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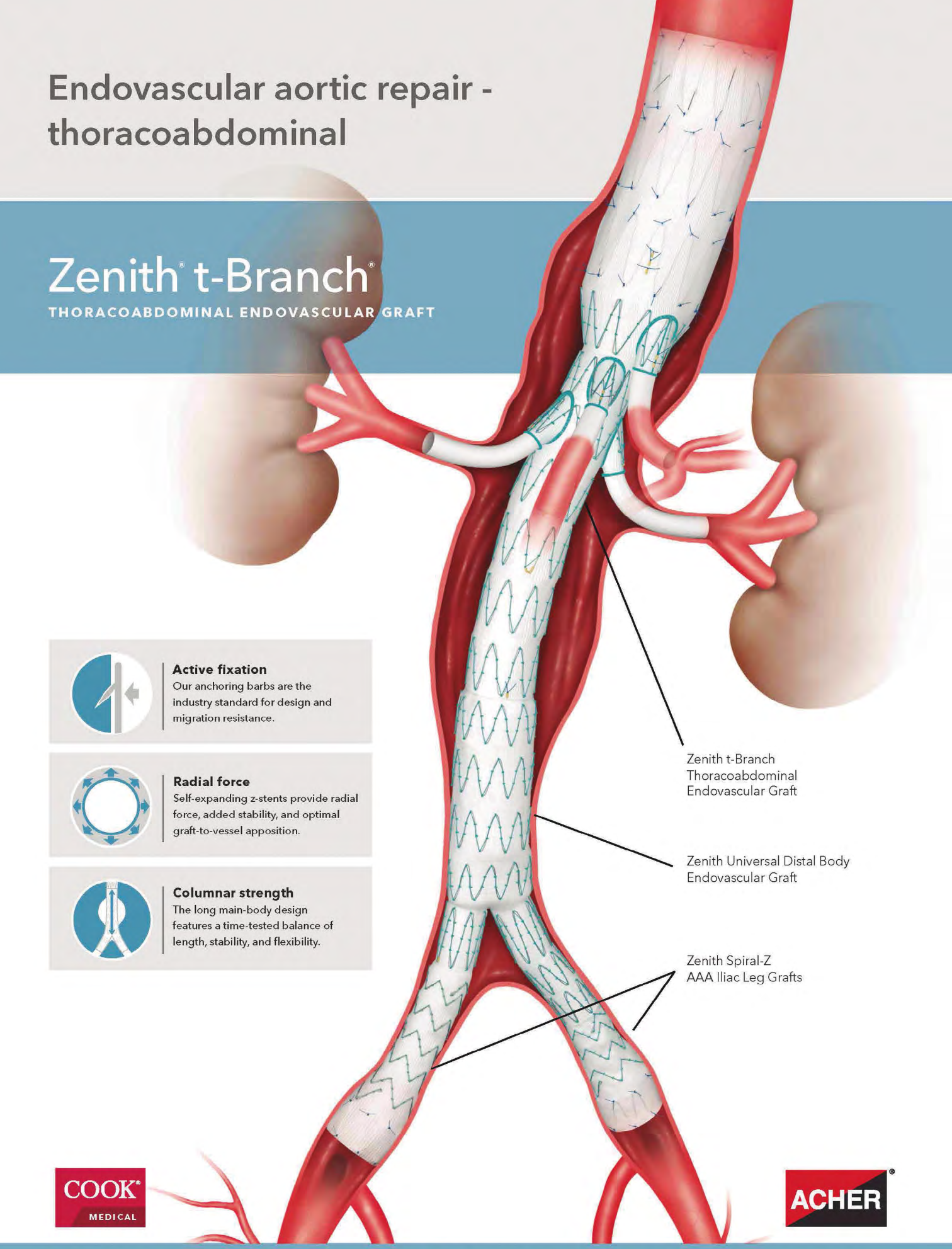

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SUMMARY

ORIGINAL ARTICLE

SPINAL CORD ISCHEMIA DURING ENDOVASCULAR REPAIR OF THE THORACIC AORTA

ABSTRACT

Background and objectives: This work aims to analyze the incidence of medullary ischemia (MI) and identify the factors contributing to its development during endovascular repair of the descending thoracic aorta in patients requiring complete coverage.

Material and methods: A retrospective study. Between April 1999 and December 2014, 176 thoracic aortic endovascular repairs were performed. Sixty-two patients (48 male and 14 female) were treated with thoracic stents from the aortic arch to the celiac trunk due to thoracoabdominal aneurysms (n = 13), aortic dissections (n = 42), intramural hematomas (n = 4), post-traumatic pseudoaneurysms (n = 2) and aortic ulcers (n = 1). All procedures were performed under general anesthesia with strict invasive blood pressure control. Cerebrospinal fluid drainage was performed in 5 patients.

Results: The success rate of stent placement was 96.7%, and mortality was 4.84%. The incidence of spinal cord ischemia was 4.84% (3 patients, one in the immediate postoperative period and two during follow-up). Permanent paraplegia was observed in 1.6%. Overall survival (Kaplan-Meier) at 1, 3, and 6 years was 76%, 69.1%, and 64.32%, respectively.

Conclusions: thoracic aortic coverage is an effective procedure with a high probability of success. Our study identified a previous procedure on the abdominal aorta and a thromboembolic aortic event as risk factors for developing medullary ischemia in patients requiring complete coverage of the thoracic aorta. In this study, full coverage of the thoracic aorta and left subclavian artery alone are not predictors of paraplegia.

Keywords: *thoracoabdominal aneurysms; spinal cord ischemia*

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INTRODUCTION

Stenting of the thoracic aorta is a procedure that is being performed with increasing frequency. Recent literature shows that extensive coverage of the thoracic aorta is associated with the incidence of neurological complications[1].

Although reports in the international literature generally reflect a lower incidence of MI during stenting than during conventional surgery, MI persists as one of the most devastating and feared complications[2,3].

Several factors have been identified as favoring the occurrence of MI; among them a history of abdominal aortic treatment, arterial hypotension during implantation, coverage of the left subclavian artery, and extension of the covered aorta[4].

This presentation aimed to analyze the incidence and identify the risk factors associated with MI in patients in whom the thoracic aorta was covered entirely.

MATERIALS AND METHODS

A retrospective study was performed between April 1999 and December 2014. A total of 176 patients were treated with thoracic stents. Sixty-two patients (48 male and 14 female), with a mean age of 59.95 years, received thoracic aortic stents from the aortic arch to the celiac trunk due to thoracoabdominal aneurysms (n = 13), aortic dissection (n = 42), intramural hematoma (n = 4), posttraumatic pseudoaneurysms (n = 2), and aortic ulcer (n = 1).

Table 1 shows the clinical and demographic characteristics of the patients.

Variable	n	Percentage (%)
Blood pressure (mmHg)	61	98,44
Active smoking	21	35,94
Diabetes	13	20,31
Obesity	27	43,55
Coronary heart disease	15	23,44
Chronic obstructive pulmonary disease	26	43,75
Chronic renal failure	10	16,13
Age (years)	59,95 (22-87)	

TABLE 1. Clinical and demographic characteristics of the patients.

RESULTS

All patients underwent angiotomography before surgery.

The left subclavian artery was intentionally occluded without revascularization in 22 cases (35.48%) because the proximal aortic neck was less than 15 mm long. The celiac trunk was deliberately covered in three patients due to a short distal aortic neck.

Spinal protection by cerebrospinal fluid (CSF) drainage was performed in five patients. All these patients had a history of abdominal surgery.

All procedures were performed under general anesthesia and invasive blood pressure monitoring, with mean arterial pressure above 90 mmHg.

Technical success of implantation was defined as a correct release of the stents, no conversion to conventional surgery, and no evidence of immediate endoleaks of types I and III.

Continuous variables are presented as the median and interquartile range (25-75), while categories are expressed as percentages with their absolute value.

The difference in survival at one, three, and six years was evaluated by the Kaplan-Meier method.

Statistical analysis was performed with the Stata program 13™.

The technical success rate of implantation was 96.7%; there were two cases of type I endoleaks (3.23%) at the end of the procedure and perioperative mortality in three patients (4.84%). No conversion to conventional surgery was recorded; the causes of death were aortic rupture in one patient and multiorgan failure in two.

The mean length of aortic coverage was 288 mm (200 to 360 mm).

No patient in whom the left subclavian artery (35.48%) and celiac trunk (4.84%) were intentionally covered developed left upper limb or mesenteric ischemia, respectively.

MR was observed in three patients (4.83%), in one immediately and in the other two, far apart in time, regarding the form of presentation of MI; one patient presented with paraparesis 24 hours after treatment while hospitalized in the coronary unit. The second patient developed retrograde ejaculation and paresthesias of both lower limbs three years after the procedure, and the third developed permanent paraplegia four years after the procedure.

Survival at 1, 3, and 6 years was 76%, 69.91%, and 64.32%, respectively (*Figure 1*).

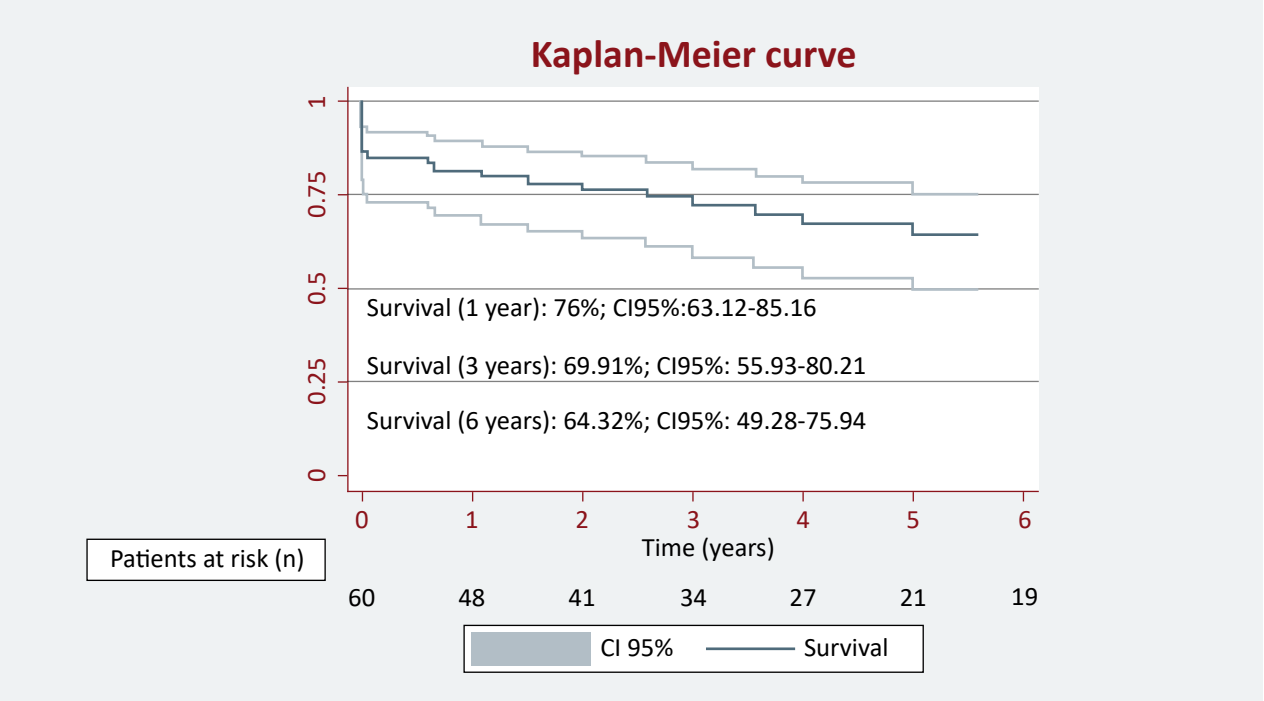

FIGURE 1. Survival at 1, 3, and 6 years.

