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Letter to the Editor

Radiofrequency pulmonary valvulotomy and valvuloplasty using transductal guidewire rail and translevofemoral venous slide: An unhackneyed solution to a newborn with pulmonary atresia, intact ventricular septum, upstream patent ductus arteriosus, and sigmoid inferior vena cava

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1. Introduction

Since the pioneer report of transcatheter laser-assisted balloon dilatation in treating patients with pulmonary atresia and intact ventricular septum (PA-IVS) by Qureshi et al. in 1991 [1], radiofrequency pulmonary valvulotomy and valvuloplasty (RFPVV) has superseded the laser-based technique to become the treatment of choice aiming at establishing continuity between the right ventricle and pulmonary trunk, provided that there is a patent infundibulum and absence of a right ventricle-dependent coronary circulation [2]. In addition to the traditional anterograde approach from the right heart, there were reports detailing uncanny shrewdness in the management of patients with PA-IVS, including transductal guidewire rail [3], transaortic approach through the patent ductus arteriosus [4], stenting of the ductus to augment pulmonary blood flow after perforating the atretic pulmonary valve [5], application of 2 Fr radiofrequency end hole catheter [6] or 2 Fr electrode catheter [7], application of inhaled nitric oxide for persistent pulmonary hypertension after RFPVV [8], and monitoring the cardiac enzymes in case of non-right ventricle-dependent ventriculocoronary communication after RFPVV [9]. In this report, we raised an unhackneyed solution to a newborn with pulmonary atresia, intact ventricular septum, upstream patent ductus arteriosus, and sigmoid inferior vena cava by using transductal guidewire rail and translevofemoral venous slide attempting to undergo RFPVV.

2. Case report

A 10-hour-old female neonate was referred from a local obstetric clinic due to overt lip cyanosis, shortness of breath, and heart murmur since birth. She was born, at the 39th gestational week, to a 32-year-old woman of gravida 2 and para 2, by vertex extraction delivery. Her birth weight was 3.0 kg (50 percentile), height 54 cm (>90 percentile), and body surface area 0.2 m^2. On the first admission day, her heart rate was 142 beats per minute and respiratory rate was 55 breaths per minute. There was a grade 2/6 continuous murmur over the left infraclavicular area. Plain chest radiograph showed cardiomegaly with a narrow cardiac waist, decreased pulmonary vascularity, and enlargement of the right atrium. Two-dimensional echocardiography showed membranous atresia of the pulmonary valve, hypoplastic right ventricle with patent infundibulum, main pulmonary trunk of adequate size, confluent branch pulmonary arteries without stenosis, and a small patent ductus arteriosus. The diameter of the tricuspid valve was 8.8 mm (a *Z*-value of −1.5), and that of the pulmonary valve was 4.2 mm (a *Z*-value of −5). Doppler echocardiography confirmed retrograde flow

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from the descending aorta through the patent ductus arteriosus to the main pulmonary artery, and lack of coronary-cameral sinusoid communication. Intravenous prostaglandin E_1 (PGE_1) was administered at 50 ng/kg/min to keep the ductus patent and to maintain the oxygen saturations above 90%.

