

Aortic valve replacement through the upper ministernotomy. Preliminary experience with modified technique

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SUMMARY: Aortic valve replacement through the upper ministernotomy. Preliminary experience with modified technique.

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Minimally invasive approach for aortic valve surgery has been developed since 1995, reducing the complications related to the full sternotomy. We have introduced a new method for central cannulation that reduces the length of surgical incision for the aortic valve replacement through upper mini-sternotomy. To improve the surgical view without enlargement of the incision, two small additional incisions are performed for both arterial and atrial cannulation. We have used the modified technique in 60 patients without sternal infection or other surgical complications and with good cosmetic results.

RIASSUNTO: Sostituzione valvolare aortica mediante ministernotomia superiore. Una tecnica modificata di cannulazione percutanea. Esperienza preliminare.

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Gli approcci mini-invasivi per la chirurgia valvolare aortica hanno iniziato a svilupparsi a partire dal 1995 con una notevole riduzione delle complicanze connesse alla sternotomia mediana. Presentiamo una nuova tecnica di cannulazione centrale, che permette una ulteriore riduzione della incisione chirurgica per la sostituzione valvolare aortica mediante ministernotomia superiore. L'obiettivo è quello di migliorare l'esposizione chirurgica, senza incrementare la lunghezza dell'incisione chirurgica, attraverso due piccole incisioni cutanee di circa 1cm che consentono sia la cannulazione venosa che quella arteriosa. Fino ad ora abbiamo utilizzato questa tecnica modificata in 60 pazienti senza avere infezioni sternali od altre complicazioni chirurgiche e con ottimi risultati anche dal punto di vista estetico.

KEY WORDS: Cardiac surgery - Aortic valve replacement - Minimally invasive approach.
Chirurgia cardiaca - Sostituzione valvolare aortica - Approcci mini-invasivi.

Introduction

Aortic valve replacement is usually performed with median sternotomy. The concept of minimally invasive approaches for isolate aortic valve surgery have been introduced since 1995. Recently, aortic valve replacement can be safely performed through upper mini-sternotomy. The minimally invasive approach reduces the surgical trauma and improve the outcomes.

We describe a new technique of central cannulation to reduce the length of the skin incision and improve the surgical view.

Patients and methods

Surgical technique

After induction of general anesthesia, transesophageal echocardiographic monitoring was set up. The skin incision of about 7 centimeters was performed from the angle of Louis to the fourth rib (Figure 1 A). The sternum was divided by a standard saw from the manubrium to the fourth intercostal space. On the lower end of the mini-sternotomy, the sternum was transversely divided to make a "T" reversed. Both internal thoracic arteries were preserved if the ministernotomy was carefully made. The sternal spreader was used to expose the pericardium. After opening the pericardium, the ascending aorta and the right atrium were exposed. Systemic heparin was administered at this time and the cardiopulmonary by-pass was established between the ascending aorta and the right atrium.

Then we performed a skin incision about of 1 cm below the suprasternal notch through which we passed the aortic cannula. We preferred to use an axillary cannula to insert in the distal portion of ascending aorta because of its shape and performance flow. The venous drainage was performed by a slim double stage cannula inserted into the right atrial appendage. Afterwards, we performed a skin incision about of 2 cm below of the right nipple through which we passed the venous cannula (Figure 1 B).

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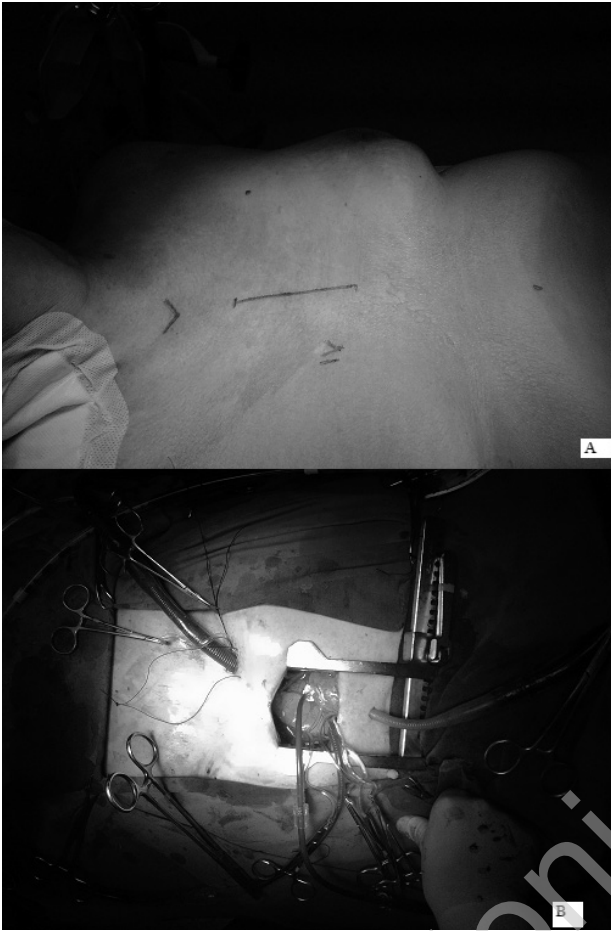