DISCUSSION

According to the international literature, MI is a severe complication during stent placement in thoracic aortic pathology; the incidence is 0 to 12%[3-5]. In our study, the incidence of MI was 4.83% (3 patients). One patient presented paraparesis 24 hours after treatment while hospitalized in the coronary unit. He had been treated for a thoracic aneurysm and, years earlier, had undergone a bifemoral aortic bypass. CSF drainage was performed using a spinal catheter placed during the intervention until reaching 10 mmHg. The patient was discharged 72 hours later, asymptomatic.

The second patient was treated for a chronic dissection and had undergone endovascular intervention of the abdominal aorta; he developed a sudden picture of paresthesias of both lower limbs and retrograde ejaculation three years after the procedure, which was corrected with blood pressure stabilization. The last patient, also treated for chronic aortic dissection, developed paraplegia four years after the procedure, probably due to atheromatous embolism in an aorta with multiple calcified fibro-lipidic plaques, with the persistence of paraplegia during follow-up.

The occurrence of MI after thoracic aortic stenting is more frequent when the arteries that supply the spinal cord (Adamkiewicz artery and intercostal and lumbar arteries) are sacrificed, as well as after a period of severe hypotension or embolisms from atheromatous lesions of the aorta[5].

Our results show that, despite covering large extensions of the thoracic aorta and the entirety of the intercostal arteries, there is no linear correlation between this procedure and the appearance of spinal cord ischemia. This may be explained by the model proposed by Griepp of spinal cord vascularization[6], according to which spinal cord irrigation depends on multiple collateral arteries supplying the anterior spinal artery instead of a single dominant artery of Adamkiewz, previously considered essential to maintain spinal cord perfusion[6].

It should also be mentioned that MI is a phenomenon that can not only occur during or immediately after endovascular treatment but can also appear after years, as occurred in two of the patients presented[6].

The only measure we systematically apply to prevent spinal cord ischemia is keeping mean arterial pressure elevated (≥90 mmHg) and stable during the intervention.

In our series, we performed medullary protection in cases where the entire thoracic aorta was covered and the abdominal aorta had been operated on. Although there is a risk of compressive hematoma of the spinal cord due to a puncture of the spinal canal, this technique should be used as a prophylactic measure only in this case.

CONCLUSION

It can be concluded that endovascular treatment of the descending thoracic aorta using stent placement should not be considered a factor causing spinal cord ischemia. When establishing a predictive factor, we consider that the only one is the previous repair of the aorta in the abdominal sector. All patients should receive medullary protection in these cases, maintaining a stable mean arterial pressure ≥90 mmHg throughout the intervention and the first 48 hours after the procedure.

Conflicts of interest
The authors declare no conflict of interest.

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REVIEW ARTICLE

VASCULAR TRAUMA EXPERIENCE AT HOSPITAL DURAND

ABSTRACT

A brief review of the guidelines for diagnosing and treating vascular trauma in civil society presents the experience with 38 patients over 3 years and 8 months in a public hospital in the City of Buenos Aires.

Keywords: *vascular injuries, differential diagnosis, image diagnosis, vascular surgical procedures*

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INTRODUCTION

Vascular trauma is considered to account for approximately 3% of all trauma worldwide in the context of emergency department admissions; vascular injuries are relatively low, representing only 0.67% of all patients.

In the past, the main source of vascular trauma came from military conflicts, where the greatest experience was gained and where knowledge was established. Nowadays, vascular emergencies come mostly from the civilian sector. For example, in the United States of America, 3% of all cases of major trauma are associated with vascular injury or are exclusively vascular[1,2], so blunt trauma and iatrogenic injuries are becoming increasingly important. The exponential increase in iatrogenic vascular injuries is related to the increase in intravascular procedures and, to a lesser degree, to laparoscopic procedures. At the same time, blunt trauma with vascular lesions is mainly attributed to traffic accidents[3].

ANATOMICAL DISTRIBUTION OF TRAUMA

Experience in civilian vascular trauma since the 1960s documents a relative increase in cervical, thoracic, and abdominal vascular trauma caused by the less deleterious effect of civilian firearms and increased stab wounds, which produce less vascular damage. The above, added to the rapid transport of injured patients, allows more patients to arrive alive to emergency services.

Most of the vascular injuries are due to penetrating trauma. Only 1% of vascular injuries in wartime are from blunt trauma, which is slightly higher in civilian trauma, between 10% and 15%.

A 400% increase in cardiovascular trauma was documented in the civilian population in Houston between 1958 and 1988, 50% of which occurred in the last 10 years. Part of this increase corresponds to iatrogenic injuries, the procedures responsible for these being mainly cardiac catheterization, angiography, and surgical procedures, the femoral and brachial arteries being the most injured[2].

MECHANISMS OF VASCULAR INJURY

The consequences and magnitude of vascular injury depend on the mechanism of injury; therefore, it is essential to identify the agent, which helps to use appropriate diagnostic resources and institute proper treatment. Different mechanisms can cause vascular injuries; these can be penetrating, the most common being those produced by firearms; in this case, the severity depends on the projectile's velocity. In the case of those produced by long-range weapons, in addition to the direct destruction of tissue, injuries secondary to the cavitational effect are observed; bone fragments can produce penetrating injuries of the vessels. Within these lesions, laceration (tear or partial rupture of a vessel and transection), which corresponds to the complete loss of continuity of a vessel, is the most frequent, with bleeding being greater in partial than in complete transections, since in this case there is retraction of both ends and vasoconstriction due to vascular spasm[2,3].

Closed lesions, the least frequent mechanism, have a more serious prognosis, given that the lesion is by crushing and diagnosis tends to be delayed. In this case, lateral disruption of the entire wall or intimal disruption (flap) occurs, leading to thrombosis or dissection and subsequent rupture. In the case of thrombosis, there is the possibility of distal embolization with deleterious effects for the patient. If the lesion is in a contained compartment, there will be a pulsatile hematoma, constituting a pseudoaneurysm. In this case, distal flow is preserved, which initially makes clinical diagnosis difficult and, in turn, changes over time with the appearance of a pulsatile mass. The great danger is rupture away from the initial trauma. The formation of an AVF occurs when trauma of the vein adjacent to the arterial vessel is associated, manifesting itself far from the trauma through cardiovascular alterations and/or rupture[3].

DIAGNOSIS

The diagnosis of vascular lesions is made by exhaustive physical examinations that reveal two types of signs: hard signs or vascular lesions and soft signs. The former includes active arterial bleeding, hematoma that increases in size rapidly, and signs of ischemia with an absence of pulses, phlegm, or murmur; the existence of any of them has surgical or exploratory indications in the operating room. The so-called soft signs of vascular injury include a history of bleeding at the scene of the accident or place of the event, small stable non-pulsatile hematoma, a neurological deficit of a nerve related to a vascular bundle, and wounds with a trajectory neighboring a vascular bundle of importance[2,4]. The presence of hard signs is associated with a high suspicion of vascular trauma (100%) with a false negative rate of 0.7%; these signs are an indication for surgical exploration. Soft signs are indicative of vascular injury but do not indicate immediate surgical exploration; these patients will be submitted to complementary studies[5]; their presence is associated with a 63% incidence of vascular

injury. Echo-Doppler may indicate the possibility of vascular injury. However, angiotomography is the gold standard for visualizing vascular lesions because, in addition to seeing the lesion itself, it allows the evaluation of the associated lesions and planning surgery more accurately.

Traumatized patients should be given first aid, airway control, and management; however, the management priorities in patients with this type of injury are to stop bleeding, restore normal circulation and avoid, as far as possible, tissue distress.

TREATMENT

Once surgical exploration of the patient with vascular trauma has been decided, good visualization of the involved vessel is paramount, so the incision should be generous. Proximal and distal vascular control is the first principle of vascular repair. Then the use of heparin in the general or systemic form must be considered if there are no associated severe lesions. However, a heparinized solution is common for the lavage of vascular ends[6].

Fogarty catheter embolectomy of both ends is essential to ensure a thrombus-free sector; intraoperative arteriographic verification indicates whether the distal sector is free of thrombus.

The distal sector is free of thrombus. For vascular shunt, fasciotomies should be used (open or semi-closed of the compartments in the limb) to avoid compartment syndrome, which occurs when ischemia is greater than 6 hours, or in closed trauma, or venous ligation or reconstruction is performed.

Regarding the type of conduit to be used, the autologous vein remains the gold standard, especially the internal saphenous vein, ideally from the leg contralateral to the trauma in the case of limb involvement. For this reason, the extremities should always be prepared to resort to the vein[7].

In case of impossibility to obtain the saphenous vein, either for technical reasons or due to urgent situations, as occurred in a patient of our statistics, it is advisable to use a PTFE prosthesis, although with a higher risk of infections (since these are emergencies) and better long-term patency.

METHODS

The present study is retrospective, performed in the hospital ward from January 2019 to September 2022; patients who presented possible vascular trauma with data available for reporting were included. Demographic data, mechanisms of injury, site of injury, vascular soft and hard signs, imaging, injured vessel, complications, and mortality were recorded.

RESULTS

Thirty-eight patients with possible vascular injury presenting with hard or soft signs were analyzed. The mean age was 29 years (18-64); sex, male, 37 cases (90.2%). We found 25 vascular lesions in 22 patients (3 had combined lesions, and vein and popliteal artery).

Of the 38 patients, 33 (86.8%) were due to penetrating trauma, and 5 (13.2%) cases were due to blunt trauma (*Figure 1*). Of the total possible injuries, 20 patients (52.6%) presented hard signs, which were intervened, and a vascular lesion was found in 19 (95%); only one patient presented hard signs, but no vascular lesion was found. The remaining 18 (47.4%) patients had soft signs, arterial Doppler ultrasound and angiotomography (*Figure 2*) were performed, and vascular lesion was found in 3 patients (16.6%). Among the 25 vascular lesions, the following were found: popliteal lesion in 8 cases (32%), 5 arterial and 3 venous, 3 patients with combined lesions (*Figures 3, 4, and 5*), superficial femoral in 4 cases (16%) (*Figure 6*), 2 common femoral (8%), 1 tibioperoneal trunk (4%) (*Figure 7*) and 1 posterior tibial (4%). In the upper limb, it was found in 8 cases (32%), 3 humeral (*Figure 8*), 4 radial and 1 ulnar, and 1 case of the right subclavian artery (*Figure 9*). The surgical techniques used were primary suture of the vessel in 4 cases (16%), ligation of the vessel in 2 (8%) (popliteal veins), closure with vein patch in 1 case (*Figure 5*), venous bypass in 17 (68%) and bypass with prosthesis in 1 case (4%), the patient was admitted in cardiorespiratory arrest in resuscitation.

Fasciotomy was performed in 4 patients (18%) (*Figure 10*), 3 due to combined popliteal injury, and 1 due to humeral injury. Amputation was required in 3 cases (13.6%). One patient died (4.5%). Follow-up is low since postoperative consultation is very rare.

CONCLUSION

Vascular lesions are challenging pathologies where rapid intervention is essential for prognosis. Generally, they are young patients with few comorbidities, where the main issue is hemorrhage control and rapid resuscitation, which explains the low mortality. The relevant data obtained are from hospitalization. After discharge, patients do not return to the office, so follow-up is challenging.

Declarations
The authors declare no conflict of interest.

FIGURE 1. Closed vascular trauma of the inguinal region.

