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COMMENTS

ORIGINAL ARTICLES

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PRESIDENT'S MESSAGE

Gonçalo Cabral
Angiology and Vascular Surgery
Hospital Beatriz Ângelo, Loures

SPCCTV 4DVisions 2021 – Together for the patients

Dear Members,

It is an honour to present our annual congress SPCCTV 4DVisions 2021, taking place from 26th to 28th November in Hotel Grande Real Santa Eulália, Albufeira.

In this year's edition, the fourth vision will be that of the Associação Portuguesa de Medicina Geral e Familiar (APMGF), one of the most representative national medical associations, incorporating the specialists that constitute the foundations of our national healthcare system.

The importance of this partnership goes way beyond the prestige and relevance of APMGF, given the difficulties the medical community is currently facing. The SARS-Cov-2 pandemic has enlightened the frailties of an healthcare system, already struggling to accomplish its mission, enhancing the need to optimize available resources, in behalf of our patients.

We strongly believe that building bridges between those who are the first line in patient's diagnosis/ treatment and Cardiac, Thoracic and Vascular surgery, will contribute to improve healthcare for all of those that had their medical assistance postponed for more than 18 months-Together for the patients!

This event will gather a faculty of national and international specialists, rewarding participants with the most recent scientific innovations and surgical techniques. As usual, hands-on practice will be one of the highlights, by means of a series of pre-congress workshops. These include echocardiography and thoracic ultrasound courses, diabetic foot sessions designed specifically for Family Medicine and, for the first time in the history of SPCCTV, live cases on pelvic embolization.

Our plenary session will have a strong focus on healthcare organization, bringing to discussion the establishment of preferential or direct referral pathways for surgical patients, the role of Family Medicine in the follow up of complex surgical patients and multidisciplinary approach in key areas of our specialities as lung cancer and diabetic foot. We are sure that this debate will be meaningful, not only for the audience, but also for the future of our healthcare system.

Another highlight of this event will be the official ceremony establishing the Alliance of Latin Societies of Cardiovascular Surgery and the agreement with the Spanish Society for Thoracic Surgery. These alliances are the corollary of the board's efforts to create educational opportunities for trainees and specialists, opening this society to training exchange programs and to the establishment of consensus with societies that share not only scientific interests, but also cultural ideals and geographic proximity.

We are confident that this will be a striking event, marked by the return to social networking, which is also an important mission of scientific societies.

The success of any event depends, not only on the commitment of its organization, but also on the enthusiasm of its participants, and, therefore, I kindly invite all the Cardiac, Thoracic and Vascular community to join us, so that SPCCTV 4DVisions 2021 becomes, once again, the celebration of multidisciplinarity.

Hope to see you soon in the Algarve, because together we are stronger!

Gonçalo Cabral | President of SPCCTV

VICE-PRESIDENT'S MESSAGE

Miguel Sousa Uva
Service of Cardiac Surgery, Hospital da Santa Cruz, Carnaxide
Department of Surgery and Physiology, Faculdade de Medicina da Universidade do Porto

Latin European Alliance of Cardiovascular Surgical Societies (LEACSS) – Towards independent evidence-based cardiovascular medicine and shared surgical education

Cardiovascular medicine is currently governed by the important standard of the scientific method, whose holy grail is evidence-based medicine. This fact is reflected in all the decisions we make, from patient assessment, interpretation of auxiliary diagnostic tests and, finally, decision on the best course of treatment, reaching the detail of defining the best conduit for a specific target vessel.

The torrential production of high-quality work from which evidence and recommendations are derived is today overwhelming for the average surgeon. The screening and quality control of the evidence that is generated is, in itself, a time-consuming and often unrewarding job, difficult to be carried out by surgeons without training in epidemiology and biostatistical analysis. Bias, cherry-picking, misreporting and inadequate leverage of composite endpoints are ubiquitous concepts that must be addressed and fought. Statistical manipulation and the influence of industry, more or less subtle, are insidious realities capable of perverting a system that is intended to be objective, free from bias, peer-reviewed and in favor of medical science. The surgeon concerned with applying the leges artis and better serving his patient, increasingly turns to entities with recognized competence to navigate this sea of evidence, such as the EACTS or the STS. Portugal, with distinct economic, populational or even social characteristics, hardly recognizes itself represented in the North American or North European realities.

Along with the constant technological development, Medicine in general and our specialty in particular, is faced with the dilemma of innovation and its implementation. Despite being indispensable for improving the results of care provided to patients, it requires, at the same time, a reputable and independent evaluation of its effects, at least in the mid-term. Innovation is seen not only in techniques, materials, devices, but also in organizational processes and analysis of results.

The ongoing transformations aim to obtain the best result with the least inconvenience for the patient, but confront us with dilemmas and trade-offs.

What will be better? Less early discomfort or a safer late outcome? Whatever the answer, the cardiac, thoracic or vascular surgeon must incorporate the new diagnostic and treatment methods in their portfolio, which is why the education and training of young surgeons is one of the most pressing issues. Education is thus one of the SPCCTV's core missions for maintaining heart-lung and vessel surgery as a relevant, autonomous discipline capable of offering the best treatment to the patient, in all circumstances.

It is true that investment is essential for technical and scientific development, but innovation and inventiveness are not always accompanied by adequate financial support. This cleavage is as great as the greater the inequality of economic realities, so evident in so many other aspects of current life.

From these premises and from the recent example of the Latin American Association of Cardiac and Endovascular Surgery, the idea was born to create the "Aliança Latino Europeia de Cirurgia CardioVascular" or the Latin European Alliance of CardioVascular Surgical Societies (LEACSS), an association of national societies of cardiac surgery (cardiovascular or cardiothoracic) which, due to their genesis, share cultural characteristics, but also similar economic and social realities. LEACSS has a unifying func-

tion, bringing the 4 founding countries together – Portugal, Spain, France and Italy – benefiting from their similarities, but also capitalizing on their differences.

There are four main objectives of LEACSS:

1. Foster relations between the founding Societies in the areas of training, education, clinical research, interaction with related specialties and dissemination of our activity to civil society.

2. Produce consensus documents/guidelines adapted to the reality of consecrated countries.

3. Encourage the production of independent evidence, analysis and dissemination of knowledge in cardiovascular medicine based on the best evidence.

4. Promote the exchange of young surgeons within member countries, training and independent research.

It is with this welcome note that we congratulate SPCCTV's integration into LEACSS, and we invite all members to be part of this initiative. We will soon more information related to this new Alliance of Latin European Societies.

Miguel Sousa Uva | Vice-President of SPCCTV

EDITORIAL COMMENT

Cristina Rodrigues
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SPCCTV and SECT: Iberic Thoracic Surgery alliance!

Thoracic Surgery was born from the fight against tuberculosis, in the late XIX century when general surgeons specialized in tuberculosis surgery. In the 1944 the discovery of streptomycin transformed tuberculosis into a medical illness. Soon after, the development of the heart–lung machine enhanced the development of Cardiovascular Surgery and most thoracic surgeons turned to Cardiac Surgery. However, a new plague in the rise, lung cancer, prompted the rebirth of Thoracic Surgery. In the late XXth century evolution in lung cancer medical therapy gave way to new perspectives for lung cancer cure. From then on, Thoracic Surgery has been developing alongside lung cancer research, into minimally invasive approaches and lung sparing techniques, requiring specific and specialized training, that has brought new advanced to the treatment of other thoracic pathologies.

In Portugal, the separation of Cardio-Thoracic Surgery residency into Cardiac and Thoracic Surgery in 2012 opened the chance for an increase in the number of specialists in this area, which has been growing each year!

Now, the Thoracic Surgeons of the Portuguese Society of Cardiac Thoracic and Vascular Surgery (SPCCTV – Sociedade Portuguesa de Cirurgia Cardíaca Torácica e Vascular) and the Spanish Society of Thoracic Surgery (SECT - Sociedad Española de Cirugía Torácica) are working in a partnership that intends to extend Thoracic Surgery cooperation on an Iberic scale, increasing scientific and clinical exchange in this area.

The agreement is to be formalized at the SPCCVT 4DVisions Congress and represents an opportunity for Thoracic Surgeons of both countries to go across the border to expand their knowledge and share their experiences.

May this cooperation flourish into an active interchange that brings forth new horizons for Thoracic Surgery!

Cristina Rodrigues

Cristina Rodrigues | Associate Editor

EDITORIAL COMMENT

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Aortoiliac occlusive disease – current approach

Almost one hundred years ago one of the "founding fathers" of contemporary Vascular Surgery, Rene Leriche, would state in a letter to the Surgical Society on the theme of occluded arteries, "the ideal treatment would be to remove the occluded zone and reestablish arterial patency but I doubt that this would ever be possible." [1]

Over the years the diagnosis of aortoiliac occlusion, the condition termed Leriche syndrome, has evolved from clinical (the classical triad of erectile dysfunction, claudication, and femoral pulse absence) to state-of-the-art computed tomographic angiography or magnetic resonance angiography with all the anatomical and hemodynamic details that is got when we add ultrasound to the equation. When it comes to treatment options, treatment has evolved from pioneering endarterectomy to aorto-femoral bypass which remains the gold standard when we search for a standard to compare with.

Endovascular intervention in the aortoiliac segment performs well and as with its open surgical counterpart achieves superior results when compared to femoro-popliteal or infra-genicular intervention. Endovascular intervention has allowed clinicians to treat high-risk patients.

Endovascular interventions used judiciously in the right situations and by the right clinicians, do not seem to preclude future open bypass options.

The management of multilevel disease is frequently seen in the older patients and when combined with open procedures in a hybrid manner provides excellent outcomes in most vascular departments.

Stent technology continues to evolve and the vast array of stents available today means that results of endovascular interventions in the aorto-iliac segment has become the standard of care that has to be referred to. The use of covered stents in the aorto-iliac segment has proven to produce superior results compared to uncovered stents. Whilst there is no argument on the usage of endovascular techniques for the treatment of TASC A-C, its use for the treatment of TASC D lesions remains controversial but nevertheless is what is being carried out in many vascular units[2]. The availability of re-entry devices has added another device to the armamentarium and results in improved results. Other factors such as the influence of sex seem to be far from being clear, as women are usually underrepresented is most studies of aortoiliac disease.

New concepts like concomitant sarcopenia, which is a natural happening of ageing, seems to be increasingly relevant as we are treating a progressively older[3].

The increasing age of western population and an increase in the prevalence of diabetes may produce new and more complex patterns of peripheral arterial disease that can challenge our current knowledge, so valuable and good evidence is warranted to make better decisions[4].

The algorithm that is used to treat patients depends on many things and is influenced by many factors - combination of local expertise and resources, the grade of disease and urgency of the intervention and patient's preference[5]. One must not forget that the ideal of reestablishing arterial patency in those that need it must be carried out in a manner that provides the best result with the lowest risk – using all available endovascular and open techniques.

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FOUNDERS

Manuel Machado Macedo

"It's not easy to be a disciple"

I am writing this biographical note on Manuel Eugénio Machado Macedo honoring the twentieth anniversary of his passing away.

More than a homage, this note represents the settling of a debt tribute to his legacy, through his personal and professional examples, while a tender evocation of our common past, full of grateful memories.

Being currently the active "inheritor" of Machado Macedo, for professing his art, for directing the service that was his service at Santa Marta's Hospital, and for holding the chair that was his chair at Universidade Nova de Lisboa, but above all for being one among many of his disciples.

As Lobo Antunes said in his preface to Celestino da Costa's autobiographical book, "It´s not easy to be a disciple". My disciple recollection of Machado Macedo follows in two striking dimensions, that I have come to know from more than twenty years of daily interactions with him: The charismatic surgical leader and man of society and culture.

Machado Macedo was truly the father of Portuguese Cardiac Surgery. For the introduction of first-time procedures among us, for the creation of new services, and for the preparation of surgical teams. Teams that he didn't just train, but that he has mentored like no one else - following them, supporting them, opening them new paths. In short, tearing open their futures. The three cardiac surgery services in the public sector in Lisbon are owed to him and to him we still owe the teams that work there today...

Machado Macedo was a surgical leader! But at a time when leadership was normally autocratic, Machado Macedo knew how to impose himself by his charisma, in a style much of his own, in which affability prevailed and authority was imposed with the most fascinating naturalness. It was truly a unique style of leadership, with ample affection and total availability, but with an undeniable authority that came from the recognition and respect that everyone felt instilled in himself while in his presence.

He exercised in life, as well as professionally, a charming aristocracy accommodated in an imposing posture, that was candidly exercised. A diplomat by nature, he hated saying no and always avoided confrontation, also not always avoiding the difficult dilemmas of conflicting expectations generated in us, dilemmas that he resolved with enormous finesse. It was his professional attitude, competent, impregnated with a genuine Hippocratic spirit, and associated with his correctly aristocratic posture, which earned him, among his peers, with undeniable justice, the nickname of "Prince of Portuguese Medicine".

But Machado Macedo was also a man of culture. From music to painting, through literature ... In fact, Manuel was already a citizen of the world, when "globalization" was not even thought of... moreover, he placed the culture he vested himself at the service of the surgical man he was. I recall long conversations in his office, when we talked about heart surgery, life stories, long travels, but also about some "unforgettable sunsets in Ponte de Lima". Conversations about everything… and even more about things of life... He was one of those doctors, rare these days, that derived from a culturally cultured generation, knew not only about Medicine, but mastered other artistic arts.

Machado Macedo always had the intuition for the right gesture, in surgery and in life. He always knew when he should move in the hospital, between hospitals, from the hospital to the medical council and then to music that he loved so much, ending up directing the São Carlos Opera theatre.... Without ever losing his temper, always with enthusiasm, without taking anything for defeat, rather taking everything with the lightheartedness of a new project that just continued the previous one... He accepted with calmness and undeniable bonhomie the generational push that imposed new challenges on him, and, at each new challenge, he always responded with enthusiasm – a dignity that requires a "special nature".

