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Personal experience in 207 Bentall procedures

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SUMMARY

This work is based on the greatest experience in Venezuela in the surgical treatment of the aortic root in pathologies that require a Bentall procedure. It represents the experience in the 207 cases carried out with this procedure; types of prosthetics and grafts, techniques used, observed care, results, complications, and mortality. Of Bentall's interventions, 59 cases (27.4 %) were done with total circulatory arrest in deep hypothermia at 18 ºC. As associated procedures, 21 patients received aorto-coronary bypass grafts and 10 patients also had mitral valve replacement. The overall operative mortality of the sample was 12.5 %. The success rate of this experience was 87.5 %, fully justifying the completion of the procedure in the pathology of very high mortality, especially when referring to dissections.

Key words: *Bentall procedure, aortic root, aorto-coronary bypass, mitral valve.*

RESUMEN

Este trabajo está basado en la mayor experiencia en Venezuela, en el tratamiento quirúrgico de la raíz aórtica, en patologías que requieren el procedimiento de Bentall. Representa la experiencia en los 207 casos realizados por el procedimiento nombrado; tipos de prótesis e injertos, técnicas utilizadas, cuidados observados, resultados, complicaciones y mortalidad. De las intervenciones de Bentall realizadas, 59 casos (27,4 %) fueron hechos con paro circulatorio total en hipotermia profunda a 18 ºC. Como procedimientos asociados, a 21 pacientes se les implantaron puentes aorto-coronarios y a 10 pacientes se les practicó reemplazo de la válvula mitral. La mortalidad operatoria global de la muestra fue del 12,5 %. El porcentaje de éxito de esta experiencia fue de 87,5 %, justificando plenamente la realización del procedimiento en una patología de muy alta mortalidad, sobre todo en lo referente a disecciones.

Palabras clave: *Procedimiento de Bentall, raíz aórtica, puentes aorto-coronarios, válvula mitral.*

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INTRODUCTION

Cardiovascular diseases are the leading cause of death in the world and an estimated 20 million people died from this cause in 2015, data from the World Health Organization (WHO) (1).

When confronting patients with pathology on the Aortic Root and Ascending Aorta during the medical exercise, we see with concern that we are often in delay with diagnostic errors and request for countless studies (often unnecessary)

finally resulting in improper management. If we add to this the high incidence of morbid mortality - which in itself entails this entity - especially in acute aortic dissections type A, where for every hour of evolution after the onset of the first symptom the mortality rate is increased by 1 % to 3 %, it is logical to understand that the favorable prognosis on many occasions depends on precise and early actions.

Approach and delimitation of the object of study

The research comprises the period from March 1977 to December 2019; most procedures were performed at the University Hospital of Caracas (UHC), the Metropolitan Polyclinic of Caracas (MPC), and in smaller numbers in centers where the author's experience in this type of surgery was required as in the Santa Sofia Clinic and Ascardio (Barquisimeto).

It was proposed to describe the experience in the approach, from the point of view of cardiovascular surgery and carried out by the main author in the treatment of pathologies that cannot be clinically treated and require the Bentall procedure as the only possible therapeutic for its resolution.

In this accumulated experience in national reference centers, patients treated were mostly conational's, with subsequent controls in their origin locality by the referring cardiologist, with a majority of patients in adulthood and elderly. This intervention is not performed in children. for this age group there is the Ross Procedure.

METHODS

Study Type

This study is a retrospective, descriptive, continuous, and cross-cutting study that describes the research's experience in the type of technique indicated as a Bentall procedure.

Population and sample

Of the 3 459 surgical heart patients, were selected 207 patients with a diversity of pathologies that required to be solved with the Bentall procedure, representing 1.67 % of all cases. The study period ranged from October 24th, 2001, the date on which the researcher performed the first procedure, until June 18th, 2019, the cut-off date, which means 17 years and 8 months experience. All patient data were taken from their medical histories and the main author's surgical record FileMaker.

Ethical aspects

It should be noted that the research takes special care in the observation of ethical aspects and methodological rigor, that all work of a descriptive-explanatory nature requires, as well as the help that this type of research provides in the decision-making on the subject, in particular, contributing to increasing knowledge the treatment of heart disease about the surgical use of prostheses and grafts for valvular replacement.

In this sense, the bioethical principle of autonomy is guaranteed, by omitting the identification of the subjects to respect their integrity, seeking alternatives for the protection of their identity, resorting to the use of identification or nomenclature codes, avoiding the exposure of any record that could identify them.

Justification and importance

Currently, compared to the onset of experience it is evident that older patients with increasing age and complexity can be intervened, although they have high-risk profiles and more associated procedures, mortality and morbidity of these patients had been decreasing due to rigorous compliance on a learning curve and accumulated experience. In addition, the mortality of the natural evolution of the mentioned diseases is always higher than that produced by the surgery, evidently made by expert hands.

There are no publications on series over time of this technique in Venezuela, in most cases, these are very limited experiences in number and as exceptional cases, with variable results and not extrapolated to the general population.

As the main objective, being the principal researcher the cardiac surgeon with most procedures of this type of in the country, we wish

to communicate on this paper all the experience based on the 207 cases performed, concerning types of prostheses and grafts, used techniques, observed care, results, complications, mortality and other aspects considered necessary to be exposed and to be taken into account by surgeons who are performing their training and learning curve.