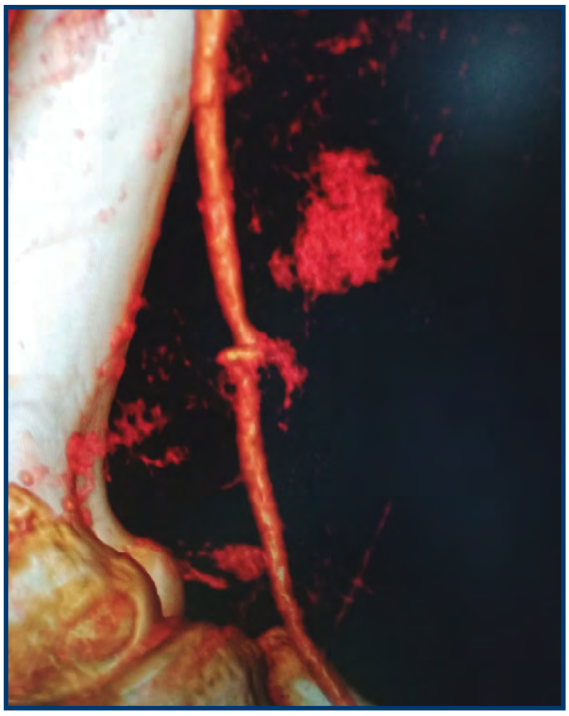

FIGURE 2. Angiotomography with a superficial femoral lesion.

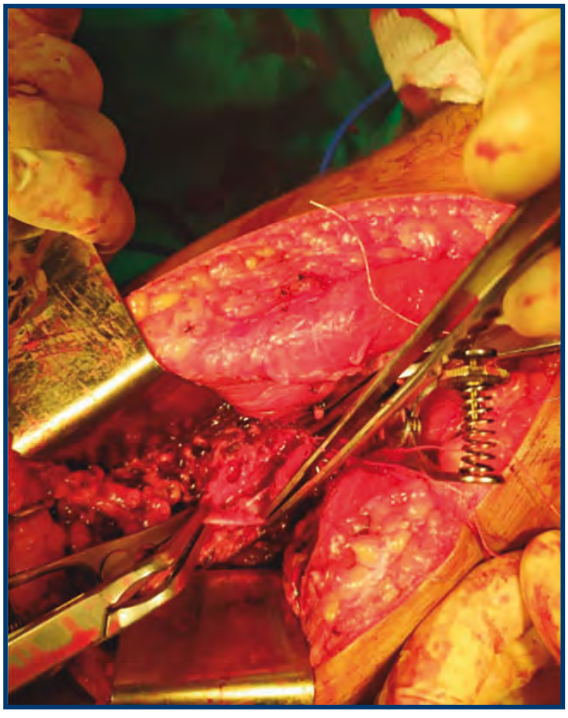

FIGURE 3. Combined vein and artery popliteal injury, posterior approach.

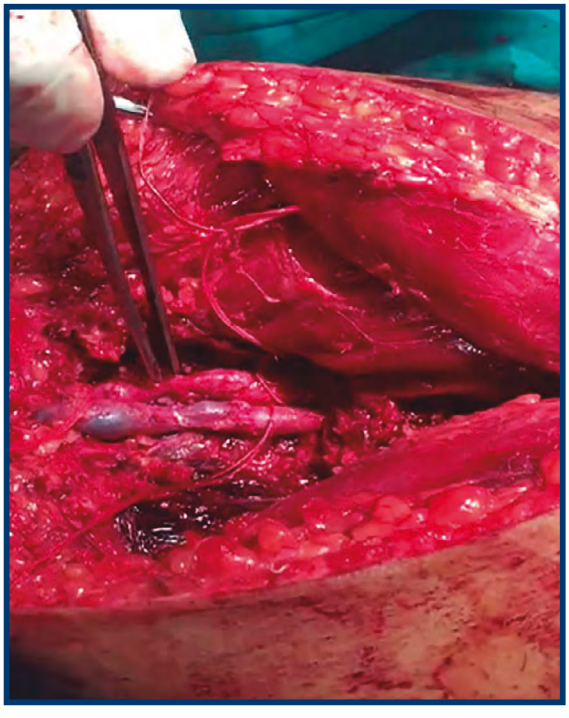

FIGURE 4. The popliteal fossa can be seen with a posterior approach; the calf muscles are towards the right of the figure -surgical repair of figure 5-, popliteal artery venous bypass, and popliteal vein venous patch.

FIGURE 5. Popliteal injury with posterior approach and venous bypass.

FIGURE 6. Repair with prosthesis separately, femoral chamber gunshot injury with common, superficial, and deep femoral involvement.

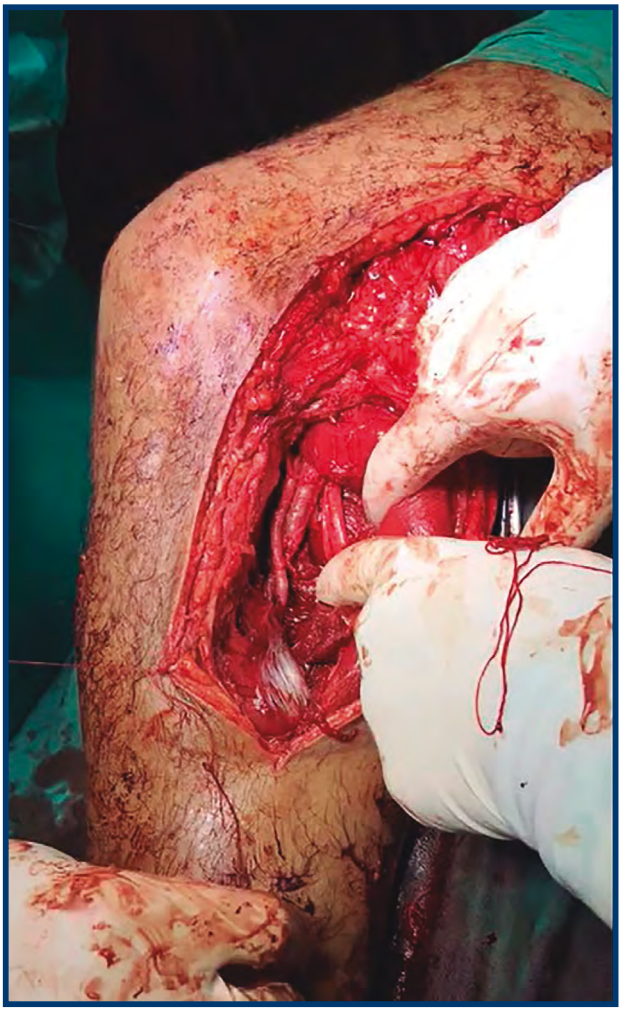

FIGURE 7. Medial approach of right leg. Proximal control was performed in the popliteal artery. The internal geniculate muscle is removed to visualize the venous bypass of the tibioperoneal trunk.

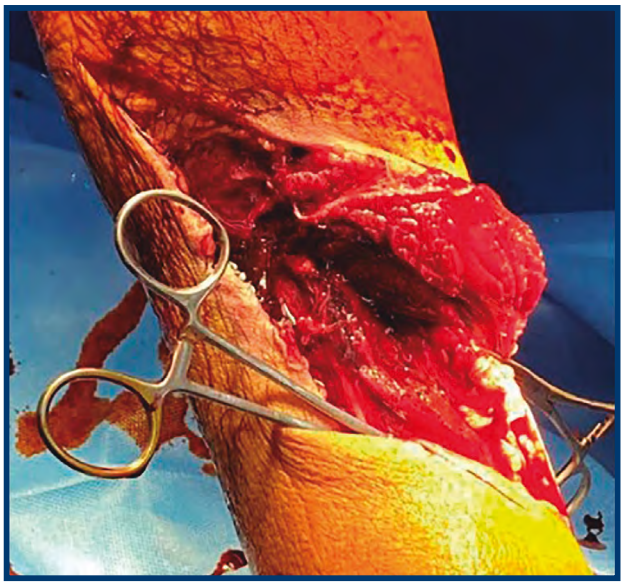

FIGURE 8. Penetrating injury in elbow crease. The biceps was completely sectioned, and the humeral artery lesion was clamped.

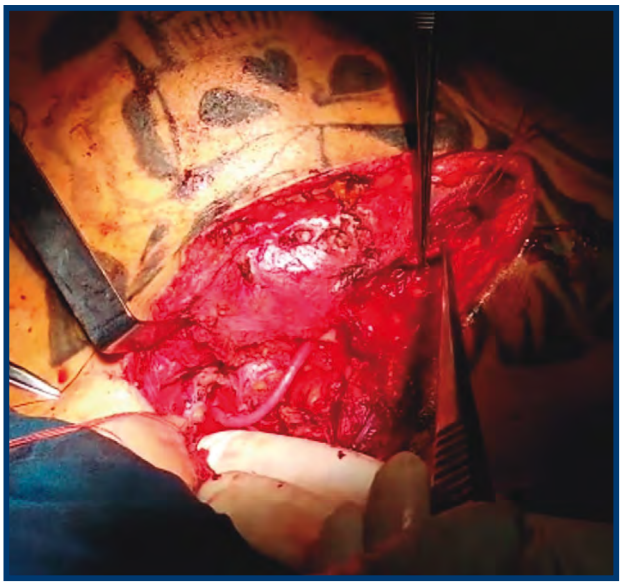

FIGURE 9. Subclavian injury. Bypass is observed coming out of the subclavian and passing under the clavicle.

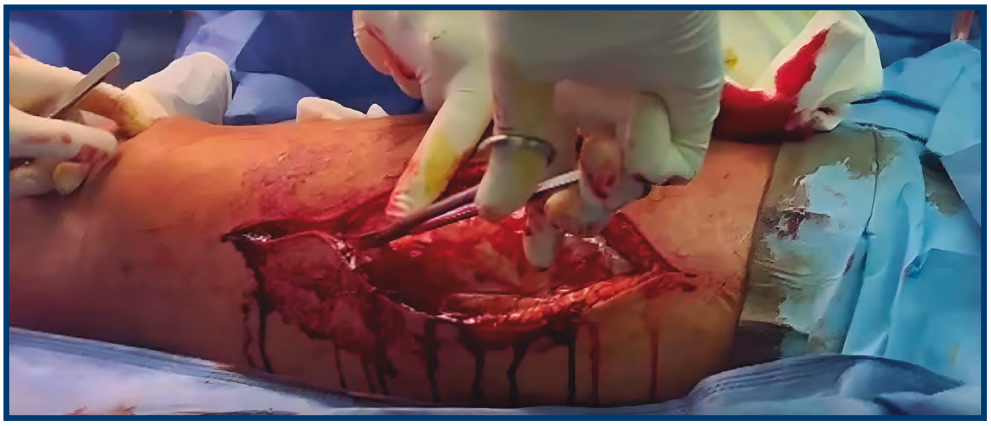

FIGURE 10. Fasciotomy due to compartment syndrome. The tension is observed where the opening of the fascia is missing.

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SCIENTIFIC LETTER

HETEROTOPIC PERCUTANEOUS IMPLANTATION FOR SYMPTOMATIC TRICUSPID REGURGITATION

ABSTRACT

Tricuspid regurgitation (TR) has shown great interest in recent years. Transcatheter endovascular procedures have acquired great relevance demonstrating to be a feasible therapy to improve the quality of life of these patients.

We report our experience implanting a bicaval valve prosthesis in an 85-year-old patient with severe symptomatic and inoperable TR.

A bicaval valve implantation (CAVI) in superior vena cava (SVC) and inferior vena cava (IVC) was performed. At the 2-month follow-up, a significant enhancement in NYHA functional class and quality of life was noted.

We believe these procedures are a feasible and safe option for patients experiencing severe heart failure with progressing symptoms and at high surgical risk. Long-term follow-up is still uncertain, and an improvement in survival should be demonstrated to be considered for lower-risk patients.

Keywords: *tricuspid regurgitation; transcatheter valves therapies; bicaval valve implantation*

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INTRODUCTION

Far from being disregarded, tricuspid regurgitation (TR) is now a disease that is being studied with a more profound interest. However, the natural history of TR remains in doubt and unpredictable, with a variable temporal evolution due to its association with confounding factors and related to its etiology (primary vs. functional)[1].

The impact of TR on morbidity and mortality is even more recognized. But despite this, this entity is still undertreated in clinical practice and underused in current surgical practice[2].

