

THE NEAR TO MID-TERM STUDY OF CONCOMITANT TOTALLY THORACOSCOPIC TRICUSPID VALVE REPAIR IN 367 CASES

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Abstract: Objectives: To discuss the near to mid-term efficacy of patients undergoing concomitant totally thoracoscopic TVP performed by the same surgeon, using retrospective analyze and follow up. Methods: A total of 367 patients with preoperative TR undergoing concomitant totally thoracoscopic TVP performed by the same surgeon between August 2011 and December 2016 were enrolled in this study. The patients were divided into ring group and suture group based on TVP technique. The transthoracic echocardiography was performed and data were gathered before surgery, 1 week, 3 months, and 1 year after surgery. Results: No death occurred after surgery and all patients were discharged. The median follow-up time was 3.4 months. The longest follow-up time was 33 months. After the surgery, LVEF improved significantly, and the diameter of RV and the pulmonary artery pressure were significantly reduced compared with that before the surgery. Conclusions: The concomitant totally thoracoscopic TVP is reliable, effective, and safe. The results in the near to mid-term were satisfactory.

Keywords: Tricuspid valve repair, thoracoscopic, follow up

1. INTRODUCTION

Tricuspid regurgitation (TR) is one of the most common valvular heart disease (VHD) and may affect 65–85% of the population [1], which divided into primary and secondary TR. The pathology of primary TR is rheumatic, degenerative, congenital, infectious, traumatic or iatrogenic. Secondary TR (STR) is more common and related to right ventricular (RV) dilatation and/or dysfunction, annular dilatation and leaflet tethering, usually secondary to left-sided VHD, atrial fibrillation, pulmonary hypertension or cardiomyopathy. It used to be thought that STR would improve naturally after correcting the left heart valvular disease. However, researches [2-3] have demonstrated that most STR was gradually deteriorating

instead of improving, which would further cause severe right heart dysfunction. Surgical intervention at that time could cause a remarkable increase of mortality rate and complications. Therefore, concomitant tricuspid valve repair (TVP) has received more recognition, and the development of minimally invasive thoracoscopy and percutaneous interventional technique has made patients more likely to accept the treatment[4]. In this study, patients undergoing concomitant totally thoracoscopic TVP performed by the same surgeon were retrospectively analyzed and followed up, and the near to mid-term efficacy is discussed.

2. METHODS

With the approval of the Institutional Review Committee and informed consent, a total of 367 patients with preoperative TR of 0.8-29.1 cm² (average 5.7±4.1cm²) that undergoing concomitant totally thoracoscopic TVP performed by the same surgeon between August 2011 and December 2016 were enrolled in this study. Their average age was 40±15 years old and average weight was 54.8±10.5 kg.

According to the results of echocardiography, TR was graded into mild (0-5cm²), moderate (5-10cm²), and severe (>10cm²) with 178, 111 and 78 patients respectively. The patients were divided into ring group and suture group based on TVP technique.

Standard general anesthesia was given to all patients. A left-sided double lumen endotracheal tube was intubated. The patient was in supine position with the right chest slightly elevated about 30 ° and right upper limb suspended on the cephalic side to fully expose the intercostal space. After standard heparinization, the right femoral artery and vein were cannulated using the Seldinger's technique to establish cardiopulmonary bypass (CPB). The procedures were performed via a 3 cm mini-thoracotomy incision in the right fourth intercostal space. Anterior axillary ports were inserted in the third, fifth intercostal spaces for assist port and camera port (Fig. 1).

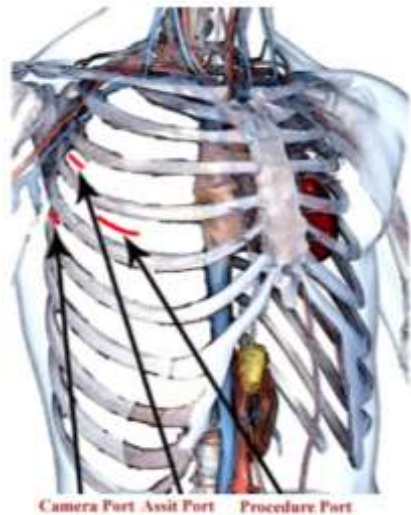


Fig. 1 Surgical incision

The transthoracic echocardiography was performed before surgery, 1 week, 3 months, and 1 year after surgery. The following data were gathered for analysis: degree of TR, right ventricular cavity diameter (RV), pulmonary artery pressure (PH), and left ventricular ejection fraction (LVEF).

Data analysis using SPSS 22 software. The continuous variables were presented as mean ± standard deviation, and analyzed with repeated measures analysis of variance. $P < 0.05$ was considered statistically significant.

