CASE REPORT

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Embolization of Cotton Pledgets Following Insertion of Porcine Cardiac Valve Bioprostheses

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ABSTRACT: A variety of complications involving heart valve implants have been documented. Embolism originating from thrombosis of the valve has been a recurrent problem in mechanical and to a lesser extent porcine implants. We report two accidental deaths as a result of embolization of cotton pledgets from porcine valves. Hospital personnel failed to remove this cotton material from the valves before surgical placement. In the first case, when portions of the pledgets embolized to both carotid arteries, fatal cerebral infarction occurred. In the second case, portions of the pledgets embolized to a coronary artery producing severe left ventricular failure.

KEYWORDS: pathology and biology, accidents, prosthetic devices, iatrogenic injury, cardiac valve prosthesis

Reported complications of heart valve implants include anticoagulant related hemorrhage, valve occlusion by thrombosis or tissue growth, prosthetic valve endocarditis, hemodynamic valve dysfunction, perivalvular leak, and thromboembolism. Emboli resulting from blood clots have been less of a problem with bioprosthetic valves than with the mechanical implants formed from man-made materials [*1,2*]. One problem arising with bioprosthetic valves, however, is that the delicate nature of their valve cusps requires that they be supported during shipping and storage by cotton balls or pledgets. If not removed during the preoperative washing procedure, cotton fibers from these pledgets may enter the vascular system. We report two cases where cotton packing material was not removed from porcine bioprosthetic valves. In the first case, cotton embolized to both carotid arteries causing fatal cerebral infarction. In the second case, cotton embolized to a coronary artery causing fatal left ventricular failure.

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Case 1

A 68-year-old woman presented with chest pain and congestive heart failure. She had had rheumatic fever as a child but had suffered no prior cardiac problems. Diagnoses of myocardial infarction and mitral regurgitation were made and the patient recovered partially but continued to experience dyspnea on exertion and episodes of chest pain. Cardiac catheterization revealed severe mitral valve insufficiency and coronary atherosclerosis. The patient was scheduled for mitral valve replacement and coronary bypass surgery. At surgery, rheumatic mitral valve disease was found and the valve was excised and replaced with a No. 27 Carpenter-Edwards bioprosthetic porcine valve. Saphenous vein grafts were used to bypass atherosclerotic portions of the three main coronary arteries. When the aortic vent from the cardiopulmonary bypass machine was removed, several cotton fibers were present on the vent. The aorta was then opened and additional cotton fibers removed. It was then suspected that cotton used to pack the porcine valve had not been removed when the valve was washed before insertion. A dental mirror was inserted through the aortic valve to visualize the ventricular surface of the porcine valve. No remaining cotton was seen in the ventricle or on the valve. The heart was restarted and the chest was closed. The patient never regained consciousness and died five days after surgery.

At autopsy, cotton obstructed both the bifurcation of the right subclavian artery and the right common carotid artery and the bifurcation of the left internal and external carotid arteries (Fig. 1). On microscopic examination (Fig. 2), the cotton showed characteristic birefringent ribbon-like fibers [*3*]. The right cerebral hemisphere of the brain showed massive infarction. A congenitally absent right posterior communicating artery and a rudimentary vertebral artery were felt to have contributed to the infarction (Fig. 3).

Case 2

A 73-year-old man presented to the hospital with the chief complaint of fatigue. Past history revealed shortness of breath while walking up one flight of stairs. There was no history of chest discomfort. Two cardiac catheterizations had been performed in the past for a "bad heart." A heart murmur had been present for a number of years.