Historical records

Historically, Wheat, Wilson, Bartley (2) are credited with the first successful ascending aortic replacement with coronary ostium reimplant and aortic valvular replacement in 1962, to a 57-year-old patient with ascending aortic aneurysm and aortic insufficiency of syphilitic etiology. In 1968, Bentall and De Bono (3) reported a case of a 33-year-old male patient with a large aneurysmatic dilation of the ascending aorta and aortic ingurgitation, without the involvement of the arch vessels, and with incipient heart failure demonstrated by angiography. Among the evidenced findings a significant dilation of the aortic ring and prominent thinning of the aortic wall above the coronaries, which made it clear that anastomosis of the prosthesis at this level was not possible. Therefore, they decided to suture the Teflon tubular prosthesis directly to the ring of a Starr No. 13 mechanical prosthesis. Then they excised the cusps of the native aortic valve and passed the attachment points on the aortic ring and from there to the composite mechanical valve ring. At that point in the surgery, coronary ostium was on the wall and cannulated and perfused as usual on the aorta outside the tube lumen, so on the Teflon tube were made holes at the height of the coronary ostium to which these were sutured, subsequently, the distal anastomosis was completed leaving a vertical cut in its ventral aspect through which were subsequently sutured the previous removal of coronary cannulas and evacuation of the air.

For about two to three decades, began to be used surgical techniques for the preservation of heart valves, initially directed at the mitral valve and tricuspid, due to the complications inherent in replacement with mechanical prostheses or biological grafts. Later, in the last fifteen years, authors seemed interested in performing procedures for the preservation of valves, plastias, and root remodeling, for patients with pathology in the aortic root. The significant interest increase in the study of this pathology and the emergence of new surgical techniques, generated that from three to four centers dedicated to this pathology, we currently find multiple institutions in North America, Asia, and Europe reporting their casuistic on this topic (4-11).

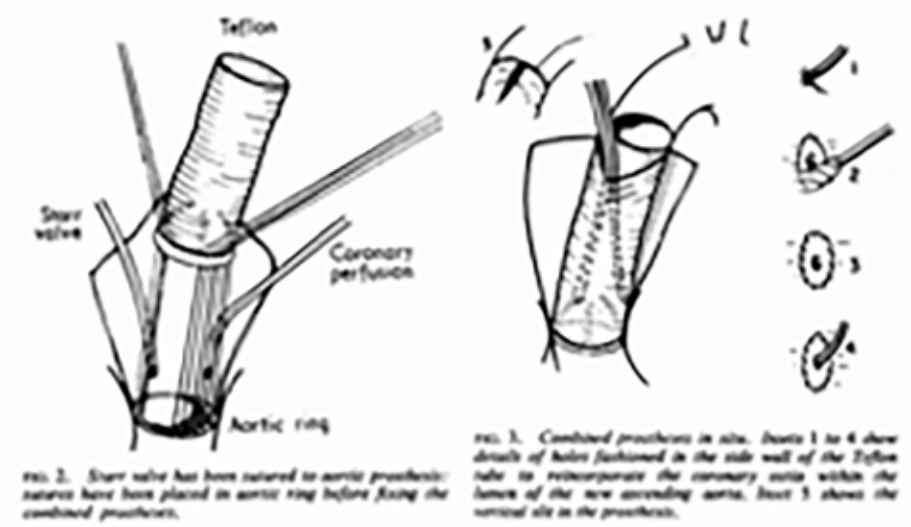


Figure 1. Original figures on the description of the surgical technique published by Bentall and De Bono in 1968 (3).

In international literature, Bentall's procedure has been thoroughly evaluated, as it is considered the Gold Standard in the treatment of patients requiring aortic root replacement, as demonstrated by the meta-analysis performed by Mookhoek et al., where they evaluated 46 publications on this procedure, concluding that with the improvement of the learning curve the reoperation rate of the aortic root and the morbi-mortality (12) also got improved. This remains a benchmark for the evaluation of more recent surgical approaches such as aortic valve preservation procedures. Of particular interest are the revisions made on the subject of aortic root repair, which involves not only the replacement of the ascending aorta but the preservation by different techniques, of the anatomy of the functional unit that represents the root, particularly in the case of those patients carrying Marfan syndrome (12), as this prolongs the durability of the repair, thereby reducing reoperation rates in the medium and long term.

It is important to note that the main technique involving treatment not only of the aortic valve but also of the aortic root is the Bentall procedure, however, there are also others designed for this purpose as the Cabrol procedure (13), as well as ascending aorta replacements with or without preservation of the aortic valve. In our country Venezuela, on May 5th, 1983 was performed the first aortic root surgery at the University Hospital of Caracas, to a 30 years old male patient with Marfan syndrome, using as a surgical technique the one described by Cristian Cabrol et al. (13). Even though it was the first experience with replacement of the entire aortic root, the result was successful and with an over a life that exceeded 15 years. This intervention was performed by the surgeons Juan P. Izquierdo and Gastón Silva C.

The Cabrol procedure represented the birth of a new era in heart surgery in Venezuela. Thus in 1990, the largest series on this topic was published in the journal of the School of Medicine of the Central University of Venezuela. The specialists, Miguel A Ortega, Gastón Silva, et al., professors of the chair of cardiovascular surgery of UHC, presented their experience of 21 patients operated between 1969 and 1989, 6 cases by the Cabrol technique and the rest with supra-coronary technique. They described an overall mortality rate of 38 % (14).

