Massive Intraoperative Pulmonary Embolism*

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Intraoperative massive pulmonary embolism is extremely rare. We describe such a case in a patient treated for a prolonged period preoperatively with intravenous heparin after an acute myocardial infarction and unsuccessful attempt at angioplasty, emphasizing that the problem should be borne in mind to facilitate expeditious and appropriate management. A clue to the diagnosis is interruption of venous return that is not due to a kink in the cannulae.

(Chest 1992; 102:307-08)

LAD = left anterior descending; PTCA = percutaneous transluminal angioplasty

The following is the report of a man who suffered an intraoperative massive pulmonary embolism.

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Figure 1. Clot retrieved from the venous cannula.

Figure 2. The yield from pulmonary emboleetomy.

CASE REPORT

A 66-year-old man with a history of hypertension, non-insulin-dependent diabetes mellitus, peptic ulcer disease, hiatal hernia, angina pectoris, and two previous myocardial infarctions presented with substernal chest pain. An acute inferolateral myocardial infarction was diagnosed and therapy with streptokinase commenced, with clinical and ECG improvement. A week later, after recurrent chest pain, cardiac catheterization revealed inferoposterior akinesis and double vessel disease (a critical circumflex coronary narrowing and subtotal occlusion of the mid left anterior descending coronary artery [LAD] that filled retrogradely from the right coronary artery). An attempt at percutaneous transluminal angioplasty (PTCA) of the LAD lesion failed. Coronary artery bypass grafts were recommended, but the patient refused surgery. He was weaned off heparin (his prothrombin time [PT] had ranged from 11.3 to 12.1 s and his partial thromboplastin time [PTT] from 26.3 to 36.9 s) and nitroglycerin therapy and he left the hospital.

He presented to another hospital two weeks later with recurrent substernal pain and pulmonary edema. No new infarction could be documented, but he required endotracheal intubation. Heparin therapy was commenced again, and his PTT ranged from 21.3 to 44.9 s. Diuretics and vasodilators were administered and a pulmonary infiltrate was ascribed to infection (after a staphylococcus grew Klebsiella) for which a third-generation cephalosporin was added. He was weaned off assisted ventilation after four days, but chest pain returned despite intravenous nitroglycerin. With no further evidence of sepsis and no new ECG changes, he was transferred to our institution for cardiac surgery (still receiving intravenous heparin). His admission PTT was 33.9 s.

There were no remarkable physical findings; the patient was prepared and anesthesia was induced. After placement of a pulmonary artery catheter (PA pressure was 55/28 mm Hg), the heart rate accelerated to 100 beats/min. The cardiac index was 2.2. The chest was opened and the left internal mammary artery and a segment of long saphenous vein was harvested in the standard manner.

The preoperative activated clotting time was 140 s, which increased to over 500 after 400 mg of heparin, falling to 480 s after 2 h of bypass, and 100 mg of heparin was given. The arterial cannula was placed in the ascending aorta and a 51-mm two-stage venous cannula was inserted via the right atrial appendage. Bypass commenced and the left ventricle was vented via the right superior pulmonary vein, the aorta was cross-clamped, and cold blood cardioplegia was administered via the aortic root; further intermittent doses were infused retrogradely.
While performing the first distal anastomosis, right atrial distention was noted with a reduction in venous return. There was no kink in the venous line, and arterial flow was reduced and the patient drained. Level in the reservoir rose, and the atrial distention resolved, but as soon as the arterial flow was increased toward normal, venous return decreased, and the right atrium distended again.

At this stage, although unsure of the cause of the problem, it was obviously necessary to change the venous cannula. A single 44-Fr venous cannula was prepared and bypass was discontinued briefly to allow its insertion. Partially trapped within the two-stage cannula, and almost totally occluding its lumen, were two clots (Fig 1). These were firm organized thrombi forming complete casts of vein segments, with side branches!

With satisfactory drainage, the distal anastomoses were completed. Reflecting on the early tachycardia and high pulmonary pressures, it seemed likely that additional clot had embolized to the lungs, and the pulmonary artery was explored surgically, obtaining a large quantity of clot (Fig 2). The pulmonary artery was repaired, aortic clamp was removed, and the proximal anastomoses were completed while administering warm blood reperfusion. The heart began to beat spontaneously, but bypass could not be discontinued without dramatic rises in PA pressures and concomitant falls in left atrial and systemic pressures. Inotropes, pulmonary arterial vasodilators, and an intraaortic balloon were used, but there was inadequate oxygenation and the right ventricle was distended. Cardiopulmonary bypass was restarted.

