

THE MIGRATION OF A SHELL FRAGMENT FROM  
THE INFERIOR VENA CAVA TO RIGHT PUL-  
MONARY ARTERY—CASE REPORT

By

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*Major, Medical Officers' Reserve Corps*



(WITH ONE ILLUSTRATION)

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THE SUBJECT of the migration of foreign bodies which is confined chiefly to fragments of military projectiles has been recently brought to date by Matas (3). It is a subject in which military surgeons have most experience and one that for many years has been of great interest to them, not only because of the bizarre nature of the course of these fragments but because of the light it throws on the tolerance of the circulatory apparatus to injury and partial block.

The case reported is that of R. C., Pvt., 1046821, Co. C, 21st Field Artillery. This man was wounded early in the afternoon of September 10, 1918, during the St. Mihiel offensive by a shell fragment. The fragment entered the right chest in the midaxillary line between the seventh and eighth ribs. Patient dressed by Major H. O. Wyneken at II. Q. 5th Division. He was there given A. T. S., 1,500 units, and at 5.25 p. m. morphia, grains  $\frac{1}{4}$ . At 11.50 p. m., September 10, 1918, he was admitted to Evacuation Hospital No. 3, Toul, France. Tag diagnosis—shell wound, right thorax. The man was in shock, slightly cyanotic, blood pressure 90/70, and was at once transferred to the shock ward. Treatment there consisted of the application of heat and the giving by rectum of one pint of a sodium bicarbonate glucose solution by the drop method. The patient remained in shock with an irregular, soft pulse, and at no time reached what was considered an operable condition or a condition justifying X-ray study. The missile was evidently retained. It seemed certain that there had been considerable loss of blood, but unless immediate operation could be performed transfusion seemed undesirable, as it was common experience that with thoracic wounds with a possibility of liver and abdominal involvement transfusion, unless followed by immediate operation permitting inspection of the source of hemorrhage, merely resulted in a subsequent loss of the transfused blood and even further depletion. The right chest cavity was dull, and the abdomen seemed more rigid on the right with suspicious dullness in the flanks. At 9 a. m., September 11, 1918, the condition of the patient was somewhat better, blood pressure 94/60. At 11 a. m. there had been no change in pressure, but operation

was being considered when the patient's condition rapidly deteriorated and by 1.00 p. m. blood pressure was systolic, 58, and patient became markedly cyanotic. At 1.55 p. m. patient died.

Autopsy was performed the same afternoon by First Lieut. H. R. Livesay, M. C. Findings as follows:

*Skin* shows a light lemon tinge. Just anterior to right midaxillary line and between seventh and eighth ribs is a dark red, irregular, ragged penetrating wound 2 cm. in diameter. This wound extends downward, backward and inward.

*Peritoneal cavity:* The cavity is filled with dark red fluid and clotted blood.

*Liver:* On upper surface of the right lobe is a star-shaped laceration that admits the little finger; this leads downward, inward and backward. On the under surface of the liver, to the right of the neck of the gall bladder, is a ragged opening, 1.5 cm. in diameter. The inferior vena cava, 5 cm. below the lower border of liver, shows a ragged opening 1.5 cm. in diameter. Dark blood emerges from this opening. On dissection the posterior wall of the inferior vena cava shows a rounded laceration extending to the outer coats of the vessel.

*Pleural cavity:* The right cavity is distended with dark fluid and semi-fluid blood. Upper lobe of right lung is bound to chest wall by firm fibrous adhesions. Right parietal pleura between seventh and eighth ribs present a ragged laceration 2 cm. in diameter. Diaphragm corresponding to this area shows a perforated, ragged wound about 2 cm. in diameter.

*Lungs:* Right lung is bluish-red, slightly smaller than left, and shows less crepitation than left. Left lung is purplish-red, voluminous and crepitant throughout.

*Heart:* Apparently negative. On dissection of the pulmonary arteries there is found located at the first bifurcation of the right pulmonary artery an irregular fragment of shell about 1 cm. in its greatest diameter.

*Anatomical diagnosis:* (1) Hemorrhage (cause of death); (2) pulmonary embolism (shell fragment); (3) hemothorax; (4) hemoperitoneum; (5) shell fragment wound of thorax; (6) shell fragment wound of liver; (7) shell fragment wound of vena cava (inferior); (8) shell fragment wound of diaphragm; (9) pleural adhesions (right).

The lungs were then removed with the heart, the heart opened, and two malleable probes passed up the pulmonary artery and beyond its bifurcation. The accompanying X-ray reproduction (Fig. 1) graphically demonstrates the location of the fragment.

Such a case is of interest because of the distance traveled by the foreign body both before and after entering the circulatory system, and because of the relatively large size of the missile. But many even more bizarre cases are on record.

