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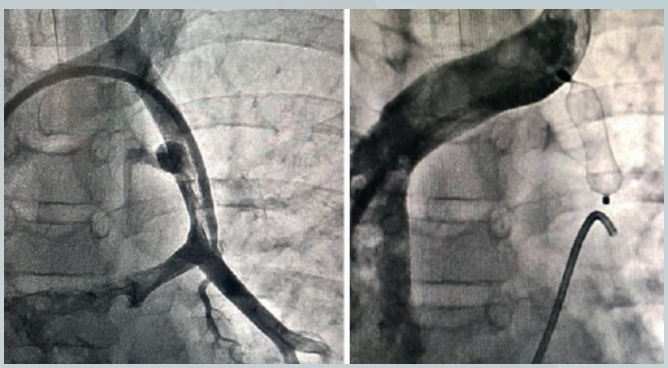

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[1] Teijink J, Power A, van Sterkenburg S, et al. 8-Year Data from the ENGAGE Registry Extension: Insights about the Long-term Performance of a Contemporary EVAR Device. Presented at ESVS 35th Annual Meeting September 20, 2021.

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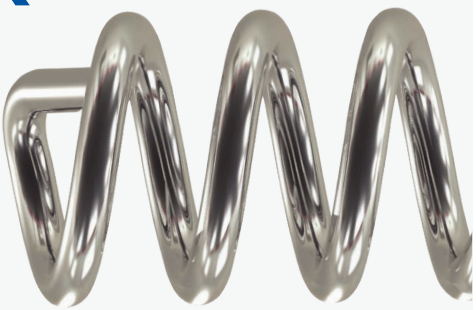

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Analytical summary

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EDITORIAL / EDITORIAL

THE 'EVIDENCE' OF 'NO EVIDENCE': ABOUT A META-ANALYSIS

Rodríguez AE

We have recently seen the publication of a meta-analysis (1) of studies on myocardial revascularization including percutaneous coronary intervention (PCI) or coronary artery bypass graft (CABG) versus optimal medical treatment (OMT) to determine if the findings of increased non-cardiac death reported in the ISCHEMIA EXTENDED study (2) could be replicated in other studies.

The authors reviewed 18 randomized controlled trials (RCT) comparing CABG, PCI versus OMT and concluded that there is no "evidence" of increased non-cardiac death with revascularization procedures compared to OMT. Therefore, the findings of the ISCHEMIA study should be considered a type I statistical error, which means accepting that after randomizing 5179 patients, things sometimes happen by chance

ORIGINAL ARTICLE / ARTÍCULO ORIGINAL

FACTORES DE RIESGO Y DISTRIBUCIÓN DE LAS OBSTRUCCIONES Y/O OCLUSIONES ARTERIALES EN PACIENTES CON ISQUEMIA CRÍTICA DE MIEMBROS INFERIORES

Parraga Meza D et al.

As a consequence of the increase in patients who come to our hospital diagnosed with Peripheral Vascular Disease (PVD) and a significant number of them present Critical Ischemia of the Lower Limbs (ICMI); We started a study with the aim of stratifying the distribution of obstructions and/or occlusions in the arterial circuit of the lower limbs of these patients and recording the cardiovascular risk factors present in patients with ICMI.

This study was carried out for 3 years, where 785 patients diagnosed with PVD were evaluated and of these, 200 patients (25.4%) presented ICMI, in the study it was possible to show that this pathology predominates in the male sex, that among the cardiovascular risk factors diabetes mellitus is present in more than half of the population studied, that smoking is a cause that increases atherosclerotic disease making possible its evolution and worsening of the disease.

ICMI, being a pathology generally of chronic evolution, its arterial distribution is mainly presented as lesions that cover different areas in the arterial circuit and its presence predominates in the Femoropopliteal and Infrapopliteal joint sectors, it was observed that the longest obstructions are present in the region infrapopliteal artery with an average of 180 mm in length and that the occlusions in this pathology occur more frequently in the posterior tibial artery.

REVIEW ARTICLE / ARTÍCULO DE REVISIÓN

ANTIPLATELET THERAPY IN ACUTE CORONARY SYNDROMES: WHAT IS THE OPTIMAL THERAPY WITH THE CURRENT GENERATION OF DRUG-ELUTING STENTS?

Guzmán LA

The managementof patients with acute coronary syndrome has progressedsignificantly over the past few decades primarily due to technological advancements made in interventional cardiology with the arrival of new drug-eluting stents, early reperfusion strategies, and a deeper understanding of anti-thrombotic therapy.

The development and addition of more effective antiplatelet drugs to the therapeutic armamentarium along with the use of dual antiplatelet therapy with more potent P2Y12 receptor inhibitors (ticagrelor and prasugrel) have shown a significant reduction in the number of acute ischemic events following percutaneous revascularization. However, over time, careful assessmentof scientific studies and real-world practice registries has revealed that these more aggressive antiplatelet regimens are associated with a significant increase in bleeding complications that jeopardize the patient's life.

Different alternatives and treatment strategies were evaluated to determine the most suitable therapeutic approach that keeps a balance between preventing ischemic events (stent thrombosis, acute myocardial infarction or cardiovascular mortality) without increasing bleeding complications. This is how the concept of "de-escalation" and individualized antiplatelet treatment was born.

CASE REPORTS / CASOS CLÍNICOS

PERCUTANEOUS RESOLUTION OF PARTIAL ANOMALY OF LEFT PULMONARY VENOUS RETURN WITH DUAL DRAINAGE IN PEDIATRIC PATIENTS. CASE REPORT

Egües Almeida RM et al.

Introduction. Partial anomalous pulmonary venous return (PAPVR) is a rare type of pulmonary vein anomaly. It is found in 0.5% to 0.7% of the overall population. The presence of a dual drainage system makes a percutaneous approach possible due to the coexistence of both a systemic venous and a normal pulmonary venous circuit. Objectives. To report the case report of a patient with PAPVR and dual drainage who was treated percutaneously.

Method:. In this study we present the case report of a patient with PAPVR who was eligible for vertical vein occlusion due to the presence of a dual drainage system.
Conclusions. Transcatheter device closure of PAPVR with dual drainage is an effective and safe approach.

TAVI IN TYPE I BICUSPID COMPLEX AORTIC VALVE WITH BALLOON-EXPANDABLE VALVE

Areco DN et al.

Transcatheter aortic valve implantation (TAVI) is a challenge when dealing with bicuspid aortic valve (BAV) anatomies. Patients are young, the morphological phenotypes are many, the calcium load is high, and there are technical considerations to obtain better results. However, we have no prospective randomized clinical data with this treatment approach. Observational studies and registries are available with data and favorable clinical experiences worldwide.
This is the case of a young patient with type I bicuspid aortic stenosis and severe coronary artery disease who underwent PCI + TAVI.

SPLENIC COMPLEX ANEURYSM. UTILITY OF 3D PRINTING IN ENDOVASCULAR INTERVENTIONAL PRACTICE

Vicario JH et al.

The objective is to highlight the benefit of 3D printing in a patient with a complex splenic aneurysm. The application of this technology made it possible to imitate an endovascular treatment in the cath lab before its definitive correction with stent-graft. This strategic-technological planning made it possible to establish an adequate anatomical assessment with its corresponding therapeutic definition in terms of technical feasibility and evaluation of results.

SUCCESSFUL EVOLUTION OF ENDOVASCULAR TREATMENT IN A COMPLEX CASE OF RUPTURED ABDOMINAL AORTIC ANEURYSM

Tesoro LJ et al..

This is the case we present refers to of a large diameter ruptured abdominal aortic aneurysm that was promptly resolved through endovascular means therapy. After a meticulous endoprosthesis stent-graft implantation, the initial evolution of the case was satisfactory. As it often happens commonly occurs in cases of high cardiovascular complexity, even when the major pathology conditionshas been overcome, certain intercurrences complicationmay arise and requirerequiring care attentionto achievefora the patient'scomplete and favorable final outcome for the patient. This report reflects the comprehensive cardiac cardiointerventional, anesthesiological, and clinical work carried out for this purposeconducted on this regard.

BRIEF COMMUNICATIONS / COMUNICACIONES BREVES

RESULT OF INTRATHROMBUS PHARMACOINVASIVE ENDOVASCULAR TREATMENT WITH FORCED INFUSION TECHNIQUE (PULSE SPRAY) AND CONTINUOUS INFUSION OF STREPTOKINASE IN PATIENTS WITH ACUTE LOWER LIMB ISCHEMIA

Parraga Meza D et al.

In the year 2020, we began a study to understand the behavior of endovascular catheter-guided streptokinase as a treatment for acute lower limb ischemia. The aim was to evaluate its benefits, potential complications, and establish a protocol for its use as the initial treatment in patients arriving at our facility with this condition.
The study included 8 patients who met the inclusion criteria. Catheter-directed fibrinolysis (CDT) was performed using two techniques combined: pulse spray and continuous infusion of streptokinase (STK) over a 12-hour period. The primary objective was to restore normal perfusion to the affected limb without causing endothelial trauma.
At the conclusion of the study, based on the observed results, it was determined that this combined strategy of pulse spray and continuous infusion showed positive outcomes in the indicated patients with acute lower limb ischemia. Due to the accessibility and availability of STK compared to other scarce and more expensive fibrinolytics, this approach can be routinely adopted in our setting.
Complications were minimal, and the success of the procedure not only relied on the chosen technique but also greatly depended on the patient's collaboration in adhering to the treatment and clinical follow-up.

LETTER FROM THE PRESIDENT / CARTA DEL PRESIDENTE

LETTER FROM THE PRESIDENT OF CACI

Cisneros M

Dear colleagues and friends, here is the latest issue of our prestigious journal, RACI, the scientific pride and joy of CACI.
The growth of RACI is the result of the effort from our entire editorial committee and each one of you who contributes to the journal valuable material for publication.
We are going through challenging times in our country where medical practice is constantly being challenged. Providing high-quality medicine, for which we are trained, is not easy in many corners of our country. We encounter numerous difficulties from financial issues to the constant struggle of getting our procedures authorized. Also, we have to deal with decisions made by health care providers and social works that often override the health professional's recommendation on what type of device should be used, making us have to decide between respecting our indication and leaving a patient without the proper treatment or losing the patient altogether.

The 'evidence' of 'no evidence': about a meta-analysis

La "Evidencia" de la "No Evidencia": a propósito de un metaanálisis

Revista Argentina de Cardioangiología Intervencionista 2023;14(2):62. https://doi.org/10.30567/RACI/202302/0062-0062

We have recently seen the publication of a meta-analysis[1] of studies on myocardial revascularization including percutaneous coronary intervention (PCI) or coronary artery bypass graft (CABG) versus optimal medical treatment (OMT) to determine if the findings of increased non-cardiac death reported in the ISCHEMIA EXTENDED study[2] could be replicated in other studies.

The authors reviewed 18 randomized controlled trials (RCT) comparing CABG, PCI versus OMT and concluded that there is no "evidence" of increased non-cardiac death with revascularization procedures compared to OMT. Therefore, the findings of the ISCHEMIA study should be considered a type I statistical error, which means accepting that after randomizing 5179 patients, things sometimes happen by chance.

Despite the authors conducted several sensitive statistical analyses, we believe that the study in question has several limitations, which prompted a letter to the editor of the journal[3].

LIMITATIONS

#1 - The analysis includes studies on PCI performed three decades ago, that is, with angioplasty techniques that are no longer widely used or even considered by the authors themselves as "poor practice" based on the actual medical standards (BARI, MASSI, MASS II, COURAGE, RITA 2) where PCI used either balloon angioplasty or conventional stents (BMS)[1].

The significant bias is that if we are analyzing the findings of the ISCHEMIA study[2], we should only consider those that used the same techniques (DES in 100% of cases and multiple stents in most).

It would be best to draw comparisons to a similar study, the COURAGE trial with a 97% use of BMS[4], and where non-cardiac death was not significantly different between PCI and OMT but numerically higher (0.7%) in the OMT group (5.4% vs 6.1% for PCI and OMT, respectively), that is, exactly the opposite of what the ISCHMIA findings tell us[5].

#2 The authors (1) did not include the REVIVED study on DES vs OMT in patients with ejection fractions < 36%[6].

In the REVIVED study, non-cardiac death was numerically higher again in the DES group compared to OMT with a significantly higher rate of cancer in the DES group, almost 5 times higher[5]. This despite the fact that the reduction of cardiac death and spontaneous myocardial infarction favored the DES treatment. The difference in the rate of cancer between the groups included in the REVIVED should make us less optimistic on the long-term outcomes of PCI in this study.

#3 The authors[1] should have acknowledged and cited the EXCEL study[7] that compared DES and CABG. Once again, in this study there was a higher rate of non-cardiac death in the group treated with PCI. The authors of this study[7] also suggested that it was a type I statistical error.

If the possibility of type I statistical error were so common, it would be impossible to analyze the results of most revascularizations performed over the past 30 years, and everything we have said and continue to say today would lack scientific value since it could all be attributed to "chance."

In sum, to draw conclusions from a study, the samples must be homogeneous, and meta-analyses should include contemporary studies in a field that has changed so dramatically over the past 20 years as percutaneous coronary interventions.

In other words, if we are using 100% DES as the default strategy in almost all cases, we should only analyze studies that utilize this revascularization strategy.

Anything else brings just brings confusion to the table and prevents us from reaching more robust and scientifically valid conclusions on a topic that is of utmost importance in our medical specialty.

Alfredo E. Rodríguez MD,PhD,FACC,IAGS
Editor-in-Chief
Revista Argentina de Cardioangiologia Intervencionista (RACI)

REFERENCES

1. *Navarese E, Lansky A, Farkouh M, et al. Effects of Elective Coronary Revascularization vs Medical Therapy Alone on Non-Cardiac Mortality. A Meta-Analysis. JACC Cardiovasc Interv 2023 May 22;16(10):1144-56.*
2. *Hochman JS, Anthopolos R, Reynolds HR, et al. Survival After Invasive or Conservative Management of Stable Coronary Disease. Circulation 2023;147:8-19.*
3. *Rodríguez-Granillo AM, Fernández-Pereira C, Mieres J. Effects of Elective Coronary Revascularization vs Medical Therapy Alone on Non-Cardiac Mortality. Editor Letter, JACC Cardiovasc Interv 2023 (in press).*
4. *Boden WE, O'Rourke RA, Teo KK, et al. COURAGE Trial Research Group. Optimal medical therapy with or without PCI for stable coronary disease. N Engl J Med 2007;356:1503-16.*
5. *Rodríguez AE, Fernández-Pereira C, Mieres J, Rodríguez-Granillo AM. High Non-Cardiac Death Incidence Should Be a Limitation of Drug-Eluting Stents Implantation? Insights from Recent Randomized Data. Diagnostics (Basel) 2023 Apr 2;13(7):1321*
6. *Parera D, Clayton T, O'Kane PD, Greenwood JP, Weerackody R, Ryan M, et al. REVIVED-BCIS2 Investigators. Percutaneous Revascularization for Ischemic Left Ventricular Dysfunction. N Engl J Med 2022;1351-60.*
7. *Stone GW; Kappetein AP, Sabik JF, et al. Five-year outcomes after PCI or CABG for left main coronary disease. N Engl J Med 2019;381:1820-30.*

Risk factors and distribution of arterial obstructions and/or occlusions in patients with critical lower limb ischemia

Factores de riesgo y distribución de las obstrucciones y/o oclusiones arteriales en pacientes con isquemia crítica de miembros inferiores

David Parraga Meza[1], Diego Martín Barbetta[1], M. Belén de Beus[1], Joaquín Etcheverre[2], Pablo Nicolás Luna[3]

ABSTRACT

As a consequence of the increase in patients who come to our hospital diagnosed with Peripheral Vascular Disease (PVD) and a significant number of them present Critical Ischemia of the Lower Limbs (ICMI); We started a study with the aim of stratifying the distribution of obstructions and/or occlusions in the arterial circuit of the lower limbs of these patients and recording the cardiovascular risk factors present in patients with ICMI.

This study was carried out for 3 years, where 785 patients diagnosed with PVD were evaluated and of these, 200 patients (25.4%) presented ICMI, in the study it was possible to show that this pathology predominates in the male sex, that among the cardiovascular risk factors diabetes mellitus is present in more than half of the population studied, that smoking is a cause that increases atherosclerotic disease making possible its evolution and worsening of the disease.

ICMI, being a pathology generally of chronic evolution, its arterial distribution is mainly presented as lesions that cover different areas in the arterial circuit and its presence predominates in the Femoropoliteal and Infrapoliteal joint sectors, it was observed that the longest obstructions are present in the region infrapoliteal artery with an average of 180 mm in length and that the occlusions in this pathology occur more frequently in the posterior tibial artery

Keywords: critical lower limb ischemia, peripheral vascular disease.

RESUMEN

Como consecuencia del aumento de pacientes que acuden a nuestro hospital diagnosticados con enfermedad vascular periférica (EVP) y de ellos un número importante presentan isquemia crítica de miembros inferiores (ICMI), iniciamos un estudio con el objetivo de estratificar la distribución de las obstrucciones y/o oclusiones en el circuito arterial de los miembros inferiores de dichos pacientes y registrar los factores de riesgo cardiovasculares presentes en los que cursan con ICMI.

Este estudio se llevó a cabo durante 3 años. Se evaluó a 785 pacientes diagnosticados con EVP, de los cuales 200 (25,4%) presentaron ICMI. Se pudo evidenciar que esta patología predomina en el sexo masculino, que entre los factores de riesgo cardiovasculares la diabetes mellitus está presente en más de la mitad de la población estudiada y que el tabaquismo es una causa que incrementa la enfermedad aterosclerótica haciendo posible su evolución y agravamiento.

La ICMI, al ser una patología generalmente de evolución crónica, su distribución arterial está principalmente presente como lesiones que abarcan diferentes zonas en el circuito arterial y predomina su presencia en los sectores conjuntos femoropoplíteos e infrapoplíteos. Se observó que las obstrucciones más largas están presentes en la región infrapoplítea con un promedio de 180 mm de longitud y que las oclusiones se presentan con mayor frecuencia en la arteria tibial posterior.

Palabras clave: isquemia crítica de miembros inferiores, enfermedad vascular periférica.

