

## CURRENT COMMENT AND CASE REPORTS

CURRENT COMMENT is a new department in ANESTHESIOLOGY. In it will appear invited professional and scientific correspondence, abbreviated reports of interesting cases, material of interest to anesthesiologists reprinted from varied sources, brief descriptions of apparatus and appliances, technical suggestions, and short citations of experiences with drugs and methods in anesthesiology. Contributions are urgently solicited. Editorial discretion is reserved in selecting and preparing those published. The author's name or initials will appear with all items included.

### THE DETECTION OF LEAKY AMPULES

It has long been recognized that ampules with an imperfectly closed tip may escape the detection of the manufacturer. Also, a slight crack in the glass may occur while handling the ampules in the hospital, when a pick-up forceps of some kind is used to immerse them or to remove them from an antiseptic solution. Through such small imperfections in the glass, antiseptic solution may leak into the ampule, diluting and contaminating the contents.

Certain chemical antiseptics may be innocuous to tissue and others may be very irritating. This may be true especially when the solution is injected into the spinal canal. Some antiseptic solutions contain formalin. If an ampule remains immersed in such a solution for a considerable period of time, the contents of the ampule not only will be diluted and contaminated by the amount of solution which leaks into it, but, under the rules of osmotic pressure, the formalin will be transmitted into the ampule more rapidly than the rest of the solution until the ampule contains the same percentage of formalin as does the antiseptic solution. Thus it is possible that if an imperfect ampule of anesthetic is immersed in an antiseptic solution containing formalin, serious damage may occur.

Ampules containing dry crystals very quickly will show the presence of liquid which has leaked into them. The presence

of intruding fluid is not so easy to detect in ampules containing a solution. If one is very alert he may notice that the ampule is fuller than usual, but the difference in amount of content must be considerable to attract attention.

A satisfactory way to detect such contamination is to tint the antiseptic solution with some bright coloring matter. Gentian violet, eosin, and colored metaphen solutions are satisfactory. If the ampule has been immersed for some time, the outside of the glass occasionally is colored when it is removed. It should then be wiped clean in order to be sure that the content is not colored. Some solutions are now being dispensed in colored glass. In such a case the contents must be sucked into a syringe before its color can be judged.

At the University of Minnesota Hospitals for years it has been the practice to immerse ampules in a colored antiseptic solution. On an average of three or four times a year we have discovered the contents of an ampule to be colored when we were unable to detect any defect in the glass of the ampule.

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### FATAL PULMONARY EMBOLISM DURING MANIPULATION OF HIP UNDER ANESTHESIA

On November 4, 1943, this 76 year-old woman fell and sustained a fracture of the neck of the left femur. She was hospitalized and treated by traction. On November

19, two weeks after the injury, she was transferred to Walter Reed General Hospital for further treatment.

Physical examination revealed that the

patient was fairly well nourished, wiry, and edentulous, with a beefy red tongue. There was 1 inch shortening of the left leg; the left foot was externally rotated and there was tenderness over the left greater trochanter.

The blood pressure on admission was 160 mm. systolic and 85 mm. diastolic, pulse 86, respirations 20, and temperature 99.6 F.

Laboratory examination revealed the following: Erythrocytes numbered 3,600,000, and leukocytes 10,500 (polymorphonuclear cells 89 per cent, lymphocytes 10 per cent, monocytes 1 per cent); hemoglobin was 70 per cent. The urine was cloudy; the specific gravity 1.024. The blood urea nitrogen was 22, blood sugar 104, and blood chlorides 498.

Although the temperature ranged from 98.6 to 100 F. from November 19 to November 22, it did not, at any time, convey any unusual significance. Pulse and respirations remained within normal limits.

After a review of the case, it was decided to reduce the hip manually and then follow this by blind nailing with a Smith-Petersen pin.

On November 22, the patient was given premedication, with morphia, grain  $\frac{1}{8}$  and scopolamine, grain  $\frac{1}{60}$  at 6:45 a.m. Before induction, blood pressure was 140 mm. systolic and 80 mm. diastolic; pulse 100 and respirations 24.

Induction was begun at 8:00 a.m. with cyclopropane and oxygen, each being delivered at the rate of 500 cc. per minute. This was continued for a matter of seven to eight minutes and was accompanied by a leak around the mask because of the poor fit. After the first plane was reached, an airway was inserted and wet gauze fitted inside the mouth to blow out the cheeks. From this time on the system was completely closed and leak proof. The to-and-fro absorption technic with the Foregger machine was considered the method of choice. At 8:10 a.m. the patient was moved on to the Albee-Compton fracture table for manipulation of the hip. Ether was started at 8:15 a.m. for maintenance of the anesthesia. The patient was then brought into the operating room. At 8:20 a.m. infusion of 5 per cent glucose in saline solution was started in the right arm as a prophylactic measure. At 8:30 a.m. the left

