

Case Report

Critical Bleeding from the Stapled Stump of the Pulmonary Artery

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Abstract

Many surgeons separate pulmonary arteries and veins using vascular stapling devices. However, unexpected catastrophic incidents can occur using this method. We experienced a case of critical bleeding from a tear located near the distal site of the stump of the first branch (common branch to the anterior and apical segment) of the left main pulmonary artery, while the patient was waking from general anesthesia after surgical manipulation. Surgeons should leave a stump length equal to half the diameter of the pulmonary artery and closely observe the chest drainage during changes in blood pressure when waking patients from general anesthesia.

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Introduction

Tearing of the pulmonary artery represents a severe incident that can occur during major lung resection. Bleeding incidents during surgery can be due to both technical and non-technical factors; we believe that surgeon care can prevent such incidents.¹ Currently, many surgeons separate pulmonary arteries and veins using vascular stapling devices. Accordingly, the gap in technical ability between skillful and unskillful surgeons is smaller than it was in the era of ligating/dividing the pulmonary vessels. However, unexpected catastrophic incidents can still occur. We present a case of critical bleeding near the stapled stump of the main pulmonary artery that occurred while the patient was waking from general anesthesia after surgical manipulation. Additionally, we discuss approaches to separate vessels using a stapling device, particularly the pulmonary artery.

Case Report

A 72-year-old man with primary pulmonary carcinoma (adenocarcinoma, cT2aN1M0, stage IIB) underwent video-assisted thoracoscopic left upper lobectomy with lymph node dissection under general anesthesia. The operating time was 270 minutes and the blood loss was less than 50 ml. No adverse event occurred during the operation but, as the anesthesiologist started to wake the patient from general anesthesia, the patient experienced bouts of coughing. We then observed bloody drainage from the chest drain, subsequent to which the patient experienced hypotensive shock. We rapidly administered intravenous fluids and the patient was placed in a lateral position, following which urgent open thoracotomy was initiated. After removing a blood clot from the pleural cavity, we identified the origin of the bleeding: an approximately 5-mm tear at the main pulmonary artery (Fig. 1). The tear was located near the distal site of the stump of the first branch (common branch to the anterior and apical segment), and the direc-

tion of the tear was parallel to the staple line. We clamped the proximal site of the main pulmonary artery and sutured the tear using an unabsorbable 4-0 monofilament. The operating time was 120 minutes and the blood loss was 2100 ml. The patient recovered without any neurological damage and was discharged.

Discussion

When a branch of the pulmonary artery is ligated, the wall of the vessel naturally follows the central direction (Fig. 2A); we placed a ligated knot in the appropriate location without excessive tension on the vessel wall. However, when a vascular stapling device is used, the

vessel is closed and divided, which results in greater tension in the central part of the pulmonary artery stump than the edge. What is the optimal location for ligated knot placement and where should we divide the pulmonary artery using a stapling device? The length of the pulmonary artery stump should be equivalent to the distance from the edge to the center of a vessel (Fig. 2B). Thus, surgeons should leave a length at least equivalent to the radius of the pulmonary artery when dividing the artery using a stapling device (Fig. 2C). If a sufficient length of the pulmonary vessel stump is not available, a stapling device should not be used, and the pulmonary artery should be ligated or sutured under a vascular clamp via open thoracotomy. However, a long vessel

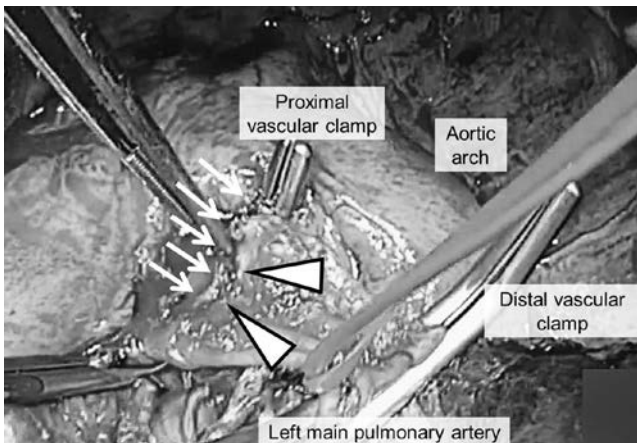


Fig. 1 Image acquired during the initial operation shows a tear (arrowheads) located near the distal site of the stump (arrows) of the first branch (common branch to the anterior and apical segment) of the left main pulmonary artery.