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INTRODUCTION

Given the presence and incessant growth of Critical Ischemia of the Lower Limbs (ICMI), as a result of the evolution and worsening of Peripheral Vascular Disease (PVD)[1] worldwide and becoming a public health problem shortly, the Cardiovascular risk factors such as age, sedentary lifestyle, diabetes mellitus, smoking, dyslipidemia, overweight, previous coronary disease and even increased life expectancy are present in patients suffering from PVD, these promote the pathological change that sews in the formation and evolution of severe obstructions in the arteries of the lower limbs; We have carried out a study that allows us to stratify the anatomical distribution of Critical Lower Limb Ischemia (ICMI) and record which are the main risk factors that are present in our study population.

This study was carried out as a result of the increase in the number of consultations in our Hospital for Peripheral Vascular Disease and a significant number of this group presented ICMI; We decided to start a registry of patients treated for 3 years in January 2020, register, diagnose and include in our study those who had a diagnosis of Critical Ischemia of the Lower Limbs Grade III and IV of the Fontaine Classification, in this way to know the main cardiovascular risk factors present in our patients and additionally observe the distribution of lesions and/or occlusions in the arterial circuit of the lower limbs.

Objective

Carry out a study that helps us record the predominant risk factors in patients diagnosed with Critical Ischemia of the Lower Limbs Grade III and IV of the Fontaine Classification and establish the distribution of obstructions and/or occlusions in the arterial circuit in our study population.

METHOD AND MATERIALS

This study is based on an observational, prospective, descriptive method, which was carried out from January 1, 2020 to December 31, 2022, in which we included patients who came to our hospital with a diagnosis of peripheral vas-

1. Fellowship del Servicio de Hemodinamia y Cardioangiología Intervencionista. Hospital Municipal San José de Exaltación de la Cruz
2. Médico Staff del Servicio de Hemodinamia y Cardioangiología Intervencionista. Hospital Municipal San José de Exaltación de la Cruz
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No conflicts of interest whatsoever.

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TABLE 1. Fontaine classification.

Grade I	Asymptomatic
Grade II a	Intermittent claudication > 200 m
Grade II b	Intermittent claudication < 200 m
Grade III	Pain at rest
Grade IV	Necrosis / gangrene

TABLE 2. Clinical demographic characteristics of the study group.

Variable	Number	Percentage
Population	200	100%
Average age	68	
Male sex	169	84,50%
Risk factors		
Arterial hypertension	152	76%
Smoking	105	52,50%
Dyslipidemia	72	36%
Mellitus diabetes	123	61,50%
Cardiovascular history		
Previous coronary heart disease	22	11%
Previous amputation	9	4,50%
Bilateral commitment	16	8%

TABLE 3. Angiographic distribution of lesions in ICMI.

Variable	Number	Percentage
Femoropopliteal and infrapopliteal	82	41,00%
Infrapoplitea	78	39,00%
Femoropopliteal	20	10,00%
Iliac femoropopliteal	10	5,00%
Iliacus femoral	8	4,00%
Femoral	2	1,00%
Obstructions present in the ICMI		
Affected area		**Length**
Iliac		60 mm
Femoropopliteus		120 mm
Infrapopliteus		180 mm
Oclusions present in the ICMI		
Affected arteries		**Percentage**
Posterior tibial		35%
Anterior tibial		30%
Peroneal artery		20%
Femoral		10%
Poplitea		5%

cular disease. Of these, the population that presented Grade III and IV Critical Ischemia of the lower limbs according to the Fontaine Classification **(Table 1)** was included in the study. It must be emphasized that ICMI also presents acutely, but this study is focused and it was based on patients with Critical Ischemia of the Lower Limbs of chronic presentation as a result of the severe evolution of PVD.

These patients were diagnosed by arterial Doppler echo of the lower limbs, Ankle/Arm Index (ABI), peripheral angiography and the distribution and severity of obstructions and/or occlusions were evaluated **(Table 1).**

Statistical analysis

The results were expressed in percentages for the variables according to each category that was established for the study.

RESULTS

This work had a study population of 785 patients who presented EVP and after its evaluation, 200 patients with ICMI Grade III and IV of the Fontaine classification entered the study, therefore 25.4% of the patients who came to our consultation with EVP presented ICMI, we established the main risk factors present in patients with this pathology, the average age of patients with ICMI was 68 +/- 6 years, 84.5% of the patients are male, 76% presented arterial hypertension, 52.5% are smokers, 36% dyslipidemic, 61.5% diabetes mellitus (DBT) under treatment, 11% with previous vascular disease, 4.5% with previous amputation, 8% of the patients presented bilateral compromise and 11% presented coronary disease previous **(Table 2).**

The distribution of obstructions and/or occlusions in the lower limbs occur in isolation, affecting a single sector of the arterial circuit, however, in this type of chronic lesions their presentation is more frequent when performed jointly between several segments of the arterial circulation of the affected lower limb.

In this way it was possible to see that the lesions occur with a higher incidence in the joint regions that cover the Femoropopliteal and infrapopliteal area with 41%, followed by infrapopliteal lesions with 39%, lesions in the femoropopliteal region occurred in 10%, Lesions that included the iliac-femoropopliteal areas occurred in 5%, the iliac-femoral region 4% and the femoral area 1%.

The length of the obstructions that occur in the iliac zone is an average of 60 mm, while in the femoropopliteal region it is 120 mm and the longest are in the infrapopliteal or infrapatellar region with 180 mm obstructions; On the other hand, occlusions in occur in a higher percentage in the arteries of the infrapatellar region with a higher prevalence in the posterior tibial artery **(Table 3).**

DISCUSSION

Peripheral Vascular Disease is a pathology that occurs in more than 200 million people in the world, with an incidence of between 500 and 1000 cases per million inhabitants[1], its pathophysiology exposes the presence of an imbalance between the contribution and the need for Blood flow to the tissues of the lower limbs, underlying atherosclerotic disease, usually manifests itself after 50 years of age, its progress is strongly linked to age, increasing by more than 10% among patients between 60 and 70 years of age[2], from slow evolution and interacts with risk fac-

tors related to age, diabetes mellitus, smoking, dyslipidemia, among others[3]; where the obstructions become severe stenosis and/or occlusion occurs in isolation or in multiple areas of the arterial circuit.

ICMI has two forms of presentation, one acute and the other chronic; Acute is the least common and its origin occurs as a result of embolism, dissection, trauma, acute thrombosis, phlegmasia alba dolens, occlusion of previous vascular reconstruction and is characterized by a clinical picture of sudden onset, ischemic pain at rest, deficit neurological (sensory and motor) and absence of pulsatile flow in Doppler; Chronic ICMI is more frequent and represents the terminal stage of peripheral arterial disease, which increases the risk of amputation over time with an incidence of 25% one year after diagnosis; Its main causes are related to atherosclerosis or severe peripheral vascular disease that has evolved and causes obstructions to become occlusions, with its clinical picture of ischemic pain at rest, with or without minor or major tissue loss (Necrosis).

Age is a non-modifiable risk factor that is present in the majority of patients with ICMI; in our study, the average age was 68 years.

Diabetes mellitus is one of the main causes related to this disease, its prevalence in the general population is 8%, it is estimated that in Latin America in 2030 there will be approximately 91 million people with diabetes and it is increasing rapidly, 15 to 25% develop ulcerations in the feet throughout their lives, more than 50% of them will have serious complications, the possibility of generating critical ischemia of the lower limbs increases 5 times and the possibility of amputation 5 to 10 times, in patients with diabetes the distribution of the lesions are found mainly in the femoral and infrapopliteal region with 36%[4].

Smoking is associated with a marked increase in the risk of peripheral atherosclerosis, excessive cigarette consumption progresses the disease and increases the risk of amputation, peripheral graft occlusion and mortality, so smoking cessation is the cornerstone in the treatment of PVD, as well as in the treatment of coronary vascular disease[5]. Smoking promotes endothelial dysfunction and alters lipid metabolism and coagulation, distribution is more frequent in the Iliaco Femoral and popliteal region.

Dyslipidemia is a risk factor in the formation of atherosclerosis, familial or acquired hypercholesterolemia is an adjuvant of PVD and therefore in ICMI, this will also be reflected in the carotid and coronary arteries. Its presence increases the possibility of presenting complications related to Cerebro Vascular Accidents (CVA) and Acute Myocardial Infarction (AMI).

Its diagnosis can be made through different study methods, among the main ones we can mention non-invasive studies such as Doppler echo, B mode, pulsed (color-energy) flow mode, three-dimensional (with intravenous contrast that enhances the image, Doppler ankle/brachial index, endovascular imaging techniques such as intravascular ultrasound (IVUS), image reconstruction techniques: Angiotac, Angio-MRI, Angiographic techniques: digital angiography[6].

ICMI treatment is based on reperfusion of the affected limb, this can be through a surgical, endovascular and hybrid strategy; the purpose of the procedure is to reperfuse and avoid amputation of the limb[7].

In the case of endovascular treatment, angioplasty with stent is performed and the surgical strategy consists of repair by this route (Aorto-bifemoral Bridge, Axillo-bifemoral Bridge, Femoro-Femoral Bridge).

The complication of ICMI if it is not treated on time is amputation, which goes beyond a disability, increases mortality up to almost 50% in the first 12 months after surgery, it is estimated that 1 million amputations are performed per year in In the world, only in the USA more than 90% of amputations per year are due to ischemia or infectious gangrene[8], 30% of infrapopliteal amputations do not walk again, 70% of general amputations do not walk again either[9], after of a major amputation[10], 60% have a contralateral amputation at 5 years and 50% die at 5 years.

CONCLUSION

This study allowed us to evaluate and identify the presence of peripheral vascular disease of the lower limbs in the population that came to our hospital, diagnose and identify patients who present with ICMI in its severe stage, helped to recognize the main risk factors involved in the formation of this pathology, in which it indicates that patients with diabetes mellitus are more likely to have ICMI because it is the main cardiovascular risk factor present in those patients with PVD, smoking is another pathology that increases atherosclerosis, aggravating PVD, so it is necessary to design anti-smoking mechanisms in our community, dyslipidemia, whether acquired or with a genetic component, produces and accelerates the evolution of PVD, follow a daily diet based on Mediterranean food, increase daily physical activity, reduce levels LDL-C <70 mg/dl, use antiplatelet agents in patients with pathological ABI (<0.5); regarding the distribution of lesions; these predominate in isolation in the infrapopliteal region, with greater prevalence in the posterior tibial, anterior tibial, and peroneal arteries in that order; on the other hand, significant lesions in multiple areas of the arterial circuit are concentrated in the region that jointly involves the the femoral, popliteal, and infrapopliteal arteries; In general, the distribution of severe lesions occurs in the infrapopliteal areas where the arteries are of smaller caliber with an average of 2.5 mm in diameter and where occlusions are more present than stenosis. Therefore, these data explain why in the ICMI signs and symptoms occur more frequently in the distal segments of the lower limbs, the recommendation of this study is that we must create a multidisciplinary team in our hospitals made up of clinical physicians, clinical cardiologists, interventional cardiologists, vascular surgeon, surgeon surgeons, traumatologists, diabetologists, psychologists and nephrologists,**11** in order to provide comprehensive care to patients undergoing ICMI.

REFERENCES

1. *Norgren L, Hiatt WR, Dormandy JA, Nehler MR, Harris KA, Fowkes FG; TASC I.I Working Group. Inter-Society consensus for the management of peripheral arterial disease (TASC II). Eur J Vasc Endovasc Surg 2007;33 Suppl 1:S1-S75.*
2. *Criqui MH, Aboyans V. Epidemiology of Peripheral ArteryDisease. Circ Res 2015;116:1509-26.*
3. *Shammas NW. Epidemiology, classification, and modifiable risk factors of peripheral arterial disease. Vasc Health Risk Manag 2007;3:229-34.*
4. *Graziani L, Silvestro A, Bertone V, et al. Vascular involvement in diabetic subjects with ischemic foot ulcer: a new morphologic categorization of disease severity. Eur J Vasc Endovasc Surg 2007;33(4):453-60.*
5. *Critchley J.A. Capewell S. Mortality risk reduction associated with smoking cessation in patients with coronary heart disease: a systematic review. JAMA 2003;290:86-97.*
6. *Plaza Martinez A, Carrera Díaz S, Alonso Álvarez MI, et al. Tratamiento endovascular de la patología obstructiva aortoilíaca. Angiología 2011;63(2):75-79.*
7. *Kalra M, Gloviczki P, Bower TC, et al. Limb salvage after successful pedal bypass grafting is associated with improved long-term survival. J Vasc Surg 2001;33:6-16.*
8. *Krupski, In: Vascular Surgery, Robert Rutherford 2000, WB Saunders*
9. *Armstrong, In: Diabetic Foot Managemnet, HMS 2000.*
10. *Tentolouris N, Al-Sabbagh S, Walker MG, Boulton AJM, Jude EB. Mortality in diabetic and nondiabetic patients after amputations performed from 1990 to 1995: a 5-year follow-up study. Diabetes Care 2004;27:1598-694.*
11. *NICE Guideline Updates Team (UK). Peripheral arterial disease:diagnosis and management. London: National Institute for Health and Care Excellence; 2018. p. 22.13*

Antiplatelet therapy in acute coronary syndromes: what is the optimal therapy with the current generation of drug-eluting stents?

Tratamiento antiplaquetario en síndromes coronarios agudos: ¿cuál es la terapia óptima con la actual generación de stents farmacológicos?

Luis A. Guzmán

ABSTRACT

The managementof patients with acute coronary syndrome has progressedsignificantly over the past few decades primarily due to technological advancements made in interventional cardiology with the arrival of new drug-eluting stents, early reperfusion strategies, and a deeper understanding of anti-thrombotic therapy.
The development and addition of more effective antiplatelet drugs to the therapeutic armamentarium along with the use of dual antiplatelet therapy with more potent P2Y12 receptor inhibitors (ticagrelor and prasugrel) have shown a significant reduction in the number of acute ischemic events following percutaneous revascularization. However, over time, careful assessmentof scientific studies and real-world practice registries has revealed that these more aggressive antiplatelet regimens are associated with a significant increase in bleeding complications that jeopardize the patient's life.
Different alternatives and treatment strategies were evaluated to determine the most suitable therapeutic approach that keeps a balance between preventing ischemic events (stent thrombosis, acute myocardial infarction or cardiovascular mortality) without increasing bleeding complications. This is how the concept of "de-escalation" and individualized antiplatelet treatment was born.

Keywords: *antiplatelet drugs, prasugrel, ticagrelor, acute coronary syndroms, de-escalation*

RESUMEN

El tratamiento de pacientes con síndromes coronarios agudos ha evolucionado significativamente en las últimas décadas, principalmente debido al avance tecnológico de la cardiología intervencionista con los nuevos stents farmacológicos, las estrategias de reperfusión temprana y el entendimiento más profundo de la terapia antitrombótica.
El desarrollo e incorporación de drogas antiplaquetarias más eficaces en el armamentarium terapéutico y el uso de doble antiagregación plaquetaria con inhibidores del receptor P2Y12 más potentes (ticagrelor y prasugrel) han demostrado una significativa disminución de eventos isquémicos agudos post revascularización percutánea. Sin embargo, con el tiempo, la evaluación más cuidadosa de los estudios científicos, como también la evidencia en registros de la práctica diaria, demostró que estos esquemas de antiagregación más agresivos se asociaron a un incremento significativo en la incidencia de complicaciones de sangrado que ponían en riesgo la vida del paciente. Diferentes alternativas y estrategias de tratamientos fueron evaluadas con la intención de determinar el esquema terapéutico más adecuado que mantuviera un equilibrio entre la prevención de eventos isquémicos (trombosis del stent, infarto agudo de miocardio o mortalidad cardiovascular) sin el aumento de las complicaciones por sangrado. Así nació el concepto de de-escalation y el concepto del tratamiento antiplaquetario personalizado. Este esquema lo estaremos analizando en esta revisión.

Palabras clave: *drogas antiplaquetarias, prasugrel, ticagrelor, clopidogrel, síndromes coronarios agudosm de-escalation.*

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The management of patients with acute coronary syndrome has progressed significantly over the past few decades primarily due to technological advancements made in interventional cardiology with the arrival of new drug-eluting stents, early reperfusion strategies, and a deeper understanding of anti-thrombotic therapy.
The development and addition of more effective antiplatelet drugs to the therapeutic armamentarium along with the use of dual antiplatelet therapy with more potent P2Y12 receptor inhibitors (ticagrelor and prasugrel) have shown a significant reduction in the number of acute ischemic events following percutaneous revascularization. However, over time, careful assessment of scientific studies and real-world practice registries has revealed that these more aggressive antiplatelet regimens are associated with a significant increase in bleeding complications that jeopardize the patient's life. The net benefit of using these agents was therefore questioned. Concurrently, the development of second and third-generation drug-eluting stents has reduced the risks of the feared acute and subacute stent thrombosis significantly with a more rapid and complete re-endothelialization process. These advancements also questioned the need for prolonged aggressive antiplatelet treatment.
Different alternatives and treatment strategies were evaluated to determine the most suitable therapeutic approach that keeps a balance between preventing ischemic events (stent thrombosis, acute myocardial infarction or cardiovascular mortality) without increasing bleeding complications. This is how the concept of "de-escalation" and individualized antiplatelet treatment was born.

CONCEPT OF "DE-ESCALATION"

De-escalation refers to those strategies used to reduce antiplatelet effects to decrease bleeding complications without compromising ischemic events. These strategies include: 1) reducing the duration of dual antiplatelet therapy to shorter periods, 2) reducing the intensity of antiplatelet effects by switching to less potent agents, and 3) reducing the number of antiplatelet agents used to a one agent only. Additionally, the concept of adjusting the degree of antiplatelet therapy based on genetic studies or antiplatelet response known

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TABLE 1.

Events (3 or 6 monthsvs 12 months)	HR (95% CI)
Death/Infarction/ST-segment elevation	1,14 (0,88-1,49)
Stent thrombosis (ST)	1,30 (0,77-2,27)
Bleeding	0,65 (0,45-0,92)
Major bleeding	0,52 (0,30-0,93)

HR: hazard ratio. 95% CI: 95% confidence interval.

as "individualized antiplatelet therapy" was evaluated. These strategies and their clinical response will be described further.

