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Type A Aortic Dissection: 10 Year Surgical Experience in Colombia

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1. Abstract

1.1. Background: Aortic dissection is considered a complex surgical emergency, that requires on-time diagnosis and management, nevertheless, even with appropriate management shows high rates of morbidity and mortality ranging from 15 – 35%. Literature regarding this population in Latin America is scarce.

1.2. Methods: A retrospective review of a prospectively collected database was conducted. All patients with the diagnosis of Stanford an aortic dissection who underwent surgical management between 2011 - 2021 were included. A demographic, clinical, and postoperative outcome description were performed.

1.3. Results: Fifteen patients met the inclusion criteria. 80% of the patients were male. Dissection comprises the aortic arch and ascending aorta in 60% of the cases. Prior to surgery, all patients were symptomatic with thoracic or dorsal pain. 60% of the patient do not present any postoperative complications. The 60-day mortality rate was 13.3%.

1.4. Conclusion: Type A aortic dissection remains to be a challenging pathology with high rates of morbidity and mortality. Multidisciplinary management shows favorable outcomes. Our study contributes to the comprehension of this condition in the Latin American population.

2. Introduction

Aortic dissection is defined as the tearing of the tunica intima from the tunica media of the aortic wall, with the consequent formation of a channel denominated as “false lumen”, located parallel to the “true lumen”. The extension of the tearing can cause compression of the true lumen, where both extension and compression occur due to the pressure exerted by the blood that circulates through the false lumen with each heartbeat. Most authors support the theory that the initial event triggering aortic dissection is a primary tear of the intima [1], while others support that the dissection is the result of a rupture of the vasa vasorum in the tunica media of the aorta causing the formation of an intramural hematoma, which subsequently ruptures through the intimal layer, thus creating a rupture of the tunica intima. With the tearing of both tunics, a false lumen is created that allows the circulation of blood through it [2]. In this way, the dissection spreads as the hours go by, with the risk of cerebral, cardiac, visceral, or even lower extremity ischemia as a consequence of the lumen obstruction [3].

Aortic dissection is classified according to the presence and location of primitive tears and the retrograde or antegrade extension of the dissection. Classically, 2 classification systems have been used: the DeBakey classification and the Stanford classification [1]. Both classifications share a common point: Type A Stanford classification (proximal or ascending) groups DeBakey’s I and II classification, referring to the dissection of the ascending aorta with or without extension towards the aortic arch and descending aorta. On the other hand, Type B Stanford classification (descending) is equivalent to that of DeBakey type III, where the dissection is in the descending aorta [2].

The annual incidence of aortic dissection in the United States is 3-4 per 100,000 people [4], where Type A aortic dissection represents two-thirds of the cases [3,5]. The risk of developing aortic dissection is higher in men than women (5.2 vs 2.2 per 100,000 per year) with consistent sex distribution between two Stanford types [6]. In Colombia, a retrospective descriptive study carried out in Valle de Lili Foundation, Cali, analyzed clinical records of 58 patients diagnosed with type A aortic dissection showing that 79.3% of the patients were men, with a median age of 56 years, reporting complications in the 36.2% of the cases and survival at 28 days higher than 70% [7]. Aortic dissection constitutes a surgical emergency per se, with critical behavior, unfavorable outcomes, and high rates of morbidity and mortality, secondary to the progressive and linear increase concerning the time of diagnosis and the time of intervention, with an increase of 1 to 2%. of mortality for each hour that progresses without intervention, more than a third of the patients die in the first 24 hours, half in the next 48 hours, two thirds in the first week and almost 90% die in the first month [1]. With surgery, the mortality of acute dissection according to the International Registry of Aortic Dissection (IRAD) reaches 26% and 37% in patients younger and older than 70 years [3]. This is the fact that makes aortic dissection the most lethal of events affecting the aorta [2] and one of the most common emergencies in cardiothoracic surgery related to aortic syndromes, and because of its health burden and catastrophic outcomes, almost always requires an urgent surgical approach [7]. Given the documentation of this problem, multiple international campaigns are being developed in order to visualize this problem and improve the percentages of the diagnostic approach. However, epidemiological and clinical data are scarce in Latin America and to a greater extent in Colombia, therefore there are no associations described between preoperative characteristics and adverse postoperative outcomes, such as cerebrovascular accident, plegia, and death. Accordingly, the aim of this study is the characterization of patients with Type A aortic dissection, as well as their postoperative outcomes in a latin-american population.

