

# Traumatic aorta to pulmonary artery fistula

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A case of chronic aortic to pulmonary artery traumatic fistula is presented and the surgical repair is detailed. Closure through the aorta is recommended; this approach provides a dry operative field and avoids the need for dissection of adhesions around the fistulous tract. Fistulae of this type are not common and the pertinent literature is reviewed.

Following the original successful repair of a penetrating wound of the heart in 1897 by Professor Rehn, many successful operations of this type have been performed. There have, however, been relatively few reports of successful repair of penetrating wounds of the aorta. Forty-eight such cases have been described between 1922 and 1970 (Lam and McIntyre, 1970; Rogers, Chesler, and du Plessis, 1969; Symbas and Sehdeva, 1970): in only nine of these was a traumatic communication between the aorta and pulmonary artery found and repaired (Table).

In this paper we present the clinical features and surgical repair of a traumatic chronic aorta to pulmonary artery fistula which we believe to be the tenth successfully repaired case in the literature.

## CASE REPORT

An 18-year-old coloured girl was stabbed in the precordium with an ice pick during July 1967 and admitted to her local hospital with a right haemopneumothorax which was treated by tube drainage.

One episode of transient loss of consciousness occurred shortly after admission to hospital. At the time of her discharge from hospital eight days later, apparently no abnormal heart sounds were detected, but four months later a continuous murmur was audible at the base of the heart during a routine physical examination and the patient herself was conscious of the abnormal heart sounds.

Over the next two years mild shortness of breath developed and she was referred to the University of Chicago Hospital and Clinics for evaluation and treatment. When seen first the important features on physical examination included a young girl of normal development with a 1-cm entry wound scar in the left third intercostal space at the level of the mid-clavicular line. Regular sinus rhythm was present, the jugular venous pressure was raised 2.5 cm at 45° with a normal wave form and the carotid impulse was of rapid upstroke and increased volume. There was no delay between the pulses in the upper and lower halves of the body. The blood pressure in both arms was 130/60 mmHg. The cardiac impulse indicated moderate enlargement of a dynamic left ventricle and there was, in addition, an easily palpable systolic and diastolic thrill at the base of the heart. On auscultation a continuous murmur was present at the left third intercostal space, and at the apex of the heart a loud left ventricular third heart sound was

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TABLE  
REVIEW OF SUCCESSFULLY TREATED TRAUMATIC AORTA TO PULMONARY ARTERY FISTULAE

Case	Author	Age	Sex	Type of Injury	Interval between Injury and Surgery	Year of Operation	Definitive Treatment Technique Approach Repair
1	Diveley <i>et al.</i> (1961)	36	F	Bullet wound	6 mth	1952	Closed - - - - Ligation and division
2	Diveley <i>et al.</i> (1961)	46	M	Stab wound	5 mth	1958	CP bypass Aorta; RA Direct suture
3	LaFlèche <i>et al.</i> (1963)	41	M	Stab wound	- - -	1962	CP bypass PA Direct suture
4	Halonen <i>et al.</i> (1963)	19	F	Bullet wound	2 mth	- - -	- - - -
5	Norman <i>et al.</i> (1965)	15	M	Stab wound	4½ mth	1963	CP bypass PA; RV Direct suture
6	Symbas <i>et al.</i> (1967)	32	M	Stab wound	3 wk	1966	CP bypass PA Direct suture
7	Lam & McIntyre (1970)	16	M	Bullet wound	10 mth	1967	CP bypass PA Suture over Ivalon sponge
8	Rogers <i>et al.</i> (1969)	23	M	Stab wound	4 mth	- - -	CP by pass Aorta Direct suture
9	Symbas <i>et al.</i> (1970)	20	M	Stab wound	9 ay	1969	CP bypass PA Direct suture
10	Present case	18	F	Stab wound	2½ yr	1970	CP bypass Aorta Direct suture

CP bypass=cardiopulmonary bypass; PA=pulmonary artery; RV=right ventricle; RA=right atrium; - - - denotes information is unknown

present. The chest radiograph showed slight enlargement of the left ventricle with a moderate increase of the pulmonary vasculature. The electrocardiogram confirmed sinus rhythm and showed early left ventricular hypertrophy. The clinical diagnosis was a traumatic fistula between the aorta and pulmonary artery, and in January 1970 right and left heart catheterization studies confirmed the clinical diagnosis. There was a left-to-right shunt of 2.1 l/min at the pulmonary arterial level but pulmonary arterial pressures were normal and there was no rise in end-diastolic pressure in the left ventricle or in indirect left atrial pressure. Retrograde aortography showed a left-to-right shunt between the ascending aorta and the main pulmonary artery (Fig. 1).