SHORTER DURATION OF ANTIPLATELET THERAPY

The first question that arose was whether the shorter duration of dual antiplatelet therapy (DAPT) with more aggressive agents (aspirin + ticagrelor or aspirin + prasugrel) could be shortened to reduce the risk of bleeding without compromising the risk of ischemic events. For over a decade now, multiple randomized clinical trials have been conducted to determine the optimal duration of more aggressive DAPT. In other words, whether the duration can be shortened from 12 months. Initially, treatment durations of 6 months vs 12 months or even 3 months only vs 12 months were evaluated in former studies with a significant number of patients. More recently, with the addition of third-generation drug-eluting stents, trials with just 1 month of more aggressive treatment have been conducted. Most of these studies have shown that a shorter and more aggressive antiplatelet treatment is associated with a significant reduction in the risk of bleeding without more ischemic events. A meta-analysis of the early randomized clinical trials of 8100 patients demonstrated that the shorter 3-6 month course of treatment was superior to the 12-month course with a 35% to 45% reduction of bleeding events and no increase in the risk of ischemic events (**Table 1**)[1]. More recently, the MASTER DAPT trial of 4500 patients with acute coronary syndrome and high bleeding risk randomized to only 30 days of aggressive DAPT showed similar results reduced bleeding (6.5% vs 9.4%; < .001) and no increase in ischemic risks (5.9% vs 6.1%, *P* = NA) in patients treated with DAPT therapy for 30 days compared to 6 months[2].

SWITCHING TO A LESS POTENT ANTIPLATELET AGENT

The second concept studied was the switch from a more potent P2Y12 inhibitor (prasugrel or ticagrelor) to a less potent agent either low-dose prasugrel (5 mg) or clopidogrel. Several studies were conducted to research this hypothesis. One of the most important studies that included patients at the highest ischemic risk such as those with ST-segment elevation myocardial infarction is the TALOS-AMI trial. This study randomized 2700 patients to receive aspirin and ticagrelor for 30 days followed by aspirin and clopidogrel for the remaining 11 months vs guideline-recommended strategy of aspirin and ticagrelor for 12 months as advised by both the American and European guidelines. The study showed a 45% reduction in the composite primary endpoint of death, myocardial infarction, stent thrombosis, and bleeding (BARC type 2, 3, or 5) with rates of 4.6% vs 8.2%, respectively, HR, 0.55 [95%CI, 0.40-0.76][3]. The HOST-REDUCE-POLYTECH-ACS trial assessed another form of switching or de-escalation (the reduction of prasugrel from 10 mg down to 5 mg after the initial 30 days of treatment with aspirin and full-dose prasugrel. The trial demonstrated a significant decrease in bleeding events with dose reduction (HR, 0.25; 95%CI, 0.10-0.61) without an increased ischemic risk (HR, 0.88; 9% CI, 0.47-1.66)[4].

TABLE 2.

Study	Patients	Strategy	Ischemic events	Bleeding events
GLOBAL Leaders	16,000	DAPT 1 mes	No difference	Fewer
TWIGHLIGHT	8,200	DAPT 3 meses	No difference	Fewer
TICO	3.000	DAPT 3 meses	No difference	Fewer
SMART CHOICE	3.000	DAPT 3 meses	No difference	Fewer
STOP DAPT 2 (*)	3.000	DAPT 1 mes	No difference	Fewer

Ischemic events: myocardial infarction, death, stent thrombosis. Bleeding: BARC type 2, 3, and 5. The STOP DAPT 2 trialused clopidogrel as a single agent vs continuing with a 9-month course of aspirin + ticagrelor.

DE-ESCALATION TO A SINGLE ANTIPLATELET THERAPY. DISCONTINUE ASPIRIN

Five randomized clinical trials specifically examined the use of dual antiplatelet therapy for 1-3 months followed by discontinuation of aspirin and continuation of a single antiplatelet agent. Most trials used ticagrelor as the sole antiplatelet agent. The 2 most important and largest studies were the GLOBAL LEADERS trial (16 000 patients randomized to 1 month of DAPT followed by ticagrelor for 23 months vs continuing with aspirin + ticagrelor for 11 months) and the TWILIGHT trial (8200 patients randomized to 3 months of DAPT followed by a 9-month course of ticagrelor)[5,6]. **Table 2** shows the main characteristics of these studies and the results of ischemic and bleeding events in each of them. A meta-analysis of all these trials showed that discontinuing aspirin and continuing with the P2Y12 receptor blocker only was associated with a 45% reduction in the rate of major bleeding (HR, 0.55; CI, 0.28-1.0), with a trend towards fewer acute or subacute stent thrombosis (HR, 0.6; CI, 0.32-1.12) and myocardial infarction (HR, 0.82; CI, 0.58-1.16). We should mention that the trials that assessed the discontinuation of the P2Y12 receptor inhibitor leaving the patient on aspirin alone were associated with a significant increase in the risk of stent thrombosis (HR, 1.55; CI, 1.02-2.36) and a trend towards an increased risk of myocardial infarction (HR, 1.28; CI, 0.97-1.68), which means that it would be ill-advised for the patient to continue with aspirin as the sole antiplatelet agent[7].

GUIDED ANTIPLATELET THERAPY ALSO KNOWN AS "INDIVIDUALIZED" THERAPY

The main reason for the higher ischemic risk associated with clopidogrel is its antiplatelet effect variability. This is so because clopidogrel is a prodrug that requires dual hepatic metabolism to generate an active metabolite. This hepatic metabolic step is determined by the enzyme of the CYP2C19 system. Genetic variations of this enzyme are associated with a decreased antiplatelet effect of clopidogrel, leading to an increased risk of ischemic events in these patients. By conducting genotype studies, we can determine whether patients have this genetic alteration and if they will respond to clopidogrel therapy. Patients with loss

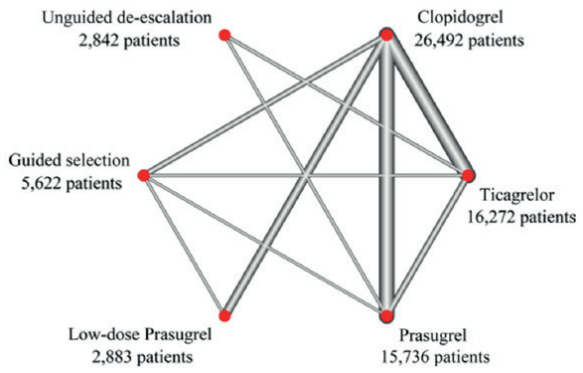

Figure 1. *Randomized clinical trials assessing different antiplatelet therapy regimens.*

of the two function alleles, homozygous genotype, have an almost zero response to clopidogrel while those with one allele present and the other one absent have an intermediate response. Instead of determining the genotype, another alternative is to measure the anti-P2Y12 effect of clopidogrel using platelet aggregation studies. Based on this concept, we hypothesized that if the presence of genetic modification or demonstration of non-response to clopidogrel were measured and more aggressive anti-P2Y12 drugs were used only in these unresponsive patients while continuing clopidogrel in the responders, the anti-ischemic profile would improve without a higher risk of bleeding. Multiple randomized studies were conducted to put this concept to the test. Although initial studies did not validate this concept, most of them showed a favorable trend to guided therapy. The TAILOR-PCI trial, probably the most important one regarding the number of patients, included 5235 patients and assessed the use of genetic studies to guide the use of clopidogrel (or ticagrelor in those with genetic loss of function) vs clopidogrel without evaluation of antiplatelet effect. The study showed a significant trend towards fewer ischemic events with guided therapy (HR, 0.66; CI, 0.43-1.02) without changes to the rate of bleeding events (HR, 1.22; CI, 0.60-2.51)[8]. A meta-analysis of 11 randomized trials that assessed multiple treatment options, guided vs non-guided therapy (based on genetic studies or platelet aggregation studies) of 27 000 patients demonstrated that guided was superior to non-guided therapy with a significantly lower ischemic risk (HR, 0.78; CI, 0.63-0.95) and a trend towards a lower risk of bleeding (HR, 0.88; CI, 0.77-1.01)[9].

GUIDED DE-ESCALATION USING GENETIC OR PLATELET FUNCTION TESTS VS DE-ESCALATION FOR ALL PATIENTS

Although based on the previous section, guided therapy appears to be safer and as effective as conventional more aggressive DAPT, it is not clear whether guided therapy should be given to all patients or instead upfront de-escalation for all patients. Although no randomized clinical trials studied these 2 strategies directly, evidence from randomized trials on different strategies suggests that genetic or platelet function testing should not be necessary to de-escalate antiplatelet therapy. Upfront de-escalation to all patients is the best therapeutic alternative. Kuno et al. evaluated data from 19 randomized trials of almost 70 000 patients treated with different antiplatelet regimens (**Figure 1**)[10]. Compared to selection based on genetic or platelet function testing, blind de-escalation of all patients was linked to a trend towards fewer ischemic events (HR, 0.82; CI, 0.53-1.28) and very few bleeding events (HR, 0.48; CI, 0.33-0.72).

SPECIAL TREATMENT GROUP

These strategies may have an even more significant application in specific clinical groups. Defining the effect of more or less aggressive antiplatelet therapy in patients at high compared to low risk of bleeding, treatment in patients at high ischemic risk, and an increasingly important group such as elderly patients with a well-known higher risk of bleeding, is of significant clinical importance. Multiple trials have been conducted to determine the benefit of de-escalation with different alternatives in high-risk bleeding and elderly patients, all showing that shorter DAPT courses (1 to 3 months) or less aggressive agents (prasugrel 5 mg or clopidogrel) are associated with very few bleeding events without an increase of ischemic events. This benefit was also seen in patients undergoing more complex procedures and a higher ischemic risk as demonstrated by the HOST-REDUCE-POLYTECH-ACS trial that randomized patients with ACS and complex procedures to a 1-month course of DAPT with prasugrel 10 mg followed by de-escalation down to a 12-month course with 5 mg and then 10 mg. There were no differences in ischemic events (HR, 0.81; 95% CI, 0.45-1.46). However, there were significanty fewer bleeding events with the reduced dose (HR, 0.25; CI, 0.10-0.61)[11]). Similarly, in elderly patients, the POPULAR AGE trial randomized patients older than 70 years to DAPT with ticagrelor vs DAPT with clopidogrel. Patients treated with clopidogrel had lower rates of bleeding (HR, 0.71; CI, 0.54-0.94) without more ischemic events (HR, 0.92; CI, 0.64-1.34)[12]. This demonstrates that in patients at higher risk of bleeding due to clinical characteristics or advanced age, less aggressive treatment was associated with fewer bleeding complications with even a trend towards fewer ischemic events.

CONCLUSIONS

The addition of second and third-generation drug-eluting stents, the understanding of the need for more advanced anti-ischemic therapies, but mainly the recent demonstration of the clinical implications of bleeding risks have led us to develop a more elaborate and individualized antiplatelet therapy to balance their positive effects of reducing the rate of ischemic events without more bleeding complications. Aggressive treatments seem necessary, but mainly within the first 30 to 90 days. In those at very high risk of bleeding or elderly patients, 30 days seem to be sufficient. After this period, de-escalation regimens should be used. While there is no single regimen and combinations of aspirin + clopidogrel or aspirin + prasugrel 5 mg are possible alternatives, based on more recent studies, the most effective de-escalation therapy would be to reduce the degree of antiplatelet

therapy by using one single agent with potent and predictable antiplatelet effects (ticagrelor or prasugrel) while discontinuing aspirin. The use of genetic or platelet function tests is not superior to discontinuing aspirin in all patients and continuing with ticagrelor or prasugrel. If, for economic or adverse events reasons, neither one of these two agents can be used, genetic or platelet function tests would be indicated to determine and confirm the response to clopidogrel.

REFERENCES

1. *Palmerini T, Sangiorgi D, Valgimigli M, et al. Short- versus long-term dual antiplatelet therapy after drug-eluting stent implantation: an individual patient data pairwise and network meta-analysis. J Am Coll Cardiol 2015 Mar 24;65(11):1092-102.*
2. *Valgimigli M, Frigoli E, Heg D, et al. Dual Antiplatelet Therapy after PCI in Patients at High Bleeding Risk. N Engl J Med 2021 Oct 28;385(18):1643-55.*
3. *Kim CJ, Park MW, Kim MC, et al. Unguided de-escalation from ticagrelor to clopidogrel in stabilised patients with acute myocardial infarction undergoing percutaneous coronary intervention (TALOS-AMI): an investigator-initiated, open-label, multicentre, non-inferiority, randomised trial. Lancet 2021;398(10308):1305-16.*
4. *Kim HS, Kang J, Hwang D, et al. Prasugrel-based de-escalation of dual antiplatelet therapy after percutaneous coronary intervention in patients with acute coronary syndrome (HOST-REDUCE-POLYTECH-ACS): an open-label, multicentre, non-inferiority randomised trial. Lancet 2020 Oct 10;396(10257):1079-89.*
5. *Vranckx P, Valgimigli M, Jüni P, et al. Ticagrelor plus aspirin for 1 month, followed by ticagrelor monotherapy for 23 months vs aspirin plus clopidogrel or ticagrelor for 12 months, followed by aspirin monotherapy for 12 months after implantation of a drug-eluting stent: a multicentre, open-label, randomised superiority trial. Lancet 2018;392:940-9.*
6. *Mehran R, Baber U, Sharma SK, et al. Ticagrelor with or without Aspirin in High-Risk Patients after PCI. N Engl J Med 2019;381:2032-42.*
7. *Garg A, Rout A, Sharma A, et al. Safety and efficacy of antiplatelet regimens after percutaneous coronary intervention using drug eluting stents: A network meta-analysis of randomized controlled trials. Progress in CVD 2020:63:243-8.*
8. *Pereira NL, Farkouh ME, So D, et al. Effect of Genotype-Guided Oral P2Y12 Inhibitor Selection vs Conventional Clopidogrel Therapy on Ischemic Outcomes After Percutaneous Coronary Intervention: The TAILOR-PCI Randomized Clinical Trial. JAMA 2020;324:761-71.*
9. *Galli M, Benenati S, Capodanno D, et al. Guided versus standard antiplatelet therapy in patients undergoing percutaneous coronary intervention: a systematic review and meta-analysis. Lancet 2021;397:1470-83.*
10. *Kuno T, Fujisaki T, Shoji S, et al. Comparison of Unguided De-Escalation Versus Guided Selection of Dual Antiplatelet Therapy After Acute Coronary Syndrome: A Systematic Review and Network Meta-Analysis. Circ Cardiovasc Interv 2022 Aug;15(8):e011990.*
11. *Kim HS, Kang J, Hwang D, et al. Prasugrel-based de-escalation of dual antiplatelet therapy after percutaneous coronary intervention in patients with acute coronary syndrome (HOST-REDUCE-POLYTECH-ACS): an open-label, multicentre, non-inferiority randomised trial. Lancet 2020 Oct 10;396(10257):1079-89.*
12. *Gimbel M, Qaderdan K, Willemsen L. et al. Clopidogrel versus ticagrelor or prasugrel in patients aged 70 years or older with non-ST-elevation acute coronary syndrome (POPular AGE): the randomised, open-label, non-inferiority trial. Lancet 2020 Apr 25;395(10233):1374-81.*

Percutaneous resolution of partial anomaly of left pulmonary venous return with dual drainage in pediatric patients. Case report

Resolución percutánea de anomalía parcial del retorno venoso pulmonar izquierdo con doble drenaje en paciente pediátrico

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ABSTRACT

Introduction. Partial anomalous pulmonary venous return (PAPVR) is a rare type of pulmonary vein anomaly. It is found in 0.5% to 0.7% of the overall population. The presence of a dual drainage system makes a percutaneous approach possible due to the coexistence of both a systemic venous and a normal pulmonary venous circuit.
Objectives.: To report the case report of a patient with PAPVR and dual drainage who was treated percutaneously.
Method:. In this study we present the case report of a patient with PAPVR who was eligible for vertical vein occlusion due to the presence of a dual drainage system.
Conclusions.: Transcatheter device closure of PAPVR with dual drainage is an effective and safe approach.

Keywords: dual drainage, partial anomalous pulmonary venous connection, device occlusion.

RESUMEN

Introducción. El retorno venoso pulmonar anómalo parcial (APRVP) es una anomalía poco frecuente de las venas pulmonares que se encuentra en el 0,5-0,7% de la población general. La presencia de un doble sistema de drenaje hace posible el abordaje percutáneo debido a la coexistencia de una conexión del circuito venoso sistémico con el circuito venoso pulmonar normal.
Objetivo: reportar el caso de un paciente que presentó anomalía parcial del retorno venoso pulmonar con doble drenaje resuelto percutáneamente.
Método: en este estudio presentamos un caso clínico de un paciente con APRVP, candidato a oclusión de vena vertical por la presencia de un doble sistema de drenaje.
Conclusión. La corrección percutánea con dispositivo de APRVP con doble drenaje es un procedimiento efectivo y seguro.

Palabras clave: doble drenaje, retorno venoso pulmonar anómalo parcial, dispositivo oclusor.

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INTRODUCTION

Partial anomalous pulmonary venous return (PAPVR) is a rare anomaly of the pulmonary veins found in 0.5% to 0.7% of the overall population.[1] It can have a single (to systemic veins) or dual drainage system (to the systemic atrium and left side).[2]

Various degrees of right chamber dilation occur due to chronic volume overload due to left-to-right shunting. Increased blood flow to the lungs leads to remodeling of the pulmonary vascular bed triggering pulmonary arterial hypertension.

Management depends on the impact of the left-to-right shunt on heart and lungs, and common treatment includes surgically redirecting the anomalous vein to the left atrium.

The presence of a dual drainage system facilitates the transcatheter approach due to the coexistence of a connection between the systemic venous circuit and the normal pulmonary venous circuit.[3,4]

OBJECTIVES

To report the case of a patient with partial anomalous pulmonary venous return and dual drainage successfully resolved through a transcatheter procedure.

METHOD

In this study, we present the case of a patient with PAPVR who was eligible for vertical vein occlusion due to the presence of a dual drainage system.

CASE REPORT

This is the case of 13-year-old patient referred to our hospital after being diagnosed with PAPVR of the left superior pulmonary vein. The transthoracic echocardiography performed revealed the presence of PAPVR of the left superior pulmonary vein to a vertical vein with mild dilation of the right atrium, and right ventricle with no signs of pulmonary hypertension.

The coronary computed tomography angiography (CCTA) performed confirmed the presence of PAPVR and a dual drainage system from the left superior pulmonary vein to the left atrium and the innominate vein through a vertical vein (**Figure 1A and Figure B**).