Being disciple is certainly difficult, especially when the master was so successful in his profession, and so brilliant in own life! In fact, a common mistake for disciples is

trying to imitate their former teachers. Without intending to do so, it's worth reflecting on the lessons that we, cardiothoracic surgeons, can extract from Manuel Macedo's life?

Firstly, the illustration of an extreme professionalism, the entrepreneurial and incessant search for the development of our specialty.

Secondly, the demonstration of the ability to leave a surgical, competent, fruitful, and prolific diaspora, capable of ensuring continuity, while maintaining leadership.

Finally, the mastering of blending personal and political diplomacies, at the service of professional interactions and for the management of conflicts - in practice, in personal life, in hospital and alongside society life.

When, every day, at the entrance to the service, I cross my gaze with the portrait of Machado Macedo, who seems to greet me with his almost paternal affability, having the privilege of working in the same place where he pioneered many of the techniques that we practice today, I feel that being a disciple is evermore difficult!

It is difficult because it imposes on us the challenge of honoring our master's past achievements, while venturing ourselves and our teams far beyond those same achievements into the future...As if challenging what, and whom, we have always admired.

It is hard to match Manuel Macedo's charisma, as charisma comes from the Greek word - charis (favor) and ma (offer), thus representing the offer of an attribute, (favor), which is recognizable only in personalities endowed with exceptional qualities that define them as leaders and, as such, inspiring examples for all of us.

This leadership is, indeed, Machado Macedo's best legacy, as perceived by one of his disciples today, and I believe, as should be remembered in the future by all those to whom I have tried to pass on his untouchable image of "Prince of Portuguese Medicine".

José Roquette

Former Head of Department, Cardiothoracic Surgery Department,
Hospital de Santa Marta (1996-2006)
Former Clinical Director, Hospital da Luz, Lisboa (2006-2019)

Manuel Eugénio de Machado Macedo was born the 10th February 1922 in Ponta Delgada, son of a renowned urologist. He studied in the Licée Français in Lisbon, at the time the high society school in Lisbon.

His father´s example influenced young Manuel, and Medical School was his natural career choice. Internal Medicine was his main focus during school and in the first two professional years, but Surgery was a special interest of him.

In November 1944, 22 years of age, MMM started collaborating with Jaime Celestino da Costa. Interest by respiratory and cardiocirculatory pathology started to develop, and was precipitated by his wife´s disease.

Back then, "Tisiology" was a full blown field and compelled MMM to study pathology and clinical medicine of thoracic diseases. From November 1946 to September 1947, he collaborated voluntarily in the main Hospital in Zurich, Switzerland, were, besides working in a modern Central European Hospital, he worked with Löeffler in the study off the syndrome that has his name. His work on this clinical entity demanded a strict collaboration with biochemists, radiologists and pathologists which influenced his later working process while in Portugal.

THE THORACIC OPTION

Back in Portugal, MMM returned to Jaime Celestino da Costa´s team at Hospitais Civis de Lisboa (HCL). Keeping his place in this team, he did his general residency and then the general surgery residency, which he completed in December 1951.

Simultaneously, he grew his experience in general surgery and his interest in thoracic surgery, which was back then in a very initial stage in Portugal. MMM accompanied many cases operated by his head of Department, and developed the ideia of specialising himself in this field abroad, due to the possibilities of developing thoracic surgery . The dimension and complexity of this surgery, as well as the need for a strong hospital organization, created the necessity of a lengthy stay abroad for the would-be thoracic surgeon, due to the need of

a profound pathological knowledge, complex surgical technique, and also personal relationships, which would later facilitate future hospital residencies and further stages to improve knowledge.

After receiving a British Council grant, he started a residency at the Brompton Hospital in London, dedicated to thoracic diseases, in the Autumn of 1952. Afterwards, by indication of Price Thomas (thoracic surgeon that performed the first bronchial sleeve lobectomies), he was invited to a full time clinical assistant position at the Leicester Chest Unit until July 1953. There he accumulated ward work with outpatient appointments and regular surgical activity, including as main surgeon. He was also responsible for the routine thoracic endoscopy, cardiac catheterisations and angiocardiographs. During his stay in the United Kingdom he ended up working in Edimburgh, Liverpool and Bristol and he was invited to stay a further year as a senior resident surgeon, which allowed him to complete his formation in thoracic surgery; During that period he performed more than 100 surgeries as a main surgeon, and he assisted over 600 surgeries. He created a detailed archive concerning all these operations.

Back in Portugal in 1954, he again returned to Jaime Celestino da Costa ´s team, working in Hospital do Desterro. In 1956, he was accepted as a thoracic surgery assistant at HCL. In1961 he initiated open heart surgery in Hospital de Santa Marta, offering differentiation to a small but active and extremely dedicated team. They initially performed some cases with whole body hypothermia, but after some experimental work, the first case under extra-corporeal circulation was undertaken on the 5th April 1962. These first success were indebted to Mr. John Raison, perfusionist from the Queen Elizabeth Hospital (Birmingham), who stayed with the team for two months and Alain Carpentier, back then a young surgeon, was also fundamental in helping MMM and his team tackle more complex cases . Due to that cooperation Carpentier visited Lisbon for extended periods of time, greatly possibilitating MMM´s team success.

MMM accumulated experience made him realise than efficient and safe cardiac surgery was only obtainable by a diverse team of dedicated cardiologists, paediatric cardiologists, anestesiologists, pneumologists, perfusionists, nurses, haematologists, pathologists and rehabilitation specialists. He kept structuring and developing such a team in Hospital de Santa Marta throughout the years.

At the same time he fostered frequent contact and friendship with the largest European cardiothoracic departments and their heads, facilitated by his extensive knowledge of the spanish, french, english and german languages, as well as his profound culture in art and history.

He also traveled frequently to Cardiothoracic units in the United States of America, to absorb innovation and knowledge steadily being created in this country.

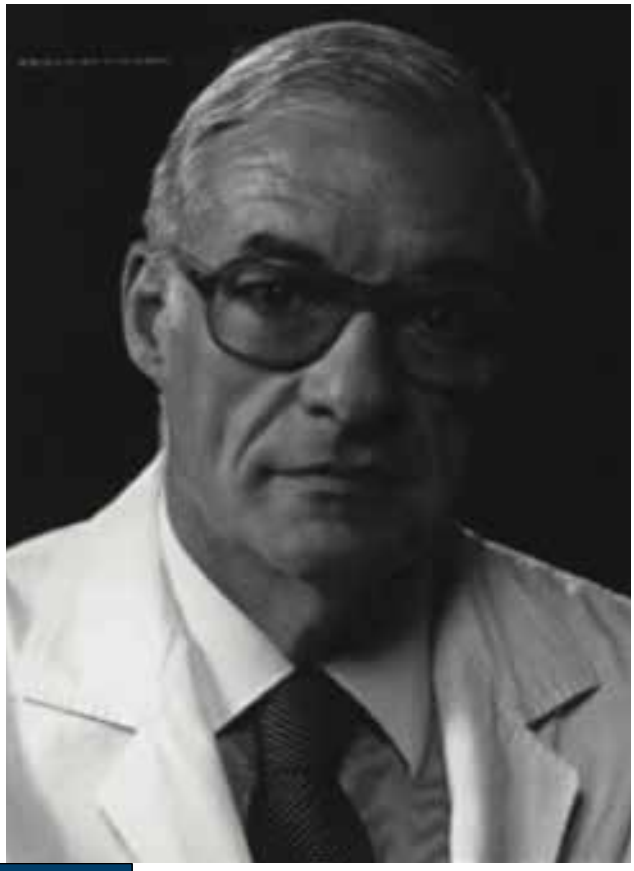

Figure 1 *Professor Manuel Machado Macedo.*

HEADWINDS

In 1973 the Cardiothoracic Department at Hospital de Santa Marta temporarily closed for renovations, and the reopening only happened in the beggining of 1975. In these times, cardiac surgery was considered less significant, and personal and social connections of MMM with the previous political regime were detrimental to his professional activity, Nevertheless, his unending energy and will made him keep up on his work. In December 1976 he presented his accumulated experience to the Portuguese Society of Cardiology: total cardiac surgery experience - 1572 patients; closed heart surgery 1281 patients, of which 305 congenital; open heart surgery 333 patients, of which 177 congenital. Tetralogy of Fallot was a shining example of his surgical results - 110 patients, with mortality under 3%.

His surgical team kept growing, and to the more experienced surgeons - Rui Bento, Rui de Lima, Ferrero Marques, Armando Serra, younger surgeons joined and were trained - Sena Lino, Queiroz e Melo, José Roquette, João Cravino, Vaz Velho, Gomes da Cruz, Moradas Ferreira, just to mention a few.

After one of his many voyages abroad, he brought with him new cardioplegia techniques, as well as the

Figure 2 *As a young medical student.*

formula for St. Thomas cardioplegia, which had been given to him by Melrose (the inventor of Melrose solution, one of the first forms of cardioplegia). He quickly created the conditions so that St. Thomas cardioplegia could be manufactured in Stª Marta pharmacy and he started using it, with excellent results. This opened new avenues for open heart surgery in Portugal, and allowed more complex operations to be undertaken.

After creating a modern cardiological unit (with state of the art medical and surgical capabilities) in Hospital de Santa Marta, he repeated the feat in Hospital de Santa Cruz; later he took over the responsibility of Head of Department in Hospital de Santa Maria, creating the modern Cardiothoracic Surgery Department in this hospital as well. He also supported the development of Cardiac Surgery in Coimbra and Porto. Even today, in Lisbon, most active cardiac surgeons were directly formed by him or by his direct disciples.

Of his work, as all human endeavours, subjected to the time and place were they occur, MMM leaves us the remembrance of the Departments he headed. MMM was an idealist of causes, of responsibility, of pioneering in cardiac surgery and of frank and fraternal clinical discussion. He was elected President of the Portugueses Medical Association between 1987 and 1992, President of the Permanent Comitee of European Union Doctors, President of the World Medical Association; President of the European Society of Cardiovascular Surgery, founder and president of the Portuguese Society for Cardiothoracic and Vascular Surgery, President and founder of the Portuguese Society of Cardiology, member of the most prestigious international scientific societies such as the American College of Surgeons, Royal College of Surgeons, American Association of Thoracic Surgery and the Society of Thoracic Surgeons.

Throughout his life, MMM published more than 250 articles and books, and supported directly or indirectly more than 500 doctors as fellows or residents. His final work is História da Medicina Portuguesa, published in 2000, the year he passed away.

"MY BOSS"

I was in the third year of Medical school the first time I heard Professor Manuel Machado Macedo, while attending a lesson on diafragmatic hernia surgery on the Hospital de Santa Maria amphitheater. Immediately aware of his superb teaching and speaking abilities, this first contact was undoubtedly determinant for my own future. A little while alter, I solicited an appointment with him which he kindly conceded me; in his bureau in Hospital de Santa Marta, we exchanged some opinions about the present and future of cardiac surgery and my interest about this specialty. By his invitation, I started attending clinical activities at his Department whenever possible. I had by then taken my decision — I wanted to be a cardiac surgeon and I wanted to have Professor Machado Macedo as my mentor.

After graduating from medical school, I again manifested my interest in Cardiac Surgery. Following the end of my General Residency, I started Cardiothoracic Surgery residency in 1973, shortly thereafter interrupted by the obligatory military service. I only returned to the Department of Cardiac Surgery in 1976, and after this, contact with Professor Machado Macedo was daily. A complex post-revolutionary period was ongoing, and only Professor MMM´s demanding attitude, firmness and ideals were able to soften the sometimes tense and unstable professional environment. A profound dedication to the Department he had created, and total availability to his team, to his patients and their families always shone through. Those were difficult but very rewarding times, which daily contact with this great man naturally turned easier.

Always mindful of his disciples´ future, he

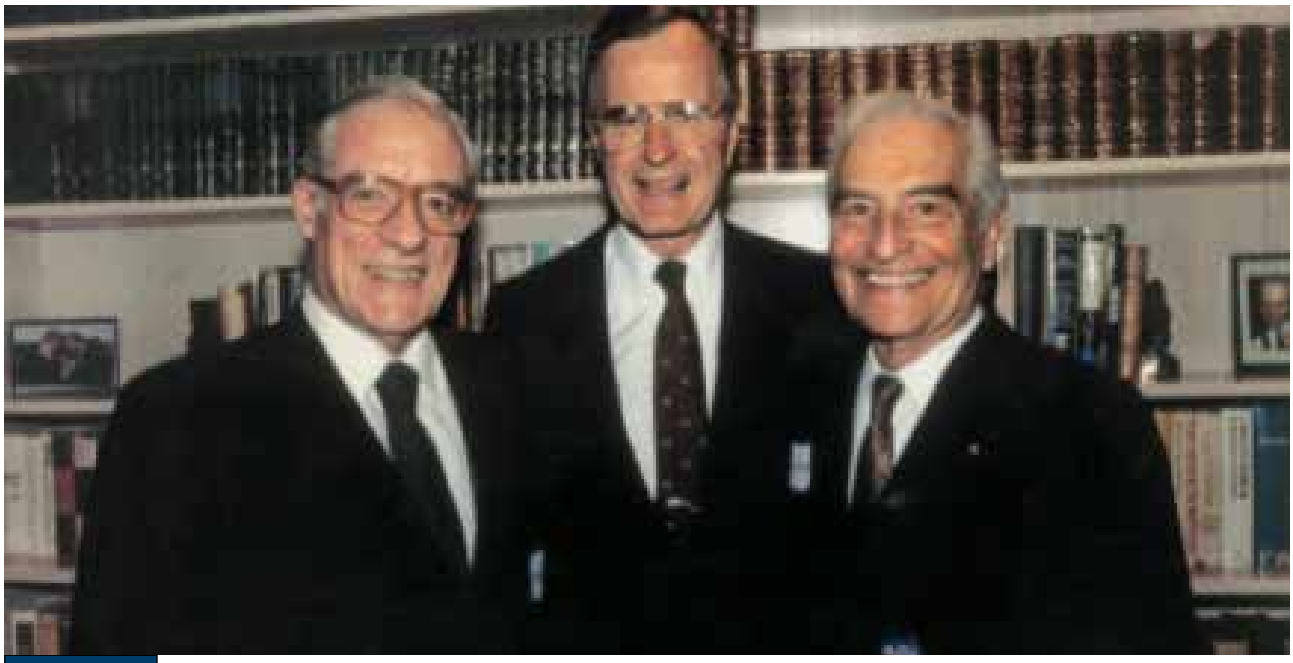

Figure 3 *Manuel Machado Macedo was a respected medical leader worldwide.*

opened up the way to increased surgical activity, surgical knowledge and innovation, and offered us contact with the greatest names of international cardiac surgery, such as Francis Fontan, Henry Cachera, Jean Paul Binet,

Alain Carpentier, Charlie Hahn, Dwight McGoon, John Kirklin, Sir Brian Barrat-Boyes, Zerbini, Adib Jatene, Ramiro Rivera, Denton Cooley, Michael deBakey, among others, names that, back then, we only knew from books and surgical publications.