3. Methods

With the Institutional (Pontificia Universidad Javeriana and Hospital Universitario San Ignacio) Review Board's approval and following Health Insurance Portability and Accountability Act (HIPAA) guidelines, a retrospective review of a prospectively collected database was conducted. All patients with the diagnosis of Stanford A aortic dissection who underwent surgical management between 2011 -2021 were included. Patients with missing preoperative and operative data, and follow-up < 1 month were excluded. Ethical compliance with the Helsinki Declaration, current legislation on research Res. 008430-1993 and Res. 2378-2008 (Colombia), and the International Committee of Medical Journal Editors (ICMJE) were ensured under our Ethics and Research Institutional Committee (IRB) approval.

4. Data Assessment

Patients' demographics and associated comorbidities were evaluated. Clinical variables including preoperative weight, height, body mass index, duration of symptoms, and time of diagnosis were evaluated, and preoperative serum analyses such as hemoglobin and creatinine were evaluated as well. Preoperative left ventricular function was assessed by echocardiography, and the extension of the dissection and type of surgical procedure was defined. Operative variables including, type of surgical procedure, perfusion, and ischemic time were evaluated. Postoperative variables include the presence of complications, intraoperative, and 60-day mortality rate.

Descriptive statistics of all study parameters were provided according to the nature of the variable. The distribution of the variables was assessed according to the Kurtosis/Skewness test. Continuous variables were summarized by means or medians and standard deviation or interquartile ranges according to their nature and distribution. Categorical data were summarized by their frequency and proportion. Data were analyzed using STATA 17 licensed version.

5. Results

A total of 15 patients matched the inclusion criteria and were included. Male patients constituted 80% (n = 12) of all patients. The mean age was 56.2 ± 11.1 years old; the median body mass index was 26.9 kg/m2 (± 4.7). Arterial hypertension was evidenced in 40 % (n=6) of cases, type 2 diabetes mellitus in 6.6% (n=1), and none of the patients had a history of collagen disorders. Prior to surgery, all patients were symptomatic, in 46.6% (n = 7) of the cases dorsal pain was evidenced, 93.3% (n = 14) presented to the emergency room with thoracic pain, and 20% (n = 3) have a history of syncope before surgical consultation. Acute myocardial infarction prior to surgery was evidenced in 20% (n = 3) of the patients. Preoperative analysis was performed, and the mean hemoglobin level was 13.4 (±1.5), hematocrit mean was 40.2 (± 4.2). Renal function was assessed, with a mean creatinine level of 1.3 (± 0.5) (Summarized data displayed in Table 1). Echocardiography was performed as well, perioperative left ventricular function mean was 56.1% (± 6.3), aortic valve insufficiency was evidenced in 14.2% (2) of the cases, pericardial effusion was documented in 21.4% (n = 3), and 64.2% (n = 9) have mixed findings.

Extension of the disease was assessed, in the majority of the population (60% n = 9), the dissection comprises the aortic arch and ascending aorta; and 20% (n=3) involves the aortic arch, ascending and descending aorta. (Summarized data displayed in Table 2). The mean time between acute symptoms and emergency room consultation was 3.9 days (±6.2); as well time between initial consultation and diagnosis was evaluated, with a mean time of 1.3 days (±2.01). The most frequent surgical technique performed was the modified Bentall procedure in 53.3% (n=8), followed by supra-coronary aortic plus aortic arch replacement in 26.6% (n=4).

The mean ischemia time was 134.4 minutes (±37.2), and the extra-corporeal circulation time median was 277.5 (IQR 134;290). Most of the cases require intraoperative vasopressor support (93.3% n=14), in 33.3% (n=5) of the patient's retrograde perfusion using superior vena cava. (Summarized data displayed in Table 3). In terms of postoperative complications, most of the cases did not present any postoperative complications (40% n=6). Any degree of coagulopathy was evidenced in 33.3% (n=5) of the cases, and 13.3% (n=2) presented cardiac blockade. Intraoperative mortality was evidenced in 3 patients, none of the patients died in the first 24 hours, and the 60-day overall mortality rate was 13.3% (n=2). (Summarized data displayed in Table 4).