Cardiac catheterization was performed, and normal pressures were found in the right chambers with a systemic-to-pulmonary shunt (Qp/Qs) ratio of 1.6. There was no pressure gradient between the left pulmonary vein and the left atrium, which is why a decision was made to occlude the vertical vein (**Figure 2A**).

The vertical vein measured 7 mm, which is why a 14 mm MemoPartTM Plug occluder was selected. Before relea-

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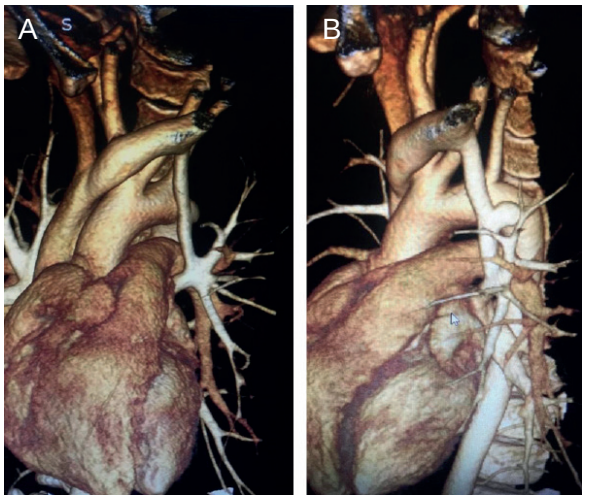

Figure 1. *A) and B) Contrast-enhanced coronary computed tomography angiography showing the dual drainage of the veins from the left upper lobe towards the innominate vein and left atrium.*

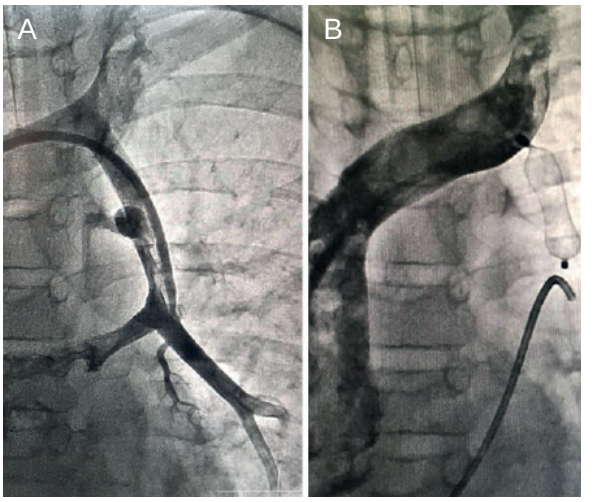

Figure 2. *A) Angiography showing the vertical vein connected to venous return. B) 14 mm Memo Part Plug™ device in its final resting position.*

sing the device, contrast agent was injected into the left superior pulmonary artery, and no obstruction of the pulmonary vein was seen in the levophase. Complete vessel occlusion without pressure changes and normal drainage in the levophase was confirmed after device release **(Figure 2B).**
The patient remained hospitalized for 24 hours and underwent echocardiography and x-rays, which showed the proper position of the device and a non-obstructive pattern of venous pulmonary flow. Follow-up at 3 and 6 months after discharge, with echocardiography and CCTA, yielded favorable results.

DISCUSSION

Anomalous pulmonary venous drainage or connection occurs due to 1 or more failed pulmonary veins when connecting to the left atrium during fetal life. PAPVR is most commonly found on the right side and often coexists with a sinus venosus-type of atrial septal defect in 80% to 90% of the cases. Occasionally, the existence of a dual drainage system connecting PAPVR to the left atrium has been reported.[2]
Diagnosis is often achieved during childhood or adulthood due to the presence of a murmur, arrhythmia or clinical signs of pulmonary hypertension resulting from chronic left-to-right shunting. The "dual drainage" of the left-sided pulmonary veins to both a vertical vein and the left atrium is a condition that should be suspected, and its presence confirmed and diligently assessed on the CCTA and cardiac catheterization, thus allowing a less invasive therapeutic approach.
In a recent series of patients, M.A. Al-Muhaya et al. demonstrated that percutaneous closure with an Amplatzer device for the management of dual drainage PAPVR is an effective, safe, and reproducible approach. It offers many advantages over surgical treatment like fast recovery, avoidance of mechanical ventilation and stay at the PICU, short lengths of stay, low cost, and patient satisfaction.[5]
Our approach consisted of the percutaneous occlusion of the ascending vertical vein, resulting in the redirection of blood flow to the left atrium with satisfactory results. This is the first report using the MemoPartTM Plug. The MemoPart™ vascular plug is a self-expanding cylindrical device made of a nitinol wire mesh with sewn polyester fabric to enhance occlusion. The device is visible on an x-ray and comes with a controlled release system with a screw-like mechanism similar to the traditional Amplatzer Vascular PlugTM (AVP).

CONCLUSIONS

Percutaneous correction with a dual drainage PAPVR device is an effective and safe procedure.

REFERENCES

1. *Allen HD, Driscoll DJ, Shaddy RE, Feltes TF. (2013). Moss & Adams' Heart Disease in Infants, Children, and Adolescents: Including the Fetus and Young Adult. Lippincott Williams & Wilkins.*
2. *Nagulakonda S, Pandey NN, Malhi AS, et al. "Dual Drainage" in the mixed variety of totally anomalous pulmonary venous connection. J Card Surg 2021;1-2.*
3. *Forbess LW, O'Laughlin MP, Harrison JK. Partially anomalous pulmonary venous connection: demonstration of dual drainage allowing nonsurgical correction. Catheterization and Cardiovascular Interventions 1998;44(3):330-5.*
4. *Gangadhara MB, Magee AG. Transcatheter occlusion of partial anomalous pulmonary venous connection with dual drainage to left atrium. Ann Pediatr Card 2019;12:144-6.*
5. *Al-Muhaya MA, Alkodami AA, Khoshhal S, Najjar AHA, Al-Mutairi M, Abdelrehim AR. Transcatheter occlusion of the vertical vein in a partial anomalous pulmonary venous connection with dual Drainage, case series with literature review. IJC Heart & Vasculature 2021;37:100889.*

TAVI in type I bicuspid complex aortic valve with balloon-expandable valve

TAVI en válvula aórtica bicúspide tipo I compleja con dispositivo balón expandible

Diego Nicolás Areco[1], Aldo Michael Rodríguez Saavedra[1], Marisa Malvina Acosta[1], Alejandra Soledad Vega[1]

ABSTRACT

Transcatheter aortic valve implantation (TAVI) is a challenge when dealing with bicuspid aortic valve (BAV) anatomies. Patients are young, the morphological phenotypes are many, the calcium load is high, and there are technical considerations to obtain better results. However, we have no prospective randomized clinical data with this treatment approach. Observational studies and registries are available with data and favorable clinical experiences worldwide.
This is the case of a young patient with type I bicuspid aortic stenosis and severe coronary artery disease who underwent PCI + TAVI.

Keywords: aortic valve stenosis, transcatheter aortic valve implantation, bicuspid aortic valve.

RESUMEN

El implante transcatéter de válvula aórtica (TAVI) representa un desafío en la anatomía de la válvula aórtica bicúspide (BAV). Los pacientes son jóvenes, los fenotipos morfológicos son muchos, la carga de calcio es alta y existen consideraciones técnicas para obtener mejores resultados5. No existe data clínica prospectiva aleatorizada con este enfoque de tratamiento. Estudios y registros observacionales están disponibles con datos y experiencias clínicas favorables de todo el mundo.
Presentamos el caso de una paciente joven con estenosis aórtica bicúspide tipo I y enfermedad arterial coronaria severa a la que se le realizó PCI+TAVI.

Palabras clave: estenosis valvular aórtica, reemplazo valvular aórtico transcatéter, válvula aórtica bicúspide.

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INTRODUCTION

Bicuspid aortic valve (BAV) is the most common congenital valvular heart disease and is present in almost 50% of patients eligible for aortic valve replacement. While transcatheter aortic valve implantation (TAVI) is an established treatment for severe symptomatic aortic stenosis (AS) in all levels of surgical risk, experience with TAVI in the management of severe bicuspid AS is limited and remains challenging due to its association with multiple and complex anatomical considerations.[1] The purpose of this publication is to introduce a challenging case of a young woman with severe type I bicuspid aortic stenosis and stable symptomatic severe coronary artery disease treated with TAVI.

CASE REPORT

This is the case of a 62-year-old woman with cardiovascular risk factors: AHT, dyslipidemia, and a past medical history of mixed connective tissue disease (MCTD), group 1 pulmonary hypertension, type I bicuspid aortic valve stenosis.
She presented with progressive dyspnea and angina and NYHA FC III/IV of a 1-year history. Doppler echocardiography revealed the presence of aortic stenosis progressing into its severe grade, derivation of continuity equation area of 0.4 cm^2, mean gradient of 60 mmHg, mild-to-moderate aortic regurgitation, LVH, left ventricular ejection fraction of 68% without regional wall motion abnormalities. The mitral valve remained sclerocalcific with mild mitral regurgitation and mild tricuspid regurgitation, estimating a SPAP of 35 mmHg. Right heart chambers looked normal with preserved right ventricular systolic function. The cine coronary arteriography performed revealed the presence of severe obstructive coronary artery disease of 2 main vessels: the proximal left anterior descending coronary artery (LAD) in bifurcation with a diagonal branch (MEDINA 1.1.1) and the mid section of the right coronary artery (RCA).
Tomographic analysis confirmed the presence of type I bicuspid anatomy (Sievers classification), severely calcified bicommissural valve with a non-calcified raphe (Jilaihawi et al.),[4] elliptical and slightly horizontal shape, with calcium in the annulus and LVOT. The following measurements were taken: perimeter, 78.2 mm; area, 456 mm^2; perimeter-derived diameter, 24.9 mm; area-derived diameter, 24.1 mm. Measurements were taken according to the LIRA 3 plane method, intercommissural distance, 24 mm; left coronary height, 12 mm; right coronary height, 14 mm. Sinus diameters: non-coronary, 33 mm; right coronary, 27 mm; left coronary, 28 mm. The caliber of femoral accesses was appropriate. Membranous septum thickness was 3.3 mm, and the ECG showed a baseline right bundle branch block (estimated intermediate risk of complete heart block during and post-implantation).
The EuroSCORE was estimated at 4.1%, the STS Score at 2.51%, and the Afilalo test equalled 2 points (intermediate frailty). Despite of this, the patient was considered of high surgical risk due to comorbidities unaccounted for in these conventional surgical risk scores and fragility. The case was discussed with the heart team including the rheumatologist. A decision was made to perform PCI + TAVI.
In the first surgical act, a PCI was performed using the bifurcation technique (provisional stenting). A 3.0 mm x 18 mm rapamycin-eluting cobalt-chromium stent was implanted in the proximal third of the left anterior descending coronary artery followed by a 3.0 mm x 22 mm zotarolimus-eluting DES in the mid section of the right coronary artery.

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In the second surgical act (30 days later), TAVI was performed using a conventional technique. The patient was under general anesthesia. Right femoral access was used and an 8-Fr valved femoral introducer sheath was inserted. Also, via left femoral access, a 6-Fr valved femoral introducer sheath was inserted. A 5-Fr J-tipped pigtail catheter was mounted over a 0.035 in support guidewire and then advanced and placed in the non-coronary sinus for angiographic testing. Via right femoral access, a 2-Fr AR catheter was mounted over a 180 cm straight hydrophilic 0.035 support guidewire and advanced towards the left ventricle. Afterwards, it was then exchanged for a second Pigtail catheter. Simultaneous invasive pressures were monitored pre-implantation: LV, 200 mmHg; aorta, 100 mmHg; gradient, 100 mmHg. The Confida guidewire (Medtronic, Minneapolis, United State) was exchanged, and the 8-Fr introducer sheath was replaced by a 14-Fr Phyton introducer. After pre-dilatation with a 20 mm Mammoth balloon, the Navigator delivery system with a crimped Myval balloon-expandable valve of 24.5 mm was advanced and positioned into the valvular plane. After proper angiographic testing, it was successfully released under fluoroscopic control and high-frequency pacing (180 bpm). The ECG showed sinus rhythm with baseline right bundle branch block. Hemodynamic stability was achieved. Peak-to-peak gradient post-implantation was 4 mmHg. Doppler echocardiography showed a mean gradient of 8 mmHg, a maximum velocity of 1.9 m/s, and trivial leakage. Surgical closure of the arteriotomy was performed. After recovering from anesthesia, the patient remained awake and without neurological deficits upon leaving the cath lab. Hospital discharge occurred without complications at 24 hours.

DISCUSSION

We presented a challenging case of a young patient with complex type I bicuspid anatomy and associated coronary artery disease who underwent PCI+TAVI with favorable procedural, hemodynamic, and clinical outcomes (VARC-3). This case presents 4 different challenges: First (Clinical) TAVI vs conventional SAVR; no prospective randomized piece of information has ever compared this approach to SAVR, the latter with well-established evidence in all risk groups. However, clinical experience with TAVI in BAV is on the rise proving to be safe and effective compared to tricuspid anatomy to the extent that data from the largest registry ever published to this date, STS/ACC TVT on this therapy has raised the level of recommendation in the latest American Valvular Heart Disease Clinical Practice Guideline (2021).[8] The second challenge (Bicuspid anatomy) involves asymmetry of valve opening, fused raphe, differential depths and dimensions of sinuses, significant calcifications, and associated aortopathy, and the likely presence of associated abnormal coronary origin. These anatomical limitations can potentially lead to the asymmetric expansion of the implanted device, which in turn requires aggressive post-dilatation to treat residual gradients or paravalvular leaks. In addition, poor long-term expansion may result in flow abnormalities, device thrombosis, and early structural valve deterioration, ultimately affecting device durability.[1] The third topic under discussion is the selection of type and size of transcatheter heart valve. We selected a 24.5 mm + 1 mm balloon-expandable valve (Myval Meril Life), which gave us a 6% oversizing, which is in full compliance with the recommendations given for this type of valve and anatomy. This valve comes in intermediate sizes too, which would theoretically be a phenomenal plus for this type of anatomy, avoiding over- or undersizing and optimizing the valve-patient interaction. The balloon-expandable system balances the risk of annular rupture with less paravalvular leak. Secondarily, it theoretically offers better future coronary reaccess thanks to its intra-annular valve design and low height of the stent frame (feature shared with the Edwards Sapien valve). The fourth challenge (Management of stable coronary artery disease) involved the decision to perform PCI before TAVI, which offered the advantages of easier coronary access, lower risk of ischemia driven hemodynamic instability (during rapid pacing), and reduced contrast use compared to concomitant TAVI and PCI. This decision was made because the patient was a young individual with long life expectancy, symptomatic angina, and presence of complex proximal bifurcation lesion in the left anterior descending coronary artery.

CONCLUSION

In this patient, TAVI turned out to be a safe and effective procedure. We should mention the significance of meticulous planning for proper device selection considering the unpredictable early anatomy.

REFERENCES

1. *Elkoumy A, Jose J, Terkelsen CJ, et al. Safety and Efficacy of Myval Implantation in Patients with Severe Bicuspid Aortic Valve Stenosis-A Multicenter Real-World Experience. J Clin Med. 2022 Jan 15;11(2):443. doi: 10.3390/jcm11020443. PMID: 35054137; PMCID: PMC8779274.*
2. *Forrest JK, Kaple RK, Ramlawi B, et al. Transcatheter aortic valve replacement in bicuspid versus tricuspid aortic valves from the STS/ACC TVT registry. Cardiovascular Interventions 2020;13(15):1749-59.*
3. *Gorla R, Casenghi M, Finotello A, et al. Outcome of transcatheter aortic valve replacement in bicuspid aortic valve stenosis with new-generation devices. Interactive cardiovascular and thoracic surgery 2021;32(1):20-8.*
4. *Iannopollo G, Romano V, Esposito A, et al. Update on supra-annular sizing of transcatheter aortic valve prostheses in raphe-type bicuspid aortic valve disease according to the LIRA method. Eur Heart J Suppl. 2022 May 18;24(Suppl C):C233-C242. doi: 10.1093/eurheartj/suac014. PMID: 35602251; PMCID: PMC9117906.*
5. *Kumar V, Sengottuvelu G, Singh VP, Rastogi V, Seth A. Transcatheter Aortic Valve Implantation for Severe Bicuspid Aortic Stenosis - 2 Years Follow up Experience From India. Front Cardiovasc Med. 2022 Jul 28;9:817705. doi: 10.3389/fcvm.2022.817705. PMID: 35966565; PMCID: PMC9369256.*
6. *Tarantini G, Tang G, Blackman D, et al. (2023). Management of coronary artery disease in patients undergoing transcatheter aortic valve implantation. A clinical consensus statement from the European Association of Percutaneous Cardiovascular Interventions in collaboration with the ESC Working Group on Cardiovascular Surgery. EuroIntervention: journal of EuroPCR in collaboration with the Working Group on Interventional Cardiology of the European Society of Cardiology, EIJ-D.*
7. *Williams MR, Jilaihawi H, Makkar R, et al. The PARTNER 3 bicuspid registry for transcatheter aortic valve replacement in low-surgical-risk patients. Cardiovascular Interventions 2022;15(5):523-32.*
8. *Writing Committee Members, Otto CM, Nishimura RA, Bonow RO, et al. 2020 ACC/AHA guideline for the management of patients with valvular heart disease: a report of the American College of Cardiology/American Heart Association Joint Committee on Clinical Practice Guidelines. Journal of the American College of Cardiology 2021;77(4):e25-e197.*
9. *Yeats BB, Yadav PK, Dasi LP, Thourani VH. Transcatheter aortic valve replacement for bicuspid aortic valve disease: does conventional surgery have a future? Annals of Cardiothoracic Surgery 2022;11(4):389.*
10. *Zhang Y, Xiong TY, Li YM, et al. Patients with bicuspid aortic stenosis undergoing transcatheter aortic valve replacement: a systematic review and meta-analysis. Frontiers in Cardiovascular Medicine 2022;9.*

Splenic complex aneurysm. Utility of 3D printing in endovascular interventional practice

Aneurisma esplénico complejo. Utilidad de la impresión 3-dimensional en la práctica intervencionista endovascular

José Humberto Vicario[1], Mario Cibils[1], Santiago Vicario[1], Matías Dallo[1], Thiago Vasconcelos Paulo Neto[2]

ABSTRACT

The objective is to highlight the benefit of 3D printing in a patient with a complex splenic aneurysm. The application of this technology made it possible to imitate an endovascular treatment in the cath lab before its definitive correction with stent-graft. This strategic-technological planning made it possible to establish an adequate anatomical assessment with its corresponding therapeutic definition in terms of technical feasibility and evaluation of results.

