

CASE REPORT

# Aortic root surgery with preservation of the native valve for Minimal Invasive Surgery. First case in Mexico

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Valve-sparing aortic root surgery has become of greater interest among surgeons, especially in young patients with Marfan's syndrome, to increase their survival. Minimally invasive surgery is an alternative that must be taken into account since it is very safe and reproducible, with the same or better results than conventional surgery. The objective is to report the first case in Mexico of aortic root surgery with preservation of the valve

**Key words:** Bicuspid aortic valve; Marfan's syndrome; Minimally invasive surgery; Valve-preserving aortic root surgery.

La cirugía de la raíz aórtica con preservación de la válvula ha tomado mayor interés entre los cirujanos especialmente en pacientes jóvenes con síndrome de Marfán para aumentar la sobrevivencia de estos. La cirugía de mínima invasión es una alternativa que se debe tomar en cuenta ya que es muy segura y reproducible, con iguales o mejores resultados que la cirugía convencional. El objetivo es reportar el primer caso en México de una cirugía de raíz aórtica con preservación de la válvula.

**Palabras clave:** Válvula aórtica bicúspide; Síndrome de Marfán; Cirugía de mínima invasión; Cirugía de raíz aórtica con preservación de válvula.

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Marfan's syndrome (MFS) is a very rare connective tissue disorder that results from autosomal dominant mutations in the gene that encodes fibrillin-1 on chromosome 15 [1]. Its expression affects the skeletal, ocular and mainly cardiovascular systems [2]. This syndrome has an estimated prevalence of one for every 5,000 people and an incidence of one for every 10,000 births, with no racial or gender predominance [3].

In 1896, a French pediatrician named Bernard Antoine Marfan published an article describing a five-year-old girl with extremely long arms and presented it at a meeting of the Paris Medical Society in the same year. Sixty years later, in 1955, Victor McKusick, a physician and geneticist at Johns Hopkins Hospital in Baltimore, United States, described the complete MSF [1].

Dissection and rupture of the aortic root are the main cause of death among patients with MFS [4]. Approximately four-fifths of all MFS patients develop annuloaortic ectasia, and many of the-

se patients will progress to aortic valve regurgitation, congestive heart failure, and aortic dissection or rupture [5]. These conditions contribute to reduced life expectancy in MFS patients [3]. Before the advent of surgery in these patients, a median survival of approximately 44 years was reported and most premature deaths were due to cardiovascular causes. Survival in patients with MFS was improved with the introduction of prophylactic surgical replacement of the aortic root [6]. The original repair method described by Bentall and DeBono [7] in 1968 involved replacing the aortic root and aortic valve with a mechanical valve sutured to an aortic prosthesis. An alternative technique, Yacoub [8] described replacement of the aortic root in which the native aortic valve was preserved. Aortic root preservation procedure, Valsalva sinuses are replaced and the coronary arteries are reimplanted in the graft. David described the reimplantation of the native aortic valve complex within the aortic prosthesis, which prevents late dilation of the aortic annulus [8].

The aortic valve is best preserved in young patients to avoid anti-coagulation for life and other possible complications related to such therapy.

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Several centers have published good results for aortic root preservation procedures in patients with MFS [9,10]. However, it remains controversial due to the long-term durability of the native valve. Over time, surgery has evolved and minimally invasive techniques have been proposed as having better results. The Society of Thoracic Surgeons (STS) defines a minimal invasion of any technique that is not performed by means of a total median sternotomy [11]. Currently, different studies [11-15] have consistently reported that minimally invasive surgery is safe, has results equal to or greater than conventional surgery, and that it provides obvious cosmetic advantages.

Other possible advantages of MIS techniques, although more controversial in the literature [13], would be: 1) less bleeding and need for transfusion; 2) less postoperative pain and less need, therefore, for pain relievers; 3) lower incidence of surgical wound infection; 4) faster recovery and earlier return to normal activity, and 5) lower hospital cost.

On the other hand, different drawbacks related to the MIS techniques have also been described, such as: 1) increased extracorporeal circulation and aortic clamping times; 2) groin complications and retrograde dissection of the aorta, in peripheral cannulation; 3) phrenic nerve injuries in thoracotomy approaches, and 4) myocardial protection problems.

In any case, to obtain good results with MIS, it is recommended: 1) to centralize this type of procedure in specialized centers; 2) perform these techniques by surgeons who are proficient in conventional surgery, and 3) address only simple heart diseases with low expected morbidity and mortality [11].

## CLINICAL CASE

This is the case of a 29-year-old female patient diagnosed with MFS since she was 9 years old, with a history of lens

dislocation in 2005 that required intraocular lens placement, medicated based on oral bisoprolol every day.