hip was manipulated. Laryngospasm occurred and immediately after that a blood pressure reading could not be obtained. However, the pulse was 84 and respiration 20. A more careful reading was sought when the surgeons began a second manipulation of the hip. The blood pressure could not be recorded and the pulse was absent at the wrist. In spite of this, respirations were still 20 and there was fairly good exchange. At 8:37 a.m., unaware that a third manipulation of the hip was necessary and assuming a reflex collapse of circulation we increased the rate of the infusion, and flushed the bag with oxygen. Still dissatisfied with the orthopedic results, we undertook the third manipulation, after which the respirations became jerky, with a definite tracheal tug. The surgeons were notified of the poor condition of the patient and were advised to refrain from any further operative procedure. At 8:40 a.m. intubation with an oral tube was carried out and artificial respiration begun with frequent dumpings of the bag, but respiration became progressively weaker and finally disappeared. Epinephrine, M ii, was given intravenously at 8:42 a.m.; but with no apparent effect. Metrazol, 1 cc., was administered intravenously one minute later. At 8:45 a.m., 1 cc. of epinephrine was injected into the heart, but none of these measures brought the least response and the patient was pronounced dead at 9:00 a.m.

#### PATHOLOGIST'S REPORT

*General:* The vessels of the neck were moderately distended and there was slight to moderate cyanosis of the nail beds. The feet, ankles, and lower third of the legs showed moderate edema. The left lower extremity showed moderate hypermobility, there being a fracture of the neck of the femur.

*Primary Incision:* The lower lobes of each lung were completely collapsed. The heart was in normal position and the pericardial sac contained approximately 15 cc. of clear fluid. The pulmonary artery contained no palpable emboli.

*Thorax:* The myocardium was of normal thickness and showed moderate diffuse loss of tone. The right coronary orifice was narrowed to 1 mg. diameter.

*Aorta:* The intima showed slight to moderate aortic sclerosis, more marked in the abdominal portion.

*Lungs:* The upper lobes were grayish white and fairly crepitant. The lower lobes were completely collapsed, being firm and dark purple. Externally, there was no evidence of infarction. The pulmonary arteries and branches were dissected and in two terminal branches in the left lower lobe fragments of emboli were found completely occluding the lumen. No emboli were found in the vessels of the right lung.

*Kidneys:* The external surface of each presented several bulging retention cysts (1 to 2½ cm.), filled with watery fluid.

*Miscellaneous:* The iliac veins opened into the femoral canal and in the right vein there was a thrombus very loosely attached to the intima. There was evidence of extension of the thrombus into the pudendal region. The left iliac vein revealed small fragments of the thrombus, and the pudendal vein was completely occluded.

*Diagnosis:* (1) Fracture of the neck of the left femur. (2) Thrombophlebitis of the iliac veins. (3) Pulmonary embolism.

#### DISCUSSION

There are several points of importance associated with anesthesia in conjunction with orthopedic surgery.

Reflex response to manipulation of long bones or a large joint is often manifested by a transient circulatory collapse. This is accompanied by a fall or absence of blood pressure, rapid respirations, and rapid pulse. This condition, however, is usually of short duration and circulation returns to normal on cessation of the manipulation.

There are two schools of thought as to the necessary depth of anesthesia: one that if it is too light, the patient is more susceptible to reflex collapse; the other, that if kept fairly deep, reflexes will be unable to break through to cause the collapse. However, it is our impression that even under deep anesthesia, traumatic orthopedic surgery will initiate a sudden collapse, and considerably longer time will be required for the patient to return to normal, the depth and duration of the reflex shock being directly proportional to the intensity of the trauma. If death should occur follow-

ing such manipulation, we believe there usually an organic pathologic basis.

In view of the pathologic findings, we have sought, in retrospect, to correlate the clinical course of the patient. We should expect, as a first indication of pulmonary emboli, respiratory difficulty but instead the not uncommon circulatory depression occurred. It is conceivable that the first two manipulations resulted in the aforementioned vasomotor response and that the third manipulation dislodged emboli cause the respiratory embarrassment. On the other hand, it is much more likely that the first manipulation resulted in a pulmonary embolus which immediately caused a reflex spasm of the pulmonary arterial tree. This in itself, from what is known of pulmonary embolism, is sufficient to initiate a sudden and severe degree of shock.

In this type of operation inhalation anesthesia with intubation is the method of choice. It is of primary importance to start an infusion before operation to combat shock and so that a vein will be available for intravenous medication if necessary. Much valuable time may be lost attempting to start an infusion when a patient is in shock.

#### COMMENT

The length of bed rest for this particular patient was eighteen days following injury. This should always bring up the possibility of thrombophlebitis, especially in the aged. Taylor reported a similar death in a 48 year-old man eleven days following injury. Elevation of temperature must be considered. Even in the absence of physical signs or complaints, thrombophlebitis must be borne in mind.

This problem in diagnosis is particularly important to the anesthetist in view of the fact that necropsy often is not performed following operative deaths, and anesthesia may be conveniently listed as the cause.

Early reduction is essential as soon as possible following the fracture rather than placing the patient at rest in bed and instituting traction, followed by surgical procedures.

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