3. RESULTS

Among the 367 patients, 329 cases were performed in ring technique, and 38 cases in suture technique. There were different kinds of concomitant surgeries and they were as followed: 192 cases of atrial septal defect repair, 14 cases of partial pulmonary venous drainage anomalous repair, 5 cases of ventricular septal defect repair, 5 cases of myxoma resection, 23 cases of mitral valve repair, 126 cases of mitral valve replacement, and 2 cases of TVP alone. The lasting time for operation was 184±57min, the lasting time for CPB was 109±42min, and the lasting time for aortic cross-clamp(ACC) was 65±31min. 16 cases required re-exploration for bleeding(4.3%). 7 cases (1.9%) had turned to median sternotomy because of complicated pulmonary venous drainage anomalous in 4 cases and pleural adhesions in 3 cases. The hospital stay after surgery was 6±5.7 days, the lasting time for mechanical ventilation was 13.1±17.2 hours, the ICU length of stay was 41.8±51.1 hours, the day required drainage of thoracic fluid was 3.3±1.4 days, and the amount of thoracic fluid drained was 245±299 ml. The standard deviation of some data was larger than the average, which indicated the data was high variability. No death after surgery and all patients were discharged.

The median follow-up time was 3.4 months. The number of follow-up cases was 294 (80.1%) three months after the surgery, and 147 (40.0%) one year. The longest time of follow-up was 33 months. LVEF improved significantly after surgery (see Fig. 2). There were 4 cases (1.1%) of recurrent moderate TR within 1 week, 3 cases (3.4%) within 3 months, and 9 cases (6.1%) within 1 year after the surgery respectively. No severe TR occurred. (Fig. 3). Among those cases, 7 cases (5.4%) had moderate TR in the ring group, while 2 cases (11.7%) in the suture group within 1 year after the surgery. No significant difference was found between the two groups. After the surgery, the diameter of RV and the pulmonary artery pressure were reduced significantly compared with that before the surgery. The changes are shown in

Fig.4 and 5.