Unfortunately, outcomes and responses to the best medical treatment (stages C and D) vary widely and are limited, with a 5-year mortality approaching 50%[3]. On the other hand, the ideal timing of surgical repair or replacement of the tricuspid valve (TV) continues to be unclear and is only offered to a small group of patients. The poor reputation of TV surgery (especially in the case of isolated TR) related to its high morbidity and mortality could be the likely cause of delay in surgical intervention for this group of patients[3]. Most of them are treated after the onset of symptoms and signs of heart failure or multiple organ failure. A range of transcatheter strategies has been developed for targeting severe TR at high-risk medical patients according to the underlying mechanism of disease.

CASE PRESENTATION

An 85-year-old woman was received in our Cardiovascular Department with symptoms and signs of right ventricular dysfunction.

She was well-known in our department for her history of recurrent hospitalizations due to heart failure (HF) and isolated functional tricuspid regurgitation (ITR). The patient referred a new onset of worsening dyspnea, fatigue, aggravation of her peripheral edema, and decreased exercise tolerance. Further known comorbidities included arterial hypertension and chronic renal failure.

A new transthoracic echocardiogram (TTE) confirmed known massive functional tricuspid regurgitation (TR) with corresponding annular dilation (anteroposterior: 54 mm). Right ventricular function was preserved (FAC 50%) without pulmonary hypertension. The jet was located mainly in the central area of the valve but also extended into the anteroseptal commissure.

After optimizing medical treatment, further treatment options were discussed in the interdisciplinary heart team. Due to the high surgical-risk constellation (EuroSCORE II: 9%, STS: 12%, and Charlson Comorbidity Index [CCI] Score: >3), surgical repair/replacement was abandoned, and interventional therapies were discussed. We decided to opt for caval valve implantation (CAVI), and an interventional heterotopic tricuspid valve replacement was eventually planned. After image-based preoperative planning, we used a 25-mm size valve for the superior vena cava (SVC) and a 32-mm valve for the inferior vena cava (IVC).

The procedure was performed under local anesthesia and sedation with TTE monitoring in a Cath Lab-hybrid operating room. An 18F venous catheter was placed in the right common femoral vein by open surgical approach. After inserting a 6F introducer sheath in the left common femoral vein, a pigtail catheter was advanced and placed distally in the right pulmonary artery to position the SVC device. Right heart catheterization was performed, confirming severe TR with regurgitation of contrast into the caval and hepatic veins. A self-expanding percutaneous SVC valve was positioned under continuous pressure monitoring. Next, the IVC valve was deployed (avoiding occlusion of the marked suprahepatic vein by previous repositioning of the pigtail). After TTE confirmed the satisfactory position, both valves were unloaded and released. No leaks were observed, and the delivery system was removed. The femoral vein access site was manually compressed and closed (*Figure 1*). The patient was transferred to the intensive care unit and discharged on the sixth postoperative day. Before discharge, TTE confirmed an adequate caval valve function with no signs of regurgitation, while right ventricular function remained unchanged.

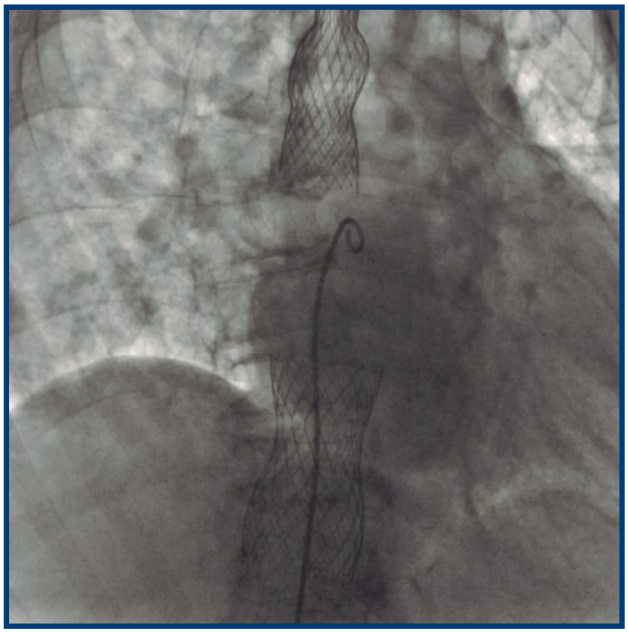

FIGURE 1. Bicaval valve implantation.

Clinical and echocardiographic at the 2-month follow-up showed a substantial improvement. Clinical signs of right-sided HF decreased compared with baseline, including peripheral edema and ascites requiring a lower dose of diuretics.

A considerable enhancement in NYHA functional class (II-IV to I-II), KCCQ score (57 vs. 90 points), and 6-min walk test (6MWT) distance was noted. No significant changes in ventricular function or echocardiographic measurements were perceived (*Table 1 and Figure 2*).

Parameter	Preprocedure	Post procedure
Heart rate (HR) (bpm)- Chronic atrial fibrilation	72	79
Diastolic blood pressure (mmHg)	20	20
Inferior cava vein (mm)	31 mm (w/inspiratory collapse)	27 mm (prior to prosthesis)
Tricuspid annulus (mm)	52	49
Tricuspid annular plane systolic excursion (TAPSE) (mm)	15	21
Tricuspid annulus velocity (cm/s)	8	10
Severity of tricuspid regurgitation	Torrential	Torrential
Right ventricle (RV) basal diameter in 4 chambers (mm)	62	55
RV systolic pressure (mmHg)	47	47.9
Pulmonary valve TAC (mseg)	76	80
Suprahepatic vein	S-wave inversion	Anterograde S-wave
NYHA	II-IV	I-II
KCCQ-Score	57	90
6 MWT	340 mts. Borg Scale: 5. Initial O2 sat.: 98%; final O2 sat.: 92%. Initial HR: 92, final HR: 134. Initial BP: 130/80, final BP: 140/80	480 mts. Borg Scale: 1. Initial O2 sat.: 99%, final O2 sat.: 96%. Initial HR: 86, final HR: 11. Initial BP: 120/70, final BP: 10/90

TABLE 1. Echocardiographic parameters pre and post procedure. NYHA: New York heart Association, KCCQ-Score: puntuación del cuestionario de cardiopatías de Kansas City; 6 MWT: prueba de caminata de 6 minutos; BP: blood pressure.

Suprahepatic Veins

Before **After**

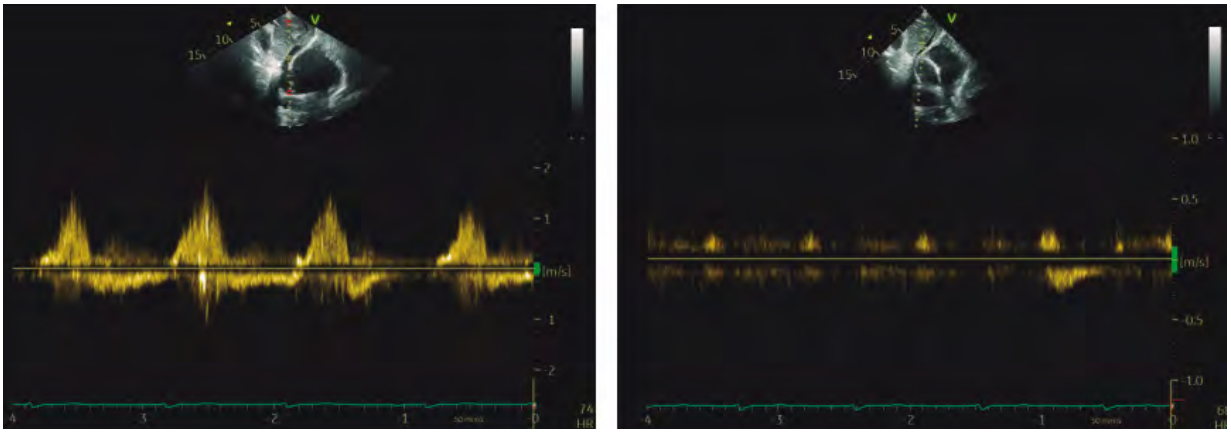

FIGURE 2. Suprahepatic veins.

DISCUSSION

Based on observations in high-risk or inoperable patients, new percutaneous transcatheter therapies have recently emerged with promising initial results for treating symptomatic TR[4].

However, despite this varied range of new devices, many patients cannot be treated due to individual anatomical characteristics or frailty conditions. Furthermore, some new technologies are often limited to highly trained operators in high-volume centers, thus restricting the generalization of procedures to a broader group of symptomatic patients.

CAVI procedures initially emerged as an alternative therapy for those patients considered "out of options" in treating severe TR and when optimal medical treatment or heterotopic valve implantation could be regarded as a palliative strategy[5].

The CAVI concept focuses on the heterotopic placement of a valve in the inferior vena cava (IVC) and another in the superior vena cava (SVC), at the level of the cavo-atrial junctions. Preventing regurgitant flow within the vena cava is attempted, reducing hepatic congestion and improving hepatorenal function with subsequent reductions in abdominal congestion, ascites, and peripheral edema4. In addition, an increase in RV stroke volume into the pulmonary circulation has been observed, improving cardiac output. CAVI would enhance the quality of life and decrease the rate of hospitalization for heart failure. Whether life expectancy can be improved remains to be proven.

CAVI can be single (IVC only) or bicaval, using two different prosthesis platforms: non-dedicated balloon expandable devices (commonly used for transcatheter aortic valve replacement) and dedicated self-expandable CAVI devices. To date, three other CAVI devices have been investigated and designed explicitly for caval anatomy: the TricValve™ system, the Tricento® system, and the Trillium™ system.

CAVI procedures have some inherent advantages due to vena cava´s relative anatomical simplicity concerning the tricuspid valve´s complex structure and its right heart.

Consequently, the procedure is relatively simple and faster than other transcatheter TV devices, enabling both the learning curve (more straightforward) and the generalization of the method to novice operators or less experienced centers.

CAVI may also be a good option for patients with TR induced by electrodes (pacemaker-ICD). The device does not interfere with the tricuspid valve.

TricValve™ (P&F Products and Features, Vienna, Austria) is a set of two self-expandable heterotopic THVs, with each having nitinol frames and different designs because intended to be deployed into superior and inferior vena cava, respectively, at cavoatrial inflow. It is available in sizes from 28 mm to 43 mm.

For the first time, in 2011, a custom-made self-expanding heart valve was implanted into the inferior vena cava (IVC) through the right femoral vein. Later, Figulla et al. placed the device, for compassionate use, in an 83-year-old patient with severe TR and prohibitive surgical risk reducing caval pressure and improving functional status[6].

Safety and feasibility of the TricValve system® have been demonstrated in the study TRICUS EURO[6-7]. Thirty-five patients withNYHA II-IV and EuroSCORE 5.8 were treated. At 30 days, procedural success was 94%, with no procedural deaths or conversions to surgery and a significant increase in QoL at 6- month follow-up correlating with a significant improvement in NYHA functional class (79.4% NYHA I-II). Two more studies are expected to provide further data on the application of this new device. The TRICUS REGISTRY (retrospective/prospective multicentric study) focused on the clinical follow-up, and the TRICAV (in progress) focused on evaluating the safety and effectiveness of the TricValve® transcatheter bicaval valves system compared with standard medical therapy in patients with symptomatic severe tricuspid regurgitation who are at high risk for cardiac surgery[8].

CONCLUSION

In our first experience, the TRICVALVE system is friendly and easy to handle, achieving accurate implantation and hemodynamic stability parameters. Our patient showed a notable quality of life improvement as assessed by the Kansas City Cardiomyopathy Questionnaire (KCCQ) and 6-minute walk, which are, undoubtedly, expected and desired results for this group of patients. We believe these procedures are a feasible and safe therapeutical strategy to relieve signs and symptoms of right heart failure, even for high-risk or inoperable patients. However, as in other TV interventions, the long-term prognosis is uncertain, and quality of life improvement is yet to be demonstrated. There are currently no randomized controlled trials (RCTs) available yet. There is an urgent need to develop and validate TV-specific risk scores to predict the clinical futility of these interventions and long-term durability before being adopted globally.

Declarations

The authors declare no conflict of interest.