She was admitted to our institute for presenting progressive dyspnea of medium efforts; on physical examination, he presented an exotropic right eye, a displaced intraocular lens, chest without apparent deformities, no cardiac murmurs. Arachnodactyly of the upper limbs, without joint hypermobility, paraclinical laboratories with no alterations. Electrocardiogram showed sinus rhythm, 55 bpm, PR 0.16, QRS 0.12, QT 0.40, normal axis. Echocardiogram reported bicuspid aortic valve by fusion of right and left leaflets (type 1), slightly thickened valves but with normal opening and flow of minimal, central insufficiency, maximum transvalvular velocity of 0.8 m / s, and LVST of 0.7 m / s., dilation of the aortic root and ascending aorta with aortic annulus of 3 cm (1.4 cm / m<sup>2</sup>), sinuses of the valsalva of 5.3 cm (2.6 cm / m<sup>2</sup>), sinotubular junction of 4.9 cm (2.4 cm / m<sup>2</sup>) and ascending aorta of 4.45 cm (2.15 cm / m<sup>2</sup>) (Fig. 1 A). CT angiography showed an aortic valve with bicuspid morphology with aneurysmal dilatation at the level of the Valsalva sinuses of 49 mm (Fig. 1 B).

With the studies previously carried out, it was decided to perform a David procedure through minimal invasion. A partial sternotomy was performed as inverted "T" up to the 3rd intercostal space, peripheral arterial and venous cannulation, moderate hypothermia at 32 ° C, establishment of left-sided venting through the right superior pulmonary vein, administration of anterograde and selective ostial modified "Del Nido" blood cardioplegia, decrease time of cardiopulmonary bypass, and aortic clamping (Fig. 2 A).

The transverse aortotomy was performed 1 cm above the sinotubular junction, showing a type 1 bicuspid aortic valve (Fig. 2 B), showing slight retraction of the raphe of the non-coronary leaflet with the left coronary-leaflet, which was released, and the cusp test was performed with adequate result. Both right and left aortic buttons were released. Ethibond Teflon felt sutures were placed at the subvalvular level. Then passed through the Woven Dacron 32mm graft, and knotting them. once the proximal su-

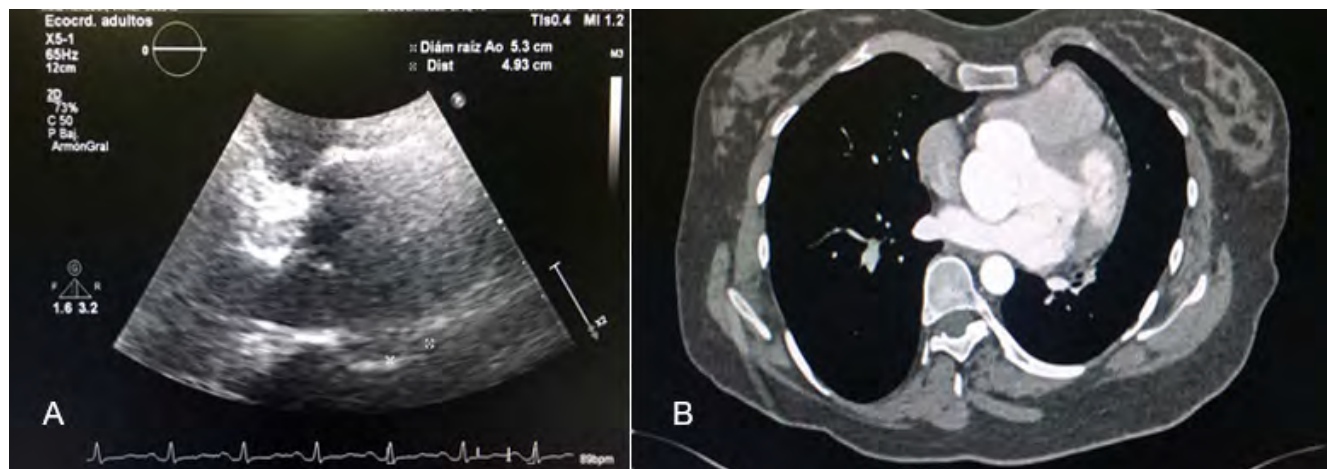


Figure 1. A) Echocardiogram showing jet of aortic regurgitation, B) Angiotomography showing significant aneurysmal dilation of the valsalva sinuses.