He kept supporting my professional development, and following a particularly demanding exam to obtain an appointment as a senior surgeon, where I obtained the best classification, he thanked me for not letting him down; afterwards he proposed me a fellowship at Clinique Genolier dedicated to coronary surgery, to be followed by a return to Portugal as a surgeon at Hospital de Santa Cruz. I told him of my preference to remain in Hospital de Santa Marta, to which he replied "Let me think about it and I will call you tomorrow". Next day he called me and told me he agreed with me. In this moment I again confirmed his humility and excellence as a human being. He had concluded this path I preferred would be more beneficial both to me, the patients and to Santa Marta´s Department. He kept, throughout my career, to support and advise me in every moment. When I obtained my doctoral degree, he asked me to treat him without titles or deference, which I was never able to do, because for me he always was "my boss".

My relation with Professor Manuel Machado Macedo endured and grew throughout the years. We always kept contact, we had dinner regularly, we planned trips (some of them never happened). I visited him often after he got sick. He left me one of his portraits, which I keep as memory of an exceptional man. I know he would be proud of my professional path, and I know that I will always keep "my boss"´s teachings with me.

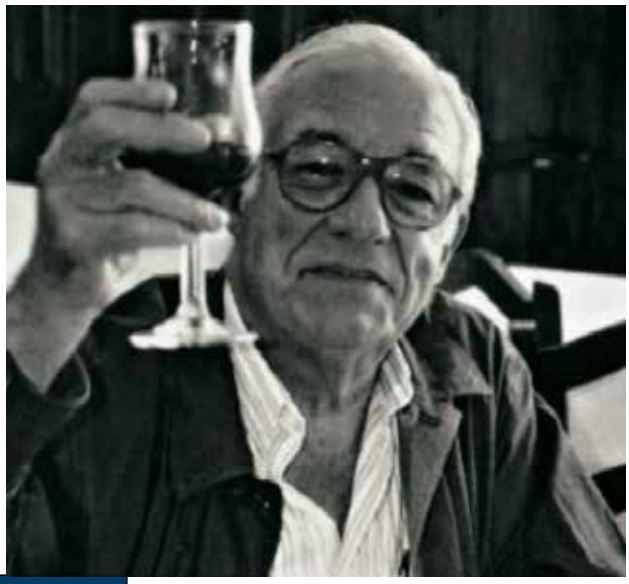

Figure 4 *Always available for his friends.*

ORIGINAL ARTICLE

SURGICAL ABLATION OF ATRIAL FIBRILLATION AND LEFT ATRIAL APPENDAGE OCCLUSION BY A TOTALLY VIDEOTHORACOSCOPIC APPROACH - NEW PARADIGM?

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Abstract

Introduction: *Atrial fibrillation (AF) contributes to increased morbidity and mortality. Pharmacological and percutaneous catheter therapies are unsatisfactory, with potential serious adverse effects. Cox-Maze III/IV surgery, with higher rates of success, has not been widely adopted because of the associated complexity of the procedure.*

Methods: *We performed a retrospective analysis of the first patients submitted to surgical ablation of AF with occlusion of the left atrial appendage with a totally videothoracoscopic (VATS) approach in our institution. We describe the surgical technique and our results, including duration of surgery, hospital stay, complications and maintenance of sinus rhythm after surgery, at 6, 12 and 18 months of follow-up.*

Results: *We studied 15 patients (ages ranging from 39 to 75 years old; 54,5% female gender). Mean time since the diagnosis of AF was 5,75 years. All had been submitted to prior catheter ablation (mean of 2 attempts). Mean diameter and volume of the left atrium was 42 mm (M-mode) and 70 ml (43 ml/m2), respectively. Mean duration of surgery was 2 hours and 22 minutes. In one patient we had to convert the surgery to median sternotomy. Mean hospital stay was 4,8 days. Mean time of follow-up was 12 months. During follow-up, 91%, 90% and 80% of the patients were in sinus rhythm at 6, 12 and 18 months, respectively.*

Conclusion: *This surgical approach represents a real benefit for those patients with multiple attempts of catheter ablation without success. However, a larger sample of patients with a longer period of follow-up is necessary for further conclusions.*

Keywords: *atrial fibrillation, surgical ablation, videothoracoscopy*

INTRODUCTION

Atrial fibrillation (AF) increases the risk of stroke by 5 times and accounts for 25% of strokes in patients over 80 years[1]. It has been identified as an independent risk factor for mortality and dementia[2]. The associated morbidity and mortality entail high costs for health systems. Anti-arrhythmic drugs have failure rates in the 1st year that reach 60%, being associated with significant adverse effects[1]. On the other hand, catheter ablation has very variable success rates after a single procedure[1].

Regarding surgical ablation techniques, Cox-Maze III/IV procedures have become the gold standard in the surgical treatment of AF, with promising long-term results, obtaining, in some series, success rates of 93% in long term follow-up[3]. Despite the success, they are technically demanding, complex, time-consuming surgeries associated with significant morbidity. It is in this context that several minimally invasive approaches for surgical ablation of AF have emerged.

METHODS

We performed a retrospective analysis of our initial experience in 15 patients who underwent surgical ablation of AF and concomitant occlusion of the left atrial appendage by VATS, between November 2017 and April 2019. It was not possible to proceed with this approach in one patient, due to extensive pleural adhesions, and he subsequently underwent open Cox-Maze surgery. We present a descriptive analysis of the characteristics of the population, describe the surgical technique used

and the results obtained, namely, duration of surgery and hospital stay, intra- and postoperative complications and conversion to sinus rhythm. In order to monitor the results of this technique, patients were evaluated by ECG at the time of discharge and at the first postoperative visit. At 6 months postoperatively they were evaluated by 24-hour Holter recording and at 12 and 18 months monitored by an external event recorder for 7 days.

RESULTS

Population

The characteristics of the population are shown in Table 1.

VATS surgical technique

The patients are placed in the supine position and intubated orotracheally through a double-lumen tube. External defibrillation paddles are used and a transesophageal echocardiogram probe is placed.

The procedure starts with the surgeon on the patient's right side, using 3 access ports. The first port is introduced into the fifth intercostal space, for video camera placement. Posteriorly, and under videothoracoscopy, the two working ports are introduced into the fourth and sixth intercostal space, approximately 45 degrees from the camera port (Figure 1).

The right phrenic nerve is identified and the pericardium incision made anteriorly and 2 centimetres parallel to it. Next, the dissection of the right pulmonary veins, oblique sinus and transverse sinus is done, allowing the insertion of the clamp for isolation of the right pulmonary veins (Figure 2) and then the upper (roof) (Figure 3) and lower lines (floor) of the box-lesion on the posterior wall of the left atrium. On the patient's left, the pericardium is opened posteriorly to the left phrenic nerve. The left pulmonary veins are isolated and the upper and lower lines of the box lesion are completed.

The bidirectional conduction block in the pulmonary veins and within the limits of the box lesion is tested (pacing with 10v output) and, finally, the left atrial appendage is excluded using a surgical clip (Figure 4) under echocardiographic control (Figure 5). The pericardium is closed. The incisions are infiltrated with ropivacaine to minimize postoperative pain.

Patients whose conversion to sinus rhythm did not occur during the procedure underwent electrical cardioversion at the end of surgery. The average duration of the intervention was 2 hours and 22 minutes.

It was necessary to convert to median sternotomy in one patient, due to hemorrhage originating in the inferior vena cava, and the procedure was completed through this approach after controlling the bleeding. 87% (n=13) of patients were extubated in the operating room and then transferred to the intensive care unit.

The average length of hospital stay was 4.8 days.

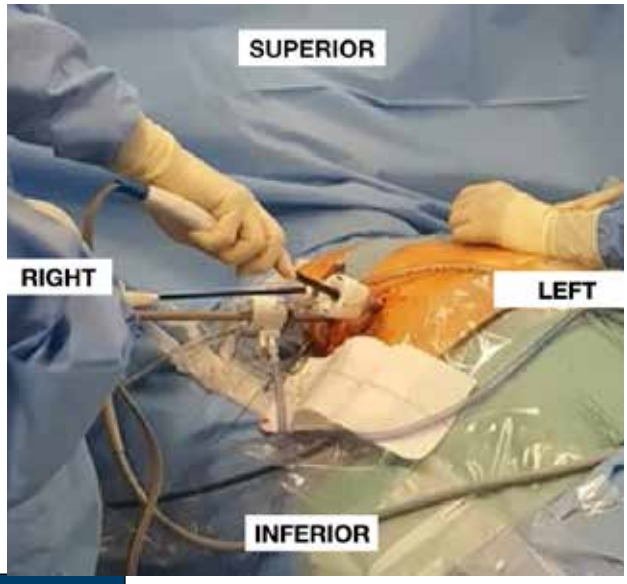

Figure 1 *Positioning of right sided 3 ports.*

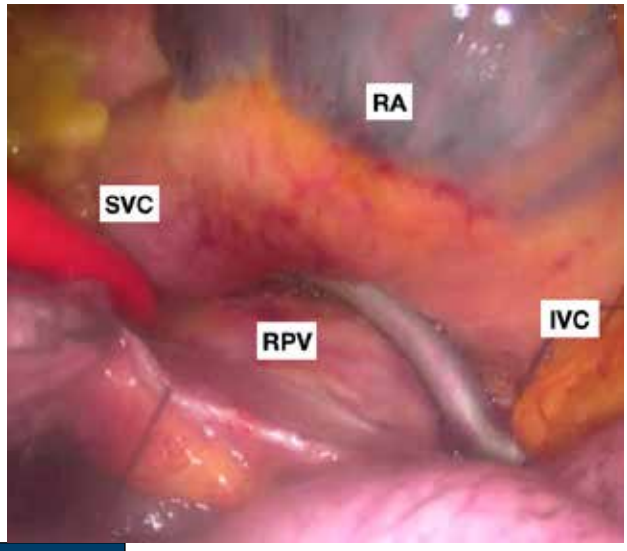

Figure 2 *Isolation of right sided pulmonary veins: RA: right atrium, IVC: inferior vena cava, SVC: superior vena cava, RPV: right pulmonary veins.*

Definitive pacemaker implantation was required in a patient with previous sinus node dysfunction.

One patient was reinterventioned on the 3rd postoperative day for hemothorax. Two patients had a prolonged hospital stay due to respiratory infections. There were no cases of stroke or mortality.

Follow-up

All patients were discharged from the hospital in sinus rhythm and maintained their previous anticoagulant therapy. Three patients (20%) were discharged medicated with antiarrhythmic drugs, namely amiodarone

and flecainide, medication they were already taking preoperatively.

The mean follow-up time was 12 months. The first outpatient evaluation was performed in the first postoperative consultation using ECG, with 91% of the patients in sinus rhythm. The first evaluation performed after the so-called blanking period (3 first months post-intervention) occurred at 6 months, using 24-hour Holter recording, with 91% of patients in sinus rhythm. At 12 and 18 months, patients were evaluated by an event recorder for 7 days, with 90% and 80% in sinus rhythm, respectively.

DISCUSSION

According to international, European and American recommendations, surgical ablation of AF alone can be considered in symptomatic patients in whom pharmacological and percutaneous ablation approaches have not been successful[4]. The results of these first-line therapies remain unsatisfactory and quite variable (influenced by the experience of the center and operator, clinical characteristics, cardiac structure and type of AF).

The effectiveness of anti-arrhythmic drugs in maintaining sinus rhythm is low, ranging between 19 and 60% in the 1st year, depending on the drug[5]. Equally or more important is the safety profile, which includes the proarrhythmic effects of this type of medication. Regarding catheter ablation, a meta-analysis including 19 studies and 6167 patients with AF followed for 28 to 71 months after multiple percutaneous ablation procedures, reports a success rate per single procedure of 65% at one year and 51% at 5 years old. After multiple procedures, the success rate increases to 86% in the first year and 78% at 5 years. The single-procedure success rate is significantly higher in patients with paroxysmal AF compared to those with persistent AF (67% versus 52%)[5].

Despite the superior results of surgical ablation, it remains reserved for symptomatic patients, in whom previous therapies were not successful, probably because the Cox-Maze procedures, even with successive alterations, are still complex, time-consuming and invasive. Minimally invasive surgical ablation approaches aim to overcome these disadvantages.

In a systematic review, which included 14 studies with 1171 patients undergoing video-thoracoscopic AF ablation, the success rate at one and two years, in patients without antiarrhythmic medication, was 78% and 77%, respectively[6]. In those who maintained the antiarrhythmic drug therapy, the success rate in the 1st year was 84%. When the results were analyzed by type of AF, patients with the paroxysmal form had better results than those with persistent AF (81% versus 63%; 95% CI)[6]. Considering that almost all patients in our series are without antiarrhythmic therapy, with 80% in sinus rhythm at 18 months, we can say that these are promising results, which are close to the published series.

