

CASE REPORT

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Cardiac Injury During Valve Replacement Surgery

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ABSTRACT: The commonly referenced mortality of cardiac valve replacement surgery is 2 to 5%. Some of this mortality is due to therapeutic misadventure during the procedure. Therapeutic misadventure during cardiac valve replacement may result in patterned injury of the heart, so that postmortem examination can establish the nature of the surgical injury. A case of patterned myocardial injury during valve replacement surgery is presented, with a review of literature and associated cases.

KEYWORDS: pathology and biology, prosthetic devices, therapeutic misadventure, cardiac valve prosthesis

Death during therapeutic misadventure falls under the investigational domain of the County Coroner in the State of Indiana. Therapeutic misadventure is an emotionally volatile issue fraught with allegations of malpractice and potential for civil litigation [1]. Forensic pathologic determination of therapeutic misadventure therefore requires a complete understanding of the therapy in question.

We recently encountered a case of unexpected postoperative death following mitral valve replacement surgery. Autopsy revealed a patterned injury of the heart. A review of previously reported complications of valve replacement surgery was obtained [2]. Descriptions in this review led us to discover another similar case among the organ specimens maintained for the

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anatomic pathology teaching set at Indiana University. These two cases are representative of a therapeutic misadventure that was well-known and clearly documented in 1967.

Case 1

A 67-year-old female with long-standing mitral stenosis and acute pulmonary edema was taken to surgery for mitral valve replacement. About 2 h after surgery she developed bloody chest tube drainage and profound hypotension. She was taken back to exploratory surgery but died before reopening of the chest.

Autopsy revealed a small elderly appearing woman, 65 in. (165 cm) tall and 119 lbs (54 kg). There was evidence of the recent surgery, with chest tube sites. There was slight bilateral hemothorax communicating anteriorly across the surgically open pericardial sac.

Examination of the 380-g heart (Fig. 1) revealed the presence of a large subepicardial hematoma around the left atrioventricular groove with some blood still adherent to the epicardial surface (Fig. 2). There was a horizontal incision through the endocardial surface of the left ventricular free wall above the tip of the excised papillary muscle (Fig. 3). The myocardium was incised through to the epicardial fat at the left atrioventricular groove. The mitral prosthesis was in good functioning condition. No sutures were found around the left circumflex coronary artery, and the strut of the prosthesis did not impinge on the left ventricular free wall.

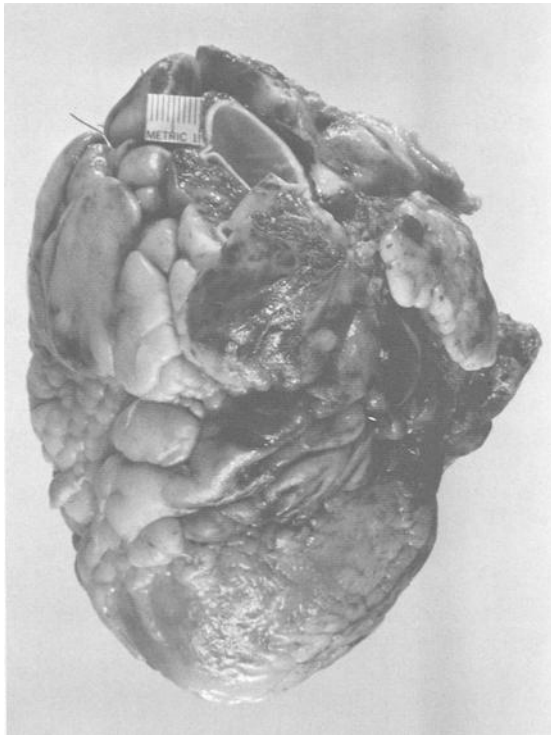


FIG. 1—Case 1: subepicardial hematoma around left atrioventricular groove.



FIG. 2—Case 1: blood adherent to epicardial surface at perforating incised wound. Note visible portion of prosthetic mitral valve fabric (arrow).

Case 2

Upon discovery of the etiology of the patterned injury observed in Case 1, one of us (B. F. W.) recalled having seen another case, with a related finding, among the hearts preserved in the anatomic pathology teaching set at Indiana University.

A 60-year-old male died with staphylococcal septicemia and acute bacterial endocarditis of the aortic valve. In 1963, at age 43, he underwent mitral valve replacement for rheumatic mitral stenosis. Eight years after valve replacement, a cardiac catheterization revealed a small saccular "aneurysm" of the inferior-posterior left ventricular free wall. He survived with significant aortic and mitral stenosis until his death 17 years after the original valve replacement surgery.

Examination of the heart demonstrated the presence of mitral valve replacement surgery and fibrosis with calcification of the stenotic aortic valve. There was endocardial fibrosis of MacCallum's patch in the left atrium. Fibrinous and ulcerated vegetations were present on the leaflets of the aortic valve, and cultures were positive for *Staphylococcus aureus*. A saccular false aneurysm, 1.5 cm in diameter and 3.5 cm in depth, projected from the posterior left ventricular free wall below the mitral ring (Fig. 4). The covering of the false aneurysm was found to be thickened pericardium, which was adherent all around the heart (Fig. 5). The fibrotic pericarditis was thought secondary to prior surgery or preexisting rheumatic pericarditis. No sutures were found around the left circumflex coronary artery.