Fig. 3 Image acquired during the initial operation shows that the staple line is slightly curved (arrowheads) at the central part of the stump of the first branch (common branch to the anterior and apical segment) of the main pulmonary artery.

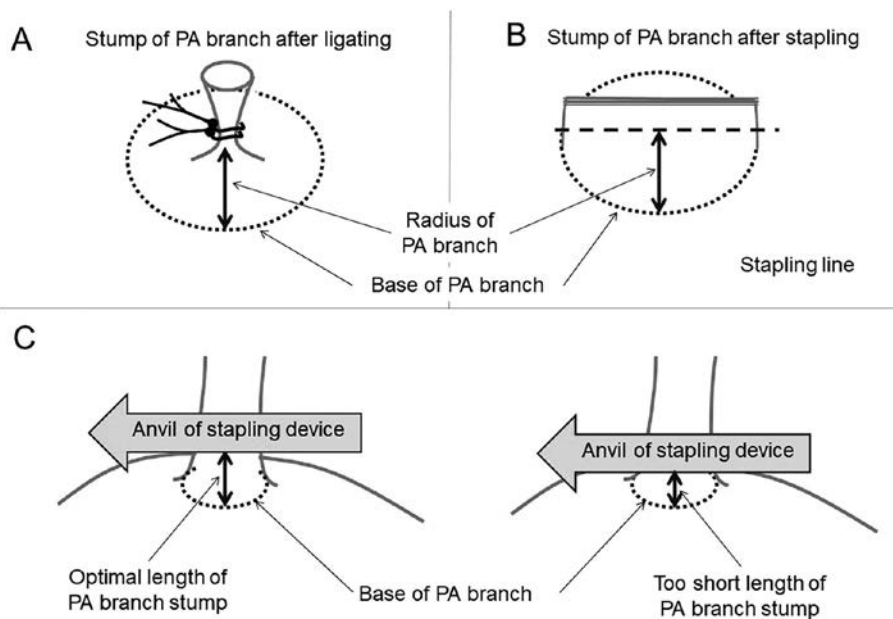


Fig. 2 (A) When a branch of the pulmonary artery is ligated, the wall of a vessel naturally follows in the central direction. (B) The length of the vessel stump should be equal to the distance from the edge to the center of the vessel. (C) It is important to leave a stump length of at least equivalent to the radius of the pulmonary artery. Abbreviation: PA, pulmonary artery.

stump should also be avoided because of the increased probability of thrombosis in the pulmonary vessels.² Therefore, to measure the optimal length of the vessel stump, it is important to use the thickness and width of thoracoscopic instruments like a measure because we cannot directly measure the stump length in the pleural cavity.

Upon review of our case, the first branch (common branch to the anterior and apical segment) of the left main pulmonary artery was found to be divided near the base of the branch. The staple line appeared slightly curved at the central part of the stump of the branch of the main pulmonary artery (Fig. 3). This central part of the stump may have been under more tension than the edge; excessive pressure developed on waking from general anesthesia, which may have caused the pulmonary

artery to tear.

Surgeons should ensure the following with respect to a stapled pulmonary artery stump: 1) leave a stump length equal to half the diameter of the pulmonary artery that can be separated using a stapling device and 2) observe chest drainage in cases showing changes in blood pressure during waking from general anesthesia.

References

1. Spencer FC. Teaching and measuring surgical techniques: the technical evaluation of competence. *Bull Am Coll Surg* 1978; 63: 9-12.
2. Ohtaka K, Hida Y, Kaga K, et al. Thrombosis in the pulmonary vein stump after left upper lobectomy as a possible cause of cerebral infarction. *Ann Thorac Surg* 2013; 95: 1924-1928.