Vasodilator treatment for acute and chronic heart failure¹

Sir,

In their recent Journal article, Chatterjee and Parmley (1977) emphasise the need for measurement of left ventricular filling pressure before therapy, since impedance reduction with baseline filling pressures below 15 mmHg may result in a fall in stroke volume (Chatterjee and Parmley, 1977, *British Heart Journal*, 39, 706). Traditionally, attainment of 'optimal' filling pressures (LVFP)—pulmonary wedge of 12 to 18 mmHg in acute myocardial infarction and pressures slightly on the 'drier' side in the adult respiratory distress syndrome—have been felt to maximise cardiac performance in the first case (Forrester *et al.*, 1971) and to prevent complicating fluid overload in the other (Moser, 1977). We would like to point out that filling pressures are but one of several factors affecting fluid exchange in the lung (Starling, 1896). Others are plasma colloid osmotic pressure, normally 20 to 25 mmHg; interstitial hydrostatic and colloid pressure, neither precisely known; and a coefficient of filtration. Despite the fact that plasma colloid osmotic pressure is now readily measurable, its influence upon cardiopulmonary function remains ignored. We believe that assessment of plasma colloid osmotic pressure may provide useful information in the management of patients for whom filling pressure assessments are crucial.

For example, in cirrhotic, crystalloid-infused, or renal failure patients plasma colloid osmotic pressure may be significantly reduced (Tremper, 1977), setting the stage for pulmonary oedema at wedge pressures formerly considered to be 'safe'. Lowering of plasma colloid osmotic pressure experimentally in animals produces pulmonary oedema (Guyton and Lindsey, 1959). In a series of 26 patients with acute myocardial infarction, it was not so much rises in left ventricular filling pressure (LVFP) that heralded pulmonary oedema as a simultaneous fall in plasma colloid osmotic pressure (PCOP), resulting in a narrowing of the PCOP-LVFP difference

(Da Luz *et al.*, 1975). A recent article has suggested that large infusions of crystalloid substances (which lower plasma colloid osmotic pressure) in patients with acute myocardial infarction during therapeutic volume expansion can cause pulmonary oedema characterised by normal left ventricular filling pressure and low plasma colloid osmotic pressure (Stein *et al.*, 1975). In severe asthma, patients have been found to have very negative intrapleural pressures throughout most of the respiratory cycle (Stalcup and Mellius, 1977). Vigorous fluid therapy in these patients might decrease plasma colloid osmotic pressure, enhancing transudation of fluid into interstitium and alveolus. The effect of vasodilator therapy on plasma colloid osmotic pressure has not been specifically studied.

In summary, we believe that the desirability of vasodilator therapy in certain clinical situations, such as refractory congestive heart failure, aortic and mitral regurgitation, and myocardial infarction complicated by pump failure or shock, should not be predicated upon the presence of any 'absolute' baseline filling pressure, as Chatterjee and Parmley suggest. Rather, filling pressures should be interpreted in the context of simultaneous plasma colloid osmotic pressure measurements, and research should be directed to answering the following questions:

- (1) Does plasma colloid osmotic pressure (PCOP) or PCOP-LVFP difference correlate with clinical indices of pulmonary oedema, and how does it change with pharmacological and fluid manipulations?
- (2) Does PCOP or PCOP-LVFP difference correlate with morbidity and mortality in pulmonary oedema? With sudden death? With incidence of serious arrhythmias?
- (3) What is PCOP in patients with respiratory failure, how does it change with therapy, and does it affect prognosis?

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¹The opinions or assertions contained herein are those of the authors and are not to be construed as official or necessarily reflecting the views of the Medical Department of the Navy or the Naval Service at large.

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This letter was shown to Professor Chatterjee and Dr Parmley who reply as follows.

Sir,

We are in complete agreement with Drs Warren

and Dennish, in that pulmonary venous pressure is one of the many factors which induce pulmonary oedema. Plasma colloid osmotic pressure is also an important determinant of interstitial oedema. In general, however, in most patients with pulmonary oedema resulting from cardiac causes, pulmonary venous pressure is the dominant factor. Furthermore, if the objective of therapy is to improve cardiac output, as well as to reduce pulmonary venous pressure, then it becomes important to determine pulmonary venous pressure before initiation of vasodilator therapy. If the pulmonary venous pressure is normal, or low, or if during vasodilator therapy there is much reduction of pulmonary venous pressure to a very low level, the stroke volume tends to decrease. We agree with Drs Warren and Dennish that absolute baseline filling pressure to differentiate between true pump failure and relative hypovolaemia is not always precise and may vary from patient to patient, but the clinical experience suggests that the filling pressure below which stroke volume tends to decrease is about 15 mmHg. These values are only suggested to provide a general guideline.

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