A centrifugal pump (Biomedicus, Minneapolis) and a membrane oxygenator (SCIMED, ULTROX-1, Life Systems Inc, Minneapolis) was used to provide bypass from the right atrial cannula to the right femoral artery. Excellent oxygenation and perfusion were obtained, with flows of 4.5 to 5.0 L/min without inotropes. A good urine output was maintained throughout. After 61/2 h of extracorporeal assist, weaning was achieved, administering levophed via the left atrial line and prostaglandins via the pulmonary arterial line. After declamping, with the chest left open, the patient was transferred to the intensive care unit with stable parameters and good oxygenation. There, alterations in ventilation were followed by acute deterioration in oxygenation and the right ventricle failed totally.

**DISCUSSION**

Successful management of a massive pulmonary embolus during cardiopulmonary bypass (for mitral valve replacement) was reported in 1978. That patient had undergone a successful embolectomy from the left leg six weeks prior to bypass.1 The embolus presented (as in our case) with difficulty with venous return, and after 10 min of low flow, both caval cannulae were replaced during a period of circulatory arrest. The pulmonary artery was not explored surgically. Despite hemiparesis, the patient made a complete recovery. Inadequate venous drainage during bypass may be due to malposition of cannulae, migration of a two-stage cannula or of caval cannulae with snared cavae, kinks in cannulae or lines, or to intraluminal obstruction by air, clot, or tissue at the level of cannulae, tubing, or filters.

Thromboembolism presenting during cardiopulmonary bypass is exceedingly rare. Our case illustrates that it can occur, even in a patient systemically heparinized for several weeks. With an increasing number of elderly patients coming to surgery after a prolonged hospital course, the diagnosis should be borne in mind. The key is interruption of venous return which is not due to the more common causes such as air locks or kinking of the cannulae.

**REFERENCE**


**High Dose Rate Brachtherapy Improves Resectability in Squamous Cell Lung Cancer**

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A 44-year-old man with squamous cell carcinoma of the left lower lobe extending to the mucosa of the main carina, was treated with high dose rate brachtherapy prior to surgery. A significant reduction of tumor infiltration was achieved allowing a radical pneumonectomy instead of a sleeve pneumonectomy with resection of the main carina. He remains disease-free after a follow-up period of 43 months.

*(Chest 1992; 102:305-09)*

| HDR = high dose rate; NSCLC = non-small-cell lung cancer |

High dose rate brachtherapy has been introduced as an alternative bronchoscopic treatment, requiring a short period of intralumenal irradiation of endobronchial tumor.1 Procedure and radiation related morbidity have been reported to be acceptable (3 and 4 percent, respectively).2 Most patients, however, were treated because of inoperable non-small-cell lung cancer and endobronchial recurrences after external irradiation.4 In more than 60 percent of the patients, an objective response could be achieved. The patient presented herein had NSCLC of the left lower lobe bronchus, infiltrating to the mucosa of the main carina. We treated him with HDR prior to surgery.

**CASE REPORT**

A 44-year-old man with a previous history of bladder carcinoma, treated with external irradiation and intravascular iridium implantation, was referred to us because of dyspnea and hemoptysis. He had been smoking more than 30 cigarettes a day from the age of 15. The chest x-ray film showed a large left hilar mass. Due to peribronchial infiltration, assessment of the hilar nodes on CT scan was inconclusive. Bronchoscopy revealed a central polyloid hemorrhagic tumor, completely obstructing the left main bronchus with pathologic mucosal infiltration of the main carina. Histologic findings confirmed the presence of squamous cell carcinoma in the mucosa of the main carina (TMNXM0). Radical surgery could only have been feasible if the main carina had been resected (sleeve pneumonectomy). The possibility of tumor reduction treatment with HDR prior to surgery was discussed. After obtaining informed consent, intraluminal irradiation was executed with the HDR-Selectron (4

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Brachtherapy Improves Resectability in Squamous Cell Lung Cancer (Sutedja et al)