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SCIENTIFIC LETTER

MODIFIED MILLER BANDING TECHNIQUE FOR ISCHEMIA IN NATIVE FISTULAE

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ABSTRACT

Treating upper limb ischemia or dialysis access-associated steal syndrome (DASS) is controversial. Many treatments have been described for this pathology; one of the techniques of preference in our institution is banding with the technique described by Miller et al. of minimally invasive endoluminal-assisted limited ligation revision (MILLER), in which we have modified to avoid the intercurrences it causes.

Four cases of stage II steal are presented in which the Miller technique is performed in which, instead of banding with a 2-0 Prolene suture, it is surrounded with a 1 cm wide PTFE segment. An angioplasty balloon is used to calibrate the desired diameter of the banding, and a Doppler ultrasound is performed to evaluate the flow before and after the procedure, as in the Miller technique.

The procedure allowed ischemia to be resolved, and the fistulas were found to be permeable without evidence of the complications usually described.

Keywords: *Miller banding, hemodialysis, fistula theft, ischemia associated with dialysis fistula*

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INTRODUCTION

Treating dialysis access-associated steal syndrome (DASS) in the upper limb is controversial. Many treatments have been described for this pathology; one of the techniques of preference in our institution is banding with the technique described by Miller et al. of minimally invasive endoluminal-assisted limited ligation revision (MILLER)[1]. In the MILLER technique, one or two incisions are made on the sides of the arteriovenous fistula, surrounded in a minimally invasive manner with a 2-0 Prolene suture. A lateral introducer is placed from the proximal region, and an angioplasty balloon of the intended diameter (generally between 2.5 and 6 mm) is advanced to calibrate the flow. Once the balloon is dilated, the Prolene ligature is tightened over the balloon. The complications described in the medium term include the suture in the autologous vein, failure of the banding for flow control (which requires a new procedure), and pseudoaneurysms[2,3]. We have performed a modification of the technique to avoid these intercurrences.

CASE PRESENTATION

We present four cases of patients with stage II steal in whom the MILLER technique is performed, but instead of banding with a 2-0 Prolene suture, it is surrounded with a 1 cm wide PTFE segment. An angioplasty balloon is used to calibrate the desired diameter of the banding, and a Doppler ultrasound is performed to assess the pre- and post-procedure flow, as in the MILLER technique.

Creating a low-resistance flow system when making a dialysis fistula can lead to dialysis-associated ischemia (ischemia) steal syndrome (DASS). This is due to poor perfusion of distal tissues, either because of flow reversal (steal per se), hypoperfusion, or other causes (e.g., distal arteriopathy). Its incidence is 2.7-4.3% in prosthetic accesses and 1% in native fistulas[4]. Ischemia syndrome presents with different clinical stages, characterized by mild pain to tissue loss[5].

Different risk factors have been identified, such as using the humeral artery as an inflow, diabetes, female sex, use of prostheses, cardiovascular disease, smoking, and age over 60 years[6].

The ideal access should maintain adequate flows and pressures to allow effective hemodialysis, usually between 600 and 1500 ml/min. Symptomatology depends on the interrelationship between fistula flow, distal bed status, and compensatory methods (e.g., vasodilatation and collateral development). Consequently, the entire circuit must be evaluated for treating ischemia associated with vascular accesses to define its best treatment.

The procedure resolved the ischemia, and the fistulas were permeable without evidence of the complications described in the literature. The average flow rate before the procedure was 260 ml/min and 950 ml/min afterward. One patient required banding angioplasty at 339 days due to decreased flow during dialysis.

METHOD

In our service, the usual treatment of dialysis-associated steal is fistula banding (except in cases of low flow). We usually perform the technique described by Miller in cases where the fistula is prosthetic. In cases where the fistula is native, we modified the MILLER technique, which consists of banding with a PTFE segment instead of a 2-0 Prolene ligature; in this way, the possibility of inclusion in the tissue is reduced.

Figure 1 shows the passage of the Halstead forceps through the two incisions, behind and in front of the fistula, close to the anastomosis, and under ultrasound control. In this way, the fistula is then surrounded by the PTFE segment. Then, retrograde puncture and placement of the lateral introducer are performed, where the angioplasty balloon is used to calibrate the fistula and pre- and post-procedure angiographic controls (*Figures 2 and 3*).

Between June 2020 and June 2023, we performed the procedure on four patients. All accesses were humerocephalic fistulas. All four patients had pain during dialysis (stage II). The success rate of the technique was 100%. All patients resolved symptoms from the day of the procedure. The average pre-procedure flow rate was 2600 ml/min and 950 ml/min after the procedure. In three cases, we performed the approach through one incision and, in one case, through two parallel incisions.

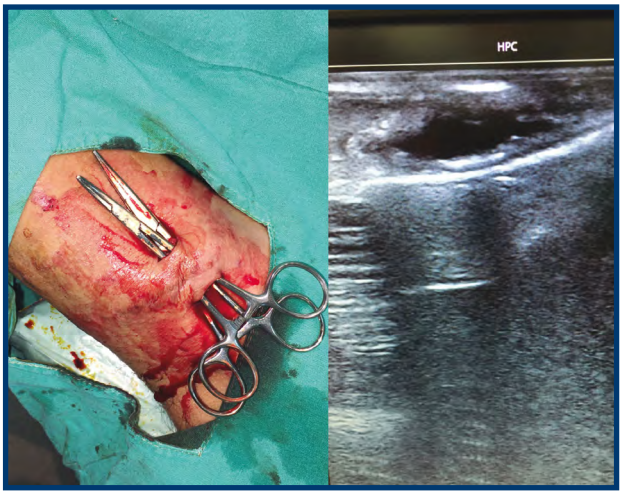

FIGURE 1. A AND B: Passage of the Halstead forceps through the two incisions, behind and in front of the fistula, under ultrasound guidance.

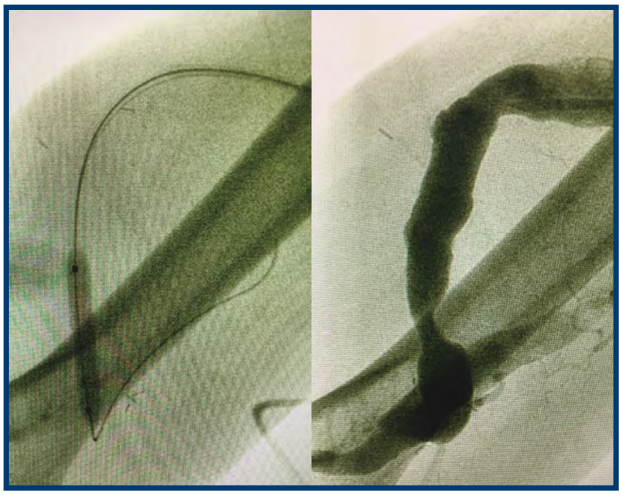

FIGURE 2. Banding with PTFE before calibration.

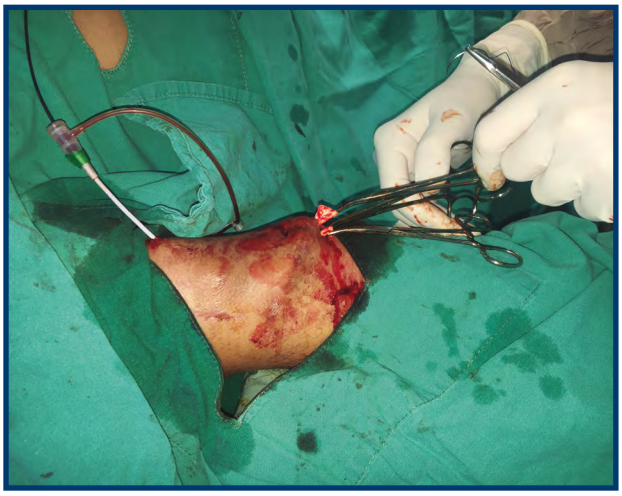

FIGURE 3. Calibration of the fistula on the angioplasty balloon.

RESULTS

In one case, it was necessary to repeat the procedure after five months due to the recurrence of symptoms. Another case required angioplasty at 339 days due to stenosis at the banding site, with consequent fistula dysfunction during dialysis. They remain patent to date without other associated treatments (average follow-up of 447 days, with a range of 231 to 507 days). There were no intraoperative or postoperative complications within 30 days. All patients were able to receive dialysis through access after this treatment.

DISCUSSION

Many treatments have been developed to solve DASS, all with their different risks and benefits, where the morbidities of the procedure are weighed against the patency of the vascular access.

To avoid fistula ligation, the first option described was banding or flow reduction by calibrating the fistula[7]. It has been performed in different ways: with clips, with continuous sutures, and using PTFE coating, as we have done in our institution[8]. For many years, there was the inconvenience that the patency of the fistula decreased significantly, which led to its use being replaced by other techniques. Doppler ultrasound is essential to evaluate the flow before and after the procedure and reduce the risk of this complication, as well as the size nomogram (*Figure 4*)[9]. In this way, the decision-making process is simplified to create a narrowing that results in a 60-80% reduction in lumen diameter.

The minimally invasive option described by Miller1 allows it to be performed without major surgical maneuvers. One incision is made over the fistula or two incisions parallel to the fistula, and the fistula is surrounded with a 2-0 Prolene suture. The fistula is then accessed percutaneously in a retrograde fashion, and an angioplasty balloon is used to calibrate the ligation to the desired diameter, with ultrasound control before and after the procedure and using the nomogram. This technique has a 100% success rate with very low morbidity. The thrombosis rate described is 0.20 per access/year for prosthesis and 0.9 access/year for native fistulas (similar to that described for other methods), and secondary patency of 90% at 24 months. Other less frequent complications described with this banding technique include the suture in the fistula with consequent thrombosis, failure in treating ischemia[2], and the formation of a pseudoaneurysm at the suture site[3].

To avoid this situation, we have modified Miller's technique with PTFE banding, as already described in 1981[8]; this reduces the possibility of alteration of the tissue structure of the native fistula due to the beats and tension generated by the suture.

Other options to solve the ischemia syndrome involve the confection of different bridges to redirect the flow. Distal arterial ligation revascularization was one of the first emerging options after banding. This is a more complex technique, where a bypass maintains distal tissue flow and directs all inflow to the fistula, generating two parallel resistance circuits instead of the series pattern[10]. Arterial inflow proximalization, where a prosthetic bridge is made from the humeral or axillary artery to the fistula, has good long-term results without ligating the native vessels that perfuse the distal tissue[11]. Another option that does not compromise the native vessels is revision using distal inflow[12]. This is exclusively used for humeral fistulae since, in this case, the humeral anastomosis is ligated, and a bridge is made to a distal artery (usually the radial artery). All these techniques involve

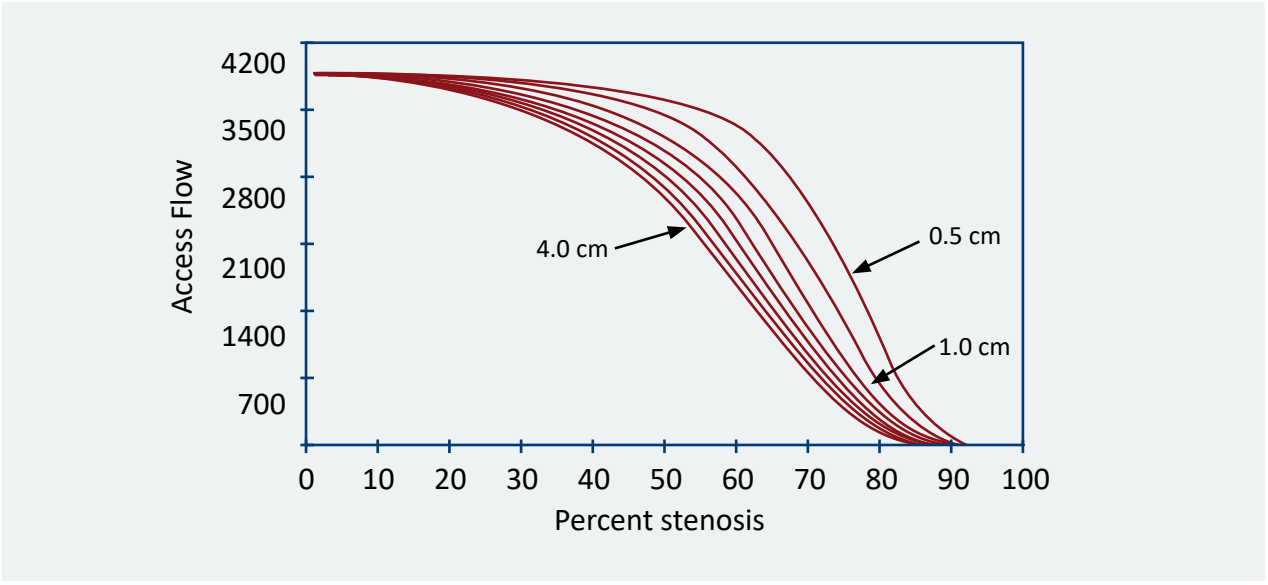

FIGURE 4. Flow nomogram. **Fuente:** Adapted from Murray BM, Rajczak S, Herman A, et al. Effect of surgical banding of a high-flow fistula on access flow and cardiac output: intraoperative and long-term measurements. Am J Kidney Dis 2004; 44: 1090-1096.

vascular surgical skills, longer surgical times, more morbidities, and patencies similar to banding, so our first choice was to perform the MILLER technique.