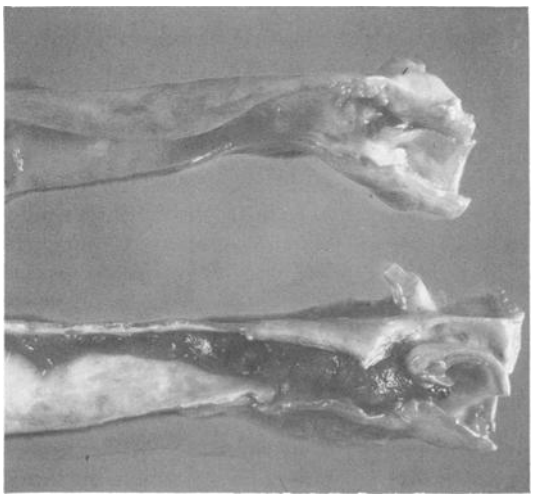

FIG. 1—*Obstruction of left carotid artery by cotton and clotted blood which embolized from surface of porcine valve bioprosthesis.*

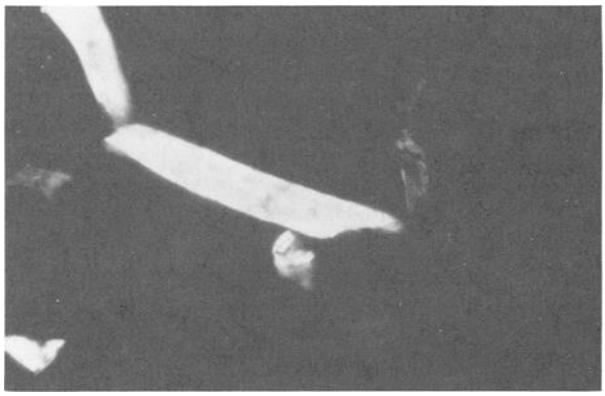

FIG. 2—*High-power photomicrograph of embolus taken with polarized light shows birefringent cotton fibers.*

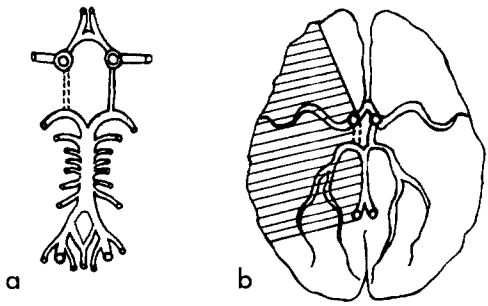

FIG. 3—*Congenitally absent right posterior communicating artery* (a, dotted lines) *impaired collateral circulation through the circle of Willis following blockage of both carotid arteries resulting in an infarct of the brain* (b, crosshatching) *in the distribution area of the right middle cerebral artery.*

Following a third cardiac catheterization, the diagnoses of pulmonary hypertension and mitral insufficiency were made. Coronary artery disease was minimal. The attending physicians decided that replacement of the mitral valve was indicated, and the patient went to surgery twelve days after admission. At surgery, the mitral valve was found to be large, dilated, and grossly insufficient. The valve was excised and a No. 31 Carpenter-Edwards porcine bioprosthesis was implanted. Shortly after removal of the aortic cross clamp, severe left ventricular failure became evident and the patient died in the operating room.

An autopsy limited to the thoracic cavity was performed. The heart weighed 600 g. Sutures were present in the right atrium and ascending aorta. Serial sections of the coronary arteries showed complete occlusion of the left main coronary artery by cotton at a point 1 cm from its origin. Cotton was also seen protruding from the left coronary ostium within the sinus of Valsalva (Fig. 4). The left anterior descending coronary artery revealed no additional distal occlusions. The first marginal branch of the left anterior descending coronary artery showed 30 to 45% atherosclerotic occlusion. Located within the right posterior coronary artery, at the level of the posterior descending branch, was a strand of cotton approximately 1 cm in length and 1 mm in diameter. The remaining coronary arteries showed only minimal atherosclerotic changes. Examination of the interior of the heart showed a normal bioprosthetic valve sutured in place. On the endocardium, attached to the papillary muscles

and chordae tendinae, were pieces of cotton similar to that seen in the lumen of the coronary arteries.

Microscopic sections of the heart showed foci of fibrotic change and focal extravasation of red blood cells. Sections of the coronary arteries showed intraluminal birefringent cotton fibers (Fig. 5).

