Axillary Artery to Pulmonary Artery Fistula following Nuss Procedure for Pectus Excavatum

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Systemic artery to pulmonary vessel fistula (SAPVF) is an uncommon condition, which is congenital or acquired. We recently encountered a patient with acquired axillary artery to pulmonary artery fistula detected by dual-source 64-slice computed tomography (DSCT) angiography who had a Nuss surgical procedure for pectus excavatum. He suffered from wound infection following bar removal. Conventional angiography also demonstrated the SAPVF and successful embolization for treatment was carried out using microcoils and polyvinyl alcohol particles. To our knowledge, there has been no report of an axillary artery to pulmonary artery fistula associated with wound infection following a Nuss procedure.

Keywords: systemic artery to pulmonary vessel fistula, Nuss procedure

Introduction

Systemic artery to pulmonary vessel fistula (SAPVF) is an uncommon condition that is usually congenital but may occur as a consequence of tumors, inflammatory processes, or trauma.1–7) Although most published cases reported internal mammary arteries and intercostal arteries as feeding arteries, only one case reported a SAPVF between the axillary artery and pulmonary vessels.1–7) We recently encountered a patient with acquired axillary artery to pulmonary artery fistula detected by dual-source 64-slice CT (DSCT) angiography who had a Nuss surgical procedure for pectus excavatum. He suffered from wound infection following bar removal. To our knowledge, there has been no report of an axillary artery to pulmonary artery fistula associated with wound infection following a Nuss procedure.

Case Report

A 27-year-old man was admitted to our hospital for the chief complaint of chest discomfort. He had a Nuss procedure for pectus excavatum 5 years prior to admission, which was followed by bar removal 3 years later. Following bar removal, he had several wound revisions at the left lower anterior chest wall because of skin necrosis. He had been healthy in the interim, and the physical examination revealed no remarkable findings. A chest radiograph on admission showed increased vascular markings in the left lower lung zone and partial blurring of the left cardiac margin.

Helical CT angiography (tube voltage, 120 kVp; tube current, 160 mA; 64 rows × 0.6 mm collimation, helical pitch, 0.33; rotation time, 330 ms) using dual-source 64-slice CT (Somatom Definition; Siemens Medical Solutions, Erlangen, Germany) was performed following intravenous administration of 90-mL non-ionic iodinated...
contrast material (Ultravist 370; Bayer Schering Pharma, Berlin, Germany) at a rate of 3–4 mL/sec. On CT, an abnormal vascular connection was seen between the external thoracic branch arising from the left axillary artery and the anterior segmental pulmonary artery of the left upper lobe (Figs. 1 and 2). The external thoracic branch of the left axillary artery was tortuous and dilated and went downward beneath the pectoralis muscles. There was whirling of contrast and blood at the drainage site of the fistula caused by mixing of contrast-opacified blood from the pulmonary artery and less opacified blood from the SAPVF (Fig. 2). Decision making for treatment was established because the patient suffered from chest discomfort and the clinician was afraid of hemodynamic complications, such as cardiac failure and pulmonary arterial hypertension due to left to right shunt.

Subsequent conventional angiography also demonstrated the SAPVF seen on CT and embolization was carried out using microcoils and polyvinyl alcohol particles. The patient had an uneventful course after embolization and was discharged from the hospital. Follow up CT obtained 10 months after embolization revealed occlusion of the external thoracic branch arising from the left axillary artery and decreased diameter of the anterior segmental pulmonary artery of the left upper lobe (Fig. 3). During this 10-month period, he enjoyed good health.

Discussion

The Nuss procedure is the preferred method for correction of pectus excavatum because it is a minimally invasive technique that does not require costal cartilage resection or sternal osteotomy. The procedure is composed of three steps. First, an introducer is pushed along posterior to the sternum and ribs through two small incisions on the side of the chest. Second, a concave stainless steel bar is slipped under the sternum anterior to the heart and lungs. Last, a smaller incision is made to insert a thoracoscope used to help guide the bar. There are several known complications of the Nuss procedure, including bar displacement, wound infection, hemothorax, pleural effusion, pericarditis, pneumonia, acquired scoliosis and others. However, to our knowledge, there has been no report in the literature on an axillary artery to pulmonary artery fistula associated with wound infection following the Nuss procedure for correction of pectus excavatum.

SAPVF is an uncommon abnormal communication between the branches of the systemic circulation and pulmonary arteries or veins. The most common feeding arteries of an SAPVF are the internal mammary and intercostal arteries, but they may arise from abnormal aortic branches and subclavian, axillary, diaphragmatic, mediastinal or coronary arteries. Outflow of an SAPVF can be the pulmonary artery, or pulmonary vein, or both. There has been only one SAPVF report that had the axillary artery as a feeding artery developing following coronary artery bypass graft; thus, our report will be the second one.

SAPVFs are congenital more than 50% of the time, but some SAPVFs may develop as a consequence of tumors, inflammatory processes of the pleura or lung, or after blunt, open, or iatrogenic chest injuries. SAPVF of the present case developed due to long-standing inflammatory and adhesive processes at the bar removal site. The etiology of SAPVF is generally thought to be due to adhesions that bridge the pleura from the chest wall to the lung, which then may develop new blood vessels that are large enough to cause significant systemic-pulmonary fistulas. Despite the presence of a left to right shunt, no symptoms are usually present, and the fistulae are discovered during a routine physical examination. The natural clinical history of SAPVF is not well known, but significant complications can occur, such as hemoptysis, cardiac failure, pulmonary
Fig. 2  Axial images show the course of the fistula in the left upper lobe draining into the anterior segmental pulmonary artery of the left upper lobe (arrows). Whirling of contrast and blood in the left pulmonary artery is noted at the drainage site of the fistula (arrowhead).

Fig. 3  Follow-up axial images obtained 10 months after embolization show occlusion of the external thoracic branch arising from the left axillary artery (arrowhead). Note the beam hardening artifact caused by microcoils. The diameter of the anterior segmental pulmonary artery of the left upper lobe as outflow of the fistula is markedly decreased (arrow).
arterial hypertension, endocarditis, and rupture. Therapeutic options include conservative management with observation, surgical ligation, and embolization, but the best treatment remains controversial.

With the wider use and technical development of multislice CT (MSCT), multiplanar reconstruction and volume rendering images are popular, and the nearly isotropic matching of in-plane resolution and section thickness in MSCT means that alternative multiplanar imaging to transaxial imaging is feasible. Although selective angiography has been used for anatomic mapping of SAPVF, MSCT also provides good anatomic detailing of them, including feeding arteries and draining vessels and may replace angiography for diagnostic purposes.

In summary, our patient had an acquired axillary artery to pulmonary artery fistula, a rare type of SAPVF, detected by MSCT. We believe this is the first reported SAPVF case associated with wound infection following a Nuss procedure, and the second case with the axillary artery as a feeding artery.

**Disclosure Statement**

The authors certify that there is no actual or potential conflict of interest in relation to this article.

**References**