and the bicycle ergometer. Also we feel that the very slow rise in oxygen consumption seen during the first six minutes of both STEEP tests make them an unsatisfactory basis for the extrapolation of maximal oxygen uptake from maximal workload and for measuring the subtle changes observed after a given treatment. Before being tested in patients, these new protocols should be extensively tested in healthy volunteers and compared with other exercise protocols.

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This letter was shown to the authors, who reply as follows:

Sir,—The data presented by Dr Essamri and colleagues agree with the need for standardisation of exercise testing within Europe—but which protocol are we to use as a standard? The STEEP protocol has several advantages over existing protocols, including short stages (as recommended by Buchfuhrer et al.), suitability for both treadmill and bicycle testing, adjustment for body weight during the bicycle protocol so that subjects of different size exercise at similar relative intensity at each stage, and exponential increments in workload making the test applicable to a very wide range of patients. None of these improvements over existing protocols is contested in the letter from Essamri et al. They have, however, demonstrated a difference in oxygen consumption during the later stages of the treadmill and bicycle protocols, which may indicate a need for a minor modification of one or other protocol. However, we did not suggest that the two tests were identical, only that they were comparable. Bicycle and treadmill testing have certain fundamental differences—which were discussed in our original report. The STEEP tests merely offer a pragmatic solution to the problem of standardisation, when some laboratories use treadmills while others use bicycle ergometers.

Their assertion that the final workload increments are too large in heavy subjects is clearly unwarranted because the whole point of adjustment for body weight is that all subjects experience the same relative workload and increments. In fact the data of Essamri et al confirm this principle because the standard deviations of the mean oxygen consumption for each stage of the bicycle protocol (assuming that their figure shows standard deviations rather than standard errors) are very small even though the study included a remarkable range of body weights—from 62 kg to 115 kg. We fully agree that the STEEP protocol is not suitable for inferring maximal oxygen uptake from maximal workload in patients with cardiovascular disease—but this is not recommended for any protocol.

Finally, we think that firm conclusions cannot be reached until new standard exercise protocols, such as the STEEP test, are validated in suitable patient populations.

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Fatal aortic rupture during balloon dilatation of recoarctation

SIR,—I read the paper by Balaji (British Heart Journal 1991;65:100-1) with interest. They reported aortic rupture and death in an eight year old child after balloon angioplasty for aortic recoarctation that developed after a patch angioplasty procedure. We have had extensive experience with balloon angioplasty of aortic coarctations, both native and postoperative, and have not observed a similar complication. We do not agree with Balaji et al that balloon angioplasty should be avoided in cases of recoarctations after patch angioplasty. The complication reported in Balaji et al is a problem related to the technique of angioplasty that they adopted.

Firstly, I do not believe that balloon angioplasty should be performed without monitoring the pressure in the balloon. The purpose of monitoring the pressure is to prevent...
overinflation (as they seem to imply) but to prevent rupture of the balloon. I believe that both the results should be presented at all cost, not only to avoid complications that reported by Balaji, but also to prevent arterial injury, which is more likely during the removal of a ruptured balloon.

Third, the Olbert catheter system that Balaji et al. used in this case produces longitudinal movement of the balloon material over the internal surface of the aorta and is likely to injure the aorta further. Based on our experience and that reported by Cooper et al. and Hellenbrand et al. we believe that aortic recoarctations that develop after all types of coarctation surgery—namely, end-to-end anastomosis after resection, subclavian flap angioplasty, patch angioplasty (Dacron, Gore-Tex, or pericardial patch), and interrupted aortic arch repair—can be successfully dilated.

To prevent aortic rupture and/or subsequent dilatation, it is vital to avoid manipulation of the tip of the guide wire and catheters in the region of freshly dilated coarctation and to avoid using a balloon that is larger than the descending aortic diameter at the level of the diaphragm.

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This letter was shown to the authors, who reply as follows:

Sir,—We thank Dr Rao for his helpful comments. However, we do not agree with some of them. Dr Rao has reported seven cases of angioplasty for recoarctation without giving any patient details, particularly about the nature of their previous surgery. All the other reports from his group deal with native coarctation in 30 cases, a lesion in which the method of action of balloon angioplasty may be very different from that in recoarctation.

The results of our experience quoted by Rao quotes to support his conclusions come from our hospital. Until the aortic rupture that we reported, our experience with angioplasty for recoarctation was very promising indeed. Our main interest in drawing attention to this case was to introduce a note of caution. As we indicated in the case report, there are few reported cases of angioplasty in patients who have previously undergone patch aortoplasty. Most workers including Dr Rao have not reported details of the previous surgery that the patients had undergone. We cited, however, the large and successful experience from the Boston group in patients who had patch repair.

We accept we should avoid balloon rupture and now suggest pressure monitoring of the balloon is used. We chose to use the smaller Olbert balloon because we believed that it was firmer than the larger Meditech balloon, which had had no "apparent" effect on the coarctation.

In our experience longitudinal balloon movement is equally likely with all balloon catheters. Perhaps what is more important is the straightening effect of the balloon within a curved structure such as the aorta. It is our long-held opinion that not to manipulate guide wires or catheter tips across freshly dilated coarctations.