Regarding complications, the same systematic review reports conversion rates to median sternotomy of 0.85%, stroke of 0.34%, pneumonia of 0.09%, mortality of 0.26% and pacemaker implantation of 0.77%, half of which had previous sinus node dysfunction.

In our series, it was necessary to convert the approach to sternotomy in two patients. A definitive pacemaker was implanted in a patient with previous sinus node dysfunction. The frequency of respiratory infections was 13% (n=2). When compared with the results of published studies, the incidence of complications in our series was higher, which we attribute to the fact that it represents the beginning of the learning curve inherent

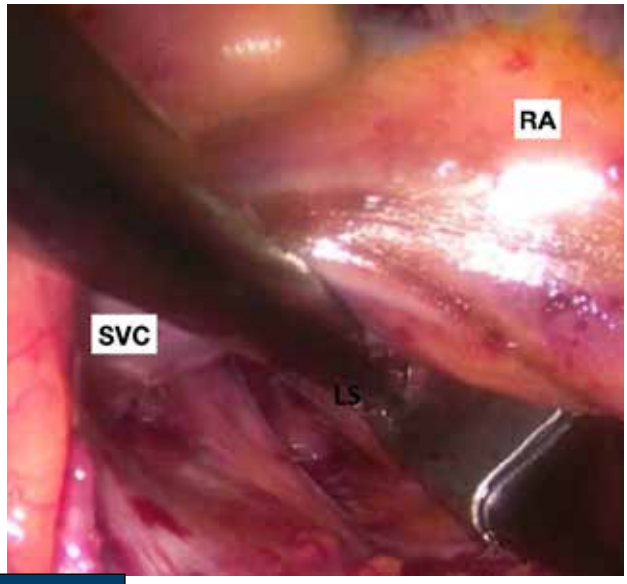

Figure 3 *Creating the upper limit of the box lesion. AD: right atrium, SVC: superior vena cava, UP: box lesion upper limit*

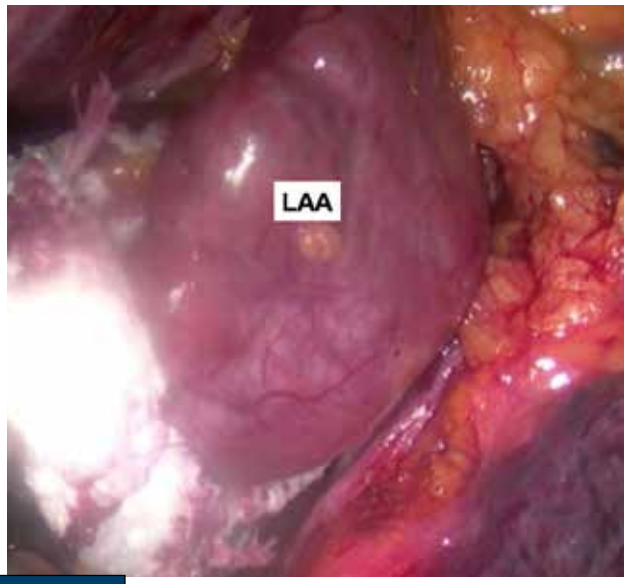

Figure 4 *Occlusion of the left atrial appendage by clip. LAA: left atrial appendage.*

Table 1 **Population characteristics**

Age (mean)	58,5 years (range 39 - 75 years)
Sex	54,5%(n=8) female
Average CHA2DS2VASc score	2
Average interval sine AF diagnosis	5,75 years
AF classification	66% paroxistic
Average LA diameter/volume	42 mm/70 ml (43 ml/m2)
Median number of previous percutaneous AF ablation	2

Figure 5 *Echocardiographic aspect after LAA occlusion.*

to any surgical procedure. We do not have any stroke nor mortality to report.

This is a population with a mean CHA2DS2VASc score of 2, which corresponds to a risk of stroke of 2.2% per year. All patients maintain anticoagulant therapy. The suspension of this and antiarrhythmic therapy will be discussed in a multidisciplinary team, and requires a longer follow-up period and longer continuous monitoring intervals, as well as the analysis of results regarding the reduction in the amount of AF (AF burden). This approach requires a multidisciplinary team, which brings together cardiologists, cardiac surgeons and anesthesiologists, dedicated to the treatment of this arrhythmia.

These are preliminary results, which represent the beginning of the learning curve, based on a small sample size and a short follow-up period. However, this is a very specific group of patients given the number of previous percutaneous interventions.

CONCLUSION

This type of surgical approach to AF represents a real benefit for patients undergoing multiple unsuccessful percutaneous ablation attempts. However, to validate its clinical impact, more follow-up time and longer periods of continuous monitoring will be needed.

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ORIGINAL ARTICLE

MAJOR PULMONARY SURGERY IN PATIENTS WITH COMPROMISED LUNG FUNCTION

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Abstract

Introduction: *The risk stratification of lung resection is fundamentally based on the results of pulmonary function tests. In patients considered to be at risk, major surgery is generally denied, opting for potentially less curative therapies.*

Objective: *To evaluate the postoperative outcomes of major lung surgery in a group of patients deemed high risk.*

Methods: *We performed a retrospective review of clinical records of all patients submitted to lobectomy, bilobectomy or pneumonectomy in a 3-year period in a reference Thoracic Surgery Unit. The patients were then divided in two groups: group A composed of patients with normal preoperative pulmonary function and group B which included patients with impaired lung function, defined as FEV1 and/or DLCO ≤60%.*

Results: *A total of 234 patients were included, 181 (77.4%) in group A and 53 (22.6%) in group B. In group B, patients had more smoking habits, were more often associated with chronic obstructive pulmonary disease and were also more frequently submitted to thoracotomy. When surgery was motivated by primary lung cancer this group had a more advanced clinical stage of the disease. In the postoperative period, these patients had longer hospital stay, longer chest drainage time and greater need for oxygen therapy at home, however, no statistically significant difference was noted in morbidity or mortality.*

Conclusions: *Major thoracic surgery can be safely performed in selected patients considered to be high risk for resection by pulmonary function tests. A potentially curative surgery should not be denied based on respiratory function tests alone.*

Keywords: *respiratory function tests, thoracic surgery, forced expiratory volume, carbon monoxide, risk assessment, lobectomy, pneumonectomy*

INTRODUCTION

Surgical risk stratification complies the analysis of a multiplicity of variables in order to establish the relative risk of the procedure towards its benefits.

Risk stratification of anatomic lung resection is fundamentally based on the results of pulmonary function tests. Forced expiratory volume in the first second (FEV1) and diffusing capacity of the lung for carbon monoxide (DLCO) are the parameters that correlate most accurately with postoperative morbidity and mortality[1-4].

Patients defined as high operative risk by pulmonary function tests are often denied lobectomy and offered less invasive alternative therapies, but also potentially less curative such as sublobar resection or stereotactic body radiotherapy in patients with lung cancer or even conservative therapy in patients with benign disease [5,6].

OBJECTIVES

The aim of this study was to evaluate the postoperative outcomes of major lung surgery (lobectomy, bilobec-

tomy or pneumonectomy) in patients considered to be at high risk according to pulmonary function tests, based on preoperative FEV1 and/or preoperative DLCO less than or equal to 60%.

MATERIALS AND METHODS

Patient population and methods

We performed a retrospective review of clinical records of all patients submitted to lobectomy, bilobectomy or pneumonectomy over a period of three consecutive years (between June 1, 2017 and May 31, 2020) in a Thoracic Surgery reference unit (Centro Hospitalar Lisboa Central). Then, patients were divided into two groups: group A composed of patients with normal preoperative lung function (FEV1 and DLCO> 60%) and group B which included patients with impaired lung function, defined as FEV1 and/or DLCO% ≤ 60%. The threshold of 60% was chosen based on previous studies that demonstrated that patients with these FEV1 or DLCO values were at increased risk of morbidity and mortality after lung resection [3,7-9]. We excluded patients without reference to FEV1 and DLCO in clinical process or missing follow-up.

The primary endpoints of this study were morbidity and mortality, defined respectively as any complication or death that occurred in the first thirty days after the surgery. The secondary endpoint was to assess patients who required home oxygen therapy after surgery.

The data collected for each patient included: sex, age, number of preoperative functional lung segments, respiratory function tests, pre-existing comorbidities and calculation of the Charlson comorbidity index 10, performance status according to the Eastern Cooperative Oncology Group [11], smoking habits, diagnosis that motivated the surgery, type of surgery performed and surgical approach, clinical and pathological stage in patients diagnosed with primary lung cancer, morbidity and mortality at 30 days of postoperative and respective Clavien-Dindo classification (Table 1)[12], length of hospital stay, chest drainage duration and need for home oxygen therapy.

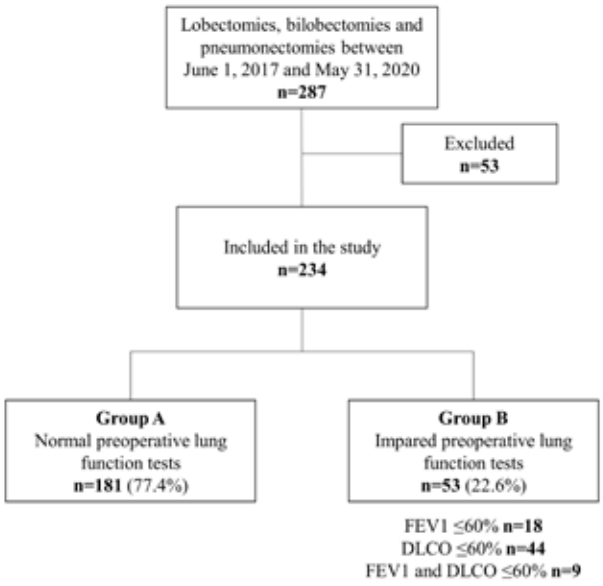

Figure 1 *Patients included in the study from June 1, 2017 to May 31, 2020. DLCO: diffusing capacity of the lung for carbon monoxide; FEV1: forced expiratory volume in the first second.*

Statistical analyses

Categorical variables are presented as frequencies and percentages, and continuous variables as means and standard deviations, or medians and interquartile ranges for variables with skewed distributions. Normal distribution was checked using skewness and kurtosis.

Categorical variables were compared with the use of Fisher's exact test or the chi-square test, as appropriate. Logistic regression was also performed.

Continuous variables were compared with the use of unpaired Student's t-test or Mann-Whitney test, as appropriate. A p-value below 0.05 was considered statistically significant.

Statistical analyses were performed using SPSS 23.0 (IBM SPSS Statistics for Windows, Version 23.0. Armonk, NY, USA).

RESULTS

Preoperative results

During the study period, 287 patients underwent lobectomy, bilobectomy or pneumonectomy. After applying the exclusion criteria, we obtained a sample of 234 patients. A total of 181 (77.4%) had normal preoperative respiratory function tests (group A) and 53 (22.6%) were defined as patients with impaired lung function (group B). In group B, 18 patients had FEV1 ≤60%, 44 patients had DLCO ≤60% while 9 patients had FEV1 and DLCO ≤60% (Figure 1). Patient demographics, clinical and pathological stages, preoperative functional status and comorbidities of the 2 groups are summarized in Table 2.

In both groups we noted a higher proportion of men, a median age of 68 years in group A and 66 yearsin group B. In group B, patients had a statistically significant higher frequency of chronic obstructive pulmonary disease (12.7% vs 35.8%, p <0.001), coronary heart disease (7.7% vs 17.0%, p = 0.047) and HIV (0.6% vs 5.7%, p = 0.037). The remaining co-morbidities were similar between the groups.

There was no significant difference between the groups when comparing the functional status according to the Eastern Cooperative Oncology Group performance status (ECOG PS) and when comparing the Charlson comorbidity index.

Table 1 **Clavien–Dindo classification of surgical complications**

I	Any deviation from the normal postoperative course without the need for pharmacological treatment or surgical, endoscopic and radiological interventions Allowed therapeutic regimens are: drugs as antiemetics, antipyretics, analgetics, diuretics and electrolytes and physiotherapy. This grade also includes wound infections opened at the bedside.
II	Requiring pharmacological treatment with drugs other than such allowed for grade I complications. Blood transfusionsand total parenteral nutritionare also included.
III	Requiring surgical, endoscopic or radiological intervention
III a	Intervention not under general anesthesia
III b	Intervention under general anesthesia
IV	Life-threatening complication (including CNS complications)* requiring IC/ICU-management
IV a	Single organ dysfunction (including dialysis)
IV b	Multiorgandysfunction
V	Death of a patient

Regarding smoking habits, we found that smoking was associated with compromisedlung function ($p < 0.001$), while not smoking was associated with normal respiratory function ($p = 0.009$). Ex-smokers showed no significant difference.

Patients with impaired respiratory function most often underwent left pneumectomy ($p = 0.011$) and had more advanced clinical stages ($p = 0.048$) according to the 8th edition of the American Joint Committee on Cancer (AJCC). Comparing the clinical stage with the pathological stage, 43.1% of patients with impaired respiratory function had upstaging and 11.8% had downstaging, however, without statistical significance.

There was also a statistically significant association between the type of surgical approach and respiratory function. Group A was more frequently submitted to minimally invasive surgery while group B was more frequently submitted to classic surgery ($p = 0.007$).

The most frequent diagnosis in both groups was primarylungcancer(89.5%and96.2%,respectively).Adenocarcinoma was also the most frequent histological type (76.5% and 58.8%, respectively), without statistical significance.

Postoperative results

To assess postoperative (30-days) complications we used the Clavien-Dindo classification and found no statistically significant difference between the degrees of classification and pulmonary function.

When we compare the risk of having or not having complications after major pulmonary surgery, regardless of the type of complication that occurred, we found that there is an increased relative risk of 17.7% in Group B (37.0% vs 54.7%, OR 1.99 CI[1.08-3.67],$p = 0.026$). However, when the logistic regression is performed excluding minor complications (Clavien-Dindo I such prolonged air leak, pneumothorax and others), the higher risk of complications in this group ceases to be statistically significant (OR 2.02 CI [0.95-4.3], $p=0.067$).In both groups, the most frequent complication was prolonged air leak, however with no statistically significant difference between groups ($p=0.584$). Group A presented 1 death (0.6%) and there was no record of mortality in Group B.

