Dear Sir,

Dennis Trumble is to be congratulated on the progress he has made towards an efficient linear muscle energy converter, and for setting out the advantages and disadvantages of various approaches needed to translate this hydraulic work into useful cardiac assistance [5]. It is certainly helpful that the linear configuration does not require sacrifice of the perforating (so-called ‘collateral’) vessels, although this problem can be overcome by preconditioning [3]. However, Trumble underestimates the capacity for pumping blood that is offered by the skeletal muscle ventricle (SMV), for the following reason.

When the muscle is wrapped to form the artificial ventricle it compresses the lumen in two ways: (a) by the shortening of its fibres, which reduces the circumference of the wrap, and (b) by the inward movement of the volume of the wrap. The latter arises because the outer fibre layers, being more lightly loaded, contract more rapidly than the inner fibre layers, so that the muscle bulges inwards during each contraction.

The importance of this effect is well illustrated in another application: the use of rectus abdominis muscle to create an artificial sphincter. Shortening of a sarcomeric muscle is normally limited to about 25%, and a double wrap of muscle of 3.6 mm thickness, around a lumen of 14 mm, would not, on this basis, be expected to cause occlusion. As a result of inward bulging, however, occlusion is total, and capable of resisting a pressure of 60 cm of water for prolonged periods ([2], and manuscript in preparation).

This phenomenon no doubt contributes to the pumping performance we have observed when an SMV is connected in circulation in pigs. Working in counterpulsation, SMVs proved capable of generating as much as 50% of the work of the native left ventricle in single contractions, and provided an assist at least equivalent to that of an intra-aortic balloon pump [1]. In dogs, SMVs were still providing effective diastolic augmentation when they were electively terminated after pumping in counterpulsation for up to 4 years [4].

There is therefore every reason to believe that this approach to long-term cardiac assistance is feasible and effective.

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