CONCLUSION

We believe that this modification of the original MILLER technique with a PTFE banding avoids the inclusion of the suture in the native fistula, which reduces the probabilities of thrombosis, reinterventions, and eventual pseudoaneurysms.

Declarations

The authors declare no conflict of interest.

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SCIENTIFIC LETTER

MIDDLE AORTIC SYNDROME IN AN ELDERLY PATIENT: DESCRIPTION OF A SURGICAL CASE

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ABSTRACT

The middle aortic syndrome is a rare form of presentation of aortic coarctation that represents 0.5-2% of this same entity. It usually presents in the pediatric or young adult population; therefore, the age of this patient is of interest. It mainly affects women with an estimated ratio of 4:1. Renal involvement is the most prevalent, and idiopathic etiology is the most frequent.

This pathology presents clinically with hypertension challenging to control along with intermittent claudication. This article comprises the case of an 81-year-old female patient with a history of hypertension, sedentary lifestyle, smoking, osteoporosis, cholecystectomy in 2010, and appendectomy in childhood. On this occasion, the patient had a stenosis of the infrarenal abdominal aorta and a simultaneous superficial femoral artery lesion and was treated in a hybrid approach with a balloon expandable stent and a suprapatellar femoral-popliteal bypass.

Keywords: *aortic coarctation, intermittent claudication, aorta, hypertension, aortic stenosis*

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INTRODUCTION

The term "medial aortic" syndrome was first described in 1947 by Quain and colleagues[1], who observed this pathology in a pediatric age group with an average age of 9 years. The medial aortic syndrome is the name we use to denote infra-diaphragmatic aortic stenosis[2]. This entity represents 0.5 to 2% of all aortic coarctation1 and mainly affects the pediatric or young adult population with a higher prevalence in women[3] (ratio of 4 to 1 for men[4]).

These stenoses occur in different locations that have a relevant influence on the clinical manifestations of the subject depending on the affected arterial territory. In most cases, the involvement of the renal artery is observed, reaching up to 70%[5] (within this percentage, both renal arteries are involved two-thirds of the time). The most frequently described affected renal areas (69% approximately) are the suprarenal; secondly, the intrarenal location (23% approximately); and, last but not least, there is the infrarenal location (8%), as in the patient described[5].

When the renal artery is involved, it generally manifests as hypertension that is difficult to control pharmacologically[6], i.e., it cannot be controlled by using up to 3 antihypertensive drugs at maximum doses. In these cases, the objective would be to reduce blood pressure to below the 95% percentile in the pediatric population or, if there is left ventricular hypertrophy or target organ damage, to reach the 90% percentile[2]; that is, maintaining systolic pressures below 120 mmHg and diastolic pressures below 80 mmHg in adults. If left untreated, this hypertension could lead to left ventricular hypertrophy, resulting in heart failure, a common cause of mortality in subjects with this pathology[7]. When the compromised artery is the superior mesenteric artery or the celiac trunk, this may be reflected as symptoms of intestinal ischemia with its suggestive periumbilical post-eating pain and weight loss due to food rejection. Recall that the patient, apart from these signs and symptoms, may also experience intermittent claudication, which will be expressed by abdominal murmurs and the possible absence of femoral pulses[8].

According to the study of Rawan and collaborators, its etiologies are multiple. However, idiopathic etiology is the most frequent among all varieties, with almost two-thirds of all cases[5]. It is followed by the inflammatory cause evidenced by Takayasu as the most relevant, and within the genetic origins, we can highlight neurofibromatosis type 1, among others. With a lower percentage of the total, other causes such as tuberculosis, syphilis, rubella, radiotherapy, or fibrosis are evidenced, to mention a few[9] (Table 1).

Diffuse congenital hypoplasias such as those seen in Noonan[3], Williams, Alagille, and tuberous sclerosis syndromes, some of them could have their embryological origin due to the overfusion of the two dorsal aortas in the fourth week of development, generating aortic hypoplasia[2].

Etiology	Percentage (%)
Idiopathic	67
Inflammatory	17
Genetic	15
Others (syphilis, tuberculosis, rubella, radiotherapy, fibrosis, etc.)	3

TABLE 1. Distribution of etiologies[5].

Knowing the origin of the medial aortic syndrome is essential because the abdominal aorta may not be the only vessel affected. For example, neurofibromatosis type 1 may be associated with aneurysms and cerebral arterio-venous fistulas[5]. In rubella, it may co-occur with aortic valve stenotic pathology. Takayasu's vasculitis mainly involves the aortic arch and descending aorta, among many other associations[8].

The medial aortic syndrome diagnosis can be made by renal Doppler, CT, or MRI. Renal Doppler is the first line, with a sensitivity of 90% and a specificity of 68%. Despite its low specificity, this modality is indicated to reduce exposure to lightning and the use of contrast. As an advantage, MRI allows us to estimate pre- and post-stenosis flows, but if we wish to evaluate the lesion and its characteristics, then angiography is the indicated method. We should consider a tomography or an encephalic resonance if we suspect brain lesions.

It is recommended as initial therapy to start with a single antihypertensive agent and reach the maximum dose or adverse effect before adding another drug. In principle, enalapril or losartan

should be started, and diuretics should preferably be used as combination therapy. Surgical treatment is evaluated when elevated pressures persist and several hypertensive drugs cannot control it. If the lesion presents as isolated stenosis, it can be treated with an isolated patch or a bypass that skips it if the coarctation is very narrow[10]. The same applies to thoracoabdominal stenosis, which can be treated with a bypass connecting the thoracic and abdominal cavities. Polytetrafluoroethylene (PTFE) patches are preferred over Dacron woven or knitted.

Renal or splanchnic reconstruction will be performed as appropriate. For renal reconstruction, reimplantation away from the diseased aorta is recommended. Homologous arterial grafts are generally preferred, but venous grafts are not recommended due to the risk of aneurysm formation. When the renal artery's stenotic lesions are multiple, or this same kidney is found to be hypotrophic, i.e., 2 to 3 cm smaller than its size and non-functioning, nephrectomy may be indicated[10]. Remember that nephrectomy is only performed if the other kidney can supply the function. An alternative to consider is renal autotransplantation which improves hypertension and renal function. Splenic artery repair can be performed with a prosthesis or implantation of venous material (*Figure 1*).

This article aims to describe a surgical case that occurred in June 2022 at the Hospital General de Agudos Juan A. Fernández. The advanced age of the patient makes this case very interesting since there is not much bibliography describing the exposed problem. Usually, cases of pediatric patients or patients younger than 25 years old presenting with significant symptomatology are reviewed.

METHODS

We review the case of an 81-year-old female patient with multiple clinical comorbidities, including hypertension, a sedentary lifestyle, smoking, and osteoporosis. Her surgical history included an appendectomy in childhood and a laparoscopic cholecystectomy in 2010. Imaging showed an infrarenal abdominal aortic stenosis with a concomitant stenotic lesion in the right femoral artery, both lesions diagnosed by arterial angiography (*Figure 2*). On physical examination of both lower limbs, she had both femoral pulses present with detection of left popliteal pulse, and the rest of the examination was complete with positive flow Doppler signals for the other landmarks (*Figure 3*).

FIGURE 1. 3D angiotomographic reconstruction image prior to surgery.

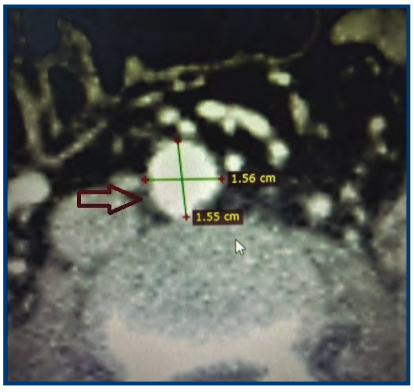

FIGURE 2. Angiotomographic image showing diameters prior to surgery.

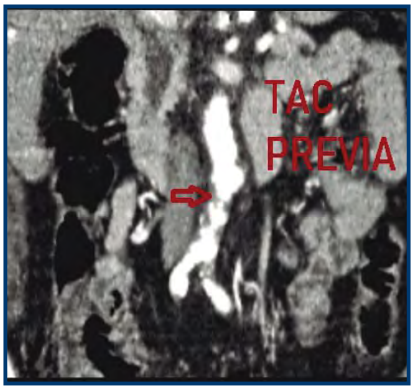

FIGURE 3. Angiotomographic image coronal view prior to surgery.

RESULTS

For this case, it was decided to hold a meeting in June 2022, where it was concluded that the hybrid approach would be the best option given the patient's age and comorbidities. A 43 mm AndraStent™ XL balloon expandable straight stent was placed through an 8F suitable femoral introducer for its resolution. The proximal anastomosis was performed using the femoral approach and exposure by constructing a suprapatellar femoral-popliteal bypass with an 8 mm PTFE prosthesis.

Immediate postoperative examination showed the presence of all pulses with favorable changes in color and temperature in both limbs. As part of the hospital protocol, typical of the institution, the patient spent the first postoperative day in a closed unit. After 72 hours, given the favorable evolution, hospital discharge was determined to continue ambulatory follow-up by outpatient clinics (*Figure 4*).

If we look at the statistics of open surgery, we see positive results concerning the treatment of hypertension in approximately 9 out of 10 cases. This type of surgery has low morbimortality in patients with good general conditions. Despite presenting good results, the reoperation rate for new stenosis is almost 10% 5-12 years after the first procedure[5].

The endovascular approach generates a more significant number of morbidities over time, such as dissections, leaks, aneurysms, or thrombosis of the stent placed. Therefore, it requires reinterventions and may cause restenosis. Studies mention that 55% of patients are free of interventions in one year and 33% in 5 years[11]. Endoluminal interventions have better results in young adults with fibromuscular dysplasia. Therefore, one should select suitable patients for endovascular procedures, especially those cases where small vessels and fibrotic are evident. Stenting after angioplasty should be considered because of the risk of neointimal hyperplasia or stenosis after the initial procedure.