Length of hospital stay and chest drainage duration were statistically significantly higher in patients with

Table 2 **Demographic data, functional status, co-morbidities, clinical and pathological stage**

Variables	Group A (n=181)	Group B (n=53)	*p*-value
Variables	111 (61.3)	40 (75.5)	0.058
Male gender, n (%)	68 (17-85)	66 (42-86)	0.060
Age (years), median (range)	19 (12-19)	19 (15-19)	0.583
Preoperative functional segments, median (range)	93 (61-178)	79 (45-117)	<0.001
FEV1%, median (range)	75 (33-131)	58 (27-99)	<0.001
ppoFEV1%, median (range)	79 (61-153)	55 (40-88)	<0.001
DLCO%, median (range)	63 (39-135)	44 (22-70)	<0.001
ppoDLCO%, median (range)	0 (0-2)	1 (0-2)	0.100
ECOG PS, median (range)	5 (0-10)	5 (2-11)	0.463
Charlson comorbidity index, median (range)			
Comorbidities, n (%)	100 (55.2)	24 (45.3)	0.201
Arterial hypertension	18 (9.9)	6 (11.3)	0.772
Uncomplicated diabetes mellitus	5 (2.8)	0	0.591
Complicated diabetes mellitus	14 (7.7)	9 (17.0)	0.047
Coronary disease	8 (4.4)	2 (3.8)	1.000
Acute coronary syndrome	4 (2.2)	2 (3.8)	0.620
Stroke	2 (1.1)	2 (3.8)	0.222
Cardiac insufficiency	23 (12.7)	19 (35.8)	<0.001
COPD	1 (0.6)	0	1.000
Hepatic failure	3 (1.7)	0	1.000
Chronic renal disease	1 (0.6)	3 (5.7)	0.037
HIV			<0.001
Smoking habits, n (%)	31 (17.1)	26 (49.1)	0.009
Smoker	73 (40.3)	11 (20.8)	0.106
Non-smoker	77 (42.5)	16 (30.2)	0.014
Ex-smoker			
Surgery, n (%)			
Right upper lobectomy	62 (34.3)	20 (37.7)	
Middle lobectomy	13 (7.2)	2 (3.8)	
Right lower lobectomy	26 (14.4)	5 (9.4)	
Left upper lobectomy	38 (21.0)	16 (30.2)	
Left lower lobectomy	36 (19.0)	4 (7.5)	0.036
Upper bilobectomy	2 (1.1)	0	
Lower bilobectomy	2 (1.1)	1 (1.9)	
Right pneumonectomy	2 (1.1)	2 (3.8)	
Left pneumonectomy	0	3 (5.7)	0.011
Systematic lymph node dissection, n (%)	173 (95.6)	53 (98.1)	0.688
Surgical approach, n (%)			0.007
Thoracotomy	62 (34.3)	29 (54.7)	
VATS	119 (65.7)	24 (45.3)	

Variables	Group A (n=181)	Group B (n=53)	*p*-value
Diagnosis, n (%)			
Primary lung cancer	162 (89.5)	51 (96.2)	0.175
ADC	124 (76.5)	30 (58.8)	
SCC	19 (11.7)	14 (27.5)	
SCLC	3 (1.9)	2 (3.9)	
Other	16 (9.9)	5 (9.8)	
Metastatic cancer	12 (6.6)	1 (1.9)	0.307
Infectious disease	5 (2.8)	0	0.591
Bronchiectasis	5 (100)	0	
Other	2 (1.1)	1 (1.9)	0.539
Hyaline fibrosis	1 (50)	0	
Inflammatory pseudotumor	1 (50)	0	
Synovial sarcoma	0	1 (100)	
Clinical stage, n (%)			0.048
IA1	8 (4.9)	2 (3.9)	
IA2	45 (27.8)	8 (15.7)	
IA3	39 (24.1)	7 (13.7)	
IB	21 (13.0)	11 (21.6)	
IIA	10 (6.2)	8 (15.7)	0.036
IIB	21 (13.0)	6 (11.8)	
IIIA	15 (9.3)	5 (9.8)	
IIIC	1 (0.6)	0	
IVA	2 (1.2)	4 (7.8)	0.025
Pathological stage, n (%)			0.180
No tumor	2 (1.2)	2 (3.9)	
IA1	8 (4.9)	2 (3.9)	
IA2	28 (17.3)	4 (7.8)	
IA3	35 (21.6)	5 (9.8)	
IB	27 (16.7)	11 (21.6)	
IIA	9 (5.6)	6 (11.8)	
IIB	22 (13.6)	10 (19.6)	
IIIA	21 (13.0)	6 (11.8)	
IIIB	5 (3.1)	1 (2.0)	
IVA	5 (3.1)	4 (7.8)	
Upstaging, n (%)	55 (34.0)	22 (43.1)	0.234
Downstaging, n (%)	23 (14.2)	6 (11.8)	0.659

ADC: adenocarcinoma; COPD: chronic obstructive pulmonary disease; DLCO: diffusing capacity of the lung for carbon monoxide; ECOG PS: Eastern Cooperative Oncology Group Performance Status; FEV1: forced expiratory volume in the first second; HIV: human immunodeficiency virus; ppoDLCO: predicted postoperative diffusing capacity of the lung for carbon monoxide; ppoFEV1: predicted postoperative forced expiratory volume in the first second; SCC: squamous cell carcinoma; SCLC: small cell lung cancer; VATS: Video-assisted thoracoscopic surgery

impaired respiratory function (p = 0.003 and p = 0.005, respectively).

When assessing the need for home oxygen therapy, we found that in group B, 3 patients needed this therapy, with statistical significance (p = 0.011). Of the 3 patients referred, 1 required oxygen for walking, 1 required oxygen therapy for 4 months and 1 required non-invasive ventilation by night.

The postoperative outcomes of the 2 groups are described in Table 3.

DISCUSSION

In this study, patients with FEV1 and/or DLCO ≤60% had more smoking habits, were more frequently associated with chronic obstructive pulmonary disease and had more advanced clinical stages when the main diagnosis that motivated the surgery was the primary lung cancer. Contrary to what might be expected, patients in group B did not have a statistically significant worse performance status or worse Charlson comorbidity index [1,5].

We also found that patients of group B were more frequently submitted to thoracotomy, while patients with normal respiratory function were more frequently submitted to minimally invasive video-assisted thoracoscopic surgery (VATS) with statistical significance. However, there are already studies including patients with impaired respiratory function, that conclude VATS lobectomy is associated with a lower risk of morbidity when compared to the conventional approach, especially in patients with early stages of lung cancer [7,13]. In our study, the authors believe that the compromised group had more often hilar nodal disease or central tumours that contributed to more thoracotomies. Furthermore, compromised lung function was more associated with previous infectious lung disease, such as pulmonary tuberculosis, that increased the risk of pleural adhesions that did not allow to proceed with a VATS technique. Unfortunately, this data and the conversion rate is not recorded in digital records. Although more than 60% of anatomical pulmonary resection surgeries are performed in this Thoracic Surgery Unit by VATS, the authors consider that it is still possible to increase the ratio VATS/thoracotomy approach, especially in patients considered at risk according to the respiratory function tests.

Patients with impaired lung function also had longer hospital stay, longer chest drainage duration and more need of supplemental oxygen therapy at home, which is in agreement with previous studies [5,6,14]. Despite this group of patients presenting, as expected, a higher relative frequency of complications in the postoperative period, in this study we found no significant difference between major complications and lung function. In fact, the most frequent postoperative complications do not jeopardize the patient's life. In 83.8% in group A and 82.8% in group B, complications were solved with conservative therapy such as respiratory physiotherapy, analgesia and antibiotics when justified.

The most important finding of this study is that patients with compromised lung function undergoing major thoracic surgery are not associated with statistically significant greater morbidity or mortality. Therefore, it is possible to perform this type of surgery in patients considered to be at risk and surgical treatment should not be denied based on respiratory function tests only, especially when surgery is considered the best option to treat the patient. These data are in accordance with the studies published by Bongiolatti and Subroto in 2020 and 2013, respectively[1,5]. It should also be noted that, although our study found no association with the performance status (ECOG PS) or comorbidities prior to surgery, these data should not be overlooked in the initial assessment of the patient since they have been associated with predictors of morbidity and mortality [15]. In fact, in our study, patients had excellent performance status and acceptable comorbidities, overcoming the impact that impaired lung function could have on postoperative recovery, as described in the literature[5]. That explains why patients at higher risk do not show a significant increase in morbidity or mortality.

In order to try to understand if the patient will tolerate major thoracic surgery, in addition to the assessment of performance status, comorbidities and respiratory function tests with FEV1 and DLCO, other preoperative studies can be performed in patients at risk, as ergometry, the 6-minute walking test or ventilation-perfusion lung scan[3,5]. However, these complementary studies are not always available and their performance often implies delaying surgical treatment, which can be harmful to the patient, so they are not usually performed and were not included in this study.

Finally, the authors would like to point out that most studies comparing postoperative results between groups with normal respiratory function and groups with impaired respiratory function were performed in patients diagnosed with lung cancer[1,2,4,5,13,16,17], however, it is also important to evaluate these results in patients with benign pulmonary pathology, since in these cases surgical treatment is more easily postponed, opting for alternative therapies that often do not completely resolve the pathology of the patient, implying greater relapse, more hospitalizations and worse quality of life. Thus, it is explained that in this study all lobectomies, bilobectomies and pneumonectomies performed in a period of 3 years were included, regardless of the diagnosis that justified the surgical need.

Limitations

Our study has some limitations. First, it has all of the inherent biases associated with a retrospective analysis. Second, the authors chose to define the group of patients with compromised lung function according to the values in percentage of FEV1 and DLCO (FEV1% and DLCO%) instead of the postoperative predictive values of

Table 3 **Postoperative results**

Variables	Group A (n=181)	Group B (n=53)	*p*-value
Clavien-Dindo classification, n (%)			0.395
I	44 (24.3)	17 (32.1)	0.257
II	13 (7.2)	7 (13.2)	0.171
III a	2 (1.1)	1 (1.9)	0.539
III b	5 (2.8)	3 (5.7)	0.385
IV a	3 (1.7)	1 (1.9)	1.000
V	1 (0.6)	0	1.000
Complications, n (%)	67 (37.0)	29 (54.7)	0.026
Impared lung function	0	2 (3.8)	0.051
Arrhythmia	1 (0.6)	2 (3.8)	0.129
Stroke	1 (0.6)	0	1.000
Thoracic empyema	3 (1.7)	3 (5.7)	0.131
Bronchopleural fistula	1 (0.6)	0	1.000
Bronchial fistula	0	1 (1.9)	0.226
Prolonged air leak	38 (21.0)	13 (24.5)	0.584
Haemothorax,	3 (1.7)	2 (3.8)	0.317
Other	6 (3.3)	3 (5.7)	0.427
Cardiac arrest	1 (0.6)	0	1.000
Pneumonia	9 (5.0)	3 (5.7)	0.737
Pneumothorax	3 (1.7)	0	1.000
Chylothorax	1 (0.6)	0	1.000
Deaths, n (%)	1 (0.6)	0	1.000
Chest drainage duration (days), median (range)	4 (1-30)	5 (2-33)	0.005
Length of hospital stay (days), median (range)	5 (2-33)	7 (2-36)	0.003
Home oxygen therapy, n (%)	0	3 (5.7)	0.011

DLCO: diffusing capacity of the lung for carbon monoxide; FEV1: forced expiratory volume in the first second.

FEV1 and DLCO (ppoFEV1% and ppoDLCO%), based on previous studies and because different studies that use ppoFEV1% and ppoDLCO% calculate these values with different formulas, making it difficult to compare them. Finally, the authors also decided not to include other parameters that can be used in the preoperative risk assessment, such as ergometry or the 6-minute walking test, since they are rarely available in clinical practice, reducing our population due to lack of data.

CONCLUSION

Patient's previous lung function is the main risk factor for morbidity and mortality in major thoracic surgery. The present study demonstrates the non-inferiority of surgery in the group of patients with impaired lung function. In summary, a potentially curative surgery should not be denied to these patients based only on respiratory function tests, but complemented with other cardiorespiratory functional tests, such as ergometry, or lung ventilation-perfusion scintigraphy, analysis of other comorbidities and global performance status, determining which patients will benefit from surgical treatment with acceptable morbidity and mortality rates.

CONFLICTS OF INTEREST

The authors have no conflicts of interest to declare.

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ORIGINAL ARTICLE

POSTOPERATIVE ATRIAL FIBRILLATION - VIDEO-ASSISTED THORACOSCOPIC SURGERY VERSUS OPEN SURGERY

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Abstract

Objectives: *Compare the incidence of Postoperative atrial fibrillation (PAF) after anatomical lung resection for Non-Small-Cell Lung Cancer (NSCLC) following open surgery versus VATS.*

Methods: *Single center retrospective study of all consecutive patients diagnosed with NSCLC submitted to anatomical lung resection from 2015 to 2019 (N=564). Exclusion criteria: prior atrial fibrillation, previous lung surgery, concomitant procedures, pneumectomy, non-pulmonary resections, urgency surgery. Study population of 439 patients. Primary end-point: incidence of PAF.*

Univariable analysis was used to compare the baseline characteristics of the 2 groups. Inverse probability of treatment weighting (IPTW) multivariable logistic regression was used including 23 clinical variables to analyze the effect of the approach. The balance was assessed by standardized mean differences.

