ROLE OF COMPRESSION OF DIFFERENT PARTS OF THE HEART IN HEMODYNAMIC DISTURBANCES IN ADHESIVE PERICARDITIS

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Experiments on dogs showed that compression of the right ventricle plays the leading role in the genesis of hemodynamic disturbances in total pericarditis. However, excision of the compressing capsule during pericardectomy must begin over the left ventricle, the right ventricle being liberated later. If the operation is performed in this order, the thin-walled right ventricle works against a lower resistance and no risk of its acute dilation arises, as is the case if the right ventricle is freed first.

Pericarditis is often accompanied by hemodynamic changes. Some workers consider that compression of the right heart plays the chief role in these changes [5, 6], butothers believe that the severity of the hemodynamic disturbances is mainly determined by the degree of left-ventricular constriction [7, 12]. There are thus differences of opinion regarding the correct operative tactics in pericarditis [1, 3, 4, 8, 10].

The object of this investigation was to study the state of the hemodynamics in experimental adhesive pericarditis and during pericardectomy.

EXPERIMENTAL METHOD

Three series of experiments involving the production of total or local pericarditis were carried out on 38 dogs. Total pericarditis (series I, 14 dogs) was simulated by injecting 0.2 ml of a mixture of turpentine and talc into the pericardial sac. In the experiments of series II, local compression of the right (12 dogs) or left ventricle (12 dogs also) was produced. This was done by suturing the pericardium to the epicardium along the border of one of the ventricles. A thin sheet of Porolon sponge was inserted into the pocket thus formed. In the experiments of series I and II the blood pressure was recorded in the femoral artery and caudal vena cava in the initial state and 24 weeks after the beginning of development of the pathological process.

In the experiments of series III, various parts of the constricting capsule were excised from all 14 animals with total pericarditis lasting 24 weeks, under general anesthesia and artifical respiration. The effectiveness of the operation was assessed from the degree of restoration of the arterial, venous, and intracardiac pressures to normality. In 8 animals of this series, the decortication was carried out over one of the ventricles, and the effects of liberating the right ventricle were compared with those of pericardectomy over the left ventricle. In the remaining 6 animals, the pericardectomy was perfomed from left to right, i.e., the left ventricle was freed first, and the right later.

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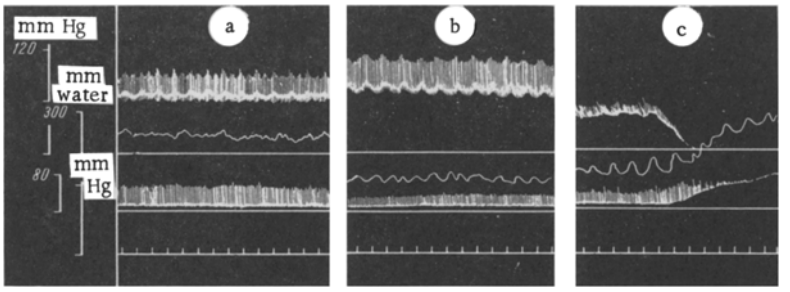

Fig. 1. Hemodynamics in adhesive pericarditis (a) and 5 min (b) and 15 min (c) after pericardectomy over the right ventricle. From top to bottom: pressure in femoral artery, in vena cava, zero line of arterial pressure, pressure in right ventricle, its zero line, time marker (3 sec), which also acts as zero line for venous pressure.

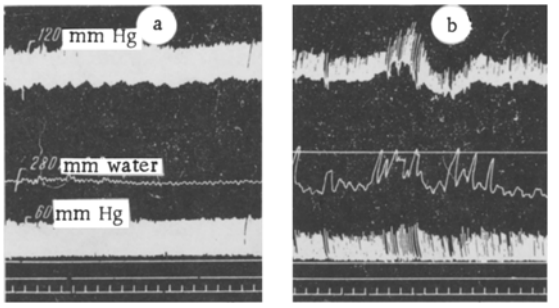

Fig. 2. State of the hemodynamics in pericarditis (a) and immediately after pericardectomy above the left atrium (b). From top to bottom: pressure in femoral artery, its zero line, pressure in vena cava, in right ventricle, its zero line, zero line of venous pressure, time marker (3 sec).

