opened. Upon return to the operating room 12 days following initial sternal debridement, the wound was closed utilizing bilateral pectoral flaps in a split-thickness skin graft. Postoperatively, the patient’s course was further complicated by an episode of pulmonary embolism confirmed by ventilation-perfusion scanning which required treatment with anticoagulants. The sternal flap closure healed satisfactorily, as did the left knee wound. After a 5-week hospital stay, incorporating continuous IV antibiotic therapy with cefazolin, he was discharged with continuation of IV administered cefazolin for 1 more week. This was followed by orally administered cephalaxin, 500 mg qid, for a 6-week course. His recovery has been entirely satisfactory, and in 7 months of postoperative follow-up, he has not developed evidence of recurrent infection.

**DISCUSSION**

The incidence of sternal wound infection after median sternotomy is generally reported to be 1 to 2%, with a mortality rate of 13 to 33%. A previous study of sternal wound infections after 835 coronary artery bypass procedures reported a time frame from operation to discovery of infection of 3 to 41 days. Another review reported a mean time from surgery to infection of 18 days. The organisms most commonly responsible for sternal infection are coagulase-negative Staphylococcus species. Other frequently encountered organisms include: *Proteus mirabilis*, *Enterobacter*, *Escherichia coli*, *Haemophilus influenzae*, group D Streptococcus, coagulase-positive *Staphylococcus*, Corynebacterium, Pseudomonas, as well as polymicrobial infections. It has been reported that insulin-dependent diabetes mellitus increases the risk for polymicrobial infections.

While no prior reported cases of late hematogenous spread of infection to a median sternotomy wound were found, hematogenous seeding of orthopedic prosthetic devices commonly is reported. In fact, hematogenous spread has been reported as the most common mechanism of orthopedic prosthetic infection. The incidence of hematogenous spread of bacteria to total hip prostheses has been reported as 0.75%, and the time period from surgery to discovery of infection ranged in one study from 1 to 96 months. The most common source of infection spread hematogenously to a total hip arthroplasty was reported to be the urogenital tract, although a skin source was reported in one patient.

In this case, because of the length of time between surgery and discovery of sternal infection, it is unlikely that the sternal infection was due to contamination at the time of coronary bypass grafting. Length of time from surgery to discovery of infection, however, is not enough to differentiate between surgical contamination and hematogenous seeding. Finding a separate source of the bacteria increases the probability that hematogenous spread has occurred. The organism in this case, group B Streptococcus, is an unusual cause of sternal infection by direct contamination and is consistent with the theory that this infection was caused by hematogenous seeding.

Although rare, it is important to recognize that a median sternotomy wound can become infected many months after surgery. Foreign material, such as sternal wires, implanted anywhere in the body can harbor bacteria after generalized bacteremia, which subsequently can lead to locoregional infection.

Because our patient had no evidence of a local source for infection, such as erosion of a sternal wire, and in view of the fact that a source existed for bacteremia harboring the same organism, we believe that hematogenous seeding of a sternal wire is the likely source of this patient’s sternal wound infection with subsequent mediastinitis.

**REFERENCES**


**Three-Dimensional Image Reconstruction of Partial Anomalous Pulmonary Venous Return to the Superior Vena Cava**

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A case of a rare partial anomalous pulmonary venous return of the right upper lobe into the superior vena cava is reported. Multiple three-dimensional image reconstructions in association with spiral CT are used in the aim of clarifying this abnormality of pulmonary venous drainage.

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Key words: concomitant cardiac diseases; partial anomalous pulmonary venous return (PAPVR); scimitar syndrome; spiral computed tomography (SCT); three-dimensional (3D) image reconstructions; vena cava superior

Part anomalous pulmonary venous return (PAPVR) is a dysgenesis in which the embryonic pulmonary venous plexus does not anastomose to the primitive sinus venosus. As a result, abnormal communications between the venae cavae superior and inferior are present.

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portions of the pulmonary venous plexus and the cardiac, cardinal, or omphalomesenteric venous system persist. We report a case in which the diagnosis of a PAPVR was initially suggested by a chest radiograph. An abnormal venous drainage to the superior vena cava (SVC) then was confirmed by spiral CT (SCT) of the chest. Three-dimensional (3D) reconstructions allowed a better understanding of the anomalous drainage due to the fact that images can be made angular and rotated on the screen of the workstation. To our knowledge, this report is the first 3D representation of a PAPVR published in the literature.

CASE REPORT

A 45-year-old woman underwent an excision of a malignant melanoma located on her back. A chest radiograph revealed a curved vessel-like density, in the upper portion of the right lung, which was suspected of being a PAPVR. Further investigation with SCT was achieved and 60 1-mm-thick native sections were obtained from the region of interest at 120 kV and 100 milliamperes second at full end-inspiratory position (Fig 1). Images were processed on a 3D workstation (Advantage Windows 1.2 GE Medical System; Milwaukee). Pulmonary vessels were extracted from the lung parenchyma with a threshold at −500 Hounsfield units. The thoracic wall was removed manually. A surface rendering algorithm was used for 3D visualization (Fig 2).

