrated with lidocaine. Vocal communication was maintained and the patient did not complain of pain. Surgical stress during light anesthesia would not seem to explain this sustained hypertension.

Fentanyl, like other narcotics, can induce respiratory depression and produce significant hypercarbia and hypoxia, stimulating the release of catecholamines. The initial blood samples of patients 1 and 2 revealed hypercarbia, but blood pressure was not elevated when the initial sample was withdrawn. Once hypertension occurred, it was sustained long after blood gases returned to normal. In the third case no significant hypercarbia or hypoxia was detected, yet sustained hypertension and tachycardia developed. Hypercarbia and/or hypoxia would not seem to explain the hypertension.

Giesecke suggests that fentanyl stimulates or facilitates the release of epinephrine. He found consistent increases in urinary epinephrine in five patients undergoing Innovar-N₂O anesthesia. In the first two cases blood pressure rose with the onset of surgery, nearly 30 minutes after the first dose of Innovar. However, in patient 3, the tachycardia and hypertension occurred a few minutes after the Inno-
var induction, before surgical stimulation. Only the third case is consistent with hypertension which might have been caused by fentanyl-induced epinephrine release. Another explanation might be that droperidol, like alpha-adrenergic blocking agents, inhibits tissue reuptake of norepinephrine and epinephrine. Corssen and Chodoff showed that droperidol blocks the alpha action of epinephrine more than that of norepinephrine, and in some cases may even potentiate the norepinephrine response. However, Dobkin administered increasing doses of norepinephrine to dogs during Innovar-\textsubscript{N}\textsubscript{2}O anesthesia and found no appreciable increase in blood pressure or pulse rate.

Another possible explanation is that hypertension resulted from the synergistic action of Innovar and other medication. Except for premedication, the three patients had not taken any drugs prior to hospitalization or surgery. In the third case, however, the nasal mucosa was swabbed with 15 per cent cocaine and infiltrated with lidocaine containing epinephrine. Cocaine is known to sensitize the cardiovascular system to epinephrine, presumably by blocking the tissue reuptake of catecholamine. If droperidol also blocks the tissue reuptake, there is reason to believe that these actions would be synergistic or additive and would enhance a catecholamine-induced tachycardia and hypertension.

At this time we only can guess at the underlying mechanism involved in these three unusual cases of sustained hypertension during Innovar and Innovar-N\textsubscript{2}O anesthesia. However, it would seem prudent to be on the alert for such responses in patients who might suffer as a result of further elevations in blood pressure: patients with severe hypertension, cerebral aneurysm or pheochromocytoma. If hypertension does occur, one effective treatment is to lower the blood pressure with a ganglionic blocking agent such as Arfonad.

 REFERENCES


The Value of Gastric Aspiration in a Comatose Child

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Coma in a previously-healthy child demands stabilization of respiration and circulation as the first step of treatment, but rapid establishment of a diagnosis is necessary for rational specific therapy. Gastric aspiration is often omitted in treating children; yet this one simple procedure may facilitate a prompt diagnosis.

CASE REPORT

A 23-month-old boy was brought to the emergency room of the Bronx Municipal Hospital Center at 7:45 AM, comatose and unresponsive to deep pain. He was areflexic, had small fixed pupils, unobtainable blood pressure, a faint pulse and shallow agonal-type respirations. Endotracheal intubation was performed immediately with a \#12