**SURGICAL REPAIR** The pericardial cavity was opened following a mid-line sternotomy. Adhesions obliterating the base of both major vessels were found between the parietal pericardium and the pulmonary artery. There was moderate enlargement of the left ventricle and the main pulmonary artery with a localized bulge just beyond the pulmonary valve where a continuous thrill could easily be felt.

Following heparinization, normothermic high-flow cardiopulmonary bypass was established using a disc oxygenator and haemodilution. The ascending aorta was cross-clamped and a longitudinal incision was made in the anterior wall which provided excellent exposure of the fistula (Fig. 2). The communication was seen 1 cm above the left coronary ostium and measured 6×3 mm with well-defined edges. A small

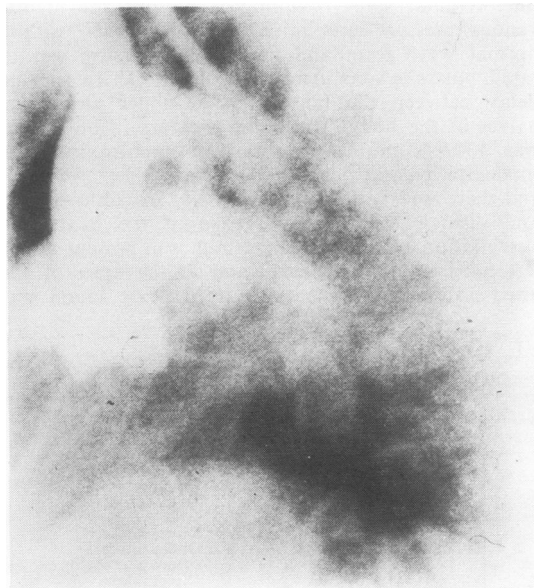


FIG. 1. Retrograde aortogram showing communication between ascending aorta and main pulmonary artery.



FIG. 2. Operative findings. A sound has been passed through the fistula. Note the proximity of the left coronary ostia.

laceration of the intima was found in the opposite wall of the aorta. The anterolateral aspect of the pulmonary artery, the point of entry of the ice pick, was sealed by adhesions (Fig. 3). Closure of the fistula was easily performed with a running mattress suture reinforced by over-and-over stitches of 4/0 mersilene (Figs 4a and b).

The incision in the aorta was then closed, and after evacuation of air cardiopulmonary bypass was discontinued. The heart took over the circulation without difficulty after 20 minutes of anoxic arrest. At the conclusion of surgery the pulmonary artery was notably less tense and no thrills were palpable.

The postoperative course was entirely uneventful. When last seen five months after surgery the patient was quite asymptomatic, normal heart sounds were noted, and the patient had returned to her normal occupation.

#### DISCUSSION

A penetrating injury to the precordium most frequently causes a traumatic ventricular septal defect (Beall, Hamit, Cooley, and De Bakey, 1965; Summerall, Lee, and Boone, 1965) or a fistula between the aorta and the right ventricle (King and Shumacker, 1958; Morris, Foster, Dunn, and Cooley, 1958; Smyth, Adkins, Kelser, and Calatayud, 1959; Villareal, Fries, Cheng, and

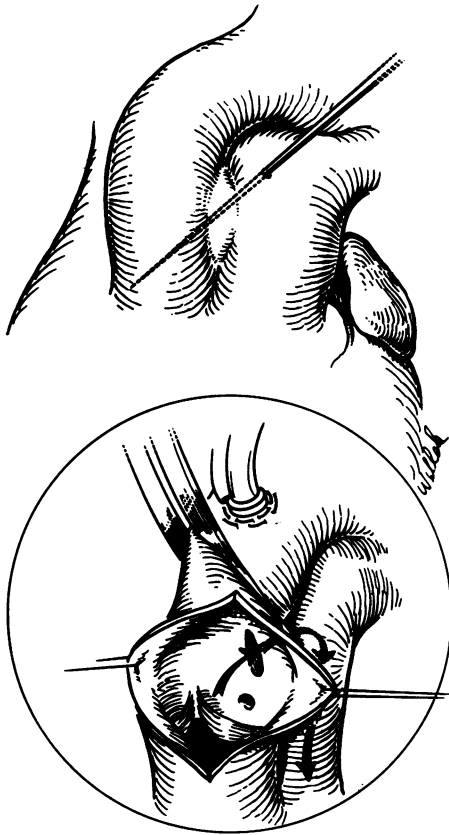


FIG. 3. Artist's conception of the mode of injury and the resulting fistula.