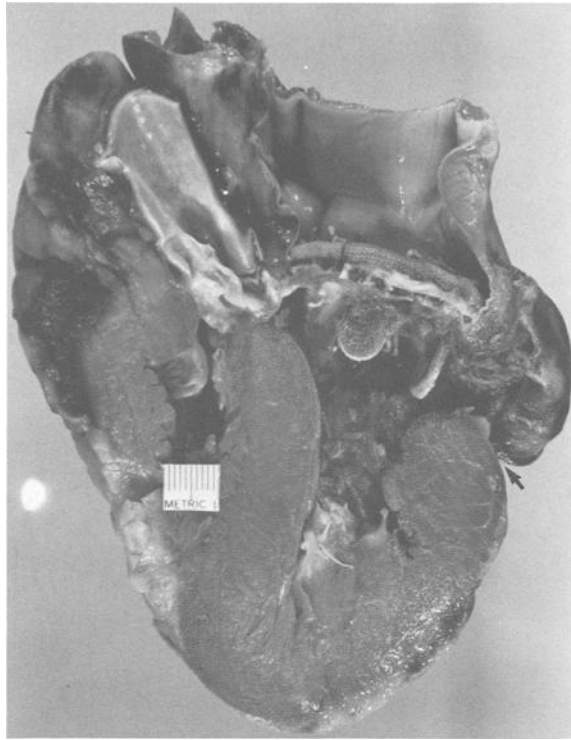


FIG. 3—Case 1: perforating incised wound through endocardial surface of left ventricular free wall (arrow).



FIG. 4—Case 2: opening (at arrow) into false aneurysm from endocardial surface of left ventricular free wall just below mitral valve prosthesis.

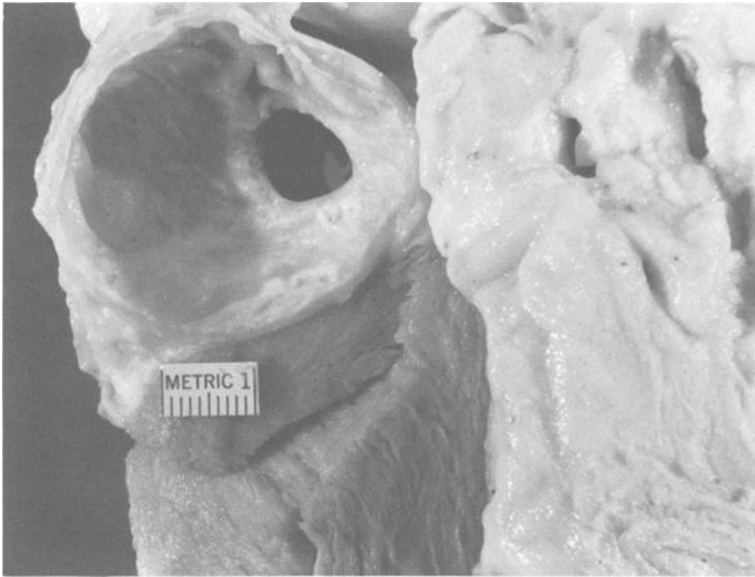


FIG. 5—Case 2: false aneurysm with adherent pericardium.

Discussion

Cardiac valve replacement surgery is accompanied with a statistically predictable mortality of 2 to 5%; those deaths occurring intraoperative or in the early postoperative period [3]. The mechanism of death varies in these cases [4]. In 1967, Dr. William Roberts attributed 7 deaths out of 350 procedures to bleeding caused by a "technical misadventure" [5,6].

In 1980, Dr. B. Woodfin Cobbs described the entity "transverse midventricular disruption," a rupture of the left ventricular free wall after mitral valve replacement [7]. He stated an incidence of 0.5 to 2% for this complication. Dr. Cobbs also pointed out that an incomplete rupture could result in a false aneurysm. In 1981, Dr. Roberts reviewed this work and attributed the lesion to "inadvertent incisions into the left ventricular free wall at the time of excising the mitral valve" [2,8]. Dr. Roberts further noted that this injury is more likely to occur if there is poor operative visualization of the tips of the scissors, in "relatively small people with relatively small hearts," and in cases where the left atrium is not dilated.

Case 1 represents a complete incision through the left ventricular free wall, with resultant bleeding. Case 2 represents incomplete incision into the left ventricular free wall with an aneurysm. Fibrous obliteration of the pericardial space, found in Case 2, would seem to promote incomplete incision and result in the false aneurysm formation as observed.

To demonstrate the myocardial injury, an angulated scissors was posed with a heart from a patient with mitral stenosis (Fig. 6). Knowledge of the size and shape of the scissors, as well as the surgical approach to the papillary muscle, is important for interpretation of the patterned myocardial injury.

Conclusion

In summary, a surgical complication of mitral valve replacement, described many years ago, has reappeared as a forensic medicine problem. Correct interpretation of this patterned injury is important for correct classification of the death as therapeutic misadventure.



FIG. 6—Heart with small left ventricle and mitral stenosis used to demonstrate cutting scissors and surgical approach to papillary muscle during valve replacement procedure.

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