

Editorial Comment

Balloon Valvuloplasty in the Neonate With Critical Pulmonary Stenosis*

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In this issue of the Journal, Tabatabaie et al. (1) present the results of balloon dilation in 37 consecutive neonates with critical pulmonary stenosis. Reduction in peak to peak systolic pressure gradient across the pulmonary valve, decrease in right ventricular/aortic peak systolic pressure ratio and increase in systemic arterial oxygen saturation occurred immediately after balloon valvuloplasty. However, the procedure could not be accomplished in 2 (6%) of 37 patients; 3 (8%) died after valvuloplasty; and 2 (6%) required immediate surgical intervention. The immediate results are generally similar to those reported by other investigators (2-5). In addition, Tabatabaie et al. showed improvement in the pulmonary valve leaflet mobility and thickness, reduction in the prevalence of right ventricular hypoplasia and increase in pulmonary valve annulus diameter Z scores at a mean follow-up of 31 months. Residual peak instantaneous Doppler gradients remained low (15 ± 9 mm Hg) at the last follow-up visit, and only two patients (6%) required reintervention. Originally described by Tynan et al. (6), balloon pulmonary valvuloplasty has been used by several groups (2-5,7-10) for relief of critical pulmonary stenosis in the neonate. The germane features of the present report (1) are that it includes the largest number of neonates that have thus far been evaluated at a single institution, and more importantly, it documents improvement and maturation of the morphology of the right ventricle and pulmonary valve after balloon dilation of critical pulmonary stenosis in neonates. They further demonstrated, in a relatively large series of neonates, that pulmonary valve dysplasia and right ventricular hypoplasia did not have a significant adverse effect on either immediate or midterm follow-up results, in contradistinction to previous clinical impressions based on a small number of patients or anecdotal experiences (9-11). These data, together with those of others (2-10), reaffirm that balloon valvuloplasty is the treatment of choice in the management of the neonate with critical pulmonary stenosis. Now

that balloon therapy is the treatment of choice, the pediatric cardiologist needs to know how best to do it (technique) and what problems are likely to be encountered during the immediate postvalvuloplasty period. These issues, by design, are not discussed in the report of Tabatabaie et al., and I wish to address these issues.

Technique of valvuloplasty. The technique of balloon valvuloplasty in neonates is generally similar to that used in older children (11), but the procedure is slightly more difficult to accomplish in neonates than in children. The first problem is crossing the pulmonary valve. Use of right coronary artery catheters (2.5-cm curve) (Cook) or 4F multi-A2 catheters (Cordis) in conjunction with soft-tipped guide wires (Bentson, Terumo; 0.014 to 0.018-in. superfloppy or high torque and, more recently, nitinol guide wires) made it easier to traverse even the most severely stenotic pulmonary valve orifices. The second problem is positioning an appropriately sized balloon dilation catheter across the pulmonary valve. If a large-bore catheter can be advanced over the guide wire already placed across the stenotic valve (as previously discussed), the guide wire can be exchanged with a 0.035-in. Teflon-coated stiff (extrastiff Amplatz or Medi-Tech) wire. Over this stiff wire, a balloon dilation catheter is positioned across the pulmonary valve and the balloon inflated. Positioning the stiff wire into the descending aorta through the ductus arteriosus, thus anchoring the wire steadily makes it easier to appropriately position a balloon dilation catheter. If a large-bore catheter cannot be passed across the pulmonary valve, it is unlikely that a balloon dilation catheter can be positioned across the pulmonary valve. In such cases, predilation with a 3- or 4-mm balloon dilation catheter (usually a coronary angioplasty catheter*), followed by insertion of large-bore catheter, stiff guide wire and appropriately sized balloon catheter successively would accomplish balloon pulmonary valvuloplasty (2,3,5,7,11,14). The neonates are usually maintained on an intravenous infusion of prostaglandin E_1 and are ventilated during the procedure. It is generally agreed that the diameter of the final balloon used for dilation should be 1.2 to 1.4 times the size of the pulmonary valve annulus (4,15) and that the balloon/annulus ratio should not exceed 1.5 (15).

Immediate postvalvuloplasty follow-up. After successful balloon pulmonary valvuloplasty, extubation and discontinuation of prostaglandin infusion are possible in the majority of cases. Some neonates do not tolerate stopping the prostaglandin infusion and develop severe arterial desaturation. As many as 17% to 27% of patients may require prostaglandin infusion for 3 to 21 days after balloon valvuloplasty (1,4,5,16). Right to left shunting across the patent foramen ovale, presumably related to a poorly compliant right ventricle, is the cause of arterial desaturation. Some of these infants may require either prolonged infusion of prostaglandins or creation of an aortopul-

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*Alternatively, a balloon on a wire, such as that used by Kirby et al. (12) for pulmonary valve dilation or by Rao et al. (13) for dilating stenosed Blalock-Taussig shunts, may be utilized for initial dilation of the pulmonary valve.

monary shunt to augment pulmonary blood flow. An alternative consideration is placement of stents (17) in the patent ductus arteriosus, although the experience with ductal stents is limited, and ductal stents are considered experimental.

Conclusions. Balloon pulmonary valvuloplasty appears feasible, effective and relatively safe in the initial management of critical pulmonary valve stenosis in the neonate. The majority of patients require no additional intervention, and appear to have remodeled ventricles and pulmonary valves at follow-up. Approximately 25% of patients may require surgical or repeat transcatheter intervention to treat unsuccessful dilation attempts, manage complications of the procedure, augment pulmonary flow despite "successful" balloon valvuloplasty or relieve recurrent pulmonary valve obstruction.

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