The first successful case of aortic arch replacement with deep hypothermia and total circulatory arrest at 18 ºC was performed at UHC by surgeons Miguel Angel Ortega and Gastón Silva C, in 1989 (15).

What is Bentall's procedure

With the indispensable help of extracorporeal circulation, in normothermia or deep hypothermia at 18 ºC with total circulatory arrest, the aortic valve, and the ascending aorta - in some cases, the arch - is replaced with a valved tube and the 2 coronary otium are re-implanted, which were removed as a button when the ascending damaged aorta was removed. The choice of technique is imposed by the pathology presented according to the diagnosis (Figures 2 and 3).

In which pathologies Bentall's technique is used

1. In patients with aortic valve insufficiency, dilation of the sino-tubular junction, and ectasia of the ascending aorta; 103 patients were involved in this group.
2. In patients with acute or chronic type I aortic dissections, according to De Bakey's classification with valve dysfunction; 71 patients were involved in this group.
3. In patients with Marfan syndrome, when the heart disease has aortic valvular insufficiency, dilation of the sino-tubular junction and aneurysm or severe dilation of the ascending aorta; 16 patients were involved.
4. In patients with severe aortic valve stenosis, accompanied by post-stenotic dilation of the ascending aorta; 12 patients were involved.
5. In cases of technical problems during an aortic valve replacement where there may be a detachment of the calcified annulus (1 patient).
6. In cases of root abscesses by endocarditis and/or prostheses detachment (1 patient).

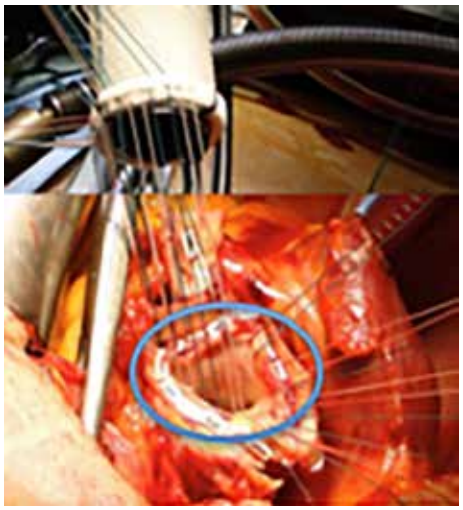


Figure 2. Bentall procedure on execution.

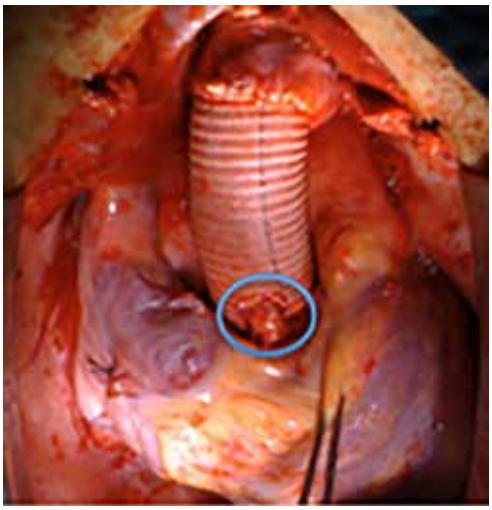


Figure 3. Finished Bentall.

The current surgical criteria for aortic root and ascending aorta surgery are as follows

1. Ascending aortic dilations over 55 mm in diameter, with no risk factors (16).
2. Ascending aorta dilations of more than 50 mm in diameter (17). In patient with risk factor.
3. Bicuspid aortic valve with more than 50 mm in diameter, if associated with aortic coarctation, with 1st-grade relatives with the acute aortic syndrome, desire for pregnancy, and growth of more than 2 mm per year (18).
4. Bicuspid aortic valve with an indexed aortic diameter greater than 2.7 cm/m^2 (17).
5. Marfan syndrome with more than 50 mm in diameter (18).
6. Marfan syndrome with more than 45 mm aortic diameter if associated with 1st-grade relatives with an acute aortic syndrome, with aortic valve insufficiency or desire for pregnancy (16).
7. Loeys-Dietz or Ehlers-Danlos type IV syndrome, with more than 45 mm of aortic diameter (19).

Some diagnostic considerations

A young adult patient with chest pain, exhaustive interrogation, and EKG suggestive of myocardial ischemia, before thinking of myocardial infarction and prescribing streptokinase, Plavix, and aspirin for angioplasty purposes, is mandatory a transthoracic/transesophageal echocardiogram to rule out aortic dissection. There have been cases of dissection diagnosis during coronary catheterism in patients impregnated with anticoagulants with normal coronaries, increasing surgical mortality to prohibitive levels.

Having a patient with the following characteristics at the physical exam, the diagnosis is very suggestive (Figures 4 and 5).

Studies of choice for evaluating ascending aorta and aortic root have traditionally been computed tomography and cardiac ultrasound (especially trans-esophageal), but magnetic resonance imaging is often shaping up as a good tool in imaging (15-20) (Figures 6 and 7).

Among the primary objectives in the imaging studies are: to evaluate the size and location of the dilation, demonstrate the presence and location of dissections, and to determine the rate of growth in successive controls.

Figure 4. Thorax carinatum in male patient with Marfan syndrome.