Results: *Thoracotomy was performed in 280 patients (63.8%) and 159 (36.2%) were submitted to VATS. Patients submitted to VATS were more likely to be females, had a lower prevalence of non-adenocarcinoma cancer, stage TNM III-IV, Diabetes Mellitus, respiratory disease, and chronic heart failure. They were submitted less often to neoadjuvant therapy, bilobectomy and they presented higher levels of diffusing capacity for carbon monoxide. After IPTW adjustment, all clinical covariates were well balanced.*

PAF occurred in 8.6% of the patients undergoing thoracotomy and 3,8% of the patients after VATS. After IPTW adjustment, VATS was not associated with a lower incidence of PAF (OR 0.40; CI95%:0.140-1.171; p=0.095).

Conclusion: *In this study, minimally invasive non–rib spreading VATS did not decrease the incidence of PAF when compared with standard thoracotomy regarding anatomical lung resection for NSCLC.*

Keywords: *diffusing capacity for carbon monoxide, non-small-cell lung cancer, postoperative atrial fibrillation, standard deviation, video-assisted thoracoscopic surgery*

INTRODUCTION

Postoperative atrial fibrillation (PAF) is one of the most common complications after noncardiac thoracic surgery, with reported rates between 4 and 37%. The incidence of PAF contributes to increased morbidity, such as increased risk of stroke, atrial thrombosis and systemic embolization, postoperative mortality and increases hospital stay and costs significantly[1-4].

There are some hypotheses for the etiology of PAF, as autonomic denervation or surgical stress induced by ribs spread, but the etiology of this condition remains unclear[1,2].

It is proved that video-assisted thoracoscopic surgery (VATS) has significantly less morbidity and a shorter hospital stay than open procedures[2-7]. Nevertheless, there are conflicting data regarding if VATS is related to incidence of PAF[1-7].

This study reviews the experience with anatomical lung resection for non-small-cell lung cancer (NSCLC) at a single center with the aim to compare the incidence of PAF following open surgery versus VATS.

MATERIALS AND METHODS

A retrospective research was conducted to identify all consecutive patients diagnosed with NSCLC submitted to anatomical lung resection at the Hospital Pulido Valente, between January 2015 and June 2019. The initial population included 564 patients. Patients with prior atrial fibrillation (26), previous lung surgery (29), concomitant procedures (10), pneumectomy (14), non-pulmonary resections (41), urgency surgery (5). were excluded. These exclusion criteria were selected a priori. Therefore, the study population consisted of 439 patients operated during a 5 year interval. We categorized patients into the following two groups according to the type of procedure: thoracotomy or VATS.

Table 1 **Operative data**

Procedure	Thoracotomy (n=280) n(%)	VATS (n=159) n(%)
Segmentectomy	11 (3.9)	4 (2.5)
Lobectomy	245 (87.5)	153 (96.2)
Bilobectomy	24 (8.6)	2 (1.3)

VATS: video-assisted thoracoscopic surgery

Operative technique

Operability was determined based on the existing guidelines for pulmonary resection. The operative data are listed in Table 1. Thoracotomy was performed in 280 (63.8%) patients. One hundred and fifty-nine patients (36.2%) were submitted to video-assisted thoracoscopic surgery (VATS). Patients converted from VATS to open surgery for any reason were assigned to thoracotomy group.

It was used an endoscopic stapler to divide the fused fissures/ intersegmental planes and to section the hilar structures. All patients were submitted to mediastinal lymph node dissection.

All patients received epidural analgesia or an intercostal nerve block for pain control.

Outcomes

Primary end-point was PAF defined by in-hospital electrocardiographically documented atrial fibrillation requiring initiation of pharmacological therapy.

Secondary end-point was the incidence of other postoperative complications, defined as a composite endpoint including at least one of the following in-hospital variables: primary respiratory failure atelectasis, respiratory infection, empyema, bleeding requiring surgery and reoperation.

Statistical Analysis

Categorical variables were expressed as absolute numbers and percentages and continuous variables were expressed as mean (standard deviation (SD)). Kolmogorov-Smirnov test was used to access the normal distribution.

Fisher's tests and t tests were used to compare the baseline characteristics of the 2 groups when data were dichotomous or distributed normally. The Wilcoxon signed-rank test was used for nonnormally distributed data.

We use inverse probability of treatment weighting (IPTW) multivariable logistic regression model to obtain unbiased estimates of average procedure effect on PAF 8. A total of 23 clinical variables were included in the model: age, gender, previous tumor, neoadjuvant treatment, Tumor, Node, Metastasis 8th edition (TNM) staging system III-IV, thoracotomy/VATS, bilobectomy, non-adenocarcinoma, hypertension, Diabetes Mellitus (DM), smoking (included ex-smokers), stroke, peripheral vascular disease, coronary artery disease, chronic heart failure, respiratory disease, gastrointestinal disease, anticoagulant therapy, diffusing capacity for carbon monoxide (DLCO%), serum hemoglobin, FEV1%, smoking index, use of beta-blockers. The balance between treatment groups after IPTW was assessed by standardized mean differences (SMD), with a difference of 10% or less considered ideal.

A probability value of $p<0.05$ was considered statistically significant. All analyses were performed using IBM SPSS Statistics for Windows, Version 23.0. (IBM Corp. Armonk, NY).

RESULTS

Patient Characteristics

Two hundred and eighty patients (63.8%) were submitted to thoracotomy and 159 patients (36.2%) were submitted to VATS. The demographic and clinical characteristics of these patients are summarized in Table 2. Briefly, patients submitted to VATS were more likely to be females ($p=0.004$), had a lower prevalence of non-adenocarcinoma ($p<0.001$) cancer, TNM stages III-IV ($p=0.001$) and no previous diagnosis of DM ($p=0.028$), chronic heart failure ($p=0.026$) or respiratory disease ($p=0,042$). They were submitted less

Table 2 **Patient demographics and comorbidities**

Demographics	Thoracotomy (n=280) n (%)	VATS (n=159) n (%)	*p*-value
Male sex	190 (67.9)	87 (54.7)	0.004
Mean age (years)	65.7	65.0	0.492
Non-adenocarcinoma	106 (37.9)	31 (19.5)	<0.001
TNM III-IV	67 (24.3)	18 (11.8)	0001
Neoadjuvancy	43 (15.4)	6 (3.8)	<0.001
Bilobectomy	24 (8.6)	2 (1.3)	0.001
DLCO% (mean)	78.7	84.5	0.001
FEV1% (mean)	89.2	91.5	0.222
Serum Hb g/dL (median)	13.4	13.7	0.188
Serum Creatinine mg/dL (mean)	0.93	0.86	0.261
Comorbidities			
Previous tumor	53 (18.9)	28 (17.6)	0.418
Arterial Hypertension	160 (57.1)	91 (57.2)	0.533
DM	48 (17.1)	16 (10.1)	0.028
Dyslipidemia	118 (42.1)	71 (44.7)	0.340
Smoker/ex-smoker	197 (70.4)	102 (64.2)	0.109
Mean smoking index (pack-year)	38.9	33.4	0.081
Stroke	22 (7.9)	6 (3.8)	0.066
Coronary artery disease	25 (8.9)	7 (4.4)	0.056
Chronic heart Failure	8 (2.9)	0 (0)	0.026
Peripheral vascular disease	12 (4.3)	5 (2.1)	0.376
Respiratory disease	90 (32.1)	38 (23.9)	0.042
Gastrointestinal disease	33 (11.8)	21 (13.2)	0.384
Anticoagulant therapy	2 (0.7)	1 (0.6)	0.702
Beta-blocker	41 (14.6)	24 (15.1)	0.501

DLCO%: diffusing capacity for carbon monoxide; DM: Diabetes Mellitus; FEV1%: forced expiratory volume in 1 s; Hb: Hemoglobin; TNM: Tumor, Node, Metastasis; VATS: video-assisted thoracoscopic surgery

often to neoadjuvant therapy (p<0.001), bilobectomy (p=0.001) and they presented higher levels of diffusing capacity for carbon monoxide (p=0.001). After IPTW adjustment, all clinical covariates were well balanced (Table 3).

PAF and outcomes

Globally, PAF occurred in 30 (6.8%) patients. Twenty-four patients (8.6%) submitted to thoracotomy and 6 (3,8%) patients after VATS presented PAF. After adjustment using the IPTW approach, VATS was not associated with a lower incidence of PAF (OR 0.40; CI95%:0.140-1.171; p=0.095).

There were no differences in other postoperative in-hospital complications, including primary respiratory failure atelectasis, respiratory infection, empyema, bleeding requiring surgery or reoperation (Table 4).

The mean length of stay was 8.7 (SD:6.8) days. The length of hospital stay was significantly greater for patients with AF compared with patients who did not have AF (p=0.001).

DISCUSSION

PAF remains one of the most frequent complications following pulmonary resection in lung-cancer patients, with described rates between 4 and 37%. The difference in incidence rates among the several studies can be explained by differences in PAF definitions, monitoring techniques, and prevention strategies[1-4]. The incidence of PAF in our study was 6.8%, encompassed in the referred range.

Several risk factors have been identified for the development of PAF. However, the type of surgical approach has been presented with conflicting data. It is widely known that VATS approach presents with significantly less morbidity after lung resection. For that reason, some studies suggest that incision-related effects may be responsible for the pathogenesis of PAF, defending VATS as a procedure with lower incidence of this complication. Ivanovic et al.[1] reported thoracotomy with a higher incidence of PAF in 3.6 folds compared to VATS; in the studies of Papiashvilli et al.[5] and Villamizar et al.[6], it was analysed only patients submitted to lobectomy/bilobectomy or lobectomy respectively and they identified a lower incidence of PAF on VATS approach. None of these researches were patient-matched.

Nevertheless, several studies with non-matched patients referred no difference between the two approaches[2,3]. Park et al.[4], with age and gender matched patients, reported equal frequency of AF after lobectomy regardless of the surgical approach[11]. From the analysis of the case-matched patients of European Society of Thoracic Surgeon database, Falcoz et al.[7] observed no difference in the incidence of PAF between the two groups. These referred studies support the concept that autonomic nerve system may play an important role in PAF - during the surgery, the autonomic nerves passing through pulmonary hilum are damaged, leading to unilateral denervation of cardium. This dissection is similar between VATS and thoracotomy, resulting in similar incidence of PAF[2]. Due to the retrospective nature of our research, we use inverse probability of treatment weighting to obtain unbiased estimates of average approach effects8. After the adjustment, VATS was not associated with a lower incidence of PAF.

In addition to increased morbidity and mortality, previous studies reported that PAF contributed to a longer hospitalization. In our study, PAF was also associated with prolonged length of stay.

This study has multiple limitations. It is based on the retrospective analysis of a population operated by different surgeons in a single center. The final decisions to select patients for surgery and the choice of surgical procedure may vary among surgeons.

Due to the low number of segmentectomies (N=15) and the fact that it is considered a less invasive procedure, they were considered with the lobectomies for statistical analysys. Only bilobectomies were analysed separately.

Table 2 **Standardized Differences in Baseline Variables Before and After Inverse Probability of Treatment Weighting**

Demographics	SMD Before IPTW (%)	SMD After IPTW (%)
Male sex	27	3
Age	6	9
Non-adenocarcinoma	32	4
TNM III-IV	32	7
Neoadjuvancy	32	8
Bilobectomy	32	8
DLCO%	32	9
FEV1%	12	8
Serum Hb	13	3
Serum Creatinine	11	7
Comorbidities		
Previous tumor	8	1
Arterial Hypertension	6	7
DM	21	2
Dyslipidemia	9	6
Smoker/ex-smoker	15	8
Smoking index	17	7
Stroke	18	1
Coronary artery disease	18	1
Chronic heart Failure	21	1
Peripheral vascular disease	9	8
Respiratory disease	20	1
Gastrointestinal disease	8	1
Anticoagulant therapy	4	1
Beta-blocker	6	9

DLCO%: diffusing capacity for carbon monoxide; DM: Diabetes Mellitus; FEV1%: forced expiratory volume in 1 s; Hb: Hemoglobin; TNM: Tumor, Node, Metastasis; VATS: video-assisted thoracoscopic surgery

Another limitation is the exclusion of other risk factors, such as electrolyte imbalance.

In summary, this study reports that minimally invasive non–rib spreading VATS did not decrease the incidence of PAF when compared with standard thoracotomy regarding anatomical lung resection for NSCLC, in our cohort of patients.