TABLE 1. Changes in Blood Pressure in Adhesive Pericarditis Lasting 24 Weeks (Mean Values, in Percent)

Type of pericarditis	Arterial pressure		Venous pressure
	systolic	diastolic	
Total	−20±2,2	−6±0,9	+480±17,6
Right-sided	−12±0,8	−5,2±0,6	+400±12,3
Left-sided	−4,5±0,5	−3,2±0,2	+290±8,6

EXPERIMENTAL RESULTS AND DISCUSSION

The results given in Table 1 show that total pericarditis caused the most marked changes in the hemodynamics. The hemodynamic changes after local right-sided pericarditis also were highly significant. Left-sided pericarditis was accompanied by the least changes, but even in this case the pressure in the caudal vena cava increased to almost 300 mm water. In all types of pericarditis, the arterial pressure, especially the diastolic, showed little change.

It can be concluded from a comparison of the hemodynamic changes in total and local pericarditis that the disturbances in total pericarditis are mainly dependent on compression of the right ventricle, since the changes in total right-sided pericarditis are approximately as severe as those in total pericarditis.

It could be concluded from these observations that to improve the state of the hemodynamics, it is first necessary to free the right ventricle. In fact, in these experiments excision of the constricting capsule above the right ventricle rapidly lowered the pressure in it and in the caudal vena cava considerably, and slightly increased the pressure in the femoral artery (Fig. 1a, b). However, acute dilation of the right ventricle developed 10-15 min after the excision and the heart stopped beating (Fig. 1c). The most likely cause of this phenomenon was that the thin-walled right ventricle, affected by the pathological process, could not cope with the increasing load [2, 11].

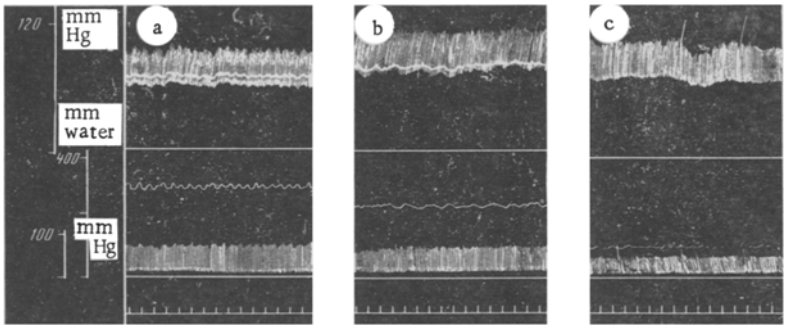

Fig. 3. State of hemodynamics in pericarditis (a), and after freeing of left (b) and right (c) ventricle. Legend as in Fig. 2 (zero lines for venous and intracardiac pressure coincide).

Liberation of the atria or of the left ventricle alone produced no marked improvement in the hemodynamics. Removal of the pathologically changed pericardium over the left atrium alone (Fig. 2) lowered the pressure in the right ventricle, but the indices of the venous and arterial pressure demonstrate how ineffective operations of this type can be. The same conclusion was reached by Isaaks et al. [9].

For pericardectomy to be as effective as possible, both ventricles must be freed, and the best results are obtained if the left ventricle is freed first and the right later. It will be clear from Fig. 3 that this is the optimum order. Removal of the constricting capsule over the left ventricle (Fig. 3b) usually led to a small decrease in the intracardiac and venous pressure and some increase in the pressure in the femoral artery. Subsequent resection of the pericardium over the right ventricle led to the almost complete restoration of the normal pressure in the right ventricle and vena cava by the end of the operation (Fig. 3c). Acute dilation of the heart is not observed after pericardectomy in this order, because after freeing of the left ventricle the thin-walled right ventricle works against a reduced resistance.

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