Figure 5. Asymmetrical thorax carinatum, in female patient with Marfan syndrome.

Figure 6. Coronal view on helicoidal tomography.

Figure 7. Aortic root dilation by echocardiography.

Figure 8. Different images demonstrating various pathologies of the root, ascending aorta, fall, and descending aorta.

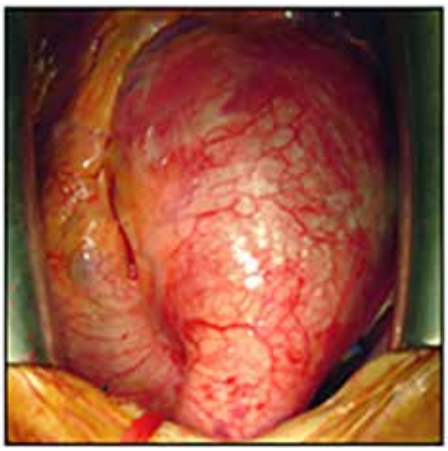


Figure 9. Aortic Root dilation in a patient with Marfan syndrome (10 cm in diameter).

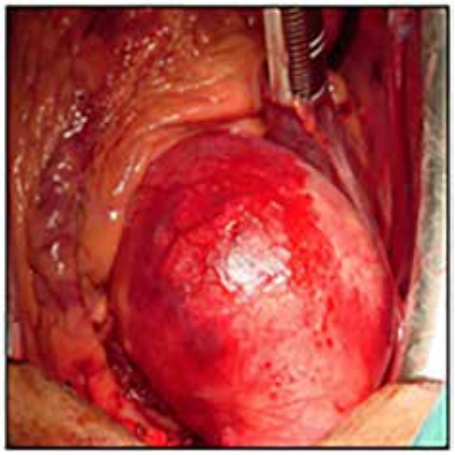


Figure 10. Ascending aortic and aortic root aneurysm (8 cm in diameter).

Figure 11. Aortic Root and ascending aorta dilation (14 cm in diameter).

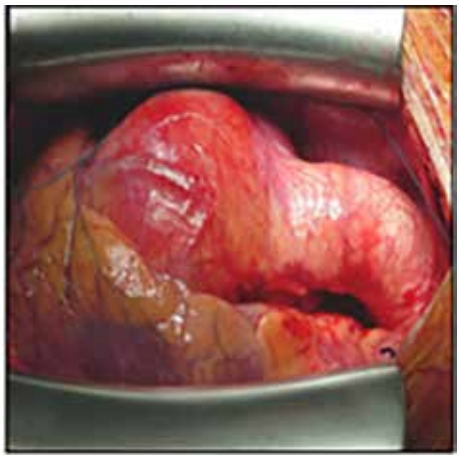


Figure 12. Isolated aortic root dilation.

In this surgical photography group (Figures 9, 10, 11, and 12) varieties of ascending aortic aneurysms can be observed at the time after the sternotomy is practiced.

Mechanical or biological valve?

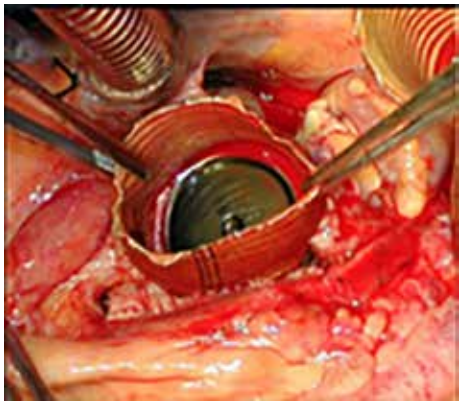
It should be noted that the term "prosthesis" implies the use of metal-mechanical elements in its elaboration, while the term "graft" refers to the use of biological tissues in the manufacture of the device that will replace the native heart valve.

In general, valvular cardiac prostheses (vcp) works with the simple principle of passive movements of the moving elements that composes it, for opening and occlusion under the effects of pressure gradients or flow changes in the cavities above or below the prosthesis.

Behavior in both cases, in relation to durability and thromboembolic complications, is totally different. At this point, it is necessary to stop to determine which valve is indicated to a particular patient (Figures 13 and 14).

Goldstone et al., in 2017, compared long-term mortality and rates of reintervention, cerebrovascular disease, and bleeding between inversely weighted probability cohorts of patients who had primary aortic or mitral valve replacement with a mechanical or biological prosthesis in California, in the period 1996 to 2013. Higher long-term mortality was associated with biological prostheses, compared to mechanical prostheses, persisting to 70 years of age in patients undergoing mitral valve replacement and up to 55 years of age in those undergoing aortic valve replacement (21).

More mechanical valves (prosthetics) than bioprosthetics (grafts) are currently being implanted, as manufacturers have failed to increase graft durability to more than 8 to 10 years, while mechanics manage to last above 30 years with the use of anticoagulants. With the improvement of its products, episodes of unwanted bleeding and thromboembolism have been better controlled. The graft-manufacturing industry has not been able to control the primary failure of biological tissues, nor calcification or vacuolization. This is not being taken into account by hemodynamic when implanting a transcatheter aortic valve replacement (TAVR) in younger patients, exposing them to more likelihood of other procedures in very short periods.