3. Technique

Cardiac catheterization was performed, on the 5th days of life, through the right femoral vein and left femoral artery of the patient, to whom endotracheal incubation and local anesthesia were given. The systolic pressures of the left ventricle, the right ventricle, the aorta, and the main pulmonary artery were 68, 159, 68, and 28 mmHg, respectively. Angiography of the right ventricle confirmed imperforated pulmonary valve and absence of the sinusoid communication. Aortography, at the ductal level, showed visible main pulmonary trunk. The patterning of the coronary arteries is normal, and the coronary circulation is non-right ventricle-dependent. However, if force is required to push the catheter along the guidewire or to manipulate the catheter impinged below the atretic pulmonary valve from the right femoral vein, there is undesirable recoil of guidewire within the sigmoid inferior vena cava that causes the guidewire flipping back from the right ventricle to the right atrium inevitably (Fig. 1A,B). This unpleasant drawback was overcome when we approached from the left femoral vein, through which all the force applied to advance the catheter along the guidewire is directed to the tip of the catheter (Fig. 1A,B). A 5 Fr right coronary Judkins catheter was placed, upstream the descending aorta to the ductus arteriosus, above the atretic pulmonary valve to serve as the "landmark catheter" (Fig. 2A,B). A 4 Fr Multipurpose catheter (Cordis, Johnson-Johnson, LJ Roden, Netherlands) was advanced with a guidewire and manipulated to impinge below the atretic pulmonary valve as the "target catheter". This target catheter could slide over the sigmoid curve and rail along the guidewire from the left femoral vein to the atretic pulmonary valve without producing recoil of guidewire. This target catheter was kept consistently below the atretic pulmonary valve, which could be confirmed by the lack of blood drawing through the tube and checked up by manual angiography at the outflow tract. A 2 Fr unipolar radiofrequency catheter (CERABLATE PA 120, Grenzach-Wyhlen, Germany) was proceeded via the target catheter to the atretic pulmonary valve, through which radiofrequency energy of 5 W for 3 s was delivered twice from the generator (HAT 200 S, Grenzach-Wyhlen, Germany) to perforate the atretic pulmonary valve. A 0.035-inch super-stiff wire of Amplatz (Medi-tech, Boston, MA, USA) was

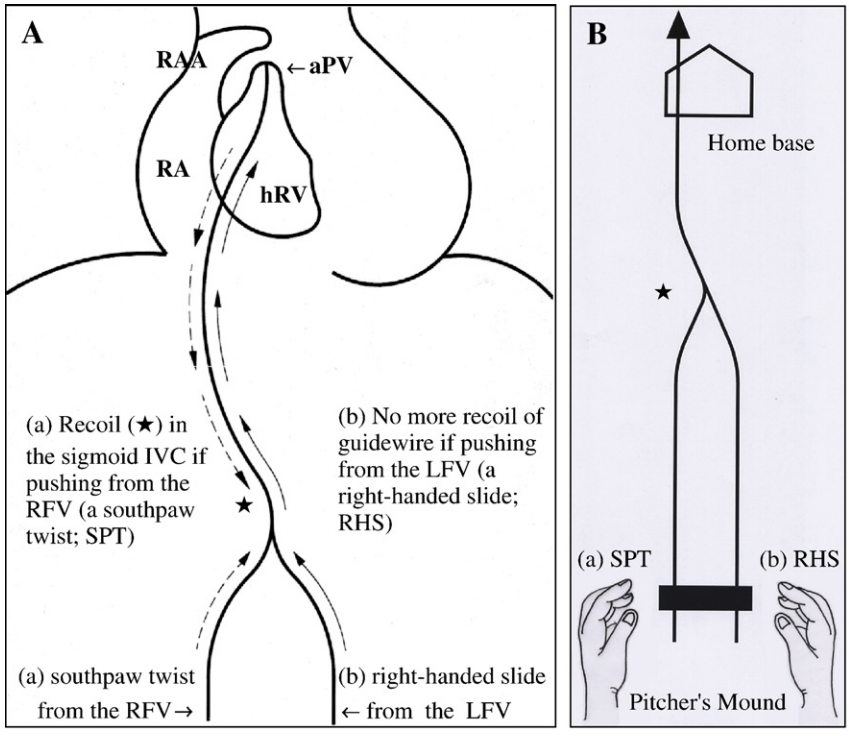

Fig. 1. (A, B) Diagram showing passage of a guidewire within a catheter through the sigmoid inferior vena cava, which may be likened as a "southpaw twist" curving from the right femoral vein to the right atrium and homing to the right ventricular outflow tract and the atretic pulmonary valve. If force is required to push the catheter along the guidewire and to manipulate the catheter impinged below the atretic pulmonary valve before radiofrequency valvulotomy, there is undesirable recoil (black star) in the sigmoid inferior vena cava causing the guidewire to flip back from the hypoplastic right ventricle into the right atrium (dotted arrows) inevitably. This unpleasing drawback can be overcome if approaching from the left femoral vein, which may be likened as a right-handed slide, through which all the force applied to advance the catheter along the guidewire is directed to the tip of the catheter (solid arrows). Abbreviations: aPV, atretic pulmonary valve; hRV, hypoplastic right ventricle; LFV, left femoral vein, RA, right atrium; RAA, right atrial appendage; RFV, right femoral vein.