CONFLICT OF INTEREST

None declared

Table 4 **Operative data**

Morbidity	Thoracotomy (n=280) n(%)	VATS (n=159) n(%)	Adjusted OR (95% CI)	*p*-value
PAF	24 (8.6)	6 (3,8)	0.40 (0.140-1.171)	0.095
Primary respiratory failure	8 (2.9)	2 (1.3)	0.78 (0.160-3.776)	0.755
Respiratory infection	36 (12.9)	11 (6.9)	0.86 (0.330-2.249)	0.760
Empyema	6 (2.1)	2 (1.3)	0.46 (0.089-2.388)	0.357
Bleeding	9 (3.2)	4 (2.5)	0.73 (0.196-2.713)	0.637
Reoperation	13 (4.6)	5 (3.1)	0.57 (0.181-1.824	0.347
Total	74 (26.4)	21 (13.2)	0.59 (0.280-1.156)	0.119

PAF: postoperative atrial fibrillation; VATS: video-assisted thoracoscopic surgery

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ORIGINAL ARTICLE

RECURRENT VARICOSE VEINS FOLLOWING SMALL SAPHENOUS VEIN SURGERY: A 5-YEAR FOLLOW-UP DUPLEX ULTRASOUND STUDY

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Abstract

Introduction: *Chronic venous disease (CVD) of the lower limbs is a very prevalent medical condition with important socioeconomic repercussions. Small saphenous vein (SSV) incompetence, although less frequent than great saphenous vein (GSV) incompetence, presents a more challenging treatment, with higher rates of complication and recurrence.*

Objectives: *To determine the incidence and associated risk factors of varicose veins recurrence in patients submitted, for the first time and exclusively, to SSV surgery with 5 years of follow-up.*

Methods: *Retrospective analysis of all exclusively first-time SSV surgeries, at Angiology and Vascular Surgery Service of Hospital Beatriz Ângelo, between January 1st, 2013, and December 31st, 2014. In March 2019, the authors performed clinical and venous doppler ultrasound reassessment of all included patients.*

Results: *A total of 23 limbs were evaluated, 56.5% were female and the mean age was 51.8 years. All patients were symptomatic and underwent ligation of the saphenopopliteal junction (SPJ), 26.1% and 43.5% had total and partial SSV stripping, respectively. After venous doppler ultrasound at 5-year follow-up, we found that 21.7% did not present a correct SPJ ligation due to failure to identify its location, with a statistically significant association between SPJ ligation and varicose vein recurrence. In follow-up, we also diagnosed GSV incompetence in 21.7% for the first time, which is in agreement with the fact that this is a chronic disease. Finally, we found that all patients with symptomatic recurrence at 5-year follow-up had CVD, however, some asymptomatic patients also had ultrasound changes.*

Conclusion: *Routine preoperative localization of the SPJ by doppler ultrasound guidance could have an impact in minimizing varicose vein recurrence. Imaging recurrence does not always translate into clinical recurrence. Because this is a chronic disease, patients should keep general care to prevent disease progression, even after surgery.*

Keywords: *saphenous vein, varicose veins, recurrence, doppler ultrasound*

INTRODUCTION

Chronic venous disease (CVD) of the lower limbs is a very common medical condition globally (20 - 60%). In most cases it is responsible for deterioration of patient's quality of life, and important socioeconomic repercussions. The disease itself and its complications can be responsible for chronic and disabling pain, resulting in the loss of regular working days, and shortening of the active working lifespan.[1]

It may or not be symptomatic and includes a wide range of clinical signs ranging from minimal superficial venous dilation to chronic skin changes such as pigmentary dermatitis, lipodermatosclerosis, atrophie blanche or ulcers.[1]

The etiology is not yet fully understood, however, some

of the risk factors associated with the development of varicose veins have been identified, such as female gender, advanced age, family history, multiple pregnancies, obesity, some dietary habits and prolonged orthostatism. [1-3]

The descriptive classification of CVD, developed by Porter and Moneta in 1995, considers its clinical signs (C), etiology (E), anatomical distribution (A) and associated pathological changes (P) - CEAP (Table 1). [3, 4]

Incompetence of the small saphenous vein (SSV), although less frequent than the incompetence of the great saphenous vein (GSV), occurs in about 20% of patients with varicose veins and has been associated as an important cause of CVD. When compared to GSV, its treatment is more challenging, has higher rates of recurrence (up to 52% at 3 years), and is frequently associated with postoperative complications, such as paresthesia (19% to 31%), nerve injury (1.1% to 6.7%), deep vein thrombosis (up to 1.2%) or pulmonary embolism (rare).[5-11]

The classic surgical treatment of varicose veins in the SSV territory is based on the ligation of the saphenopopliteal junction (SPJ). Partial or total stripping of the SSV is not routinely performed, being reserved only for patients in whom the SSV is incompetent.[11]

Table 1 **CEAP classification for chronic venous disorders**

C – Clinical Classification	E – Etiology Classification
C0: No visible or palpable signs of venous disease	Ec: Congenital
C1: Telangiectasias, reticular veins	Ep: Primary
C2: Varicose veins	Es: Secondary
C3: Edema	En: No cause identified
C4: Changes in skin and subcutaneous tissue secondary to chronic venous disease	**A – Anatomic Classification**
C4a: Pigmentation and/or eczema	As: Superficial venous system
C4b: Lipodermatosclerosis and/or atrophie blanche	Ad: Deep venous system
C5: Healed ulcer	Ap: Perforating venous system
C6: Active venous ulcer	An: No location identified
	P – Pathophysiology Classification
Each clinical class is characterized by a subscript for the presence of symptoms (s, symptomatic) or absence of symptoms (a, asymptomatic)	Pr: Reflux
	Po: Obstruction
	Pr,o: Reflux and obstruction
	Pn: Non identified

OBJECTIVE

The aim of this study was to determine the incidence and associated risk factors of varicose vein recurrence in patients who underwent, for the first time and exclusively, SSV surgery with 5 years of follow-up.

MATERIALS AND METHODS

Patient population and methods

The authors performed a retrospective analysis of all SSV surgeries performed over a period of two consecutive years (between January 1st, 2013, and December 31st, 2014) at the Angiology and Vascular Surgery Service of Hospital Beatriz Ângelo. Subsequently, in addition to the usual follow-up appointments, for the purpose of the study, all patients included were submitted to a clinical and imagiological revaluation with a venous doppler ultrasound during the month of March 2019.

All patients simultaneously intervened to the GSV, patients submitted to surgery because of varicose recurrence in the territory of the SSV and patients whose follow-up was lost were excluded from the study.

Surgery technique

Although surgeries were performed by five different vascular surgeons, it was possible to compare the results, since all members of the team used a standard surgical technique

Table 2 **Sample characterization**

Variable	Operated Limbs (n=23)	Non-recurrence group (n=15)	Recurrence group (n=18)	*p*-value
Gender, n (%)				0.685
Male	10 (43.5)	6 (40)	4 (50)	
Female	13 (56.5)	9 (60)	4 (50)	
Age (years), mean (standard deviation)	51.8 ± 9.9	52.1 ± 10.2	51.4 ± 10.1	0.877
BMI, n (%)				
Underweight (<18.5 Kg/m2)	1 (4.3)	1 (6.7)	0	1.000
Normal (18.5-24.9 Kg/m2)	6 (26.1)	4 (26.7)	2 (25)	1.000
Overwieght (25.0-29.9 Kg/m2)	13 (56.5)	9 (60)	4 (50)	0.685
Obese (>30.0 Kg/m2)	3 (13.0)	1 (6.7)	2 (25)	0.269
Smoking habits, n (%)	7 (30.4)	6 (40)	1 (12.5)	0.345
Use of hormonal therapy, n (%)	0	0	0	-
CEAP Classification				
Clinical, n (%)				
C2	19 (82.6)	13 (86.7)	6 (75)	0.589
C3	1 (4.3)	0	1 (12.5)	0.348
C4	2 (8.7)	2 (13.3)	0	0.526
C6	1 (4.3)	0	1 (12.5)	0.348
Etiology, n (%)				0.589
Primary	19 (82.6)	13 (86.7)	6 (75)	
Secondary	4 (17.4)	2 (13.3)	2 (25)	
Anatomic, n (%)				-
Superficial veins	23 (100)	15 (100)	8 (100)	
Pathophysiology, n (%)				-
Reflux	23 (100)	15 (100)	8 (100)	
Pre-operative symptoms, n (%)	23 (100)	15 (100)	8 (100)	-

(Figure 1). With patient in prone position, the popliteal fossa was explored formally through a transverse incision (step 1). The SPJ, popliteal artery and major nerves were identified, and the junction was ligated with absorbable suture material (step 2). If total stripping of the SSV was decided the surgeon performed an incision on the posterior surface of the external malleolus, isolated the SSV and introduced a stripper in its lumen. The SSV was stripped from proximal to distal to avoid nerve injuries and removed through the popliteal incision with the aid of silk surgical thread (step 3). On the other hand, if proximal partial stripping of the SSV was decided the surgeon proceeded with knee flexion, isolation and ligation of the SSV as distal as possible (step 4). Then the hemostasis was reviewed and the incision of the popliteal fossa was closed (step 5). SSV varicose tributaries were avulsed through multiple stab incisions (step 6). Postoperative care included the use of compression stockings and administration of prophylactic enoxaparin (step 7 and 8).

Statistical analyses

Categorical variables are presented as frequencies and percentages, and continuous variables as means and standard deviations or medians and interquartile ranges for variables with skewed distributions. Normal distribution was checked using the Shapiro-Wilk test.

Categorical variables were compared with the use of Fisher's exact test or the chi-square test, as appropriate. Continuous variables were compared with the use of unpaired Student's t-test or Mann-Whitney test, as appropriate. A p-val-

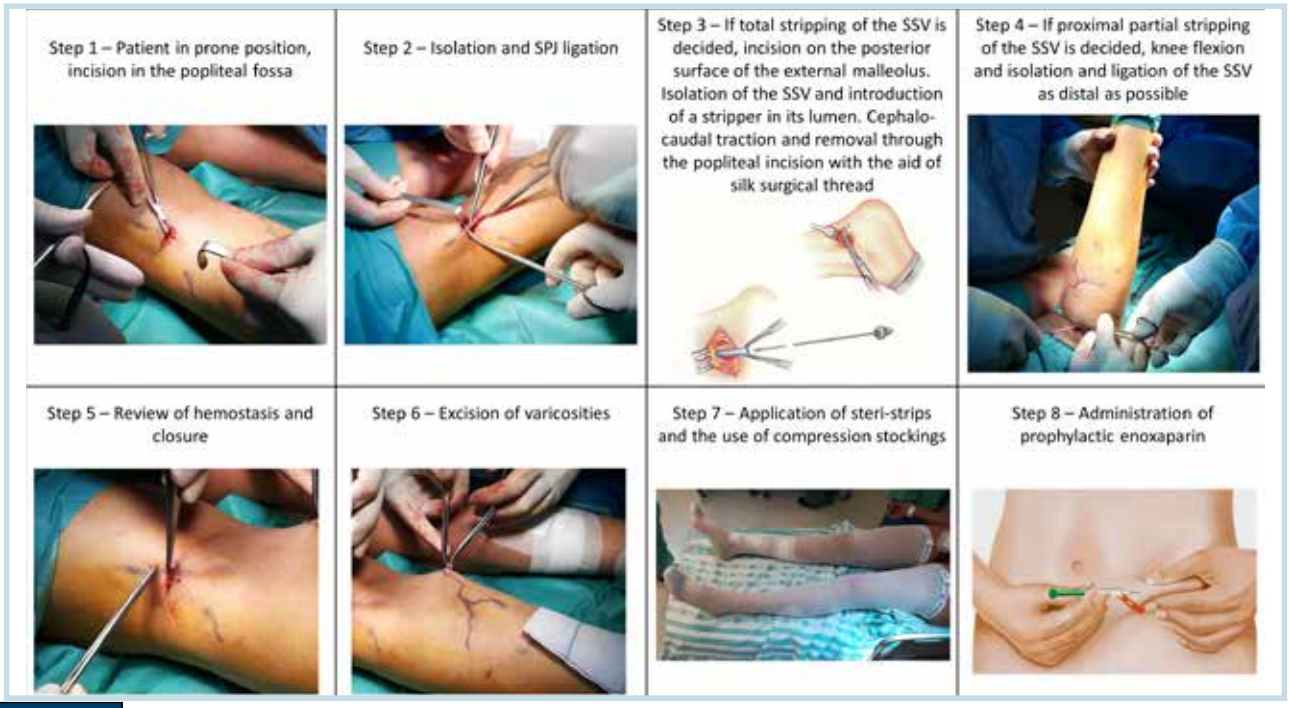

Figure 1

Classical surgical technique for treating varicose veins in the SSV territory (Step 1 – Patient in prone position, incision in the popliteal fossa; Step 2 – Isolation and SPJ ligation; Step 3 – If total stripping of the SSV is decided, incision on the posterior surface of the external malleolus. Isolation of the SSV and introduction of a stripper in its lumen. Cephalo-caudal traction and removal through the popliteal incision with the aid of silk surgical thread; Step 4 – If proximal partial stripping of the SSV is decided, knee flexion and isolation and ligation of the SSV as distal as possible; Step 5 – Review of hemostasis and closure; Step 6 – Excision of varicosities; Step 7 – Application of steri-strips and the use of compression stockings; Step 8 – Administration of prophylactic enoxaparin).

Table 3 **Surgery and postoperative results**

Variable	Operated Limbs (n=23)	Non-recurrence group (n=15)	Recurrence group (n=8)	*p*-value
Limb, n (%)				1.000
Right	11 (47.8)	7 (46.7)	4 (50)	
Left	12 (52.2)	8 (53.3)	4 (50)	
Surgical technique, n (%)				
SPJ Ligation	23 (100)	15 (100)	8 (100)	-
SSV Total Stripping	6 (26.1)	5 (33.3)	1 (12.5)	0.369
SSV Partial Stripping	10 (43.5)	5 (33.3)	5 (62.5)	0.221
Postoperative symptomatic improvement, n (%)	23 (100)	15 (100)	8 (100)	-
Postoperative use of compression stockings, n (%)				
Yes	18 (78.3)	12 (80)	6 (75)	1.000
No	2 (8.7)	2 (13.3)	0	0.526
Intermitent	3 (13.0)	1 (6.7)	2 (25)	0.269
Postoperative complications, n (%)				
Paraesthesia at the site of incision	2 (8.7)	2 (13.3)	0	0.526
Haematoma	1 (4.3)	1 (6.7)	0	1.000
Hyperpigmentation	1 (4.3)	1 (6.7)	0	1.000
Consultation discharge (months), median (range)	6.5 (1-61)	13.5 (0.5-47)	14.4 (0.5-61)	0.771

ue between the non-recurrence and recurrence group below 0.05 was considered statistically significant.

Statistical analyses were performed using SPSS 23.0 (IBM SPSS Statistics for Windows, Version 23.0. Armonk, NY, USA).

RESULTS

Sample characterization

From January 1st, 2013 to December 31st, 2014, 33 limbs in 31 patients were submitted to vascular surgery exclusively on non-recurring varicose veins in the territory of the SSV, of which 10 limbs were excluded due to lack of follow-up.

Thus, 23 limbs were evaluated, 56.5% were female and the mean age was 51.8 ± 9.9 years. Most patients had a body mass index (BMI) > 25 kg / m2, only 7 (30.4%) were smokers, none were taking hormone therapy and all patients were symptomatic. As for the CEAP classification, 19 (82.6%) were clinically classified as C2, 1 (4.3%) as C3, 2 (8.7%) as C4 and 1 (4.3%) as C6. Only 4 patients (17.4%) had secondary etiology, with the remaining presenting primary etiology. According to the study design, all patients had an anatomical classification of superficial veins, and all had reflux as pathophysiological classification. There was no statistically significant association between any variable and varicose vein recurrence (Table 2).