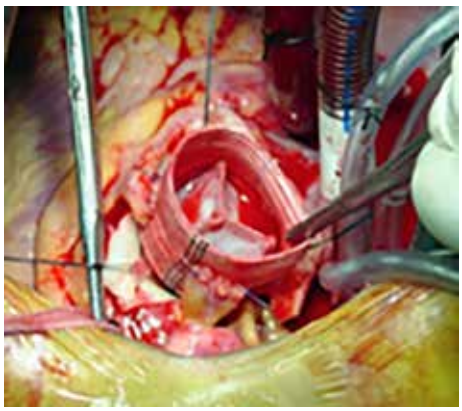


Figure 13. Mechanical valve.

Figure 14. Biological valve.

Different moments of the surgical act

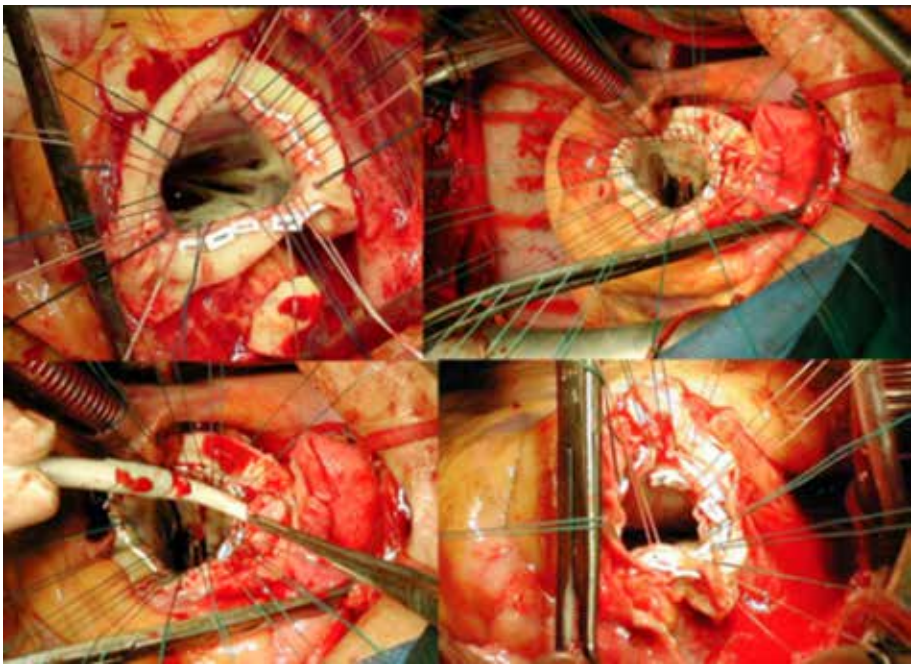


Figure 15. Crown of stitches on the aortic annulus. Coronary ostium buttons can be appreciated.

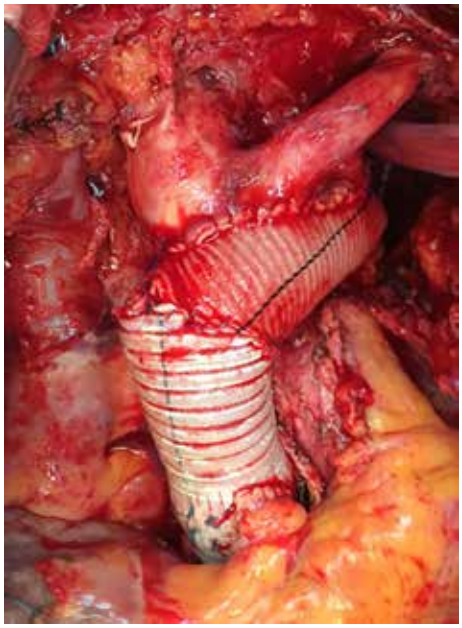


Figure 16. Bentall with the complete reconstruction of the aortic arch and anastomosis of the vessels isle that goes to the brain and neck.

Figure 17. Type A dissection, where can be seen the difference between false and true lumen, from the ascending aorta.

RESULTS

From January 25, 1973, the date on which the researcher intervened the first heart patient with extracorporeal circulation, until December 03, 2019, the date of the experience presented, has operated 3,459 patients with heart problems (Universe). We will refer to patients intervened with aortic pathology 778 (Population), since here are included the 207 Bentall procedures (Sample).

Table 1

Description of the study space in Aortic Root Surgery
July 1977 – December 2019

Description	Cases	Percentage
Universe	3,459 heart-involved patients from 25-01-1973 to 03-12-2019	Total percentage of Universe 100 %
Population	778 patients involved with aorta pathology from 25-10-1978 to 03-12-2019	Total percentage of population 22 %
Sample	207 patients involved with Root aorta pathology from 24-10-2001 to 18-06-2019 (Bentall)	Percentage of the sample over a population 26.6%

Source: Medical records and FileMaker of surgical record from the main author.

The first procedure used by the lead author to solve this type of pathology, from 1987 to 2001, was the Cabrol procedure of which 15 interventions were carried out, pursued the same objective but with a different technique.

Faced with the unenthused results obtained and with a somewhat complicated technique in its execution, from 2001 to date was chosen the Bentall procedure, whose technique seemed simpler and more reproducible. The results currently obtained are comparable to those obtained by surgeons of global experience.