Keywords: splenic aneurysm, 3D printing, stent graft.

RESUMEN

El objetivo es resaltar el beneficio de la impresión 3-dimensional en un paciente con aneurisma esplénico complejo. La aplicación de esta tecnología permitió imitar un tratamiento endovascular en la sala de cateterismo antes de su corrección definitiva con stent graft. Esta planificación estratégica-tecnológica permitió establecer una valoración anatómica adecuada con su consiguiente definición terapéutica en cuanto a factibilidad técnica y evaluación de resultados posibles.

Palabras clave: aneurisma esplénico, impresión 3D, stent graft.

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CASE REPORT

This is the case of a 66-year-old man with a past medical history of hypertension and the incidental finding of a splenic aneurysm on an abdominal computed tomography scan performed in the context of renal lithiasis. Anatomical evaluation was decided using percutaneous angiography and CCTA that revealed the presence of a giant 27/37 mm x 8 mm fusiform aneurysm located in the splenic hilum **(Figure 1A and Figure B).** The celiac trunk showed an anatomical variant consisting of right and left hepatic arteries (lack of common hepatic artery), left gastric artery, and gastroduodenal artery from the splenic artery **(Figure 1C and Figure D).** The size of the splenic artery before and after the aneurysm was between 8 mm and 10 mm according to the CT scan. Due to the anatomical complexity and for endovascular correction with a stent-graft, 3D printing was indicated based on a 64-slice CCTA with views < 1 mm **(Figure 2A and Figure B).** This strategy simulated the procedure in the cath lab before the definitive correction being the most appropriate angiographic projection for visualization and endovascular correction being the left anterior oblique and caudal at 40° and 20°, respectively. It also facilitated the proper selection (size and type) of the device that would eventually used **(Figure 2C and Figure D)**.

RESOLUTION

The procedure was performed via a left radial access with a 5-Fr introducer sheath and placement of a multipurpose catheter in the abdominal aorta for control angiography. Also, via right femoral access with a 10-Fr introducer sheath to perform the procedure. Using the selected angiographic projection from 3D printing, a 5-Fr Cobra catheter mounted on a hydrophilic guidewire was placed into 1 intraparenchymal branch of the spleen after the aneurysm occurred **(Figure 3A).** This allowed the hydrophilic guide to be exchanged for a 0.035 in extra-support guidewire. Throu-

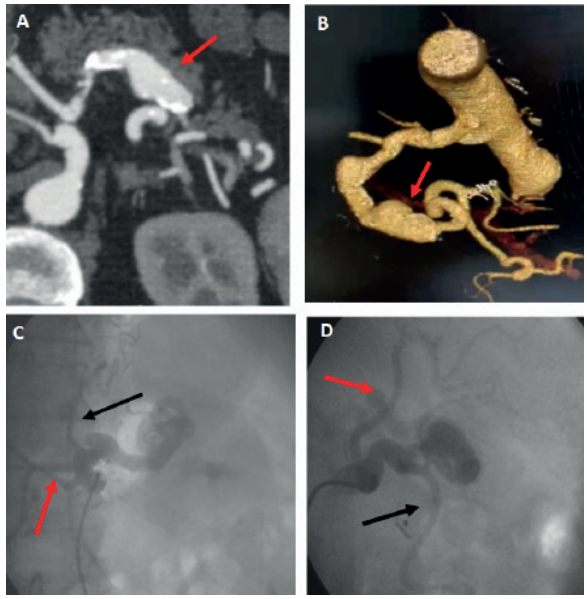

Figure 1. *A) 64-slice CCTA (arrow). B) 3D reconstruction of CCTA (arrow). C) celiac trunk angiography, right hepatic artery (black arrow) and left hepatic artery (red arrow). D) left gastric artery (red arrow) and gastroduodenal artery from the splenic artery (black arrow).*

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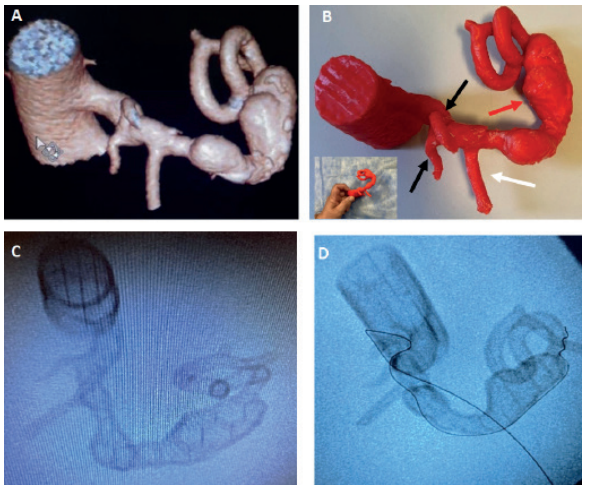

Figure 2. *A) Tomographic segmentation. B) 3D printing of hepatic (black arrow) and gastroduodenal arteries (white arrow). Splenic arteryaneurysm (red arrow). C) Angiographic projection selected for the surgery, LAO at40° and caudal at 20°. D) Proceduralsimulation with guidewire.*

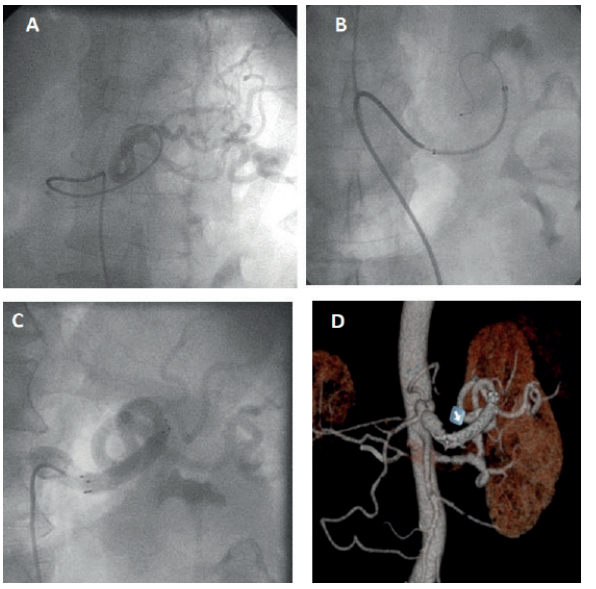

Figure 3. *A) Cobra catheter positioned in an intraparenchymal branch of the spleen. B) Deploymentof an 8/60 mm self-expanding Fluency Plus® stent-graft. C) Aneurysm exclusion and splenic flow preservation. D) Follow-up CCTAat 3 months (blue arrow).*

gh the multipurpose catheter positioned in the abdominal aorta, an angiography was performed to confirm the correct position of the wire. A 8/60 mm self-expanding stent-graft (Fluency Plus®) was deployed that achieved aneurysm exclusion and splenic flow preservation **(Figure 3B and Figure C).** The patient progressed uneventfully and was discharged 48 hours after surgery. A follow-up CCTA 3 months after surgery confirmed aneurysm exclusion without contrast leakage **(Figure 3D).**

DISCUSSION

Splenic aneurysm is the third most common type of abdominal aneurysm followed by aortic and iliac aneurysms[1]. It amounts to 60% of all visceral aneurysms reported[2]. Approximately one-third of splenic aneurysms have a distal location in the artery[3], and their size can be between 2 cm and 9 cm [4]. They are asymptomatic in 97% of patients, making their detection incidental in imaging studies. In our case, the patient showed many of the characteristics described by the medical literature since the aneurysm was an incidental finding on the images, asymptomatic, and complex due to the anatomical variant of the celiac trunk, giant in size, and of distal location in the splenic hilum. Comprehensive understanding through imaging is crucial for successful treatment. 3D printing has been recognized and gradually added as a useful addition to the field of vascular and endovascular surgery[5-7]. The production of a patient-specific anatomical replica has a significant impact on the management of the patient in terms of anatomical understanding, procedural planning, endovascular navigation, and patient communication. 3D printing was extremely useful to plan aneurysm exclusion with a stenting. It allowed us to select proper guidewires, catheters, and determine the most suitable angiographic projection, thereby avoiding repeated angiographies, minimizing contrast volume, and reducing fluoroscopy time. In conclusion, 3D printing is an innovative tool to develop strategies and optimize interventional procedures, thus enabling successful treatment outcomes in complex patients.

REFERENCES

1. *Orsitto G, Fulvio F, Pinto AG, et al. Geriatric assessment of a giant splenic artery aneurysm accidentally diagnosed. Aging Clin Exp Res 2011;23:491-4. [PubMed] [Google Scholar].*
2. *Zhang HY, Chai DZ. Endovascular coil embolization for a giant anomalous splenic artery aneurysm. J Vascular Surg Cases 2015;1(2):141-3.*
3. *Abbas MA, Stone WM, Fowl RJ, et al. Splenic artery aneurysms: Two decades' experience at Mayo Clinic. Ann Vascular Surg 2002;16(4):442-9.*
4. *Al Jalbout N, Moreland AJ. Syncope in a middle-aged female: Splenic artery aneurysm revisited. Clinical Imaging 2018;52(2018):8-10.*
5. *Rocatello G, El Faquir N, De Santis G, et al. Patient-specific computer simulation to elucidate the role of contact pressure in the development of new conduction abnormalities after catheter-based implantation of a self-expanding aortic valve. Circ Cardiovasc Interv 2018 Feb;11(2):e005344*
6. *Wang DD, Eng M, Myers E, et al. Inferior and posterior: utilization of 3d print and computer aided design to spatially map optimal transseptal crossing point for left atrial appendage occlusion with the WATCHMAN device. J Am Coll Cardiol 2016;67(13 Supplement):323.*
7. *Alasnag M, Al-Shaibi K, Stankovic G. Computational Simulation, Bench Testing, and Modeling: Novel Tools to Strategize an Optimize Interventional Procedures. Curr Cardiovasc Imaging Rep 14, 3 (2021).*

Successful evolution of endovascular treatment in a complex case of ruptured abdominal aortic aneurysm

Evolución exitosa del tratamiento endovascular en un complejo caso de aneurisma abdominal aórtico roto

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ABSTRACT

This is the case of a large diameter ruptured abdominal aortic aneurysm that was promptly resolved through endovascular therapy. After meticulous stent-graftimplantation, the initial evolution of the case was satisfactory. As it often happens in cases of high cardiovascular complexity, even when the major conditions has been overcome, certain complication may arise requiring care for the patient's complete and favorable final outcome. This report reflects the comprehensive cardiac interventional, anesthesiological, and clinical work conducted on this regard.

Keywords: *abdominal aneurism, EVAR, endoprosthesis, aneurism rupture.*

RESUMEN

El caso que comunicamos hace referencia a un aneurisma aórtico abdominal roto de gran diámetro el cual recibió pronta resolución por vía endovascular. Luego de un laborioso implante de endoprótesis, la evolución inicial del caso fue satisfactoria. Como habitualmente ocurre en casos de alta complejidad cardiovascular, aun cuando la gran patología principal queda superada, determinadas intercurrencias pueden suscitarse y requerirán su atención para lograr un completo buen resultado final en el paciente. El presente reporte refleja la integralidad del trabajo cardiointervencionista, anestesiológico y clínico realizado a tales fines.

Palabras clave: *aneurisma de aorta abdominal, endoprótesis, EVAR, aneurisma roto.*

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INTRODUCTION

Abdominal aortic aneurysm (AAA) has an incidence rate of up to 7.6% in patients older than 50 years. Risk of rupture varies depending on its diameter, ranging from approximately 10% to 20% annually for cases > 60 mm. Ideally, treatment should be performed electively during intermediate stages of its progression to prevent he acute event associated with the aneurysm (contained or free rupture), a catastrophic event with a very grim prognostic. Overall, we estimated that 80% of the patients with a ruptured aneurysm do not survive. This high mortality rate includes both the pre-hospital stage and in-hospital mortality, including adverse events of surgical treatments with mortality rates up to 50%. Therefore, aortic aneurysm ruptures can account for up to 2% of the causes of death in men older than 65 years.

Currently, there are 2 treatment options available: a) open surgery repair (OSR) and b) endovascular aneurysm repair (EVAR) through endoprosthesis implantation. In this report we will be describing a case of EVAR to treat a ruptured abdominal aneurysm (its EVRAR variant) as an example of a growing trend supported by the medical literature available over the past 10 years towards the interventional resolution of complicated aneurysms, as we will describe below.

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DESCRIPTION OF CASE REPORT

This is the case of a 75-year-old man who initially presented to the ER with abdominal pain. His personal medical history includes a) hypertension, b) dyslipidemia, c) obesity, d) severe coronary artery disease requiring coronary artery bypass surgery 4 years ago at a different center (without anatomical details of the referred treatment), e) idiopathic pulmonary fibrosis diagnosed 2 years ago, f) maculopathy in the left eye with near-total loss of visual acuity in that eye.

The patient's current drug treatment includes a) bisoprolol 5 mg/day, b) esomeprazole 40 mg/day, c) atorvastatin 40 mg/day, d) perindopril 10 mg/day, e) amlodipine 5 mg/day, f) deltisona 10 mg/day, g) spironolactone 25 mg/day.

The initial reason for consultation was right sacro-lumbar and abdominal pain, asthenia, adynamia, nausea, dizziness, and symptoms consistent with orthostatic phenomenon.

An abdominal computed tomography scan was requested to study the abdominal condition of this patient with risk factors and cardiovascular history. The report reads: *"Infrarenal aneurysm with eccentric mural thrombus of heterogeneous density and disorganized parietal calcification. Hyperdense periaortic and retroperitoneal fat planes with signs of blood content, attributed to aneurysmal rupture with retroperitoneal hematoma. No active contrast substance extravasation is observed. The maximum diameter of the aneurysmal sac measures 85 mm,; he proximal neck, 29 mm; and is located approximately 35 mm from the left renal artery. Presence of severe aortic and iliac parietal calcification."*

Regarding the cardiovascular system, the ECG report indicates: sinus rhythm; HR, 100/min; axis -30°; PR, 150 ms; QRS, 100 ms; QS wave in leads DIII and aVF,

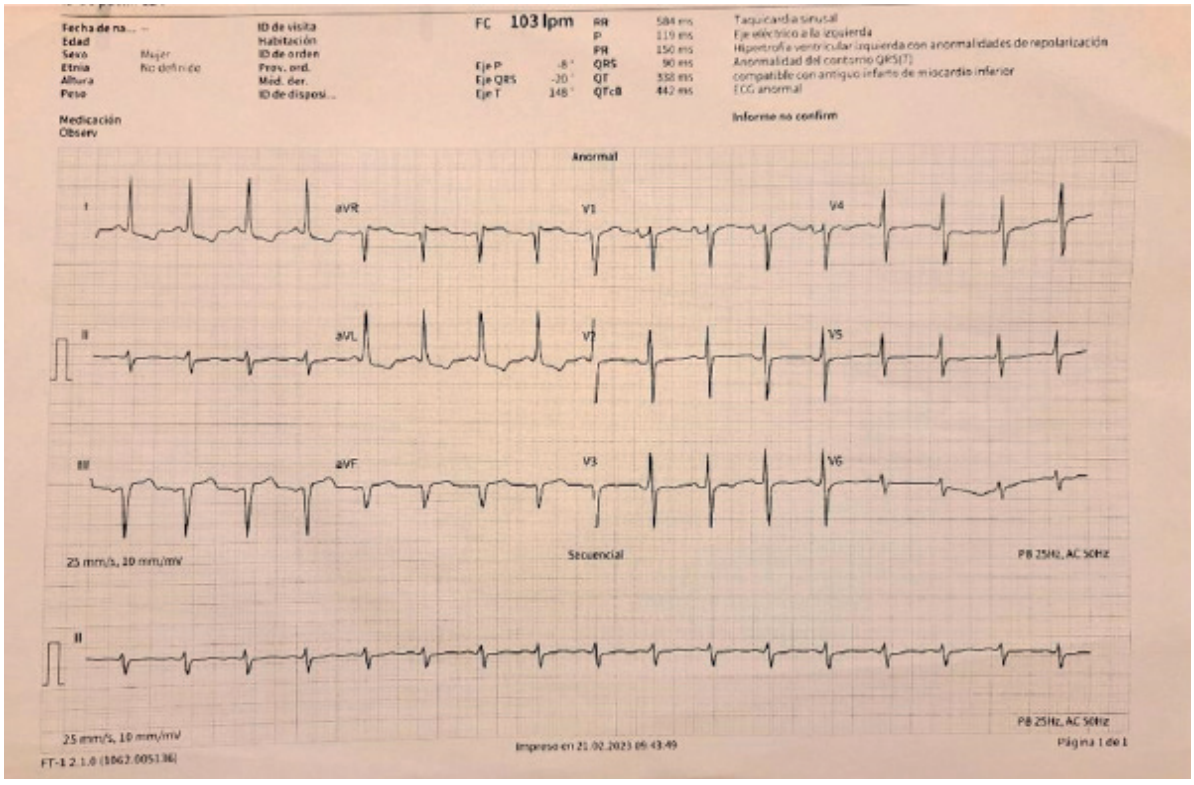

FigurE 1. *Preoperative electrocardiogram, of relevance as the patient required MRS to treat severe coronary artery disease.*

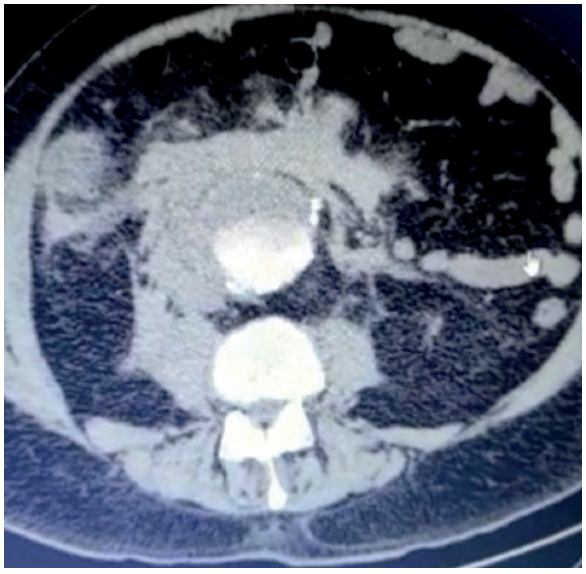

Figure 2. *CT view of a ruptured abdominal aortic aneurysm and hematoma in the retroperitoneal space.*

isoelectric ST-segment and T-wave, regular progression of R in precordial leads. This was the report from the transthoracic echocardiogram requested for perioperative assessment: *"Left ventricular hypertrophy, normal-sized cardiac chambers, preserved left ventricular global systolic function. Normal-sized aortic root. Aortic valve calcification with moderate aortic stenosis. Mitral filling pattern consistent with prolonged relaxation."*

The patient's clinical condition was complex but remained stable. During the preoperative period, the patient had a tendency towards hypertension of diastolic predominance (blood pressure values between 135/90 and 160/110). The initial heart rate was 90 bpm up to nearly 110. The patient remained lucid, cooperative, in a mandatory dorsal decubitus position, with an initial arterial oxygen saturation ($SatO_2$) of 92% in breathing room air up to 94%-95% with a nasal cannula delivering 3 L/m of O_2. Some noticeable cutaneous-mucosal paleness was seen. The standard drug treatment to prepare for surgery (labetalol + NTG infusion pump) partially controlled the vasoconstrictive and tachycardic tendencies associated with the acute vascular event.

