We describe a new technique of perventricular closure of a perimembranous ventricular septal defect on a beating heart using transesophageal echocardiography guidance and video-assisted thoracoscopy. Ventricular septal defects were closed successfully, and no shunts, rhythm disorders, or valve incompetence developed during the short hospital stay. This procedure is safe and effective for selected patients. These early and mid-term results encourage further evaluation.


Since the first successful on-pump ventricular septal defect (VSD) closure, this procedure has been the gold standard in pediatric cardiac surgery. Transcatheter VSD closure has been used to date, but it has a number of limitations. Another alternative technique of transesophageal echocardiography (TEE)–controlled VSD closure on a beating heart using an occluder recently came into practice. This method is widely used in China and other countries [1]. The described method was used for the first time, and it unifies modern minimally invasive methods of VSD repair.

Technique

The operation was performed in an operating room using an Image 1 HD (H3–Z) videostand (Karl Storz GmbH & Co KG, Tuttingen, Germany). The patient was in a 20-degree right lateral decubitus position. Trocars (3.5 and 3.9 mm) were set through punctures in the third and sixth intercostal spaces along the midclavicular line, in the fourth intercostal space along the anterior axillary line to the left. The puncture to set the delivery system was created at a point determined by TEE in the fourth intercostal space to the left at the level of sternoclavicular joint. The thoracoscopic ports were used as follows: the right one for atraumatic forceps (Clacks line Reddick-Olsen [diameter, 3 mm; length, 20 cm] and Kelly [diameter, 3 mm; length, 20 cm]), and a needle holder (KOH ulramicroneedle holder; diameter, 3 mm; length, 20 cm); the left one for micro scissors (diameter, 3 mm; length, 20 cm)

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disconnection was performed under TEE control. The puncture spot was controlled endoscopically while manipulating the delivery system. The pursestring suture at the anterior wall of the right ventricle was tied using a pusher through the left trocar and cut off. The punctures were sealed with Dermabond Advanced topical skin adhesive (Ethicon). A 3-mm Blake drain (Ethicon) was placed in the left pleural cavity through the lower puncture site. Extubation was performed within 1 hour after the operation. Aspirin 75 mg/day per os was administered.

Three patients were treated with this approach (ages 4, 5, and 6 years; weight, 15 to 17.5 kg, one of them had subaortic VSD and we used an eccentric occluder). The first operation was performed on August 15, 2013. The 3-month follow-up examination revealed excellent cosmetic results in all patients, with no shunts, conduction disturbances, or valve complications in any patient.

Comment

The results of open surgery are improving, and there has been growing interest in decreasing surgical trauma. Thus far, less-invasive techniques have been developed, including the PVDC and video-assisted thoracoscopic surgery [2–4]. The technique of PVDC of VSDs on a beating heart under TEE control that was first described by Amin and associates [5] and later developed by Bacha and colleagues [6] is simple and safe, easy to reproduce, and provides good results [4]. Our series includes more than 150 such operations performed within 1 year since July 1, 2012, with excellent results [7]. We consider
PVDC of VSDs to be the preferable approach for children compared with the transcatheter procedure that is preferred for all age groups because all advantages have been previously described and proved [4, 7].

In 2006, Amin and coworkers [8] in their experimental work in pigs showed PVDC of VSDs on a beating heart with robotic assistance, but this technique has not been introduced to clinical practice.

We were the first to combine the two procedures of video-assisted thoracoscopic surgery and PVDC of VSDs on a beating heart under TEE control. The two techniques complement each other perfectly and result in a new method that has the advantages of both techniques and provides great results. Applying this technique in the future mainly in a young pediatric cohort, we expect to achieve high cost-efficiency because this procedure is off-pump, avoids incisions, is effective and safe, and reduces surgical trauma, operation time, and the patient’s length of stay.

References