Table 1: Demographic and preoperative characteristics

Variable	Result
Gender % (n)	
Male	80 (12)
Female	20 (3)
Age Mean (SD)	56.2 (11.1)
Body Mass Index Mean (SD)	26. 9 (4.7)
Comorbidities % (n)	
Type 2 Diabetes Mellitus	6.6 (1)
Smoking Habit	26.6 (4)
Arterial Hypertension	40 (6)
Heart Disease	0 (0)
Previious aortic surgery	6.6 (1)
Pre operative data	
Hemoglobin mean (SD)	13.4 (1.51)
Hematocrit mean (SD)	40.2 (4.27)
Creatinin mean (SD)	1.31 (0.55)
Ureic Nitrogen mean (SD)	19.8 (5.2)
Symptoms % (n)	
Dorsal Pain	46.6 (7)
Thoracic Pain	93.3 (14)
Syncope	20 (3)
Myocardial infarction	20 (3)

Table 2: Ecocardiographic findings

Variable	Results
Disection % (n)	
Ascending aorta	20 (3)
Descending aorta	0 (0)
Ascending + Aortic branch	60 (9)
Ascending + Aortic branch + Descending aorta	3 (20)
Ecocardiography % (n)	
Aortic valve insuficiency	14.2 (2)
Pericardial effussion	21.4 (3)
Aortic Valve insuficiency + Pericardial effusion	64.2 (9)
Left ventricular function mean (SD)	56.1 (6.32)

Table 3: Operative characteristics

Variable	Result
Surgical proccedure % (n)	
Modified Bentall procedure	53.3 (8)
Supracoronary aortic replacement	6.6 (1)
Supracoronary aortic replacement + Aortic valve resuspension	6.6 (1)
Supracoronary aortic replacement + Aortic branch replacement	26.6 (4)
Modified Bentall procedure + Aortic branch replacement	6.6 (1)
Surgical characteristics	
Ischemia Time mean (SD)	134.4 (37.2)
Extracorporeal circulation time medan (IQR)	277.5 (134;290)
Circulatory arrest % (n)	53.3 (8)
Time of circulatory arrest mean (SD)	18.26 (18.9)
Intraoperative vasopressors % (n)	93.3 (14)
Neurologic protection %(n)	
No circulatory arrest	46.6 (7)
Retrograde perfusion (Superior cave vein)	33.3 (5)
Retrograde perfusion (Axilary artery)	6.6 (1)
Anterograde perfusion (Brachiocefalic trunk)	13.3 (5)

Table 4: Postoperative outcomes.

Variable	Result
Postoperative complications	
No complication	40 (6)
Coagulopaty	33.3 (5)
Cardiac Blockade	13.3 (2)
Coagulopaty + Renal Failure	6.6 (1)
Coagulopaty + Cardiac Blockade	6.6 (1)
Intraoperative mortality	20 (3)
24 hour mortality	0 (0)
60- day mortality	13.3 (2)

6. Discussion

Aortic dissection occurs between 0.2-0.8% of the world population [8]. According to data analysis from the report of the International Registry of Acute Aortic Dissection (IRAD) 62.3% of patients are classified as type A; furthermore, overall in-hospital mortality from all cases of aortic dissection regardless of their classification showed to be up to 27.4%, whereas the rates in the group of type A alone would reach up to 34.9%, constituting an entity that despite its low prevalence is associated with very high mortality [9]; this may be more easily seen when identifying the progressive and linear increase of these rates in relation to the time of diagnosis and the time of intervention, with a 1-2% increase in mortality for every hour that passes without intervention, 20% of the patients die if it's not treated in the first six hours, 50% die in the first twenty four hours, and 70% in the first seven days, according to international records [10]. Additionally, about 50% of patients with acute aortic dissection do not receive specialized medical attention, and its confirmation is part of the postmortem diagnosis. Taking this into consideration, it is essential to have a high diagnostic suspicion and an accurate and early therapeutic approach that impacts significantly in the outcomes of the patients.