Potter, 1968). In contrast, traumatic fistulae between the aorta and the pulmonary artery are relatively rare, for the initial laceration must be considerable if the shunt is to persist, and the immediate mortality of these extensive wounds is high; only 12% of 456 patients who died following penetrating wounds of the aorta survived longer than one hour (Parmley, Mattingly, and Manion, 1958) or indeed long enough to reach medical facilities.

In a few patients, however, particularly in those in whom the initial entry occurs through the chambers or vessels of the right side of the heart, the initial haemorrhage may be partially controlled by the surrounding structures, resulting in a certain degree of tamponade, thus preventing death from exsanguination. Once reabsorption of the clots has occurred, a fistula may well persist between the high-pressure chamber or vessel and

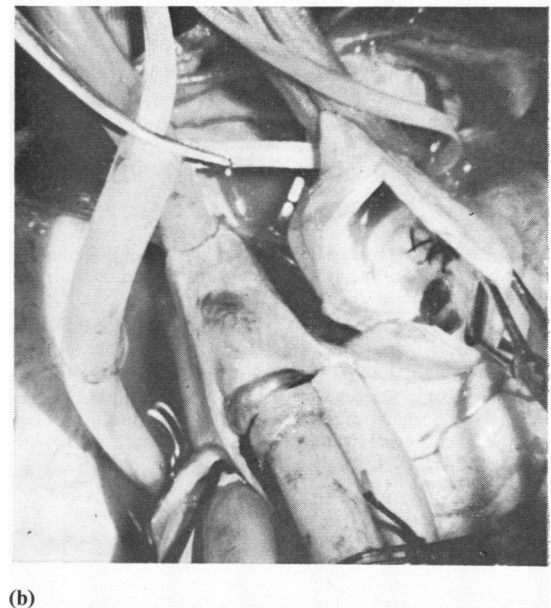
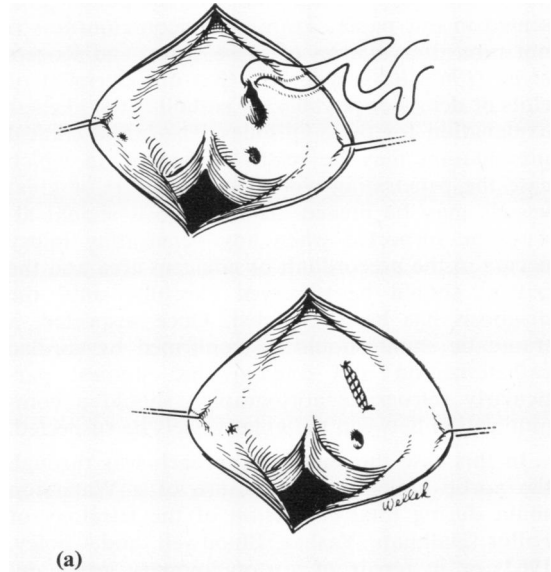


FIG. 4. (a) Technique of closure of the fistula; (b) operative view of the repair.

the low-pressure area, thus creating a left-to-right shunt. With establishment of the communication or fistula thus caused, a continuous murmur now becomes audible, which in many cases is only evident several days after the initial injury, and



this is the likely clinical course of the patient presented in this paper. Transient unconsciousness is not rare after injuries of these types, and Rogers *et al.* (1969) have suggested that dislodgement of clots or debris or possibly air emboli is the likeliest explanation for these episodes. The initial clinical presentation may be relatively benign, in which case the penetrating wound of the heart or great vessels may be missed. The diagnosis should always be suspected when any penetrating injury occurs in the precordium or adjacent area and the patient should be observed carefully until the diagnosis has been excluded. Once suspected, a traumatic shunt should be confirmed by cardiac catheterization and angiographic studies, particularly retrograde aortography, should a communication between the great vessels be suspected.

In this case the surgical approach was through the aortic lumen as for closure of a Waterston shunt during total correction of the tetralogy of Fallot (Hallman, Yashar, Bloodwell, and Cooley, 1967) or in repair of aortopulmonary septal defects (Deverall, Lincoln, Aberdeen, Bonham-Carter, and Waterston, 1969). This technique proved to be very satisfactory for it was not necessary to dissect adhesions around the fistula, and furthermore a completely dry operative field was obtained which materially facilitated the closure of the fistula.

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