Discussion

Cotton fiber emboli are a common finding at postmortem examination of patients who have undergone cardiac surgery, catheterization procedures, or have received large amounts of intravenous solutions [*4–7*]. Usually they are an incidental finding, but when sufficiently

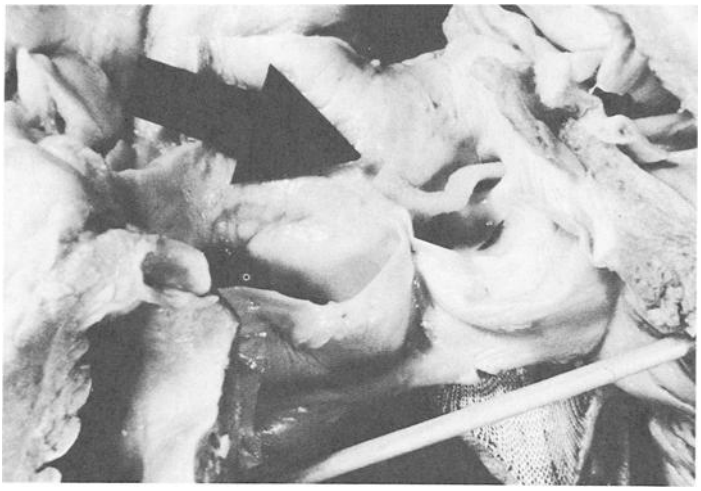

FIG. 4—*Cotton material* (arrow) *within lumen of left coronary ostium.*

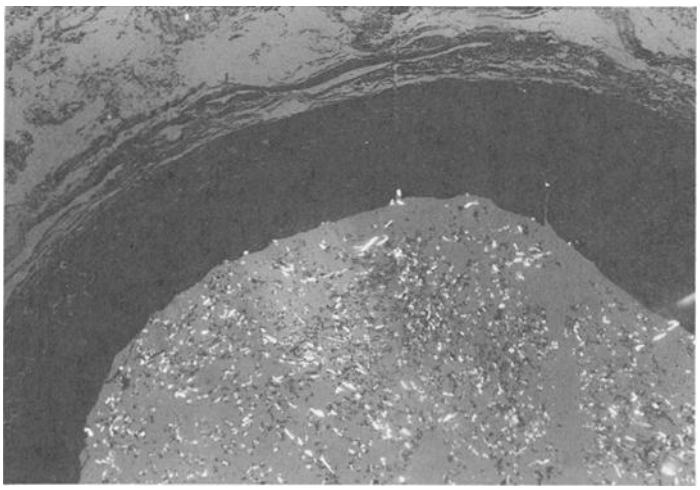

FIG. 5—*Low-power photomicrograph of coronary artery taken with polarized light shows birefringent cotton material which originated from the bioprosthetic mitral valve.*

large or numerous, they may result in infarction. Cotton fibers are birefringent, ribbon shaped, and readily distinguishable from talc or starch granules [3,6]. Embolization of pledgets of cotton packing material has been previously reported, and in those cases death occurred when cotton embolized to the coronary circulation causing cardiac ischemia [4]. We have found no previous reports of cotton packing material causing fatal cerebral infarction.

Several factors combined to cause the fatal accident in the first case. The incident occurred with newly trained operating room personnel who were not familiar with the packaging of the porcine valve. The valve's package insert specifically warns that all cotton material must be removed from the valve during the washing procedure—apparently this was not done. The wet cotton, adherent to the ventricular side of the valve, was not seen by the surgeon inserting the valve into position through an opening in the left atrium. Once the cotton had embolized to the carotid arteries, the brain might have been protected by collateral blood flow through the circle of Willis; however, in this patient, the right posterior communicating artery was congenitally absent and the left vertebral artery was very small. This lead to insufficient circulation after bilateral carotid obstruction and a "watershed" infarct in the distribution of the right middle cerebral artery.

In our second case, cotton material was found within the coronary circulation. Again, the cotton material was incompletely removed when the bioprosthetic valve was unpacked and washed in the operating room. Subsequent coronary embolization occurred with resultant death when attempts were made to wean the patient from the artificial heart pump.

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