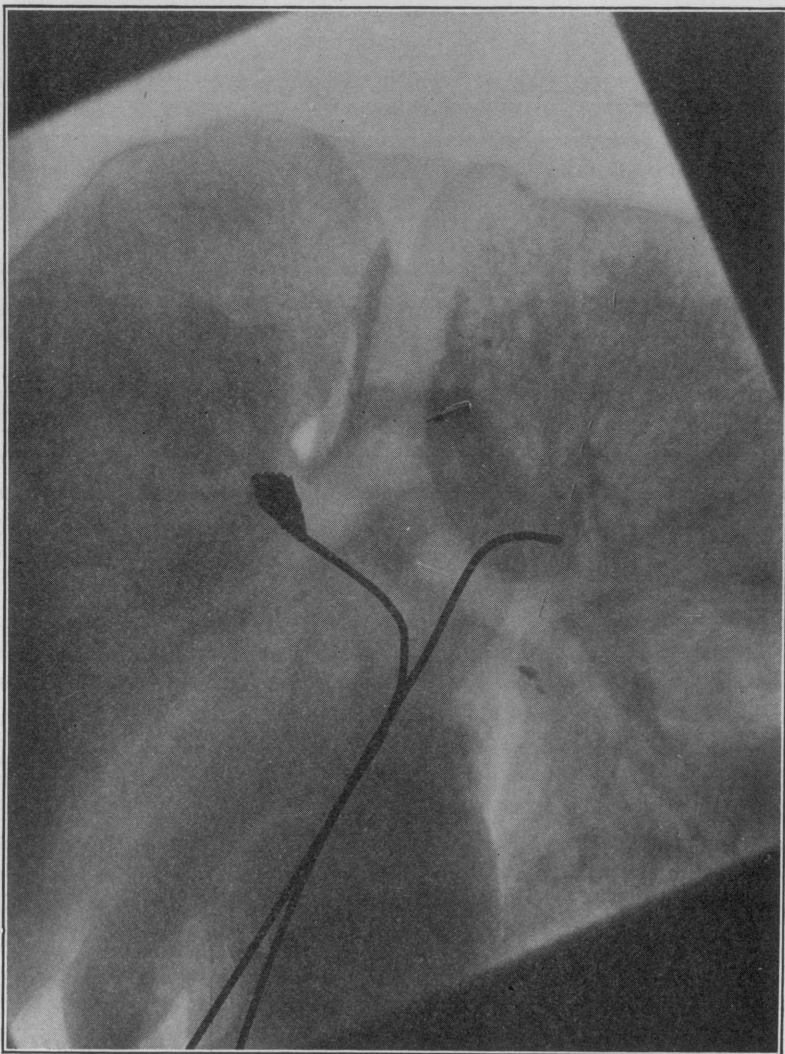


FIG. 1.—Roentgenogram of lungs with probes passing from the heart up into the pulmonary artery showing missile lodged in the first bifurcation of the right pulmonary artery.

Three general classes of migration occur: (1) Where the missile enters the heart and is carried out into the peripheral arterial circulation where it lodges according to its size as the vessels narrow and there produces all the local signs and symptoms of an embolus; (2) where the missile enters the larger venous channels and is carried to or through the heart, lodging, as in the case reported, in the lung; (3) where there is retrograde migration, the missile entering either the heart or large venous trunks and then dropping back against the venous current to lodge at some point where again the caliber of the missile and vessel become the same.

O'Neill (4) and Baumgartner (1) report cases belonging to Class 1. In both instances missiles entered the left ventricle but were eventually recovered in the common iliac vessels. Baumgartner's case is of special interest, as the missile was recognized in the heart by the X-ray over a period of twenty days. Ten days after the second X-ray examination it was found lodged at the bifurcation of the right common iliac artery. Examples of cases of retrograde migration are not so common. One of the most interesting is that reported by Grandgérard (2). In this case the missile was located by the X-ray one week after the injury in the right auricle, substernal pain drawing attention to the case. A little over an hour later it was gone from the heart but was seen in the pelvis. Exploration revealed the missile in the internal iliac vein.

These cases are always of interest, and one continually wonders how patients survive such wounds. Cases in group one, where the missile enters the heart and progresses outwards with the blood stream, are certainly the more common. This is easily understood when one realizes the small chance any missile has, first, of penetrating a blood vessel, and next, if it does penetrate, of not perforating. The heart is large enough to catch and hold a missile, but it is well recognized that blood vessels, with their relative greater firmness of structure than the medium in which they lie and the ease with which they are dislocated to one side, offer a very poor target.

In the particular case cited it is interesting that the missile almost perforated the cava, a definite injury to the intima and even to the muscularis coat being found on the side opposite the wound of entry. Death, doubtless, was due to a combination of events, chiefly hemorrhage, but also probably to the pulmonary embolus, the time of occurrence of which we cannot prove but which may well have been the final factor in killing the patient.

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