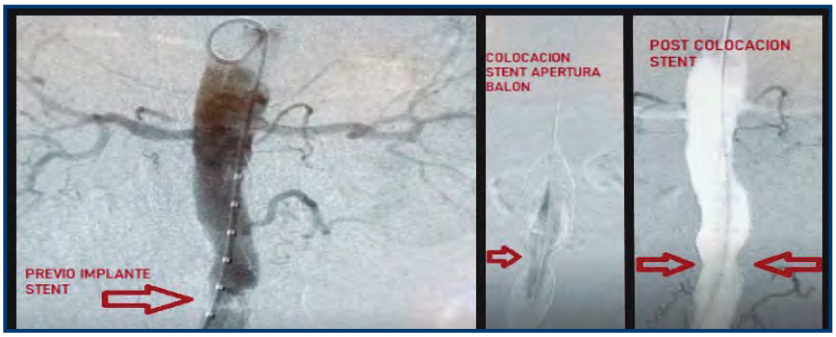

FIGURE 4. Series of angiographic images of endovascular resolution.

CONCLUSION

In conclusion, for all the data presented and the favorable outcome demonstrated by the patient, a hybrid approach is the best way to resolve this type of pathology with the same lesions. On this occasion, the patient's characteristics, age, comorbidities, and availability of resources were evaluated. The hybrid approach would be the best option because it improves surgical times, and the patient's postoperative period is less aggressive. Outpatient follow-up is performed with imaging follow-up using contrasted tomography at one month and then every six months or yearly, depending on renal function.

DISCUSSION

We want to raise the question and consider which is better: an endovascular or an open approach.

Declarations

The authors declare no conflict of interest.

Acknowledgments

We express our deep gratitude to all donors who make anatomical teaching and research possible every day.

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SCIENTIFIC LETTER

TRAUMATIC PSEUDOANEURYSM THORACIC AORTA ARTERY

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ABSTRACT

Thoracic aortic trauma is a frequent injury in patients with closed chest trauma and polytrauma in general; its association with injuries in other territories adds an important morbimortality. A multislice axial tomography with intravenous contrast should be performed in patients suspected of this lesion. The correct management and treatment of this lesion constitutes an emergency. Endovascular treatment is considered a valid option in these cases. Some lesions may be susceptible to medical-conservative treatment.

Keywords: *blunt chest trauma, thoracic pseudoaneurysm, polytrauma, endovascular treatment*

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INTRODUCCIÓN

Thoracic aortic trauma is a frequent injury in patients with closed chest trauma and polytrauma in general[1]; its association with injuries in other territories adds an important morbimortality. In those patients in whom this lesion is suspected, a multislice axial tomography with intravenous contrast should be performed[2]. The correct management and treatment constitute an urgency[3-5]. Endovascular treatment is considered a valid option in these cases[6,7]. Some lesions may be susceptible to medical-conservative treatment[8,9].

CLINICAL CASE

Male patient of 21 years old admitted after motorcycle vs. wall trauma. Hemodynamically stable, with dyspnea, chest pain, and severe trauma to the right lower limb. Brain and thoracoabdominal CT and other relevant studies were requested. Diagnosis: absence of acute brain injuries, right hemopneumothorax, descending thoracic aortic artery pseudoaneurysm at isthmus level, with aberrant right subclavian artery (*Figure 1*), absence of intra-abdominal solid organ injuries, right femur fracture. In the shock room, he suffered arterial hypotension, which reverted with fluid replacement and vasoactive drugs at low doses. The femur fracture was stabilized, a right pleural drainage tube was placed, and urgent treatment of the aortic lesion was indicated.

This lesion was resolved by placing two stents lined CP Stent NuMed - Braum of 24 mm diameter x 45mm length, platinum-iridium stent with ZIGS configuration, coated with PTFE. Stent with good radial strength and possible future re-expansion (*Figure 2*).

Post-surgical course in the ICU with imaging control by CT angiography at 48 hours (*Figure 3*) shows the correct positioning of the stents without filling the pseudoaneurysm sac nor the presence of leaks.

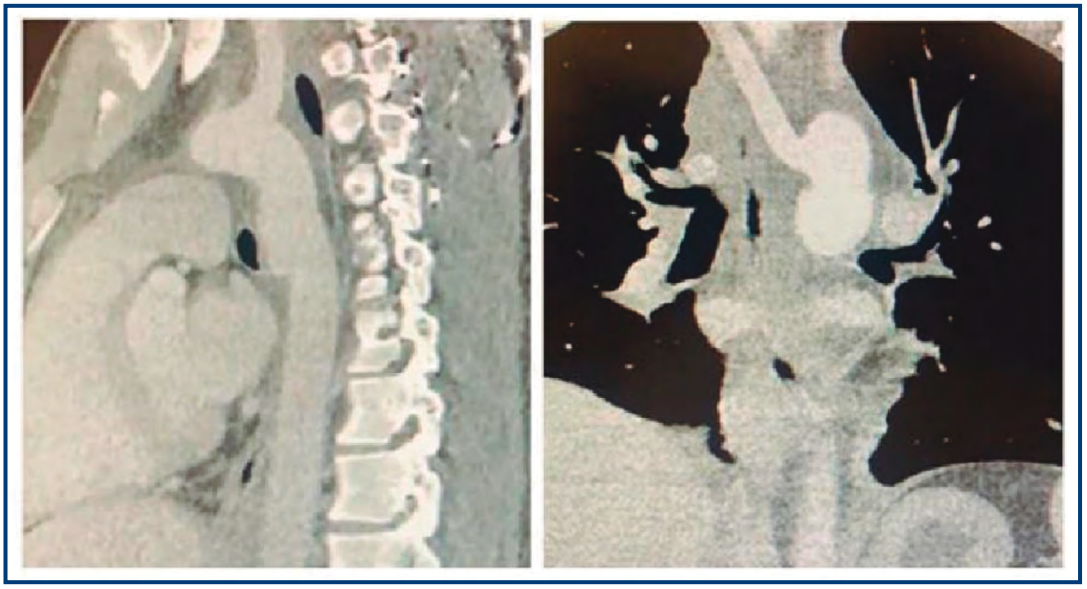

FIGURE 1. Thoracic CT showing pseudoaneurysm of the descending aorta at the level of the isthmus.

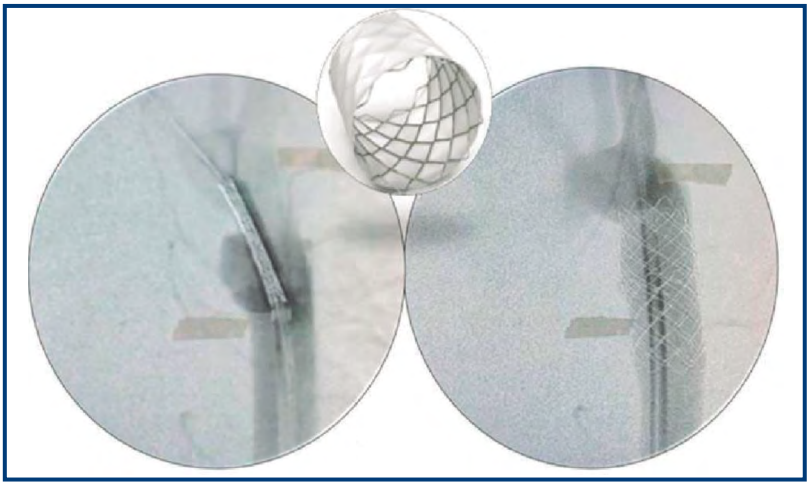

FIGURE 2. Intraoperative angiographic image, stent placement (left, positioning stent; right, open stent).

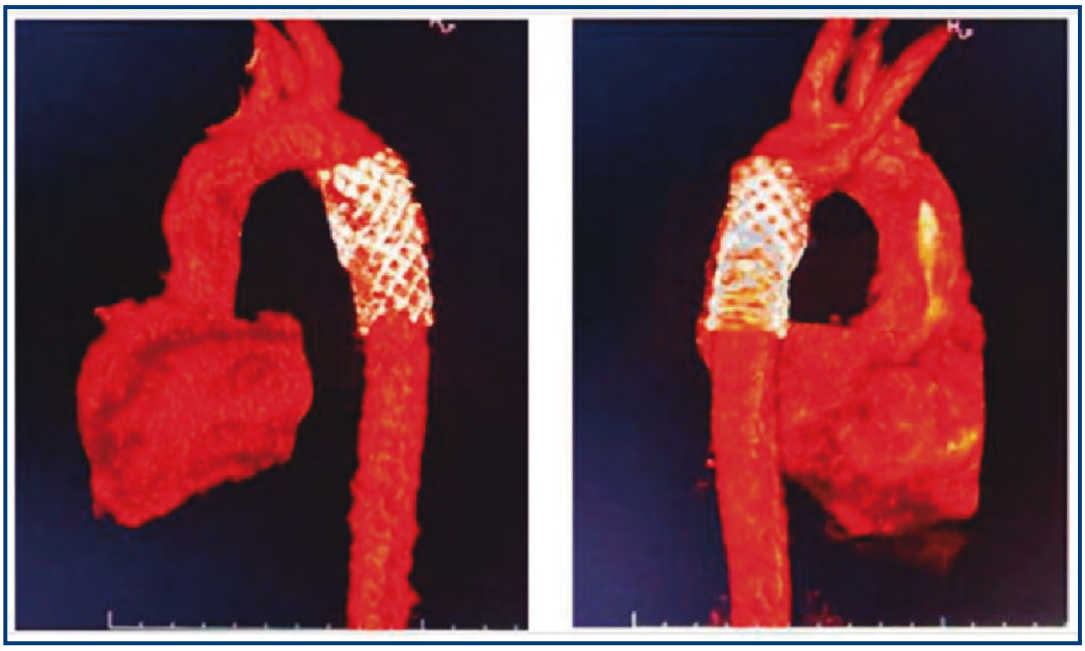

FIGURE 3. 3D thoracic CT reconstruction showing stent, without contrast leakage to the pseudoaneurysm.

CONCLUSION

In our experience, we consider that, in severe trauma, aortic lesions should be actively ruled out with a thoracoabdominal CT at admission. Aortic endoprosthesis placement should be done as soon as possible in case a major vascular lesion is found.

We believe that the most important thing in this type of trauma is to make an early diagnosis when there is a strong clinical suspicion. This will allow us to optimize the therapeutic options and times in each case and to carry out a correct follow-up of the lesions.

Declarations

The authors declare no conflict of interest.

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SCIENTIFIC LETTER

ABSENT PULMONARY VALVE IN CORRECTED TETRALOGY OF FALLOT

ABSTRACT

We present the case of a 24-year-old male patient with a history of correction of tetralogy of Fallot when he was 2. He reports presenting 6 syncopal episodes during the last 6 months. Therefore, a transthoracic color Doppler echocardiogram was performed, reporting right ventricular dilatation, mild global deterioration of the right ventricular systolic function, absent pulmonary valve with severe insufficiency, and free passage. A diagnosis of absent pulmonary valve with severe valvular insufficiency was made. Surgical treatment was performed by placing an aortic bioprosthesis (stentless) No. 25, Medtronic Freestyle™, in the pulmonary position. The patient evolved favorably and was discharged without complications on the fourth postoperative day. In addition, a brief bibliographic review of the disease is made.

Keywords: *absent pulmonary valve, tetralogy of Fallot, adult congenital heart disease*

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INTRODUCCIÓN

Tetralogy of Fallot (TOF) is the most common cyanotic congenital heart disease in children and adults. Absent pulmonary valve is a rare variant. In 90% of cases, it is associated with other malformations[1]. Tetralogy of Fallot with an absent pulmonary valve represents 3% to 6% of patients with a rare congenital anomaly characterized by rudimentary ridges or total absence of pulmonary valve tissue and usually with a hypoplastic pulmonary valve annulus[2].

We present the clinical case of a 24-year-old male patient with a pathological history of tetralogy of Fallot that was corrected at two years of age. He evolved well and remained asymptomatic for a long time until 6 months before the consultation, when he began to present episodes of syncope and palpitations. Physical examination showed no particular signs or characteristic facies. During the physical examination of the cardiovascular system, a holodiastolic pulmonary murmur was auscultated. Spirometry was requested, within normal limits, and a 24-hour Holter reported sinus rhythm and frequent ventricular extrasystoles grouped up to 3 beats. A transthoracic color Doppler echocardiogram was performed (*Figure 1*), with right ventricular dilatation, preserved size of the remaining cavities, preserved left ventricular systolic function (Fey 59%), slight global deterioration of right ventricular systolic function, TAPSE 18 mm, and absent pulmonary valve with severe insufficiency with free passage. No significant valvulopathies, no masses, or intracavitary shunt were observed. As a complementary study, coronary angiography was requested, which showed coronary arteries without significant angiographic lesions.

