

second or third handful of soda lime into the canister its wall should be tapped with the fingers. The canister should be slightly rotated after each tapping. This maneuver should be repeated until the canister has been filled. These suggestions apply to all types of canisters. Canisters for circle filter assemblies are now ready to place on the anesthetic machine and are subject to immediate use. The "to and fro" canisters require certain additional attention. Firstly, it is essential that the cover screen be placed on the canister in such a manner as to exert just enough pressure on the soda lime to keep the granules from being displaced during handling. The anesthetist must avoid the practice of over-filling the canister and then forcing the screen cover down over it, thus causing the screen to bulge.

Under-filling results in the "bean bag" type of canister, with resulting fragmentation of the granules and dust formation. Over-filling results in the "flour sifter" type of canister. Fragmentation and dust formation are produced by compression of the granules of soda lime. Secondly, the

resistance offered to the patient's respiration is appreciably increased. The likelihood of aspirating dust is even greater than with under-filling.

#### TESTING THE CANISTER FOR THE PRESENCE OF DUST

All "to and fro" canisters should be tested for the presence of dust both immediately after they are filled and prior to each period of use.

Testing may best be effected by forcefully blowing into the outlet of the canister while intermittently occluding and freeing its inlet with the palm of the hand. The position of the canister should then be reversed by blowing into its inlet. This procedure should be continued until no dust is recovered in the palm of the hand. When a canister has been properly filled forcefully blowing through it once or twice in each direction will remove any dust present.

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#### CASE REPORT:

##### FATAL PULMONARY EMBOLISM OCCURRING DURING OPERATION

A man, age 48 years, white, was admitted August 17, 1942. He was mildly intoxicated but fully conscious. There were lacerations of the forehead and a fracture of the neck of the right femur. He was placed in bed and Buck's traction was applied. The blood pressure was 132 mm. systolic and 80 mm. diastolic, the pulse rate 90 and the temperature varied between 99 and 100 F. for five days. Examination of the urine gave negative results. Blood studies were not recorded. Roentgenograms showed an impacted fracture of the neck of the right femur, with some displacement and poor alignment. The temperature was normal for four days before operation. There was no swelling or edema of either leg.

Reduction and pinning of the fracture was carried out August 28. Preanesthetic sedatives were given at 8:00 a.m.; they consisted of morphine, 1/4 grain, and atropine, 1/150 grain.

Anesthesia was begun at 9:05 a.m. Nitrous-oxygen-ether sequence with the semi-closed method was employed for induction, with a change to the carbon dioxide absorption technic (circle type) and oxygen-ether anesthesia. Coughing occurred during induction; otherwise the patient's condition was satisfactory. At 9:25 a.m. relaxation was not adequate for manipulation. The method of administration was changed to the open drop ether method. At 9:30 a.m. relaxation was satisfactory. The blood pressure was 150 mm. systolic and 85 mm. diastolic, pulse rate 96 and respiration was unobstructed. An oral pharyngeal airway was in place. Following manipulation the blood pressure could not be obtained by auscultation. The pulse was 54 and weak, the color satisfactory. The method of anesthesia was changed to oxygen-ether by the absorption technic. The blood pressure apparatus was readjusted and the systolic pressure was 60

and pulse 50. I was called to see the patient at 9:35 a.m. The systolic pressure was 50 by palpation, pulse 90, and color of face and hand satisfactory, but I had not seen the patient previously for comparison. The respiratory exchange seemed adequate.

The surgeon asked if the procedure should be discontinued, as only the manipulation and taking of roentgenograms had been completed. Believing that the drop in pressure was from an overdose of ether or reflex in nature, I advised him to proceed with the pinning of the fracture. The ether concentration was reduced by emptying the breathing bag twice and filling it with oxygen. An infusion of 5 per cent glucose in physiologic saline solution was started.