Within a few hours, during which the management of supplies and participating personnel was arranged, the patient was transferred to the cath lab for emergency aorto-bi-iliac stent-graft implantation. Technically, a hybrid surgical and interventional approach was performed. The vascular surgery team initially performed open dissection of the common femoral arteries bilaterally. Following the placement of introducer sheaths in both arteries an aortography was performed with a pigtail catheter. The aortogram revealed the presence of iliac trajectories with pronounced curves as seen during imaging planning. After meticulous instrumentation with increasing rigidity wires, the suitable juxtarenal level of the aorta was reached to start implantation. A 26 mm x 100 mm Endovascular Minos device was ascended via left femoral access of the main branch using an extra-rigid wire, and the upper limit was positioned just below the lower edge of the renal arteries. Subsequently, a 16 mm x 120 mm Amplatz catheter and the right extension were introduced from the right side. Afterwards, the 16 mm x 120 mm left extension was placed through a sheath via left femoral artery. At the end, a control aortography was obtained with no evidence of leaks and preserved patency of all branches. As the final surgical act, both femoral branches were closed using endarterectomy and arteriorrhaphy. Preserved

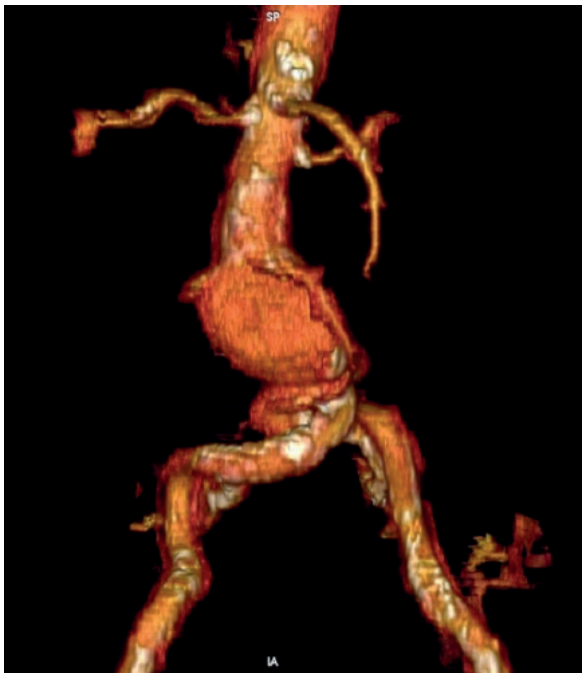

Figure 3. *Aneurysmal reconstruction from a frontal view showing preserved aortic branches, aneurysm neck, and iliac tortuosity.*

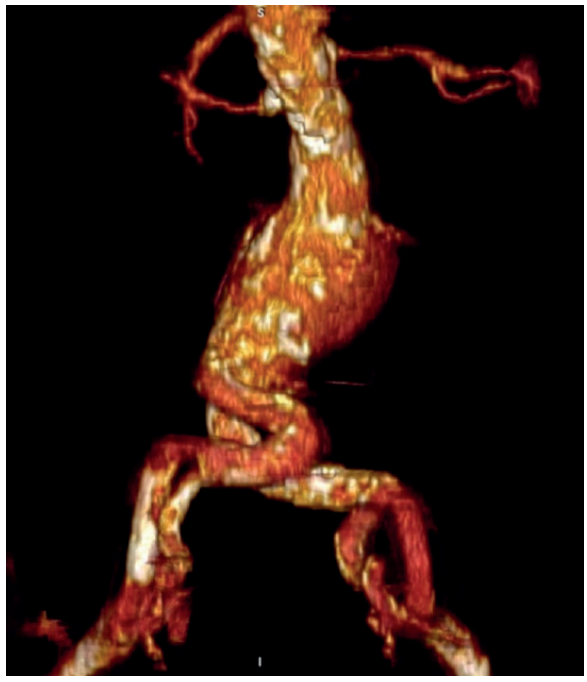

Figure 4. *CCTA-based reconstruction of the abdominal aortic aneurysm from a posterior view. It shows iliac tortuosity, aneurysm diameter, and calcified vascular disease.*

pulse in the vessels distal portion and palpable posterior tibial pulse in both limbs were reported without changes compared to baseline.

In terms of clinical management, this procedure was performed under general anesthesia. The anesthetic procedure began with a peripheral 16G IV line in the upper limb followed by the IV induction of general anesthesia (midazolam 15 mg, propofol 180 mg, fentanyl 200 mcg, rocuronium 30mg). Induction was followed by hemodynamic stability without need for vasopressor support until that point. After preoxygenation and assisted ventilation with a mask without difficulties, orotracheal intubation was performed using a video laryngoscope. No airway complications were reported, achieving satisfactory glottic view and successful orotracheal intubation in a single attempt. Anatomically, our patient presented parameters indicative of a difficult airway, which is a common finding in cardiointerventional anesthesiology, such as a) obesity, b) short and thick neck, c) limited cervical extension, d) age, e) male gender, f) soft tissue proliferation in the pharyngeal area, and g) presence of coronary artery disease and lung pathology. Therefore, using the video laryngoscope as a valuable tool, our patient's airway was both rapidly and effectively secured, and mechanical ventilation was initiated using the lung-protective setting. Additionally, a 20G arterial line was placed in the left radial artery for invasive monitoring and sampling. Afterwards, a dual-lumen 7-Fr central venous catheter was inserted under ultrasound guidance via right internal jugular vein, with strict asepsis in both vascular procedures. The maintenance phase of anesthesia was conducted with 0.8% sevoflurane, propofol infusion at 50 mcg/kg/min, and remifentanil at 0.1 mcg/kg/min. Ten minutes into the procedure, a mild trend towards hypotension was noticed, and noradrenaline was started via a central line. The slightly decreased blood pressure progressed into moderate hypotension when aortic instrumentation started, requiring increased noradrenaline up to 0.4mcg/kg/min, along with intravascular expansion using Ringer's lactate solution at a rate of 2000 mL intraoperatively. Additionally, 1 unit of packed red blood cells was transfused during this period due to the presene of significant retroperitoneal hematoma, limited surgical bleeding, and hypotension.

Intraoperatively, close metabolic monitoring was performed using arterial samples to assess the internal milieu throughout the 3.5-hour procedure. We saw lactate levels dropping, with intraoperative values of 4.9 mmol/L compared with 6.76 mmol/L before surgery. This favorable metabolic evolution was reinforced by the clinical correlation of hemodynamic normalization in the later surgical phases and complete cessation of vasopressor drug requirements. A unanimous decision was made to extubate the patient immediately after surgery in the cath lab. The patient regained consciousness rapidly and effectively, without periods of disorientation being cooperative and responsive to commands, with good ventilatory mechanics, and bilateral air entry. $SatO_2$ was 97% with a nasal cannula, with spontaneously preserved circulatory parameters without adjuvant drugs. Afterwards, the patient was transferred to the ICU for postoperative recovery. At follow-up, the postoperative situation remained the same, with blood pressure and HR levels of 140/90 and 90 bpm, respectively.

During the immediate postoperative period, the patient recovered moderately well, although not uneventfully. Within the first 36 hours, in a context of arterial hypertension according to the baseline records, the patient experienced symptoms described as blurry vision. The brain CT scan, ophthalmology and neurology assessments performed revealed: *"Presence of cortico-subcortical hypodensity in the occipital region causing effacement of the cortical sulci at convexity level, which is consistent with acu-*

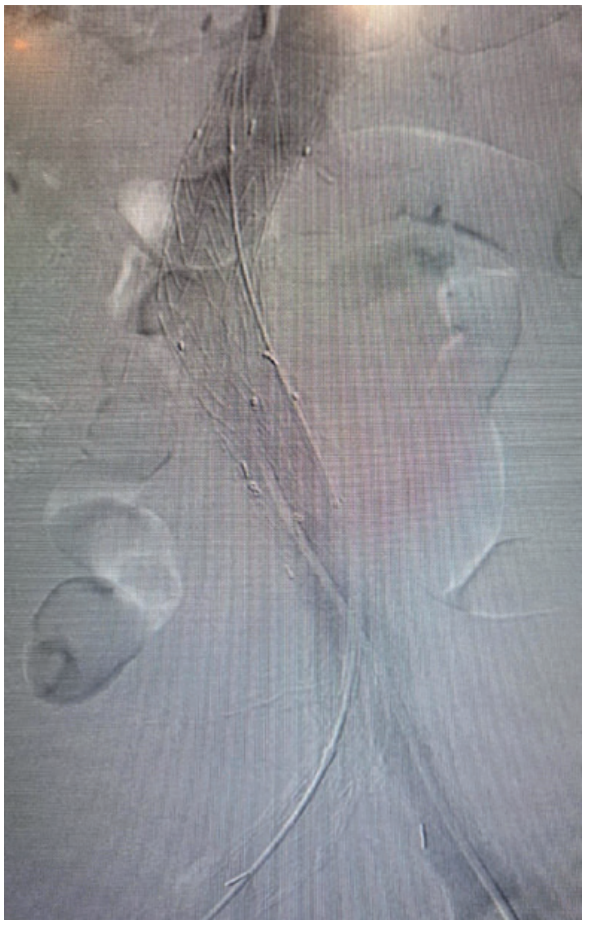

Figure 5. *Digital subtraction view of the fully implanted stent-graft with visualization of patent renal and iliac arteries and no evidence of endoleak.*

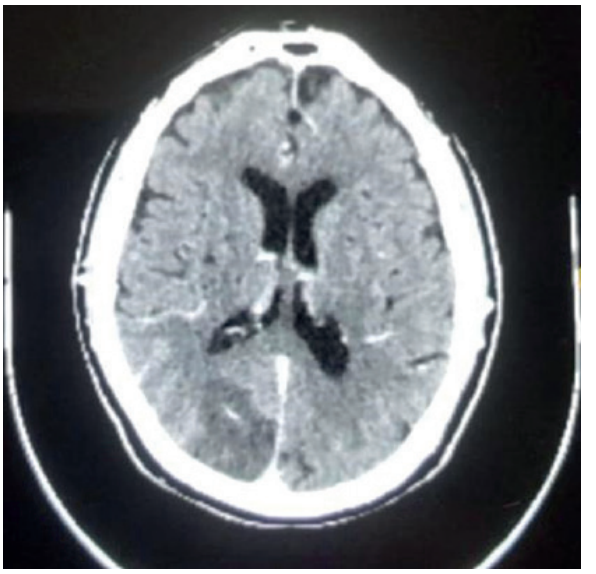

Figure 6. *Brain CT scan 36 hours after surgery showing an ischemic region in the right occipital lobe.*

te-to-subacute ischemic injury. Some focal hypodensities can also be seen at periventricular white matter level associated with microangiopathic vascular sequelae." In other words, the finding of an ischemic region at right occipital lobe level was later interpreted as *"cardioembolic stroke of limited territory due to to recent surgery."* Additionally, the CCTA of neck and intracranial vessels described: *"Both common carotid arteries, carotid bulb, and internal carotid arteries show atherosclerotic calcifications sparing their caliber without significant obstruction. The vertebral arteries have adequate flow, the right one looking hypoplastic. There are also atherosclerotic calcifications in the intracranial portions of the carotid and vertebral arteries."* The central embolic finding was pharmacologically treated with concomitant administration of acetylsalicylic acid and clopidogrel, as indicated for the recently placed aortic device.

Over the following days of recovery, visual symptoms improved favorably, with acceptable recovery of the right eye visual acuity and visual field. On the hematology level, 2 additional units of red blood cells were required during the postoperative period to compensate for initial losses during the aortic event, along with subsequent fluid redistributions. The patient's renal function remained within the normal range, with adequate creatinine and urea levels, and proper diuresis via a urinary catheter. The metabolic prognosis remained favorable, with good alkaline availability in plasma throughout the intraoperative period: bicarbonate levels at around 20 mmol/L, normal base excess, and a decreasing lactate curve. Seventy-two hours into the postoperative period, there was a tendency towards feverish recordings. Serial blood cultures were obtained, all yielding negative results. The gram-negative bacterium *Klebsiella oxytoca* isolated in a urine sample exhibited low antibiotic resistance. A 1-week IV course of antibiotics with a combination of imipenem and vancomycin was used to treat this complication. The febrile syndrome resolved few days after starting antibiotic therapy. The patient's recovery continued with a 6-day stay in the coronary care unit and 8 days in a general ward to rehabilitate the motor function. Having completed this intense but successful clinical course and being in a very good condition, both objectively and subjectively, the patient was successfully discharged.

CONCLUSIONS AND DISCUSSION

As multiple studies reveal throughout the world, the mortality rate of ruptured aortic aneurysms has traditionally been high, reaching overall values of 80%[1]. Being a critical condition with a grim prognosis. The innovative endovascular repair (EVAR) that has been using aortic stent-graft implantation over the past 20 years is a feasible solution to this problem. The use of this technique has been on the rise since it was first introduced[2] because it offers multiple device variations and novel designs. The endovascular approach for the management of aortic pathology offers advantages associated with less tissue invasiveness and fewer repercussions on systemic physiology compared with surgery.

Since this technique was introduced in 1991[11], it was initially adopted for the elective resolution of aneurysms the best approach for ruptured aneurysms was still controversial. At that time, all aneurysms ended up on the operating room. However, since 2010, articles with solid evidence recommending EVAR have been published, and we now have important meta-analyses[3] that suggest significant differences favorable to EVAR over OSR in complicated aneurysms.

The proven advantage of the interventional approach com-

TABLE 1. Pre and postoperative lab values.

	Preoperative		Posoperative				
	Pop – 10 hrs	Pop -4 hrs (venous)	Pop + 1 hr	POP + 10 hrs	POP + 34 hrs	POP + 58 hrs	POP + 82 hrs
Hematocrit. %	37,9	36,6	34,4	30,7	23,3	27,5	27
Hb (g/dL)	12,8	12,3	11,6	10,5	8,1	9,4	9,5
Leukocytes (/mm^3)	14300	13400	23000	17700	15500	11500	10300
Platelets (/mm^3)	147000	13400	104000	99000	79000	81000	194000
Lactic acid mmol/L	4,04	6,76	5,48	4,99	3,36	2,42	
Na + (mEq/L)	135	141	133	137	136	140	136
K + (mEq/L)	3,5	3,8	4,7	4,3	3,7	3,5	3,5
Cl – (mEq/L)	105	101	101	104	104	102	104
Urea (mg/dL)	65	62	63	70	66	56	42
Creatinine (mg/dL)	1,11	1,01	1,24	1,23	0,91	0,8	0,8
pH	7,39	7.29	7,35	7,42			
HCO3- (mmol/L)	21,6	25	19	21			
pCO2 mmHg	36,4	53	35	33			
EB (mmol/L)	-2,7	-2,3	-6	-3			
pO2 (mmHg)	66	36		68			
SatO2 %	92	61	91	93			
Glycemia (mg/dL)	189		262	179	153		
TP (%)	114		85	92			
RIN	0.94		1,06	1			
KPTT (s)	28		37	35			

pared to open surgery is in the lower in-hospital mortality rate of EVAR cases (7), with an odds ratio (OR) for this outcome of 0.53. In addition to this crucial difference, there are other evidence-based interventional advantages. EVAR has a lower relative rate of pulmonary (OR, 0.53), complications (OR, 0.53), cardiac (OR, 0.65), and mesenteric complications (OR, 0.42). In other words, its impact on multiple target organs is not as strong *P* values < .01 in all cases. The rate of transfusions is also lower with EVAR, there is less variability in results among operators with different case volumes, and it is the preferred approach in multimorbid patients older than 80 years (2).

Stent-grafts have become the treatment of choice of ruptured aneurysms. In the United States, the rate of complicated aortas treated with endovascular techniques went up from 39% in 2009 up to 59% in 2015[3]. The Society of Vascular Surgery guidelines from January 2018 recommended EVAR for cases of ruptured aneurysms whenever anatomically feasible, with a level 1 recommendation (strong evidence)[4]. Obviously, the option of open repair will always have its place and is currently evidence-based in cases deemed anatomically unsuitable for stent-graft implantation or cases of ruptured aneurysms with very complicated clinical situations. Also, it may be preferred in cases where there is limited availability of endovascular resources in a short timeframe, predominantly in peripheral centers, or guided by rational preferences or the skills of the personnel involved.

EVAR also has its own complications, especially in cases of ruptured aneurysms. The most common ones are endoleaks in their various subtypes, arterial occlusions of lower extremities, bleeding, and refractory shock leading to the death of the patient. Ruptured aneurysm is an event with a high physiological impact, and the expansion of endovascular techniques has improved many survival rates. However, we are still facing a problem with a high overall mortality rate[3]. The vascular surgical team will always act as an essential safety support when performing complex interventional procedures.