It was also the procedure assumed by the rest of the surgeons of the Cardiovascular Surgery Service of UHC with excellent results. Obviously, the learning curve to master this technique is longer than for other pathologies.

The lead author has performed 207 Bentall procedures, of which 59 (27.4 %) were made with total circulatory arrest in deep hypothermia at 18 ºC, because the injury of the ascending aorta took the entirety or proximal part of the arch, inserting the branches of the arch: brachio-cephalic arterial trunk, carotid and left subclavian, by separate anastomosis or through a contented button of the three vessels.

Associated procedures

21 patients had aorto-coronary bypass grafts implanted (Figure 18) and 10 patients had mitral valve replacement (Figure 19), being this the most complex type of surgeries.

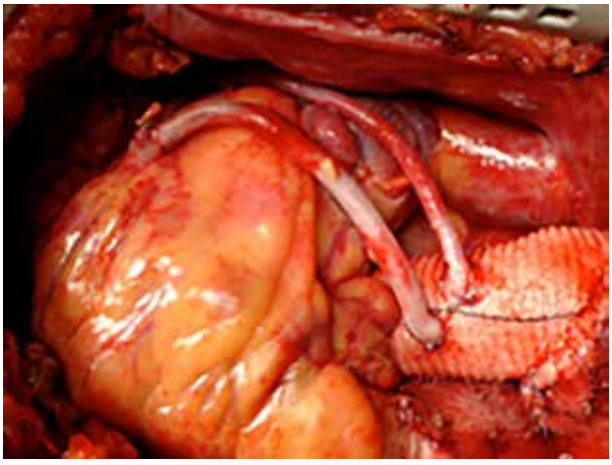


Figure 18. Bentall Procedure with coronary artery bypass grafts.

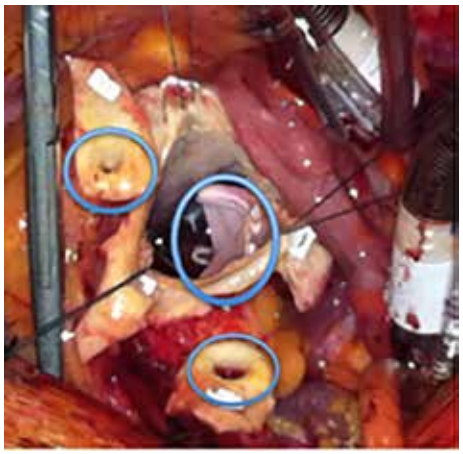


Figure 19. Bentall procedure with implanted mitral graft.

The mean aortic cross-clamp time of all cases was 101.1 minutes (1 hour 41 minutes). Variations ranged from 65 to 180 minutes.

Mortality

In the pathologies where the Bentall procedure is applied, the ones with the highest mortality are the aortic dissections. In these, 5 episodes occur and each separately is a cause of death. With the violent evolution of the pathology, there can be summaries of them, making it even more catastrophic. One is the aortic rupture, producing cardiac tamponade; also acute aortic valve insufficiency, which cause acute heart failure; another may be acute coronary dissection with its consequent ischemia that can produce a myocardial infarction; also the dissection of the vessels of the arch that can cause cerebral ischemia and finally, distal dissection of the arch with generalized multi-organic insufficiency.

Has been stated classically that acute dissection of the untreated ascending aorta, has mortality between 1 and 3 % per hour from the onset of symptoms. It is estimated 25 % in the first 24 hours, 50 % the first week, 75 % per month, and 90 % per year. Mészáros et al. (22) found that 21 % of patients die before arriving at the hospital.

The sample´s overall operative mortality was 12.5 %, which corresponds to 26 deceased patients. It should be noted that in the first half of the experience, mortality was 15 % (out of 94 interventions, 15 deaths), ostensibly improving in the second half to 9.7 % (out of 113 interventions, 11 deaths), even though were involved higher-risk patients in this second period. It is clear that the learning curve plays an important role in the results of this surgery, which is the riskiest and difficult performed by the researcher, even more, when accompanied by associated procedures.

If mortality in the first 24 hours is 25 %, 75 %, and 90 % a year, but if 21 % of patients die before arriving at the hospital, and this is correlated with surgical mortality (first 30 days) which in this experience is 12.5 %, there is no doubt that the risk posed by surgical choice is undeniably lower at the time of deciding on a patient's treatment. That's why the quote in the introduction to this paper: "We see with concern that we often go in delay and diagnostic errors, requesting unnecessary studies which ultimately results in improper handling".

Surgical mortality causes

Of 207 patients involved, 26 died (12.5 %), being bleeding the most important cause. The most vulnerable group was acute dissections. Why? They are emergency patients, for described causes already arrive at the operation room in disability, of these cases most were resolved with the total circulatory arrest at 18 ºC because of involvement of the arch in the dissection. The perfusion takes an hour to bring the organism to this temperature and to reheat at 37 ºC for about an hour and a half more, in all that time, the patient must be subjected to the trauma of the extracorporeal circulation. There should be no difference to >10 ºC between the patient and the blood infused to reheat. Rapid overheating can result in cerebral ischemia due to cold-triggered vasoparesis, which decouples blood flow and brain metabolism.

The hemolysis that produces the extracorporeal circulation time, trauma induced by machine rollers on the erythrocytes, plus low temperatures, and the laborious surgery in terms of anastomosis adds many causes to make this surgery very bleeding. Multitransfusions have an impact on many systems and make the overall inflammatory post-bomb response important, greatly

increasing mortality in this group. The other causes of mortality are inherent in the increased risk of pathology.