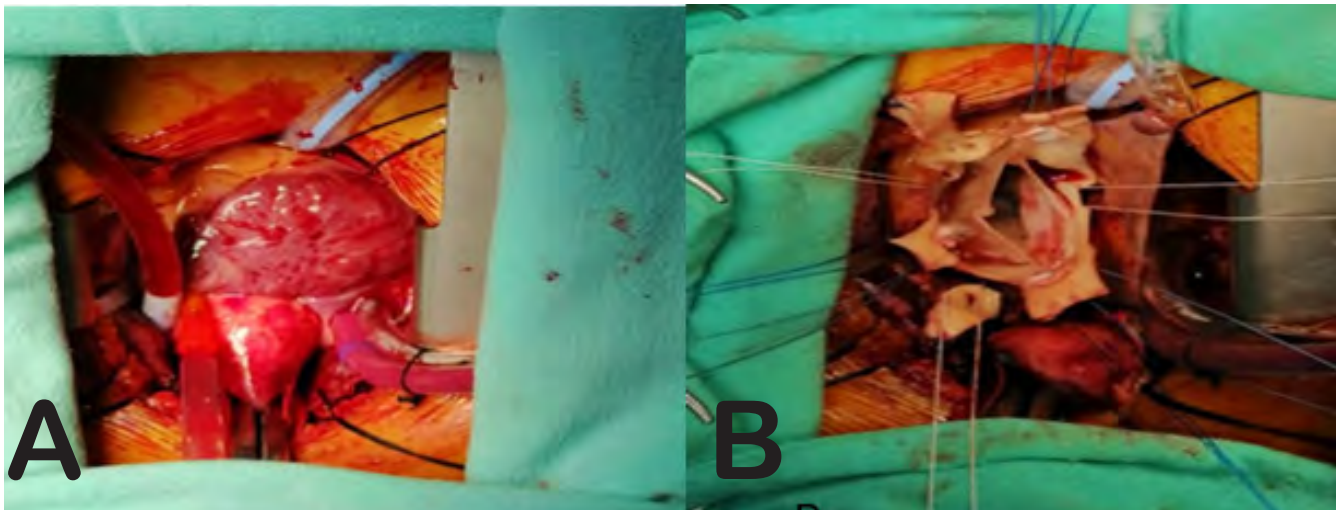


Figure 2. A) Mini-Sternotomy Incision, B) Bicuspid aortic valve

tures were completed, the commissures were fixed to the tubular graft, by using polipropylene sutures supported on Teflon patches. Next, and in order to ensure correct hemostasis, a continuous suture was made, from inside to outside of the graft and so forth, between the remaining aortic wall and the graft. The proper procedure was verified, showing a prolapse of the right leaflet, requiring a Trusler point with adequate coaptation of the cusps. Reimplantation of the aortic buttons to the graft was performed. Finally, the distal anastomosis from the tube to the aorta reinforced with Teflon bands was performed. (Fig. 3A) (Fig. 3B). Cannulation was removed and hemostasis verified. Two Blake 24fr retrosternal and retrocardiac drains were placed and sternal closure completed. The final result is compared with a complete sternotomy (Fig. 4A) (Fig. 4B)

#### COMMENT

Minimal access surgery is becoming an important area of research and commercial interest. Several original studies and meta-analyses of minimally invasive operations have been published for valvular heart disease, particularly aortic and mitral valve surgery [12-14]. The number of studies evaluating the use of the minimum access incision in aortic root replacement surgery is significantly smaller with smaller sample sizes in each compared to published studies in aortic valve surgery. Therefore, there is a clear need for a better evidence base to help clinicians and patients make informed decisions.

It should be emphasized that new advances in minimally invasive surgery make this a safe procedure that confers a survival benefit with a statistically reduced clinically early