Moreover, the IRAD registry evaluated other demographic and clinical aspects in the presentation of these patients. Data shows that of the study population two thirds were male, the mean age identified was 63.1 years (95% confidence interval, 61.8-64.4 years) and a history of hypertension was confirmed in 72.1% of patients. Regarding the diagnostic approach received at first medical contact the majority of patients described chest pain as their main complaint, typically anterior chest pain in patients with type A dissection, reaching up to 72.7%, as for patients presenting with syncope the rates were of 12.7%. Subsequently, cardiac function was assessed and identification of aortic insufficiency was done in half of the patients [9].

The results of the present study unequivocally confirm that the epidemiological variables evidenced in registries of the literature are

reproduced within the Colombian population. Male population encompassed 80% of patients, the mean age of 56.2 ± 11.1 years was established in the same age group of prior international registries, arterial hypertension was evidenced in 40% of patients, chest pain was the main symptom described in up to 93.3% of cases, and in 20% of cases a history of syncope was present. Recognition of the similarity between the results described in these different populations opens the door to a greater understanding of the importance of identifying certain factors when approaching these patients. The risk of mortality in patients with type A aortic dissection who do not receive early surgical intervention has been reported to be approximately 60% [11].

According to the reports in the guidelines for the repair of type A aortic dissection, it is recommended to perform a Bentall procedure that involves complete resection of the intimal tear and replacement of the ascending aorta and if it requires repair of any other alteration (valve replacement), often combined with a hemiarch replacement under circulatory arrest [12]. As described in the literature, this is also the procedure that is most used in our population.

Myocardial protection is of utmost importance in these operations, using initial induction with antegrade and retrograde blood cardioplegia and repeat retrograde cardioplegia approximately every 60 minutes. In addition, it is necessary to guarantee varying degrees of hyperthermia and some cerebral protection technique, which includes anterograde or retrograde cerebral perfusion [12]. The objectives of this procedure are based on reestablishing the flow through the true lumen, eliminating the main tear, restoring the anatomy of the root and the competence of the aortic valve [13]. One of the main techniques is open distal anastomosis without aortic clamping, because it allows more accurate approximation of the dissected layers, also direct visualization of any arch tears, and hemostatically secure anastomosis [14]. On the other hand, aortic clamping is only recommended if the heart distends on fibrillation because of severe aortic regurgitation, because can induce false lumen pressurization, leading to propagation of the dissection, malperfusion or incensed risk of inducing additional aortic injury [14]. However, there are other strategies more aggressive that involve the replacement of ascending aortic and total arch with a "frozen" elephant trunk technique. But it has been shown that the other interventions present more long-term complications, so the conventional technique is preferred. Also, operative mortality for acute type A dissection are related to massive hemorrhage, cerebral ischemia, cardiogenic shock, and distal malperfusion, which are responsible for almost 85% of perioperative deaths [12], for this reason, is important to choose the technique that is best recommended for the patient and perform it as early as possible. The present study's analysis of postoperative outcomes revealed that 60% of cases exhibited complications, with any type of coagulopathy being the most prevalent (33.3%, n=5), followed by cardiac blockade (13.3%, n=2). In terms of intraoperative mortality, 20% of patients were affected; although no fatalities occurred within the first 24 hours post-surgery, the overall mortality rate at 60 days was 13.3% (n=2), this data is in line with one reported by some authors [7], with a mortality rate between 10.5 and 30%. Among limitations include the retrospective nature of the study, and small sample size, however strengths of our study are that our data increases the literature regarding Latin American population in terms of sociodemographic and clinical characterization of patients with Type A aortic dissection, as well as their postoperative outcomes.

7. Conclusion

Aortic dissection remains to be a surgical challenge due to the increased rate of morbidity and mortality even with on-time surgical management. Data regarding the latin american population is scarce, our study contributes to the knowledge and comprehension of the pathology, and reflects the importance of multidisciplinary groups in order to achieve favorable perioperative outcomes.

8. Acknowledgment

To our patients

9. Conflict of Interest

Authors do not declare any conflict of interest

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