In 1950, Bigelow, Callahan and Hopps (23) introduced deep hypothermia to protect organs during circulatory arrest. From 06-03-1998 the author began to use deep hypothermia in acute dissections at 18 ºC in extracorporeal circulation for brain protection, and total circulatory arrest to perform open distal anastomosis.

Circulation reversal

In cases when the total circulatory arrest is performed in deep hypothermia, before releasing the aortic clamp to restart circulation and reheating, femoral canulation is removed and replaced with an aortic cannula that is introduced through the Dacron that replaced the ascending aorta (Figure 20), the air is extracted at that time as a preventive maneuver. It aims to reverse the direction of circulation (retrograde from the femoral) to the physiological form, from the ascending aorta and thus avoid the shock of pressure on the suture line of distal anastomosis which would come by the false lumen of the dissection, drastically decreasing the bleeding in addition to favoring the leaning of the walls and collapsing the false lumen.

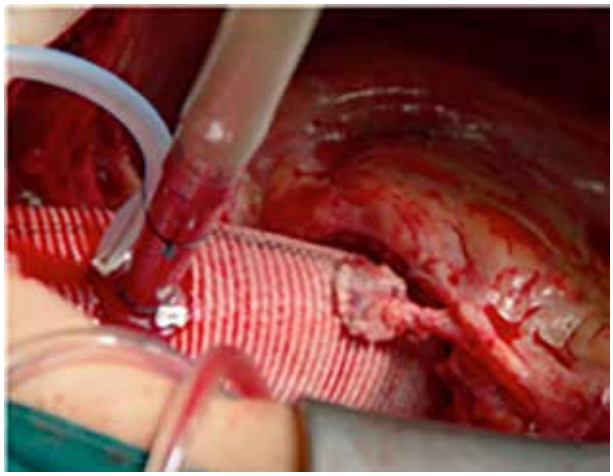


Figure 20. The arterial line is connected to the Dacron.

From the time of use of this maneuver, bleeding reinterventions and also the surgical morby-mortality decreased. There is no knowledge of any publication in the world medical literature that has described this technique.

The first case using this technique was on October 24th, 2000, in a De Bakey type I aortic dissection, broken to the pericardium, with no impact on valve performance, which resulted in a replacement of the ascending aorta.

The circulation reversal procedure from the femoral artery to the Dacron in the ascending aorta is used for cases of De Bakey type 1 dissection with or without impact on the aortic valve, for the Bentall procedure, or on the simple replacement of the ascending aorta to reheat, in addition to this being the physiological form. For this it is necessary to do the following: interpose in the arterial line of the extracorporeal circulation a "Y" connection where will be received from the machine oxygenated and progressively reheated blood, with two outputs, one (A) to the femoral artery and another (B), a longer line, to feed the ascending aorta Dacron when ordered (Figure 21).

Figure 21. "Y" connection of the arterial line.

Once the distal termino-terminal anastomosis is finished and with the hypothermic, exsanguinated in arrest patient, an arterial infusion cannula is inserted through the anterior face of the Dacron prosthesis that replaces the ascending aorta, supported by a tobacco bag-valve suture (Figure 22).

Figure 22. Arterial infusion cannula through the anterior face of the Dacron prosthesis.

Figure 23. Purge of the Dacron cannula.

It is ordered to restart perfusion by the femoral pathway, very slowly, until the retrograde flow is obtained in the exchanged cannula, allowing with some pressure, the output of blood and air, until consider having done the retrograde washing and is occluded with a tube clamp (Figure 23).

Line B is then given clearance for the retrograde purge of it, connecting it with the ascending aorta cannula under direct vision (Figure 24) and occluding the femoral line (Figura 21), being very careful to check the absence of air bubbles to prevent gas embolism. The infusion is started and thus the patient's overheating is obtained (Figure 25).

Figure 24.

Figure 25.

Statistical characterization of the results

Before 2001, interventions involving the replacement of the ascending aorta and aortic valve with re-implantation of the main coronary trunks were performed by the lead author under the Cabrol procedure modality, of which 15 patients were involved through this technique. From 2001, with the description of the Bentall-De Bono procedure, this was chosen to treat the aforementioned pathologies, performing a total of 207 procedures for the time of end cut of this investigation (Table 2). The anoxia time for Bentall's procedures was 101.1 minutes. Table 3 summarizes the anoxic arrest averages for Bentall.

Table 2

Aortic valve procedures with Root and ascending aorta

Cabrol Procedure	15
Bentall-De Bono Procedure	207

Tabla 3

Aortic cross-clamp time averages for Bentall

Procedure	**n (min)**
Bentall Procedure	101,1

At the beginning of the description of ascending aortic aneurysms, there was doubt and it was a cause for discussion at what time of dilation the rupture of the aorta could occur, with the intention of an early indication of surgery and thus avoiding that this serious complication did not occur, decreasing the mortality of the pathology. Here there is a dilemma similar to that of the choice of the type of valve, between when the balance is more in favor of the benefit than the surgical risk to the patient, whom being asymptomatic and having the diagnosis of an aneurysm in the aorta, knows that it has a high risk of complication.