Fig. 1 - The skin incision is performed from the angle of Louis to the upper margin of the fourth rib (A). The image shows how we pass the aortic and venous cannulae through the small additional skin incisions, improving the surgical view (B).

A suction catheter was inserted into the pulmonary artery trunk to decompress the heart. The aorta was cross-clamped with a Cosgrove clamp at the distal part of ascending aorta. The blood cardioplegia was infused into the aortic root through a needle of 14 Gauge or into the coronary orifice after aortotomy in case of aortic valve regurgitation.

A transverse aortotomy was performed. The aortic valve was excised and replaced with a mechanical or biological prosthesis. The aortotomy was closed with running suture. Before removing the aortic clamp, a venting needle was inserted into the aorta in order to make a deairing. Extracorporeal circulation was weaned after re-warming of the patient. Only one chest tube was usually set up through the lower skin incision previously used to pass the venous cannula. The sternum and skin was closed as usual.

Until now we have used this technique in 60 patients. Patient characteristics and their surgical outcomes are shown in the Table 1.

Discussion

The minimally invasive surgical approach for aortic valve replacement have been recently developed to

TABLE 1 - PATIENT CHARACTERISTICS AND SURGICAL OUTCOMES.

Age (y)	75.61 ± 8.64
Sex, n (%)	
Male	14 (23.3)
Female	46 (77.7)
Cross-clamp time min (SD)	54.47 ± 10.59
Chest tube drainage ml (SD)	294.12 ± 149.4
Transfusion, units	0
Wound problems	0
Ventilation support, h (SD)	5.53 ± 1.71
Length of incisions, cm (SD)	6.91 ± 0.32

Categoric data are presented as the actual number, with percentages in parentheses. Continuous data are presented as mean + standard deviation.

minimize the complications, improve the outcomes and obtain good cosmetic results. There are several ways to perform aortic valve replacement with minimally invasive procedure: it can be made through a right parasternal incision (1, 2), right minithoracotomy (3), transected sternum (4) or upper ministernotomy. The mini-invasive techniques allow to lessen incisional pain, minimize incisional length, speed up the functional recovery and shorten hospital stay (5). Moreover, the partial sternotomy reduces the risk of sternal dehiscence and wound infection and so it should be used in the elderly, especially if they are affected by Chronic Obstructive Pulmonary Disease (COPD) and/or osteoporosis.

We think that the upper mini-sternotomy remains the safest minimally invasive approach for the aortic valve replacement. We prefer this technique for the following reasons.

First, cardiopulmonary bypass must be established by peripheral cannulation when the aortic valve replacement is performed through a right para-sternal incision, an anterior right minithoracotomy at the second intercostal space, or a transected sternum at the third intercostal space. We think that the central cannulation should be preferred mainly in elderly to reduce the incidence of neurological events (6).

Second, in the transected sternum the bilateral internal thoracic arteries are divided, increasing the risk of sternal dehiscence or wound infection. Nevertheless, in the upper mini-sternotomy the length of the skin incision may be longer than the other minimally invasive approaches. On the contrary, if the incision is reduced, the presence of the cannulae can narrow the operative field, increasing the surgical time. After having ruled out the hypothesis to use the peripheral cannulation in the upper mini-sternotomy, we have solved this problem using a new strategy of central cannulation. We make to pass the aortic and venous drainage cannulae through the

two very small additional incisions and this trick allows us to reduce the length of skin incision and improves the surgical exposure. The skin incision used to pass the venous cannula afterwards it is utilized to introduce the chest drainage tube. In this way, the aortic valve replacement becomes more feasible even if the operative field remains very narrow and deep. In our experience, the cross-clamp time is not significantly longer than when we perform the aortic valve replacement through a full sternotomy.

Finally, we prefer to perform a T inverted upper ministernotomy rather than an J upper ministernotomy because it allows to spread apart the sternum in a more sym-

metrical way, determining a good exposure. Even if the both internal mammary arteries could be damaged, in our experience, this event is never happened.

Conclusion

In conclusion, we think that, with our central cannulation technique, T reversed upper ministernotomy may be considered the most safe and feasible among the minimally invasive approaches for aortic valve replacement, with also very good cosmetic results.

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