Both axial sections and 3D reconstructions clearly showed that the PAPVR arose from 3 vessels. These originated from the anterior, apical, and posterior segments of the right upper lobe and joined just before entering the lateral aspect of the SVC at the level of the carina (Fig 1). No other abnormality was observed on the SCT examination. The patient was discharged without any treatment for this asymptomatic PAPVR.

DISCUSSION

Frequency of PAPVR is about 0.4 to 0.77% in autopsy series of patients with congenital heart disease, and involvement of the right lung is shown to be twice that of the left lung. Concomitant cardiac diseases may be found, commonly an atrial septal defect (ASD) of the sinus venous type. Ninety percent of patients with PAPVR draining into the SVC or the right atrium have an associated ASD, whereas the same malformation can only be present in 15% of PAPVR to the inferior vena cava. Apart from ASD, additional cardiac malformations occur in about 20% of patients, including ventricular septal defect and Fallot’s tetralogy.

In the absence of associated anomalies, patients remain asymptomatic, thus explaining the difficulty in knowing the real incidence of PAPVR. Physiologic disturbances depend on the number of anomalous veins, their site of connection, the presence of concomitant diseases, and the state of the vascular bed. Right cardiac failure, with progressive fatigue, dyspnea, a fixed secondary heart sound, right atrial and ventricular hypertrophy, and right axis deviation with incomplete right branch block is a common alteration, related to the severity of the associated ASD.

Chest radiographs in patients with PAPVR are not always specific, but when positive, they typically show a curvilinear vascular structure in the mid or upper lung directed toward the right atrium, the SVC, or the azygos vein. A vertical-oriented crescentic vascular structure in the lower area of the right lung represents a PAPVR to the inferior vena cava, the so-called scimitar syndrome. Symptoms and radiologic presentation of this entity depend on the degree of associated conditions.

Dextroposition of the heart and mediastinal shift to the right are related to right lung hypoplasia. The latter is proportional to the reduced size of the right pulmonary artery found in about half the cases. Pulmonary parenchymal alterations (unusual segmentation) and tracheal or bronchial stenosis may be found as well as bronchiectasis. Recurrent pulmonary infections can then be explained on this anatomic base. Congenital heart disease is present in about 25% of the patients. Most commonly, patients suffer from a second...
ASD. The radiologist also may search for associated diseases like evantration of the right half of the diaphragm and hemivertebra.

Therapeutic decision-making in PAPVR depends on two factors: the hemodynamic situation and the associated cardiac malformations. If the pulmonary flow to systemic flow ratio is less than 1.5, patients can be followed up until adolescence. However, patients presenting with cardiac malformations should undergo surgery after diagnosis.5

SCT with 3D reconstruction was useful in our case to confirm PAPVR and may become the modality of choice for imaging asymptomatic vascular pulmonary anomalies. However, angiographic examination may be necessary for specific treatment planning, such as surgical correction of a vascular anomaly. MRI and angiography might give useful anatomical and functional information through flow quantification in the PAPVR.

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### Key words: adult; heart failure, congestive; pulmonary edema; pulmonary emphysema

Congestive heart failure (CHF) and emphysema are among the most common disease states treated by internists. In the United States, CHF is newly diagnosed in approximately 400,000 persons per year and 2 million people are currently being treated for this condition.1 Emphysema is also present in approximately 2 million people.2 The chest radiograph is routinely used in assessment of the dyspneic patient. The following case demonstrates an unusual radiographic presentation of CHF in the setting of bullous emphysema.

### CASE REPORT

A 65-year-old man with a history of bullous emphysema and chronic atrial fibrillation/flutter presented with progressive dyspnea and lower extremity edema. The patient noted two episodes of blood-tinted sputum 2 weeks prior to presentation. There was no fever or change in sputum color or cough. The patient had self-discontinued his verapanil therapy 3 months prior to presentation. An echocardiogram 4 months prior to hospital admission had demonstrated ++ mitral regurgitation and an estimated left ventricular ejection fraction of 60%.

Physical examination on presentation was notable for a temperature of 36.7°C, BP of 133/75 mm Hg, heart rate of 75 to 150 beats per minute, respirations of 24 breaths per minute, oxygen saturation of 97% on 21 of nasal cannula oxygen. The chest was dull to percussion with decreased breath sounds at the bases bilaterally. Jugular venous pressure was 5 cm. Heart sounds were distant. Two plus bilateral lower extremity edema was present.

The initial WBC was 11,200/mm³ with 73% neutrophils, 17% lymphocytes, 8% monocytes, and 1% eosinophils. An ECG showed atrial flutter with variable atrioventricular block and a right bundle...