Acute aortic dissection, although relatively rare compared to other causes of cardiovascular death, continues to defy attempts to predict and prevent it, often described as catastrophic with most patients presenting with intense severe pain simultaneously concurring with the fast development of complications previously accounted. Despite better imaging diagnostic methods and newer treatment techniques, mortality for type A aortic dissections ranges from 14 % to 30 % maintained an average of approximately 25 % (24-26).

Identifying patients at risk for aortic dissection is difficult. Established clinical risk factors are systemic hypertension (widely distributed in the general population) and aortic dilation or aneurysm, which can only be found with diagnostic imaging. Even in patients with Marfan syndrome, Ehlers-Danlos syndrome, familial aortic aneurysm, or congenital bicuspid aortic valve, who are known to be at increased risk of dissection, they often go undiagnosed until they develop an acute aortic syndrome (27).

Pape et al. (27) emphasized that, while it is known that the risk of rupture increases with the size increase of the aorta, few studies are linking acute dissection to aortic size, so they went to evaluate all those patients recruited through the International Acute Aortic Dissection Register (IRAD) in the period 1996 to 2005, including a total of 591 patients with acute type A dissection. The average maximum aortic diameter was 5.3 cm; 349 (59 %) patients had aortic diameters less than 5.5 cm, and 229 (40 %) patients had diameters of <5 cm, finding that among the predictor factors of dissection in smaller diameters (<5.5 cm) were the presence of hypertension (P-0.04), irradiated pain (P-0.03) and older ages (P-0.03). Patients with Marfan syndrome tended to dissect in larger diameters (P-0.002). They found no relationship between mortality (27 % of patients) and aortic size.

Most patients with acute aortic dissections presented with <5.5 cm aortic diameters and therefore do not fall within the current guidelines for elective aneurysm surgery. They concluded that other methods are needed, in addition to measuring the size of the ascending aorta, to identify patients at risk for dissection (27). In international guidelines, the risk estimate for thoracic ascending aortic aneurysms (TAAA) is based on the aortic diameter (28).

In the same order, Zafar et al. (28), used the aortic size index (ASI), defined as aortic

size/body surface area as a predictor of aortic dissection, rupture, and death. They sought to evaluate a high-based index, the aorta-high index (AHI) against the ASI for risk estimation, and review natural history calculations. They stratified patients into four annual risk categories for complications based on their ASI and AHI. ASIs (cm/m^2) from 2.05, 2.08 to 2.95, 3.00 to 3.95 and 4, and AHIs (cm/m) from 2.43, 2.44 to 3.17, 3.21 to 4.06, and 4.1 were associated with 4 %, 7 %, 12 %, and 18 % of average annual risk of complications, respectively (28).

Five-year complications free survival was progressively worse as ASI and AHI increased. Both ASI and AHI were shown as significant complication predictors ($P<0.05$). The categories of AHI 3.05 to 3.69, 3.70 to 4.34, and 4.35 cm/m were associated with a significantly increased risk of complications ($P<0.05$). They concluded that the simple height and aortic size index yields satisfactory results when assessing the risk of natural complications in patients with TAAA (28).

Although the author's personal experience did not correlate the size or aortic diameter at the time of surgery with the findings (complications arising from these), it is important to emphasize that it should not only be taken into account the aortic diameter when making the decision on the surgical act and a Bentall Procedure but balancing the risks of possible future complications taking into account factors such as age, high blood pressure, rate of growth of dilation or aneurysm, smoking, among other factors, to offer the best possible treatment to each patient in an individualized approach.

CONCLUSIONS

This work is based on Venezuela's greater experience of treating the aortic root with the Bentall procedure.

The overall operative mortality in the sample was 12.5 %, which corresponds to 26 of the 207 operated patients who died throughout the period. The results were divided into two equal halves, in the first-period mortality was 15.9 %, ostensibly falling in the second to 9.7 %, 6.2 points, which is equivalent to lowering mortality by 58.6 % between the two periods; taking into account that higher-risk patients with a higher number of associated procedures were involved in this second period. It is clear that the learning curve played an important role in improving the observed results. Also, deep hypothermia with total circulatory arrest for brain protection thus facilitating distal anastomosis has been introduced as a technique since 1998. Finally from 2000 on, was included the circulation reversal, which decreased postoperative bleeding, being this the leading cause of general mortality.

By the results obtained in Centers of Experience and by that of the main author, the number of mechanical valve implants in relation to bioprothesis, without taking into account the age of the patient despite the use of anticoagulation, was increased.

In patients with pathology on Aortic Root and Ascending Aorta, especially in cases of dissection, it should not go into delays, diagnostic errors, or requests for unnecessary studies, as it results in inadequate management and produces an inexorable increase in mortality.

In cases of acute dissection where deep hypothermia with the total circulatory arrest was required, this was sufficient for brain protection. This technique was used in 90 % of cases where there were no non-recoverable neurological postoperative complications.

Femoral cannulation, with the presence of uni- or bilateral femoral pulses, is recommended by the author. It's faster and more effective.

Although the main author's personal experience did not correlate the aortic diameter with the findings and their complications involved at the time of surgery, in recent years international guidelines base their risk estimates on ascending thoracic aortic aneurysms on the aortic diameter. Other authors have gone further, indexing not only the aortic size but the patient's height, as predictors of dissection, rupture, and death.

Note: Figures from numbers 2 to 25 were taken by the author.

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