THE MISUSE OF EPINEPHRINE DURING ETHER ANESTHESIA: A CASE REPORT * †

MARY LOU BYRD, M.D.‡
New York City

THE vasoconstrictor action of epinephrine has been utilized by surgeons to aid hemostasis from the time such an effect was known and, until recently, no untoward reactions were feared from its use. The work of Meek and his associates (1, 2) has established the danger from epinephrine given during cyclopropane anesthesia. However, its application to bleeding surfaces during ether anesthesia is not generally recognized as dangerous. Clinical experience has demonstrated that the practice is not safe. The following case report is cited as an example of such an experience.

CASE REPORT

A poorly nourished, anemic negress, aged 41, with a squamous cell carcinoma of the left face, was prepared for a Caldwell-Luc operation. Morphine sulphate 0.01 Gm. (gr. 1/6) and scopolamine hydrobromide 0.0006 Gm. (gr. 1/100) were given hypodermically one hour before anesthesia. The blood pressure was 170/80, pulse rate 120, and respirations 20 per minute before induction. Nitrous oxide-oxygen-ether was given by the carbon dioxide absorption method. An oral endotracheal airway with inflatable cuff was utilized. The surgical procedure was begun eighteen minutes after anesthesia was started. The blood pressure and pulse rate remained at the preoperative level during the first twenty minutes of the operation. Then a large pack soaked with epinephrine (1–1000) solution was placed over a bleeding area. The patient had not lost a significant amount of blood. In five minutes the pulse rate increased, reaching 150 in ten minutes. It was totally irregular. At the same time the blood pressure fell from 160/80 to 70/50 and remained for ten minutes before falling to 60/50, at which time the pulse rate had decreased to 84. The epinephrine pack was removed, hemostasis was controlled by dry gauze packing and a transfusion was started. The surgical procedure was completed and administration of the anesthetic agent was discontinued twenty-five minutes later. Fifty-five minutes after the epinephrine was used the blood pressure was 90/56 and the pulse rate 80. The patient was returned to bed awake with oropharyngeal oxygen therapy.

Postoperatively the patient had a spiking temperature and drained a large amount of purulent material from her nose. Twenty-four days later she developed convulsions and died.

* From the Division of Anesthesia, Bellevue Hospital, New York City.

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‡ Presently located at Butterworth Hospital, Grand Rapids, Mich.

DISCUSSION

In an analysis of this untoward reaction, two factors should be considered: first, the unusual action of epinephrine, and secondly, the delayed recovery from the circulatory disturbance. To produce such an immediate circulatory reaction, the epinephrine applied to the bleeding surface was absorbed rapidly. A subcutaneous injection of epinephrine (1–1000) 0.5 to 1 cc. causes a rise of systolic blood pressure and pulse rate in fifteen minutes. Only an intravenous administration of a similar dose of epinephrine will cause the immediate pressor response noted in this patient.

The theory of Knoepfel that ether has a sympathomimetic action is generally accepted. Inasmuch as this patient was anesthetized with ether, the possibility of the agent's augmenting the response to epinephrine must be considered.

The majority of the studies on the effect of epinephrine during anesthesia have been completed with animals (dogs and cats). Meek (1) used dogs to study the effect of sympathomimetic drugs during ether anesthesia. He observed frequently an auriculo-ventricular rhythm after the intravenous injection of epinephrine. Ventricular fibrillation did not occur with standard test doses of epinephrine and larger doses were not used. If epinephrine is injected intravenously in the dog there is an immediate rise of systolic and diastolic pressure to a peak proportional to the dose given with a subsequent rapid fall of blood pressure, in some instances to below the previous normal levels (3). At the height of the rise in blood pressure the pulse becomes rapid and then slows due to vagal influence. There are three concepts which attempt to explain this hypotension after an initial rise of blood pressure. First, the effect of epinephrine on the capillaries; that is, a dilatation after an initial vasoconstrictor effect on arterioles with the dilator effect more prolonged. Second, that epinephrine consists of two separate components—sympathin E with a constrictor effect on blood vessels which is stronger than sympathin I—a dilator to blood vessels with a more prolonged effect. Finally the vagal cardiac effect of slowing the cardiac rate with a reduction of stroke volume.

In the case presented, the direct effect of epinephrine on the heart with the rise of pulse rate and an arrhythmia may suggest an impaired conducting mechanism, possibly auriculo-ventricular (nodal rhythm). As to the effect of epinephrine on the blood vessels (arterioles), there was no rise of blood pressure but a marked fall of both systolic and diastolic pressures with marked decrease in pulse pressure from 80 to 20 mm. Hg. It is possible that an initial rise in blood pressure preceding this fall was not detected. Epinephrine probably caused a marked vasodilator effect for this patient, and this, associated with an impairment in the conducting mechanism of the heart, resulted in a marked decrease of cardiac output.

It is interesting to note the influence of the vagus with a decreased pulse rate to 80 beats per minute. Atropine given before epinephrine to dogs and man has been shown to exaggerate the pressor response as well as pulse rise, since the regulating action of the vagus has been removed. This patient received scopolamine before anesthesia, which may have been an influence on the delayed vagal action. The prolonged response to epinephrine, fifty-five minutes before improvement in circulation, is not readily explained although epinephrine in dilute solution will elicit a vasodilator response. This, augmented with some blood loss during surgery, may account in part for the prolonged circulatory failure and the inability of the cardiac mechanism to readjust rapidly from the lowered cardiac output. Freeman (4) has shown in experimental animals a condition analogous to shock when continuous large doses of epinephrine are injected.

This case resembles in some respects a typical picture of acute hemorrhage but there are several factors against this as more than a contributing factor. In the presence of shock due to acute hemorrhage a rapid rise in pulse rate without arrhythmia is the rule. In the presence of shock from hemorrhage the pulse rate remains rapid.

SUMMARY

Report of a case is presented to support the contention that the indiscriminate use of epinephrine during ether anesthesia is unwise.

Greater caution is advised in employing vasoconstrictor drugs in the anesthetized than in the unanesthetized patient.

The anesthetic agent is but one of the many factors that need be considered before epinephrine is employed during anesthesia.

The use of epinephrine packs on bleeding surfaces is a pernicious practice.

REFERENCES

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3. Goodman, L., and Gilman, A.: The Pharmacological Basis of Therapeutics, New York, Macmillan Company, 1941.
4. Freeman, N. E.; Freedman, H., and Miller, C. C.: Production of Shock by Prolonged Continuous Injection of Adrenalin in Unanesthetized Dogs, Am. J. Physiol. 131: 545 (Jan.) 1941.

COMING EXAMINATION

The November 1st written, Part I examination of the American Board of Anesthesiology, Inc., has been cancelled. The next written examination will be held on March 31, 1942. Applications must be in the headquarters' office on or before December 31, 1941. Sec., Paul M. Wood, M.D., 745 Fifth Avenue, New York City.