There is a long list of rare complications whose chances of happening run parallel to EVAR technical complexity[10]. Thus, the more complex cases of stent-grafts have a higher rate of these adverse events: a) myocardial infarction (OR, 18.7), b) acute kidney failure, c) major cardiovascular events (OR, 11.1), and d) stroke (OR, 7.3). In case described in this study, the severe complications mentioned earlier did not occur. However, we saw a lateral event less frequently, the aforementioned cerebral embolism at occipital level, which showed a favorable progression.

Although our case did not require fenestrated vascular branches or angioplasties using the chimney-stent technique, it did require a high level of technical complexity for anatomical reasons related to sharp curves in the iliac and aortic paths that required instrumentation to higher levels. The sources of embolism towards the posterior cerebral circulation were undoubtedly related to the plethora of atheromatous calcifications in aortic and carotid circulations, which is consistent with the presence of a hypoplastic right vertebral artery shown by imaging. In addition, aortic instrumentation, which was proposed as the cardioembolic source, and postoperative hypertensive events were other factors in the etiology of the event.

The great positive aspect of this case is that the most notable and adverse complications that lurk in these complex clinical contexts were avoided, and the patient underwent successful stent-graft implantation, remaining within the 20% overall survival rate after ruptured aortic aneurysm.

REFERENCES

1. *D.W. Harkin, M. Dillon et al. Endovascular Ruptured Abdominal Aortic Aneurysm Repair (EVRAR): A Systematic Review Eur J Vasc Endovasc Surg 34, 673-681 (2007).*
2. *James McPhee, Mohammad H Eslami et al. Endovascular treatment of ruptured abdominal aortic aneurysms in the United States (2001-2006): a significant survival benefit over open repair is independently associated with increased institutional volume J Vasc Surg. 2009 Apr;49(4):817-26.*
3. *George A Antoniou, George S Georgiadis et al . Endovascular repair for ruptured abdominal aortic aneurysm confers an early survival benefit over open repaira J Vasc Surg 2013 Oct;58(4):1091-105.*
4. *Elliot L. Chaikof et al. The Society for Vascular Surgery practice guidelines on the care of patients with an abdominal aortic aneurysm Society for vascular surgery Document Vol 67, issue 1, p2-77, Jan 2018*
5. *Hiroyuki Ito. Postoperative Ruptured Abdominal Aortic Aneurysms and Management of Complications Ann Vasc Dis Vol. 12, No. 3; 2019; pp 323–328.*
6. *IMPROVE trial investigators Endovascular or open repair strategy for ruptured abdominal aortic aneurysm: 30 day outcomes from IMPROVE randomised trial. BMJ 2014;348:f7661*
7. *Real-world evidence of superiority of endovascular repair in treating ruptured abdominal aortic aneurysm, J Vasc Surg VOLUME 68, ISSUE 1, P74-81, JULY 2018*
8. *Nicholas J. Swerdlow et al. Rate of Stroke Following Endovascular Aortic Interventions in the Society for Vascular Surgery Vascular Quality Initiative.*
9. *Koji Sato et al. Treatment Strategy of Endovascular versus Open Repair for Ruptured Abdominal Aortic Aneurysm Based on the Fitzgerald Classification. Ann Vasc Surg 2020 Nov;69:324-331.*
10. *Thomas F X O'Donnell et al. The state of complex endovascular abdominal aortic aneurysm repairs in the Vascular Quality Initiative . J Vasc Surg 2019 Aug;70(2):369-38.*
11. *J. C. Parodi, J. C. Palmaz, H. D. Barone Transfemoral Intraluminal Graft Implantation for Abdominal Aortic Aneurysms. Annals of Vascular Surgery. Vol 5, Issue 6, Nov 1991, Pages 491-499.*
12. *Complications of endovascular aneurysm repair of the thoracic and abdominal aorta: evaluation and management. Cardiovascular Diagnosis and Therapy. Vol 8, Supplement 1 (April 13,2018).*

Result of intrathrombus pharmacoinvasive endovascular treatment with forced infusion technique (pulse spray) and continuous infusion of streptokinase in patients with acute lower limb ischemia

Resultado del tratamiento endovascular farmacoinvasivo intratrombo con técnica de infusión forzada (pulse spray) e infusión continua de estreptoquinasa en pacientes con isquemia aguda de miembro inferior

David Parraga Meza[1], Diego Martín Barbetta[1], M. Belén de Beus[1], Joaquín Etcheverre[2], Pablo Nicolás Luna[3]

ABSTRACT

In the year 2020, we began a study to understand the behavior of endovascular catheter-guided streptokinase as a treatment for acute lower limb ischemia. The aim was to evaluate its benefits, potential complications, and establish a protocol for its use as the initial treatment in patients arriving at our facility with this condition.
The study included 8 patients who met the inclusion criteria. Catheter-directed fibrinolysis (CDT) was performed using two techniques combined: pulse spray and continuous infusion of streptokinase (STK) over a 12-hour period. The primary objective was to restore normal perfusion to the affected limb without causing endothelial trauma.
At the conclusion of the study, based on the observed results, it was determined that this combined strategy of pulse spray and continuous infusion showed positive outcomes in the indicated patients with acute lower limb ischemia. Due to the accessibility and availability of STK compared to other scarce and more expensive fibrinolytics, this approach can be routinely adopted in our setting.
Complications were minimal, and the success of the procedure not only relied on the chosen technique but also greatly depended on the patient's collaboration in adhering to the treatment and clinical follow-up.

Keywords: acute lower limb ischemia, catheter-directed thrombolysis, pulse spray thrombolysis, intrathrombus thrombolysis, streptokinase.

RESUMEN

En el año 2020 iniciamos un trabajo para conocer el comportamiento de la estreptoquinasa endovascular guiada por catéter como tratamiento frente a una isquemia aguda de miembros inferiores, evaluar sus beneficios, posibles complicaciones y protocolizar como tratamiento inicial en el paciente que llega a nuestro servicio con dicha patología.
El estudio fue realizado con 8 pacientes que cumplían los criterios de inclusión, se realizó la fibrinólisis dirigida por catéter (FDC) utilizando dos técnicas de forma conjunta que consistían en la técnica de infusión forzada (pulse spray) y la infusión continua de estreptoquinasa (STK) durante 12 horas, con la finalidad de recuperar la perfusión normal de la extremidad afectada sin generar trauma endotelial.
Al final del estudio se dio como conclusión, de acuerdo con lo observado, que esta estrategia combinada de infusión forzada y continua dio buenos resultados en los pacientes indicados que presentan isquemia aguda de miembros inferiores; que su utilización se puede adoptar de forma rutinaria en nuestro medio por la accesibilidad y disponibilidad de la STK frente a otros fibrinolíticos escasos y de mayor valor.
Las complicaciones son pocas, el beneficio del procedimiento no depende únicamente del resultado de la técnica utilizada, va de la mano y es de suma importancia la colaboración del paciente cumpliendo con el tratamiento y el seguimiento clínico..

Palabras clave: isquemia aguda de miembro inferior, trombólisis dirigida por catéter, pulse spray trombólisis, trombólisis intratrombo, estreptoquinasa.

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INTRODUCTION.

Acute ischemia of the lower limb is a pathology that produces a significant and dramatic reduction in blood perfusion of a lower limb as a result of the genesis of one or more thrombi lodged at any level of the limb, compromising function, viability and reaching the amputation of the affected limb if not treated on time and even cause the death of the patient, has an incidence of 1.5 cases per house 10,000 people.[1]

For this reason, we began work in 2020, with the aim of learning about the benefits of pharmacoinvasive endovascular therapy with streptokinase, a well-known fibrinolytic drug in our environment, with which we have a greater chance of working in our services due to its availability and accessibility. economical compared to other more current fibrinolytics, but more expensive such as rt-PA.

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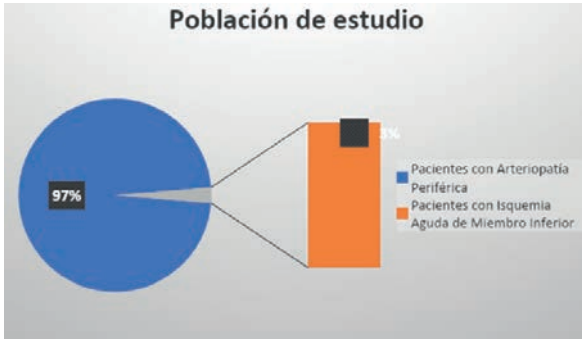

Figure 1.

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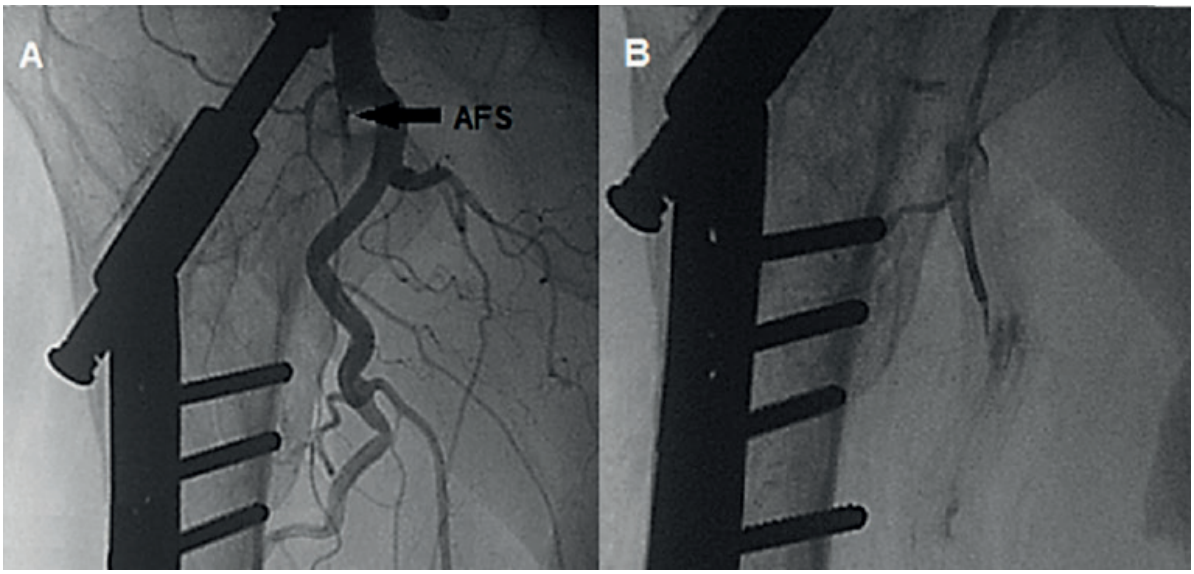

Figure 2. *A) Proximal occlusion of the superficial femoral artery. B) Intrathrombus pulse spray technique.*

MATERIAL AND METHOD

It is a prospective, descriptive study of patients undergoing intrathrombotic pharmacoinvasive endovascular treatment with the forced infusion technique (Pulse Spray) and continuous infusion of streptokinase in patients undergoing Acute Lower Limb Ischemia treated between January 2020 and December 2021 at our hospital. The initial screening was 300 patients who presented peripheral arterial disease, of which 8 patients who met the inclusion criteria were included in the study (**Figure 1**).

The inclusion criteria for the study were based on patients presenting acute ischemia of the lower limb with less than 72 hours of evolution from the onset of the clinical picture, audible arterial and venous Doppler signal and without total loss of sensation and motor capacity of the affected limb, those patients who had criteria for emergency surgery or contraindications for catheter-directed thrombolysis were excluded.

Absolute contraindication

Active bleeding. Intracranial hemorrhage, compartment syndrome. Severe limb ischemia, requiring immediate surgery.

Relative contraindication

Trauma or major non-vascular surgery within the last 10 days. Uncontrolled AHT (>180 and/or 110 mmHg). Non-compressible vessel puncture, intracranial tumor, recent eye surgery, neurosurgery in the last 3 months, history of severe allergy to contrast. intracranial trauma in the last 3 months, gastrointestinal bleeding in the last 10 days, liver failure, with coagulopathy, endocarditis, pregnancy/postpartum, hemorrhage in diabetic retinopathy. life expectancy <1 year.

Once the patient has been diagnosed, angiography is performed urgently and targeted thrombolysis is started with a 5-french multi-perforated multipurpose catheter; using 250,000 IU of streptokinase with the intrathrombo[2] forced infusion technique (Pulse Spray) as shown in Figure 2, to then leave a continuous infusion of 1250,000 IU of streptokinase by means of the multipurpose catheter per infusion pump at 42 ml/h for 12 hours.

After 12 hours and the medication has been infused, a control angiography is performed where the lysis of the thrombus will be visualized, and based on the angiographic result, the decision is made to end the treatment or complement it with the stent implantation (Figure 3); He undergoes 48 hours of hospitalization and if there are no complications he is discharged.

We call the reperfusion of the vessel treated by this technique a "Successful Procedure" after lysis with thrombolytics, which is reflected through the clinical improvement of the affected limb, with the return or increase of the distal pulse, recovery of sensitivity, abolition of pain. and the angiographic image shows completion of occlusion or reduction of vessel stenosis of less than 50%.

At the time of discharge, each patient was evaluated according to their cardiovascular history. Two patients with a history of AF (Atrial Fibrillation) and reperfusion without stent implantation were given anticoagulation with dose-response Acenocoumarol + 100 mg of ASA (Acetylsalicylic Acid); two patients with AF and stent implantation received dose-response acenocoumarol + 75 mg of clopidogrel, the remaining three patients with stent implantation and no history of AF were given dual antiplatelet therapy with 75 mg of clopidogrel + 100 mg of AAS, all schemes were suggested for 1 year.

Subsequently, the patient is followed up for 12 months to evaluate the result and if he presents complications in the medium or long term, typical of the therapy used.

Objective

The objective of this work is to evaluate the result of the proposed treatment and to follow the evolution of the patients during 12 months post-treatment, to identify the benefits and complications of the therapy and to demonstrate that its implementation as a protocol is beneficial in our institution and in other institutions of our environment and even put into practice in the different services in Latin America.

Statistical analysis

The results were expressed in percentages for the variables according to each category that was established for the study.

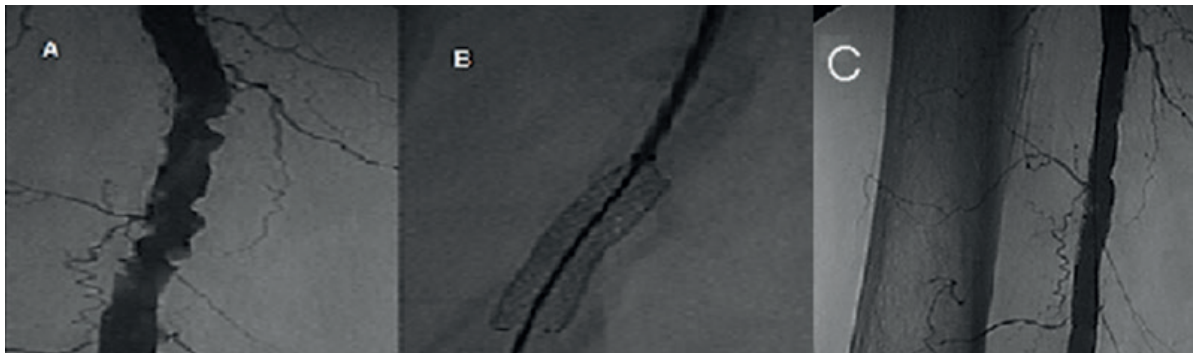

Figure 3. *A) Ulcerated plaque in the middle third of the superficial femoral artery post-procedure. B) Implantation of a elf-expandable stent at the lesion site of superficial femoral artery. C) Patent post-stent superficial femoral artery,*

TABLE 1. Baseline clinical and angiographic demographic characteristics of the study group.

Variable	Number	Percentage
Population	8	100%
Average age	72,6	
Male sex	7	87,50%
Risk factors		
Arterial hypertension	8	100%
Dyslipidemia	6	75%
Overweight	4	50%
Sedentary life style	2	25%
Mellitus diabetes	6	75%
Smoking	7	87,50%
Cardiovascular history		
Myocardial infarction	1	12,50%
Coronary angioplasty	1	12,50%
Peripheral vasculopathy	5	62,50%
Atrial fibrillation	4	50,00%
Angiographic characteristics		
Variable	**Number**	**Percentage**
Common iliac artery	1	12,50%
External iliac artery	1	12,50%
Common femoral artery	1	12,50%
Superficial femoral artery	4	50%
Popliteal artery	1	12,50%

RESULTS

All the included patients presented acute lower limb ischemia of less than 72 hours of evolution, the average age was 72 years, with a predominance of males (87%). The main clinical characteristics of the patients can be seen in Table 1. It is noteworthy that 100% of the patients presented arterial hypertension as a cardiovascular risk factor, 87% are smokers, 75% diabetics, and 62% are dyslipidemic. they suffered from peripheral vascular disease and 50% of the patients had atrial fibrillation, of which 2 did not receive treatment.

TABLE 2. Post-treatment angiographic results..

Variable	Number	Percentage
Total reperfusion	2	25,00%
Partial reperfusion + ATP	5	62,50%
Unsuccessful reperfusion	1	12,50%

The anatomical distribution of the thrombus was 50% in the superficial femoral artery and in 6 of the 8 patients there was ischemia in the right lower extremity **(Table 1).**
The treatment used was successful in 87% of the patients, of which 25% of the patients had total reperfusion and did not present significant angiographic lesions, residual thrombus or plaques, for which reason a stent should not have been implanted, while 62.50 % of patients had partial reperfusion due to the presence of significant angiographic lesions and was completed with stent implantation to optimize the final result **(Table 2).**
The complications we had were the presence of 1 patient with a hematoma at the puncture site that was resolved without major problems and was discharged after 7 days, additionally 2 patients presented intrathrombus thrombosis before reaching 6 months post-treatment as a result of who stopped taking the prescribed medication, including antiplatelet drugs, on their own.

DISCUSSION

Acute ischemia of the lower limb is a pathology that causes partial or total obstruction of blood flow to an extremity as a result of the formation of a thrombus in that area. If the patient does not receive immediate attention, he runs the risk of not only losing the extremity , you can also lose your life; in fact, studies that show that revascularization of the affected limb when it is Rutherford Class A must be performed within 6 to 24 hours; On the contrary, when it is Class IIa and IIb, the ideal is to do it within the first 6 hours[5]. Its main causes are related to acute arterial thrombosis due to atherosclerotic accident of its wall, Embolism secondary to the presence of arrhythmias and finally as a result of arterial Trauma.
Acute ischemia of the lower limb, depending on its clinical presentation and viability of the affected limb, can be treated in the first hours and up to 14 days after the onset of the condition[3].
Its clinical presentation begins with pain, paleness of the extremity and as the hours of evolution pass, the limb loses

TABLE 3.