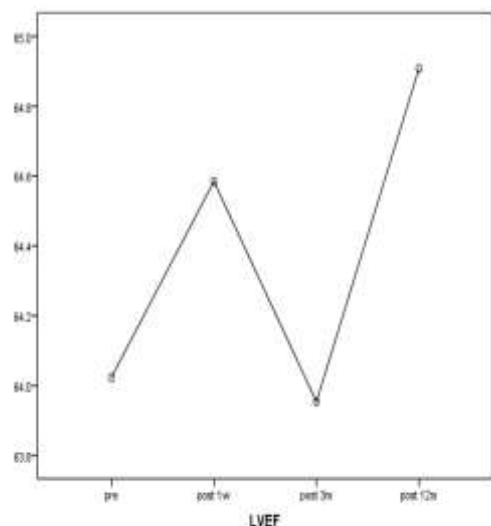


Fig.2 Change of LVEF

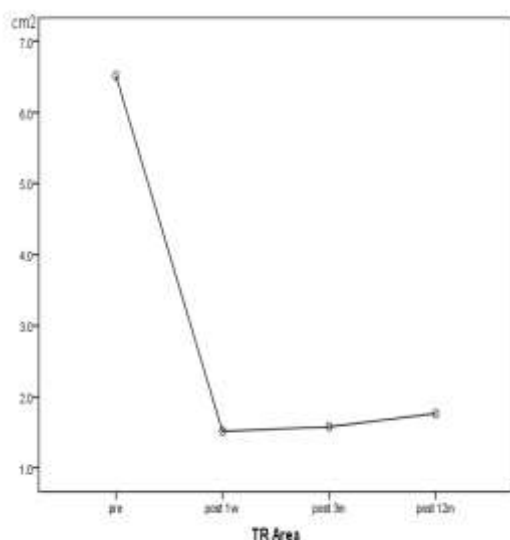


Fig. 3 Change of TR

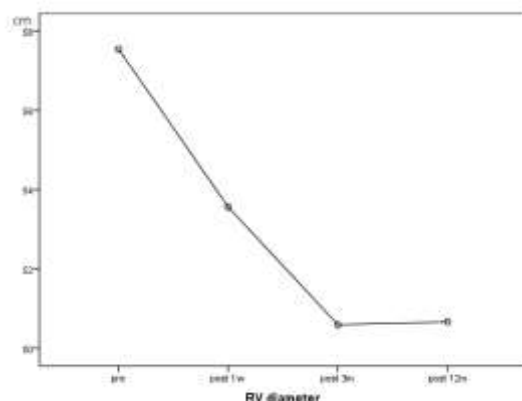


Fig. 4 Change of RV

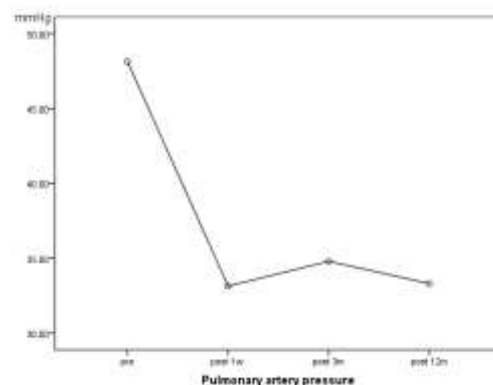


Fig. 5 Change of PH

4. DISCUSSION

The anatomical structure of the tricuspid valve is relatively complex[5], including: 1) a saddle-shaped annulus that change shape in systole and diastole phase; 2) three valve leaflets; 3) chordae and papillary muscles; 4) right ventricular myocardium. Tricuspid competency relies on the interplay of these four structures with the normal crescent-shaped right ventricle. The degree of TR after anesthesia would be underestimated and should be evaluated prior to anesthesia. When performing tricuspid ring annuloplasty, attention should be paid to⁵: 1) identifying the Koch triangle, membranous septum, and the atrioventricular node area, and to stay away while taking the stitch; 2)not going too deep while taking a stitch along the anterior annulus ,to avoid damage to the right coronary artery; 3) the last stitch is not going too far to the septal leaflet, and not too deep to avoid injury to distal right coronary artery, posterior descending artery.

A more aggressive surgical intervention strategy is currently used for STR [6,7]. It is because of the high incidence of TR after left heart surgery alone, significant impact on survival rate and complications due to long-term TR on, safety and effectiveness of TVP, high mortality rate for reoperation against STR. The prognosis of patients with STR depends on the severity of TR. The 10-year survival rate of patients with non-severe TR and severe TR is 70% vs 38% respectively¹. It has been widely accepted that surgical treatment should be considered for patients with moderate to severe TR, but it is still controversial for patients with mild or no TR. It has been suggested that even if with mild TR, patients with tricuspid annulus dilatation, evidence of right heart failure, and

pulmonary arterial hypertension should consider concomitant TVP in recent European¹ and American[8] heart valvular disease guidelines.

But several doctors still have concerns about TVP surgery⁴, such as prolonged ACC and CPB time to cause potential myocardial and organ damage, extra right atrium incision, and ring-related complications (atrioventricular block, thrombus, ring detachment or rupture). Recent studies [9-10] have shown that TVP is a low-risk procedure and concomitant TV repair does not increase the perioperative mortality and morbidity significantly when correcting left-sided valve disease. The concomitant thoracoscopic TVP had also shown the same results [11]. Moreover, video-assisted thoracoscopic surgery was easily accepted by patients, and it had a short recovery time and improved quality of life in the early postoperative period. These make it become a popular trend in recent days[12].

Shinn et al.[13] conducted a follow-up study of 415 patients who underwent TV repair with suture (De Vega) or flexible ring annuloplasty at the time of MV surgery, from which 148 matched pairs were screened and identified by propensity score analysis. Late survival rate and TV durability following concomitant TV repair during MV surgery did not differ with respect to TV repair technique. However, the study of Charfeddine et al.[14] showed that TVP using ring seems to guarantee better results than De VEGA. In this study, no statistically significant difference was found between the ring and suture groups which maybe because of the small sample size. There is no conclusion of which technique is better so far. However European heart valvular guideline[15] believes that ring annuloplasty is currently the main technique of TVP.

Concomitant TVP can improve long-term right heart function and reconstruction effectively. When there is appropriate timing for TVP surgery, it can reduce the right heart volume load effectively, and it is beneficial to right atrial and ventricular reconstruction. As a result, significant improvement of postoperative life quality could be achieved[6,16]. In this study, compared with data in pre-operation, LVEF was improved significantly, the diameter of RV and the PH were reduced significantly. These changes indicated that the concomitant totally thoracoscopic TVP technique can improve

the prognosis of patients effectively.

The advantages of thoracoscopic heart surgery have been proved. At present, the advantages of ring annuloplasty for TVP are increasingly recognized. Our experience have shown that concomitant totally thoracoscopic TVP is reliable, effective, and safe. The results in the near to mid-term were satisfactory.

5. Competing Interests

The authors declare that they have no competing interests.

6. Authors' contributions

Author.Shengjie Liao: Study concept and design; collection of data; statistical analysis; drafting of the manuscript. Xuejun Xiao, Zhiwen Zhong and Hao wang: Study concept and design; interpretation of data; statistical analysis. Xiaoshen Zhang: Study concept and design; statistical analysis; drafting of the manuscript; revising manuscript critically for important intellectual content; final approval of the version to be published. Xiaohui LI and Chengfeng Huang: Collection of data.

7. Acknowledgments

This work was supported in part by Science and Technology Program of Guangdong Province, China (Grant NO: 2017A020215076), Science and Technology Planning Project of Guangzhou, China (Grant NO: 201804010230).

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