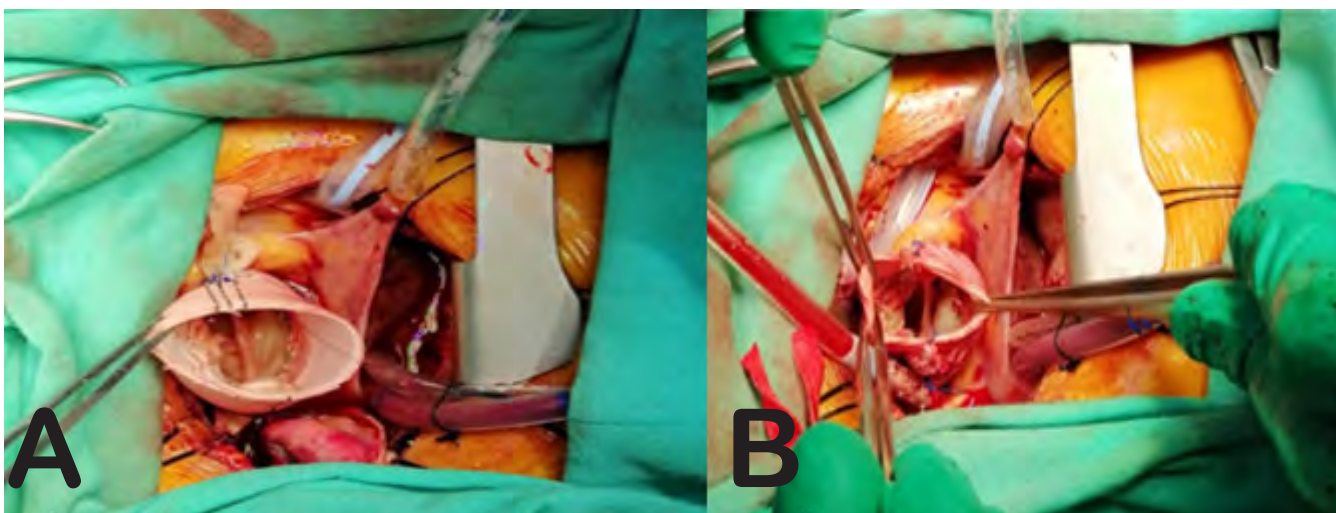


Figure 3. A) Replacement of the thoracic aorta with Woven Dacron tube, B) Reimplantation of the coronary artery buttons

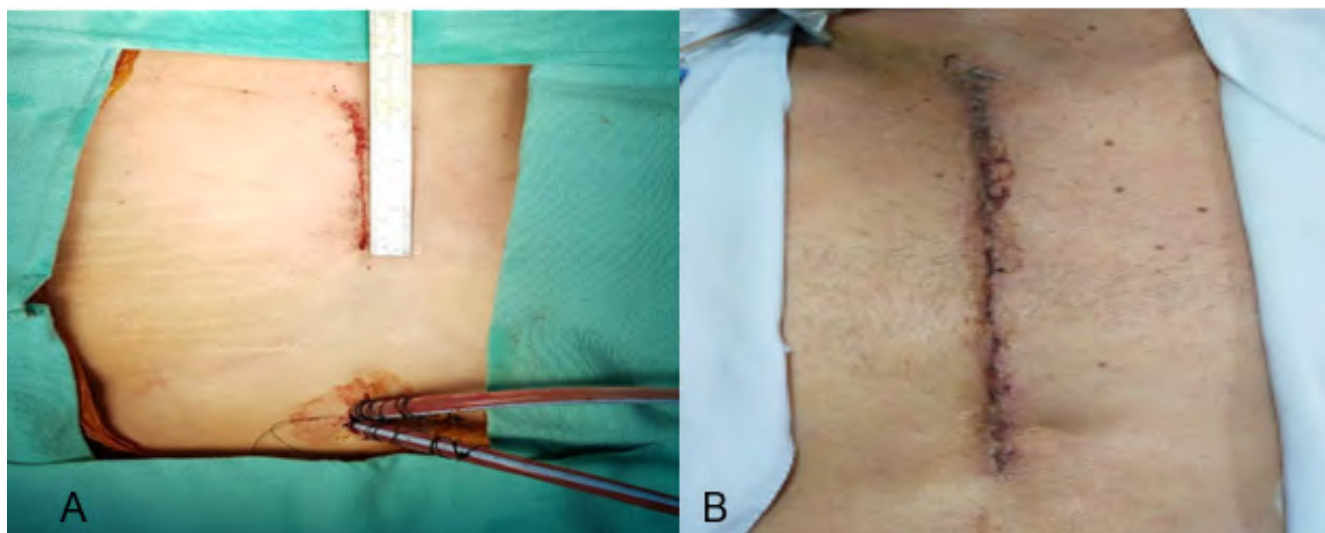


Figure 4. A) Final results of Mini-Sternotomy B) Postoperative scar of full sternotomy

mortality rate with no difference in the risk of re-exploration, stroke or wound infection compared to open surgery. Although open surgery is associated with shorter pump and surgery times, there were no statistically significant differences according to the meta-analysis comparing these techniques [15].

Something that we will always find in the studies is the learning curve to enter this area, which is already complex aortic surgery, because the studies suggest first having sufficient experience in cases of aortic valve change due to minimal invasion and then continuing in the cases of greater complexity, due to this parameter, there is a lot of experience in valve changes due to minimal invasion, so we decided to take the big step towards complex and minimal invasion aortic surgery.

In conclusion, minimally invasive surgery to preserve the aortic valve is an excellent option for a bicuspid aortic valve with aortic root dilation in young patients with Marfan syndrome.

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