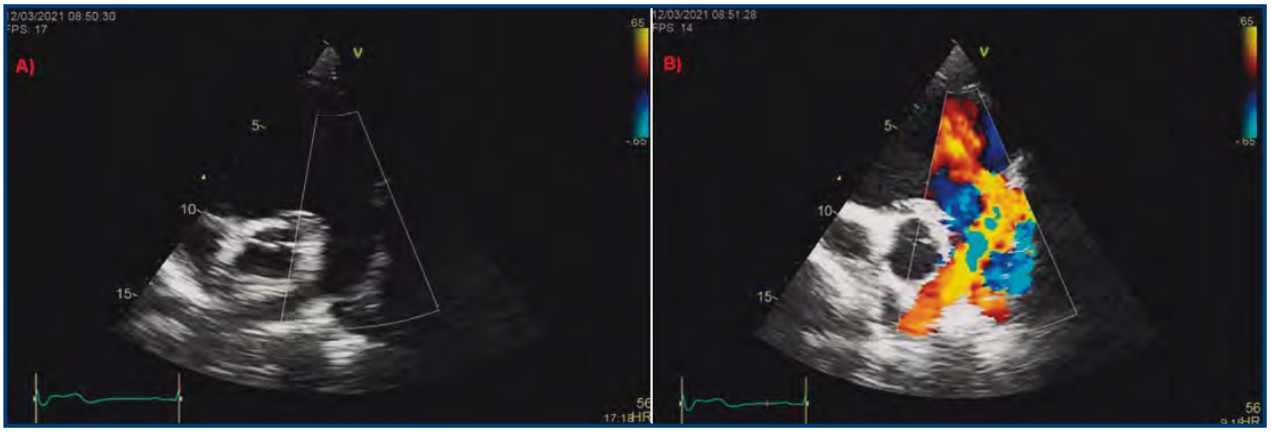

FIGURE 1. Transthoracic color Doppler echocardiogram. Short axis at the level of great vessels. A. Pulmonary valve is absent. B. Color Doppler shows severe pulmonary regurgitation.

With these findings, a diagnosis of absence of pulmonary valve with severe valvular insufficiency was made, and surgical treatment was decided.

Several types of prostheses can be implanted in the pulmonary valve position or surgical correction of the absent pulmonary valve. The types of conduits used are mechanical prosthesis, biological prosthesis, and homografts[3]. Patients with surgically corrected tetralogy of Fallot in pediatric age 5-10% are reoperated over 20-30 years of follow-up, most commonly undergoing surgery for pulmonary valve replacement[4].

A pericardial patch was visualized through a median sternotomy, with extracorporeal circulation, double cava and ascending aorta cannulation, crystalloid cardioplegia, and controlled hypothermia at 28 degrees centigrade. A longitudinal incision was made at the level of the pulmonary artery trunk and infundibulectomy with right ventricular outflow tract enlargement, visualizing the absence of a native pulmonary valve. Aortic bioprosthesis No. 25 biological Medtronic Freestyle (*Figure 2*) was placed in a pulmonary position with a continuous suture of Prolene 4/0 SH, extracorporeal circulation (73 minutes) and aortic clamping (49 minutes).

The patient evolved favorably with extubation at 8 hours postoperatively, hemodynamically stable, without vasopressor or inotropic support, and sinus rhythm; chest drains were removed at 24 hours, leaving the cardiovascular recovery unit on the second postoperative day. A control transthoracic color Doppler echocardiogram was requested, where the prosthesis was observed in pulmonary position, without perivalvular leaks, with maximum velocity 2.7 m/s and mean gradient 25 mmHg of the pulmonary valve, mild tricuspid insufficiency, estimated pulmonary systolic pressure 27 mmHg. On the fourth postoperative day, he was discharged without complications.

Declarations

The authors declare no conflict of interest.

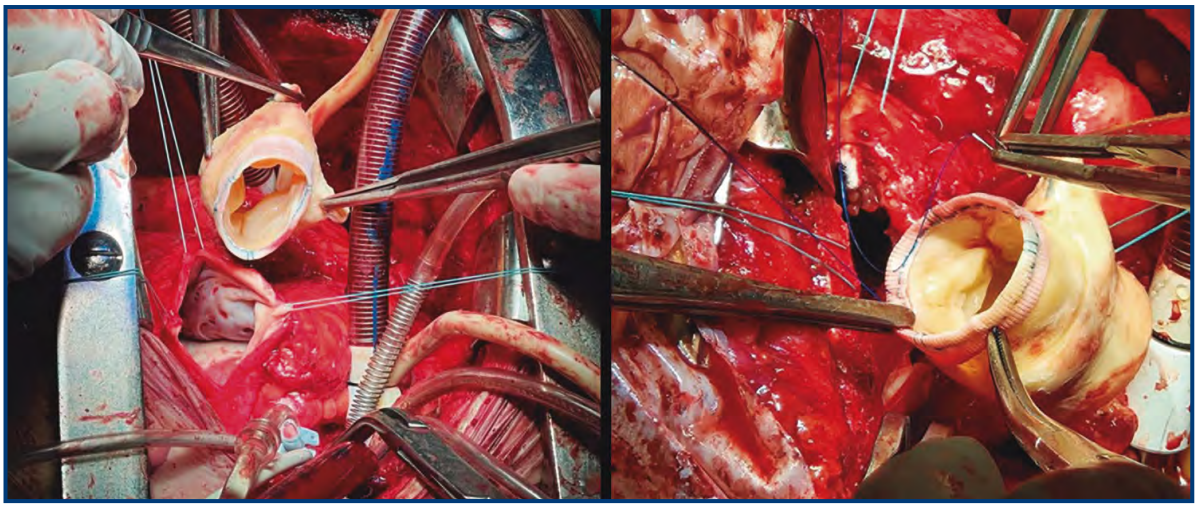

FIGURA 2. Surgical treatment: placement in a pulmonary position of aortic bioprosthesis No. 25 biological Medtronic Freestyle™.

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MEDIASTINAL FOREIGN OBJECT

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A male patient of 50 years old, with a history of drug and alcohol addiction and multiple suicide attempts was admitted for penetrating thoracic trauma self-inflicted with sewing needles. Complementary studies were performed, showing the presence of hemopneumothorax and hemopericardium, in addition to a foreign body crossing the tip of the heart, which entered through the right ventricle (RV) and reached the left ventricle (LV) (*Figures 1A and 1B*). Figure 2 shows how close the object passed through the anterior descending artery (AD).

The patient was started on antibiotic prophylaxis, vaccinated against tetanus, and admitted to the operating room for removal of the foreign body.

A median sternotomy was performed, and the needle was extracted within the granuloma formed in the anterior region, close to the tip of the heart (*Figure 3*). Slight bleeding from the entry site was contained with a 4/0 Prolene U-suture reinforced with Teflon plates. Left mediastinal and pleural drainage was left.

He had a postoperative course with febrile syndrome, atelectasis, and mild effusion. The latter resolved during hospitalization, but the fever became persistent, requiring rotation of antibiotic regimen.

Given the negative cultures and clinical improvement, hospital discharge was granted, and family support and social assistance were arranged.

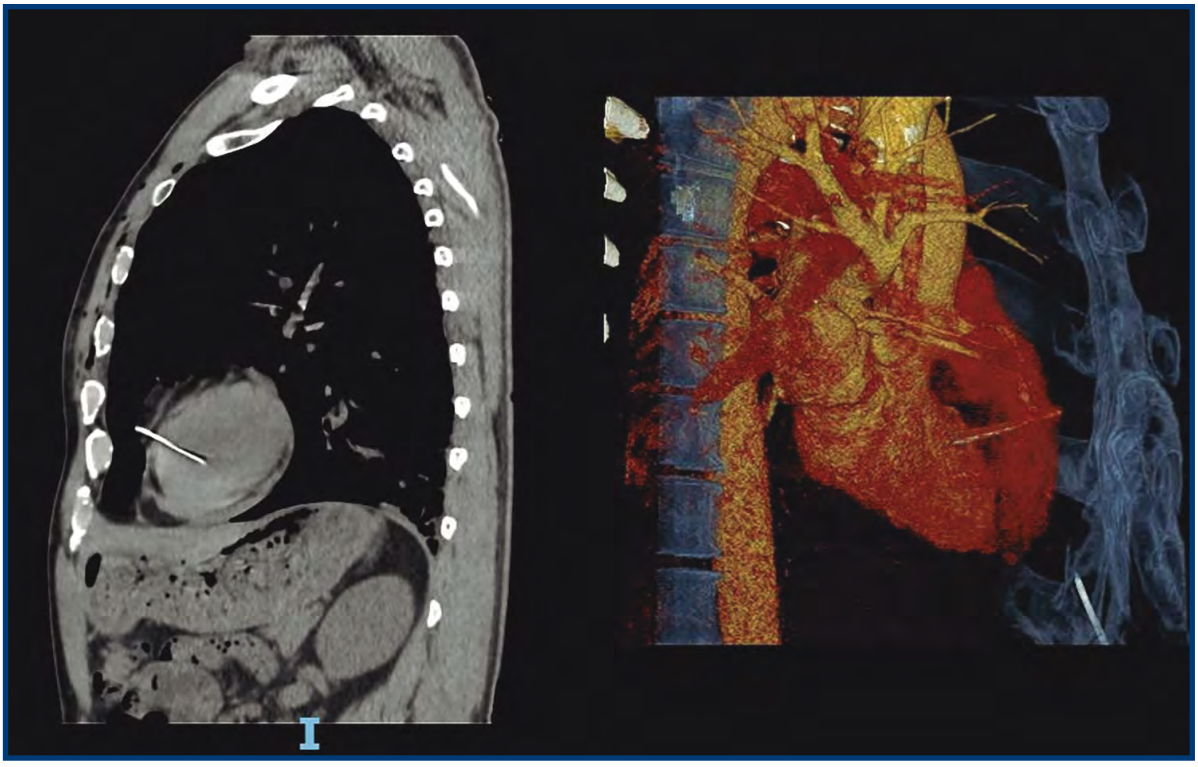

FIGURE 1. A AND B: Complementary studies showed the presence of hemothorax and hemopericardium, and a foreign body passing through the tip of the heart.

FIGURE 2. Proximity of the foreign object to the anterior descending artery.

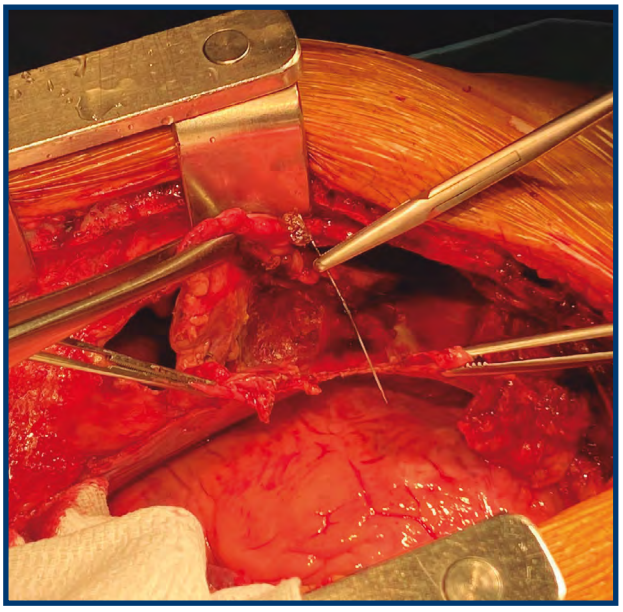

FIGURE. 3. Sternotomy and needle removal.

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