At 9:45 a.m., the skin incision was made and the blood was very dark. I took over administration of the anesthetic at that time, realizing that I had been deceived by the color of the face and hand as to the actual state of oxygenation of the blood. The lungs were inflated with oxygen, and the breathing bag was emptied frequently to eliminate ether from the patient, but still the blood was cyanotic. An oral endotracheal tube was inserted and suction through this elicited a cough reflex but only a small amount of mucus was obtained. The pulse was palpable at the wrist, but with energetic inflation of the lungs with 100 per cent oxygen by manual pressure on the breathing bag, it was impossible to oxygenate the blood properly. When this condition was fully appreciated at 10:00 a.m., the operation was completed. The surgeon was informed that the patient probably would not survive, and the diagnosis of pulmonary embolus was made. The pulse soon became weaker and the face became cyanotic in spite of continued and exaggerated pulmonary ventilation as previously stated. At 10:14 a.m., the heart action ceased. Throughout these procedures and in the presence of marked over-ventilation through the soda lime, respiratory activity by the patient continued nearly as long as cardiac activity.

Postmortem examination revealed an embolus which appeared to block the right branch of the pulmonary artery entirely and occlude the left branch partially. The

clot was friable and pulled apart on removal. Examination of the right femoral vein (fracture side) revealed small pieces of blood clot in the proximal portion retained by extensions into two small branches entering the vein. The femoral vein below this contained no thrombus and the iliac vein was clear. Gross examination of the pathologic specimens revealed the two fragments of the embolus and the section of femoral vein with two small pieces of thrombus still attached. The blood clot showed no organization on microscopic examination.

*Comment:* This case is of more significance to surgeons than to anesthetists, for on surgeons falls the task of avoiding manipulation in the presence of venous thrombi. In this case traction had been applied for some ten days. There was no swelling of the leg nor any fever for four days preceding the operation. If pain had occurred it probably would have been attributed to the fracture.

It seemed almost certain that oxygen was entering the alveoli; therefore, it was concluded even before death that the block was of a circulatory nature, and a pulmonary embolus seemed the most likely cause. This was the first instance I ever encountered in which the blood could not be oxygenated by inflating the lungs with oxygen in the presence of a peripheral pulse.

I have encountered one other proved case of fatal pulmonary embolus during operation on the leg (under spinal anesthesia) but that patient died suddenly from a large pulmonary embolus. The clinical picture of what could easily be diagnosed as a pulmonary embolus probably is rarely encountered, but it might be helpful in determining the cause of death, particularly when permission for postmortem examination cannot be obtained. The surgeon should not have been permitted to carry out the pinning of the fracture. However, this made no difference in the outcome, since the measures carried out in an effort to save the patient's life were the same as they would have been had the operation not been in progress. In fact, it was an aid in correcting the erroneous diagnosis of the state of oxygenation as indicated by inspection of the skin of the

face and one hand. It is difficult to understand how the type of anesthesia could have changed the outcome of this case, since the clot apparently was dislodged by the necessary manipulation to reduce the displacement of the fracture. In fact, it may have

state of oxygenation before and during this time.

In determining the state of oxygenation of the blood, the deceptive appearance of the skin may have been the result to some extent of the damming back of blood into



The upper specimens are the two pieces of the embolus; the lower, an opened segment of the right femoral vein. These specimens had been in formalin twelve hours before the photograph was taken.

been fortunate that the patient was unconscious in that he was spared the agony of death. The leg was not manipulated until the muscles were relaxed, and the clot was so soft that very little trauma would have dislodged it.

This case may have been suitable for pulmonary embolectomy. No one present was familiar with the technic, and the idea was not entertained. The patient lived fifteen minutes after the diagnosis was made, although his tissues were in a poor

the venous system, while the blood that did pass through the lungs was oxygenated, giving a satisfactory color to the capillary bed for some twenty-five minutes. The incision permitted venous bleeding, and marked cyanosis was evident. During the last fifteen minutes, cyanosis was plainly evident in the skin.

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#### CORRESPONDENCE

September 8, 1942.

To the Editor of *Anesthesiology*:

On page 458 of the July issue I had an article on "Pentothal Sodium Rectally."

It states that one cubic centimeter of a 10 per cent solution should be used per 50

lb. weight. This is, of course, a mistake, and should be 5 lb. weight.

This mistake is my own; however, so many have written me perhaps it should be corrected.

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