Category	Description
I. Viable	No immediate threat
II. Threatened	Salvageable if it comes...
a. Marginal	... promptly
b. Immediate	... immediate revascularization
III. Irreversible	Not salvageable

sensitivity, motor capacity and the pallor turns into cyanosis as a consequence of hypoxia of the extremity.

The diagnosis must be made early and the treatment must be immediate, it can be diagnosed and confirmed through a Doppler echo of the lower limbs, which is a more accessible and non-invasive technique, another alternative is angiotomography with contrast which has a sensitivity and specificity of 90%[4], however, not all services have this technology; Once the severity of the ischemia is categorized, the most appropriate treatment is decided **(Table 3).**

Catheter-directed fibrinolysis (CDF) is a technique that consists of applying streptokinase in two stages, the first by forced infusion into the thrombus itself and the second with the help of an infusion pump to infuse the fibrinolytic for 12 hours, the objective of this method is to dilute the thrombus in the larger and smaller diameter vessels, reducing the risk of sudden reperfusion injury and avoiding endothelial trauma, in addition to recanalizing the occlusion, it allows angioplasty of the underlying lesion if necessary.

Current AHA/ACC guidelines recommend the use of FDC as Class I, level of evidence A; At present, this type of treatment has been studied with fibrinolytics such as urokinase, rt-PA and streptokinase (STK), with STK not showing inferiority compared to other alternatives, but with the advantage that it is available and economically cheaper in our environment. accessible[6,7], so this type of technique is ideal in these patients.

CONCLUSION

The catheter-guided pharmacoinvasive endovascular strategy using streptokinase initially with an intrathrombotic pulse spray technique and continuous infusion of streptokinase for 12 hours is a therapeutic option that gives good results for acute lower limb ischemia in patients who they meet the criteria for this and do not present contraindications for their use, reducing the endothelial trauma caused by sudden reperfusion and acting on vessels of greater and lesser diameter. It can be routinely performed in catheterization centers anywhere in the country with successful results soon, it is more accessible and its 12-month follow-up was favorable as long as the patient collaborates with the lifestyle change, does not abandon medication and medical controls.

REFERENCES

1. *Mitchell ME, Mohler ER, Carpenter JP. (Noviembre de 2014). Overview of acute arterial occlusion of the extremities (acutelimb ischemia).*
2. *Kessel DO, Berridge DC, Robertson I. (2004). Infusion techniques for peripheral arterial thrombolysis. Cochrane Database Sys tRev 1:CD000985.*
3. *Rutherford RB, Baker JD, Ernst C, et al. Recommended standards for reports dealing with lower extremity ischemia: revised version. **J Vasc Surg** 1997;**26**:517-38.*
4. *Sociedad Argentina de Cardiología, Área de Consensos y Normas. Consenso de enfermedad vascular periférica. Rev Argent Cardiol 2015;83(Supl.3):101. Fecha de consulta: 21 de julio de 2019. Disponible en: https:// www.sac.org.ar/wp-content/uploads/2016/01/consenso-de-enfermedad-vascular-periferica.pdf*
5. *Marie D. Gerhard-Herman, Heather L. Gornik, Coletta Barrett, Neal R. Barshes, Matthew A. Corriere. et al. 2016 AHA/ACC Guideline on the Management of Patients With Lower Extremity Peripheral Artery Disease: Executive Summary: A Report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines.*
6. *Aboyans V, Ricco JB, Bartelink MEL, et al. 2017. ESC Guidelines on the Diagnosis and Treatment of Peripheral Arterial Diseases, in collaboration with the European Society for Vascular Surgery (ESVS): Document covering atherosclerotic disease of extracranial carotid and vertebral, mesenteric, renal, upper and lower extremity arteries Endorsed by: the European Stroke Organization (ESO) The Task Force for the Diagnosis and Treatment of Peripheral Arterial Diseases of the European Society of Cardiology (ESC) and of the European Society for Vascular Surgery (ESVS). Eur Heart J 2018;39:763-816.*
7. *Giannakakis S, Galyfos G, Sachmpazidis I, et al. Thrombolysis in peripheral artery disease. Ther Adv Cardiovasc Dis 2017;11:125-*

Letter from the President of CACI

Carta del Presidente de CACI

Revista Argentina de Cardioangiología Intervencionista 2023;14(2):87. https://doi.org/10.30567/RACI/202302/0087-0087

Dear colleagues and friends,
Here is the latest issue of our prestigious journal, *RACI*, the scientific pride and joy of CACI.
The growth of *RACI* is the result of the effort from our entire editorial committee and each one of you who contributes to the journal valuable material for publication.
We are going through challenging times in our country where medical practice is constantly being challenged. Providing high-quality medicine, for which we are trained, is not easy in many corners of our country. We encounter numerous difficulties from financial issues to the constant struggle of getting our procedures authorized. Also, we have to deal with decisions made by health care providers and social works that often override the health professional's recommendation on what type of device should be used, making us have to decide between respecting our indication and leaving a patient without the proper treatment or losing the patient altogether.
This reality has strengthened our association, transforming it into a professional medical society to defend all our rights. To this end, we have been organizing labor workshops to propose alternative courses of action that will undoubtedly take time. However, it is the only way to start a new way that will eventually lead us to that objective. Participation from all our members is crucial because only consensus and acceptance can guarantee that the necessary changes will be implemented.
Next September 16th we will be celebrating the "International Day of Interventional Cardiology," which reaffirms the commitment of all interventional cardiologists with public health and excellence in clinical practice. We have the obligation to continue maintaining the highest quality standards as the history of our specialty requires. That is why the college continues to organize scientific activities throughout the year to facilitate and maintain the process of continuous education required by our medical specialty.
I wish to take this opportunity to invite you all to our 32nd National CACI Congress 2023 that will be held next Nov. 24th-26th 2023 at the Hilton Pilar Hotel in Buenos Aires, Argentina.
Best regards.

Martín Cisneros
President of CACI

Publications rules Argentine Journal of Interventional Cardioangiology

Reglamento de Publicaciones de la Revista Argentina de Cardioangiología Intervencionista

La *Revista Argentina de Cardioangiología Intervencionista* (RACI) es una publicación trimestral editada por el Colegio Argentino de Cardioangiólogos Intervencionistas (CACI) con objetivos asentados en la divulgación de material científico y educativo para la especialidad. La distribución nacional es gratuita y está dirigida a cardioangiólogos intervencionistas, cardiólogos clínicos y pediátricos, radiólogos, neurólogos, técnicos en hemodinamia y especialidades afines. La publicación es de tipo impresa y electrónica (www.caci.org.ar).
Los principios editoriales de la revista se basan en las recomendaciones para manuscritos enviados a revistas Biomédicas *(Recommendations for the Conduct, Reporting, Editing, and Publication of Scholarly Work in Medical Journals)* redactados por el Comité Internacional de Editores de Revistas Médicas *(International Committee of Medical Journal Editors - ICMJE)* en su más reciente actualización, disponible en www.icmje.org.

A partir del número 2 volumen 9 año 2018, por razones editoriales, los elementos gráficos (figuras, tablas, fotos) se editan a lo sumo en dos colores (azul y negro). Aquellos que los deseen a todo color deberán pagar un costo adicional por el trabajo de 200 US$.

Los artículos enviados deben ser originales. El Comité Editorial evaluará los trabajos y luego de un primer análisis sobre si el artículo sigue las normas Editoriales de la Revista, el Director y/o Directores Asociados serán los encargados de enviarlos a un arbitraje externo, que será simple ciego, que significa que los autores no conocen el nombre de los revisores y los revisores a su vez no conocen el nombre de otros revisores. Esta política del RACI se hace siguiendo los mismos criterios empleados por el Comité de Revisión y Editorial del *J Am Coll Cardiol* (JACC), que es la revista de cardiología de mayor factor impacto. La decisión final quedará en manos del Comité Editorial de acuerdo con las conclusiones del arbitraje. Asimismo, el Comité Editorial tendrá la facultad de introducir, con el consentimiento de los autores, todos los cambios editoriales exigidos por las normas gramaticales y las necesidades de edición de la revista. Los artículos de Revisión y Editoriales también serán objeto de la misma revisión. Los artículos Editoriales son usualmente pedidos por el Comité Editorial.

Luego de la primera revisión, los trabajos pueden ser aceptados en la forma en que fue incialmente enviado; Revisiones Menores es cuando si bien el trabajo tiene aportes importantes existen limitaciones menores que deben ser corregidas antes de su eventual publicación; Revisiones Mayores es cuando el trabajo es inaceptable para publicar de acuerdo a como fue presentado. Sin embargo, el Comite Editorial consideraría un posible nuevo envío, tambien llamado *de novo submission*, si el trabajo es modificado sustancialmente; Rechazo, es cuando los revisores y el Comité Editorial consideran que el trabajo es inapropiado para publicar en la Revista RACI
En casos especiales de consensos de diagnóstico y/o tratamiento realizados en conjunto entre el CACI y sociedades científicas afines, tal consenso, de común acuerdo entre las mismas y con conocimiento del Comité Editorial, podrá ser publicado en forma excepcional por las revistas oficiales de ambas sociedades en forma simultánea.

PRESENTACIÓN GENERAL DEL MANUSCRITO

Todos los autores así como los miembros del Comité Editorial deben declarar conflictos de intereses, en caso de que existan, con las publicaciones.

Cada artículo debe ser presentado con una primera página que debe contener: (a) el título, informativo y conciso; (b) los nombres completos de los autores y de las instituciones en que se desempeñan; (c) un título abreviado para cabeza de página; (d) el número total de palabras del artículo, sin las referencias bibliográficas; (e) el nombre y dirección completa, con fax y dirección electrónica, del autor con quien se deba mantener correspondencia. La segunda página debe incluir el resumen (abstract) en español y en inglés, con 3-6 palabras clave al final de éstos con términos incluidos en la lista del Index Medicus *(Medical Subject Headings - MeSH)*. Luego, en la tercera página, se debe desarrollar el contenido del manuscrito (véase Preparación del manuscrito), iniciando una nueva página para cada sección. Todas las páginas deben ir numeradas desde la portada.

El envío del artículo (texto, tablas y figuras) debe realizarse por correo electrónico a revista@caci.org.ar, con una nota firmada por todos los autores (véase modelo página web), con la indicación de la sección a que correspondería el manuscrito y la aseveración de que los contenidos no han sido anteriormente publicados. Una vez recibido el material, el Comité Editorial iniciará el proceso de incorporación que tiene una duración media de cinco semanas.
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Para cada artículo se permite un máximo de 8 autores, que deben adaptarse a las normas sobre autoría expuestas por la IMCJE. Cada manuscrito recibido es examinado por el Comité Editor y por uno o dos revisores externos. Posteriormente se

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(véase Preparación del manuscrito)
Son trabajos científicos o educativos de investigación básica o clínica original. Condiciones: a) texto general, hasta 5.000 palabras, incluidas las referencias; b) resumen, hasta 250 palabras; c) tablas + figuras, hasta 8; e) autores, hasta 10.

Comunicaciones breves
Los trabajos de esta sección cumplen con los lineamientos de Artículos originales, pero no tienen la suficiente cantidad de pacientes como para ser considerados como tales.

Artículos de revisión
Son artículos sobre temas relevantes de la especialidad solicitados por el Comité Editor a autores de reconocida trayectoria (nacionales o extranjeros). Puede ser escrito por diferentes tipos de médicos (no más de 3 autores). Condiciones: ídem Artículo Original.

Educación básica
Son artículos sobre el manejo racional y protocolizado de diferentes circunstancias que se presentan en la práctica diaria. Son revisados y consensuados previamente con especialistas en el tema, y se culminan con un diagrama de flujo sobre el manejo diagnóstico y terapéutico de la patología. Es solicitado por el Comité Editor. Condiciones: a) texto general, hasta 2.500 palabras excluyendo referencias; b) resumen, hasta 150 palabras; c) tablas + figuras, hasta 6; d) referencias, hasta 20; e) autores, hasta 4.

Caso clínico
Es la descripción de un caso clínico de características inusuales, con su abordaje diagnóstico y terapéutico y su resolución final. Debe acompañarse de una breve discusión bibliográfica. Condiciones: a) texto general, hasta 1.200 palabras; b) resumen, hasta 100 palabras; c) tablas + figuras, hasta 4; d) referencias, hasta 10; e) autores, hasta 5.

¿Cómo traté?
Bajo el título "¿Cómo traté?" los autores presentarán un caso desafiante y la descripción del tratamiento realizado. El título deberá estar incluido al comienzo del texto, por ejemplo "¿Cómo traté un aneurisma en la descendente anterior?". Luego se incluirán los nombres, apellidos, títulos y lugar de trabajo de los autores. Deberá indicarse el autor que recibirá la correspondencia, incluyendo su dirección postal y e-mail. Todos los autores deberán declarar sus conflictos de interés y, en el caso de no tenerlos, indicarlo. Texto, figuras y referencias seguirán los criterios del Caso Clínico

Imágenes en intervencionismo
Se aceptarán para publicar imágenes de casos excepcionales, ilustrativas, y que el Comité Editorial y los revisores externos consideren de sumo interés para su publicacion en la revista. Deben ir acompañadas de una leyenda explicativa y un breve resumen de historia clínica. Condiciones: a) texto general, hasta 300 palabras; b) solo 2 figuras originales; c) referencias, hasta 3; d) autores, hasta 5.

Protocolos de investigación
Como artículos especiales la Revista aceptará la publicacion de Protocolos de Investigacion Clinica, preferentemente multicéntricos y siempre que los mismos no hubiesen reportado antes los resultados parciales o totales del estudio.

Editoriales
Son análisis y/o comentarios de temas relevantes de la especialidad o de la Cardiología General que tuviesen relación con nuestra especialidad. Siempre serán solicitados por el Comité Editor a un experto en el tema. Asimismo, pueden solicitarse comentarios sobre temas no relacionados a un artículo en particular. Condiciones: a) texto general, hasta 2.000 palabras; b) referencias, hasta 40.

Cartas del lector
Es una opinión sobre un artículo publicado en el último número de la revista, el cual requiere un arbitraje realizado por miembros del Comité Editor. Condiciones: a) texto, hasta 250 palabras; b) se podrá publicar una tabla y/o figura; c) referencias, hasta 5. Se aceptarán solo aquellas cartas enviadas dentro del mes de haber salido la versión impresa del número de la revista donde se publicó el artículo original.

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El artículo debe estar escrito en castellano, en un procesador de texto Word (Microsoft®) y guardado con extensión *.doc. El tamaño de la página debe ser A4 o carta, con doble espacio interlineado, márgenes de 25 mm con texto justificado y con tamaño de letra de 12 puntos tipo Times New Roman o Arial. Las páginas se numerarán en forma consecutiva comenzando con la portada. El manuscrito (artículo original) debe seguir la estructura «IMR D», es decir, Introducción, Material y métodos, Resultados y Discusión (véanse las normas de publicación ICMJE). Además, debe incluir Título, Resumen, Conclusiones, Conflicto de Intereses y Bibliografía. Al final de cada artículo original, antes de las referencias, deberá hacerse como una tabla destacada de los puntos relevantes del trabajo que se llamará Resumen de Puntos Salientes.

En estos 4 o 5 renglones se deberán señalar los problemas y el conocimiento que hay en el tema tratado hasta el momento y además cuáles serían los interrogantes.

En los dos últimos renglones se destaca el aporte y/o los aportes del trabajo más relevantes sobre este tema. Al final de las referencias se escribirán los Agradecimientos y un Apéndice Suplementario cuando correspondiese en estudios aleatorizados o registros multicéntricos que necesiten reportar todos los investigadores incluidos en el estudio.

Como unidad de medida se utilizará el sistema métrico decimal, usando comas para los decimales. Todas las mediciones clínicas, hematológicas y químicas deben expresarse en unidades del sistema métrico y/o UI. Solo se utilizarán las abreviaturas comunes, evitándose su uso en el título y en el resumen. La primera vez que se empleen irán precedidas por el término completo excepto que se trate de unidades de medida estándar.

Las tablas deben presentarse en hojas individuales, numerándose de forma consecutiva utilizando números arábigos (0, 1, 2, etc.) según el orden en que fueron citadas en el texto, con un título breve para cada una de ellas. Todas las abreviaturas de la tabla no estandarizadas deben explicarse. Las notas aclaratorias deben ir al pie de la misma utilizando los siguientes símbolos en esta secuencia: *, †, ‡, §, ¶, **, ††, ‡‡, etc.

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2. *Magid DJ, Wang Y, McNamara RL, et al. Relationship between time of day, day of week, timeliness of reperfusion, and in-hospital mortality for patients with acute ST-segment elevation myocardial infarction. JAMA 2005;294:803-812. (Revistas en inglés.)*
3. *Aros F, Cuñat J, Marrugat J, et al. Tratamiento del infarto agudo de miocardio en España en el año 2000. El estudio PRIAMHO II. Rev Esp Cardiol 2003;62:1165-1173. (Revistas en español).*

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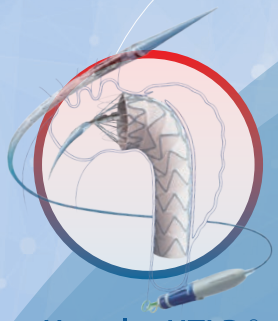

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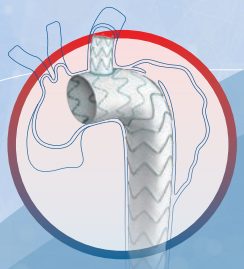

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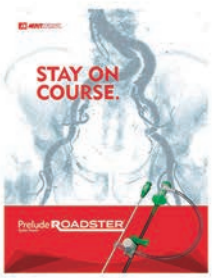

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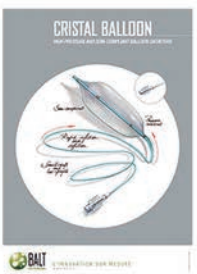

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