Surgery and postoperative results

Regarding surgical procedure, all patients underwent ligation of the SPJ. In 6 cases (26.1%) it was associated with total stripping of the SSV due to incompetence of the entire vein and in 10 cases (43.5%) partial stripping of the SSV due to the presence of proximal incompetence only. All patients reported improvement of typical CVD symptoms in the postoperative period and 18 (78.3%) used compression stockings on a regular basis during the first 6 months after surgery. In regard to complications in the postoperative period, there were 2 cases of local paraesthesia at the site of the incisions, 1 case of haematoma and 1 case of hyperpigmentation. No other complications such as injury to the sural, common, or tibial nerves, deep venous thrombosis or pulmonary thromboembolism occurred. Patients were discharged from consultations, at a median of 6.5 months. Once more, there was no statistically significant association between any variable and varicose vein recurrence (Table 3).

Follow-up

At a 5-year follow-up, 4 patients (17.4%) reported

Table 4 **Clinical and imagiological evaluation at 5 years of follow-upresults**

Variable	Operated Limbs (n=23)	Non-recurrence group (n=15)	Recurrence group (n=8)	*p*-value
Symptomatic improvement, n (%)				0.103
Yes	19 (82.6)	14 (93.3)	5 (62.5)	
No	4 (17.4)	1 (6.7)	3 (37.5)	
Use of compression stockings, n (%)				
Yes	6 (26.1)	5 (33.3)	1 (12.5)	0.369
No	11 (47.8)	7 (46.7)	4 (50)	1.000
Intermitent	6 (26.1)	3 (20)	3 (37.5)	0.621
Visible varicose veins in the SSV territory, n (%)				0.131
Yes	6 (26.1)	2 (13.3)	4 (50)	
No	17 (73.9)	13 (86.7)	4 (50)	
Confirmed SPJ Ligation, n (%)				0.033
Yes	18 (78.3)	14 (93.3)	4 (50)	
No	5 (21.7)	1 (6.7)	4 (50)	
Recurrence, n (%)				
Without recurrence	15 (65.2)	15 (100)	0	
Residual varicose veins	3 (13.0)	0	3 (37.5)	
Neovascularization	1 (4.3)	0	1 (12.5)	
Progression of SSV disease	4 (17.4)	0	4 (50)	
GSV Incompetence	5 (21.7)	4 (26.7)	1 (12.5)	0.621

symptomatic recurrence, only 6 (26.1%) maintained the use of compression stockings on a regular basis and 6 (26.1%) presented visible varicose veins in the SSV territory. Regarding the imaging reassessment with venous doppler ultrasound, 5 patients (21.7%) did not present ligation at the level of the SPJ, thus presenting a more distal ligation. 4 patients (17.4%) presented progression of SSV disease, 3 (13.0%) presented residual varicose veins responsible for varicose veins in the SSV territory and 1 patient (4.3%) had neovascularization responsible for varicose veins in the SSV territory. Five cases (21.7%) of GSV incompetence were also identified, not present in the preoperative period (Table 4). When assessing recurrence, we found that there is only a statistically significant association with the ligation of the SPJ ($p = 0.033$). Of the 18 cases in which a correct SPJ ligation was observed on venous doppler ultrasound, only 4 presented recurrence at a 5-year follow-up. But, of the 5 cases in which a correct SPJ ligation was not performed, only 1 did not present varicose recurrence in the SSV territory. All others presented recurrence: 3 due to low ligation (leaving a portion of SSV that originates collateral vessels responsible for varicose veins) and 1 due to low ligation and neovascularization (Table 5).

DISCUSSION

Although, in recent years, thermal techniques have emerged as an effective alternative to open surgery, the classical surgical technique of SPJ ligation, with or without SSV stripping, is still the most used in Portuguese public hospitals. International recommendations for endovenous saphenous ablation are heterogeneous, particularly for SSV treatment. The 2011 American Venous Forum (AVF) guidelines did not mention thermal treatments, but rather surgery, with level 1B evidence. The 2013 National Institute for Health and Care Excellence (NICE) guidelines recommend thermal treatment and foam over surgery, but considered all the saphenous axes together, without making a specific analysis of the small vs the great saphenous vein. The 2015 European Society for Vascular Surgery (ESVS) guidelines gave endovenous thermal ablation of the SSV a grade 2B recommendation but access to the SSV should be gained no lower than mid-calf. [12–15] More studies and guidelines are needed for the specific treatment of SSV, including cost analysis, in order to a similar worldwide treatment in the future.

In this study, all evaluated patients were approached with a popliteal fossa incision for aesthetic reasons, however, it is known that the SPJ may have different locations depending on the patient. [5, 8, 9, 16] Despite this, none of the patients were evaluated by ultrasound on the day of surgery, for preoperative localization of the SPJ, which may justify the 5 cases of failure to identify it.

In fact, when SPJ ligation and varicose recurrence are compared, there is a statistically significant association between the variables. It means that distal ligation of the SPJ is associated with recurrence of the disease.

The literature shows higher rates of recurrence in the treatment of varicose veins of the SSV, with the ligation of the SPJ, than in the treatment of varicose veins of the GSV, with the ligation of the saphenofemoral junction (SFJ), respectively 52% and 20% at 3 years. [6, 17] The main cause of recurrence is attributed to the failure in the identification of the SPJ, however, there are few studies that analyse the recurrence of varicose veins of the SSV with the adequate technique of SPJ ligation.[7, 11] A retrospective study by Rashid, in 2002, revealed that only 59% of the incompetent SPJ was successfully disconnected, with failure to locate and ligate the SPJ being the main cause of recurrence of varicose veins.[5] Tong and Royle presented similar conclusions, with recurrence of varicose veins in patients undergoing SSV surgery attributed to non-ligation of the SPJ in 28% of cases.[8] In our study, a slightly higher success rate was achieved, with 78.3% (18 cases) of SPJ ligation and 21.7% (5 cases) of non-ligation.

The recurrence observed in patients with a correct SPJ ligation is related to the progression of the disease since all these patients had only underwent partial SSV stripping, highlighting the fact that this is a chronic disease, whose symptoms can be improved, and progression delayed but not hindered. In this study, we were also able to assess that the progression of SSV disease (4 cases) was responsible for the recurrence of varicose veins in the same proportion as the incorrect SPJ ligation (4 cases), both 50% of the recurrence group.

According to the inclusion criteria, no patient had incompetence of the GSV prior to the surgery, and the surgeries were performed exclusively on the SSV. At 5 years of postoperative follow-up, 5 cases (21.7%) of GSV incompetence were identified. There was no statistically significant association between the progression of the disease in the GSV and the use of compression stockings or the recurrence of symptoms. However, these cases of new diagnosis of GSV incompetence and progression of SSV disease even after successful surgery showed the need to maintain general care to prevent the progression of CVD of the lower limbs, such as the regular use of compression stockings, regular exercise, less hours standing or sitting (especially with legs crossed), avoiding hot places or tight clothes and adopting healthy dietary habits to avoid overweight. [2, 18]

Regarding the symptoms of CVD after 5 years of surgery, of the 4 cases in which there was symptomatic recurrence, 3 had recurrence of varicose veins in the territory of the SSV and 1 had progression of the disease of the GSV. However, there was no statistically significant association between symptoms and recurrence of varicose veins at 5 years of follow-up. Of the 19 cases in which symptomatic improvement was maintained 5 years after surgery, 8 presented changes in the venous doppler ultrasound (4 had recurrence of varicose veins in the SSV territory, 1 had simultaneously recurrence in the SSV territory and progression of the GSV disease and 3 had disease progression in the GSV without recurrence in the SSV territory), implying that imaging recurrence is not always related to clinical recurrence, and most patients may be treated conservatively.

Although some studies have identified 1.1% to 6.7% of peripheral nerve damage during total stripping of the SSV (most frequent in the sural nerve and common peroneal

Table 5 **SPJ ligation and recurrence association at 5-year follow-up (p = 0.03)**

		Recurrence		
		Yes	No	Total
SPJ Ligation	Yes	4	14	18
	No	4	1	5
	Total	8	15	23

nerve), in this study, no nerve damage was identified, which may be related to a correct and careful identification and dissection.[19] Other major postoperative complications, such as deep vein thrombosis or pulmonary embolism, were also not identified in this study. Despite the good postoperative results of this study, major complications related to surgery are well known and the patient should be informed when choosing the surgical treatment.

LIMITATIONS

The main limitation of our study is the fact that it is a retrospective study, based on a small sample (given the tight inclusion criteria), increasing the risk for type II error for variables that we believe could contribute to varicose vein recurrence, such as gender, age, obesity, use of hormone therapy, smoking habits or use of compression stockings on a regular basis in the postoperative period and in the follow-up. Another limitation is the fact that the patients did not undergo a venous doppler ultrasound evaluation in the immediate postoperative period in order to compare, in a more reliable way, with the results obtained after 5 years of surgery.

CONCLUSION

Although, in recent years, new minimally invasive techniques have been developed, the classical surgical technique of SPJ ligation, with or without SSV stripping, is still the most used in Portuguese public hospitals.

Routine preoperative localization of the SPJ by doppler ultrasound guidance could have an impact in minimizing varicose vein recurrence. Imaging recurrence does not always translate into clinical recurrence.

Because this is a chronic disease, patients should keep general care to prevent disease progression, even after surgery.

Additional studies are necessary, with larger samples, to verify that other measures can be taken to reduce the recurrence of varicose veins in the SSV territory.

CONFLICTS OF INTEREST

The authors have no conflicts of interest to declare.

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REVIEW ARTICLE

SUPERIOR GLUTEAL ARTERY PSEUDOANEURYSM: TWO CASES REPORT AND REVIEW OF THE LITERATURE

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Abstract

Introduction: *Gluteal pseudoaneurysms are extremely rare and respond to pelvic trauma, penetrating wounds, inflammation or infection in the gluteal region.*

Clinical cases: *Two men, 73 and 82 years respectively, who presented gluteal pseudoanerysm after drainage of perianal abscess the first one and after trauma the second one. In both cases the diagnosis was made by imaging tests (doppler ultrasound that was completed with computed tomographic angiography). The first one was successfully treated by ultrasound-guided injection of thrombin at the pseudoaneurysm sac. However, secondary treatment with thrombin injection and coil embolization was performed due to pseudoaneurysm reperfusion. The second one was successfully treated by embolization with hydrocoils through contralateral percutaneous femoral access as well as thrombin injection by direct ultrasound-guided puncture.*

Discussion: *The incidence, presentation and surgical strategy are discussed. Current literature is also reviewed.*

Conclusion: *Ultrasound scan is the first diagnostic test, computed tomographic angiography can give more topographic information. We found selective percutaneous embolization to be the treatment of choice. Open surgical treatment should be reserved for selected cases.*

INTRODUCTION

Pseudoaneurysms located in the superior and inferior gluteal artery are uncommon, and occur mainly due to pelvic trauma or penetrating injuries.[1]

We present two cases of gluteal artery pseudoaneurysm successfully treated in our Department. A literature review and incidence, etiology and therapeutic strategy of this rare disease discussion is also reported.

CASES REPORT

The first case is a 73-year-old man, diagnosed with chronic obstructive pulmonary disease. Perianal abscess surgery was performed in 2009.

He presented a history of necrotizing myositis secondary to perianal abscess which required surgical drainage in 2009. During the follow up, incidental finding in a computerized tomographic (CT) scan of left superior gluteal artery pseudoaneurysm (figure 1).

At physical examination the patient presented a non-pulsatile mass with a murmur in the left external gluteal region. In CT scan, mass compatible with pseudoaneurysm of the superior gluteal artery was described. He was admitted in our Department and ultrasound-guided thrombin injection was performed.

Two months later, the follow up CT scan showed partial thrombosis of the pseudoaneurysm. With these findings, the patient was admitted again to perform secondary embolization with thrombin injection and coils (figure 2). Patient was discharged 24 hours after procedure without clinical complications. Duplex ultrasound follow up was performed demonstrating no residual

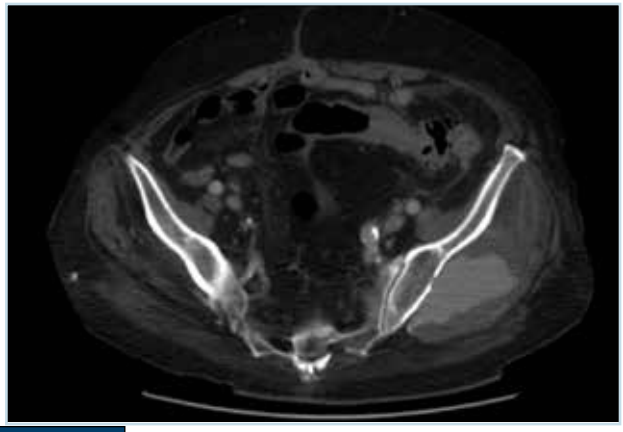

Figure 1 *Computed tomographic scan showing left superior gluteal artery pseudoaneurysm (axial slices).*

flow or patency of pseudoaneurysm.

The second case is an 82-year-old male patient with post-trauma cava filter in 1996. He presented with a rapidly growing mass in the gluteal region. A Duplex ultrasound exam and CT scan showed vascular mass that seems to communicate with the superior gluteal artery (figure 3). Incidental finding of abdominal aortic aneurysm (4.5 cm). Due to these findings, the patient was submitted to embolization of the superior gluteal pseudoaneurysm with embolization material (AZUR helical hydrocoil 15 * 30/12 * 20 / * 10 * 20). This procedure was performed through contralateral percutaneous femoral access. Also, thrombin injection by direct ultrasound guided pseudoaneurysm puncture was performed (figure 4). The control duplex ultrasound examination was satisfactory, without residual flow in the pseudoaneurysm and with no complications at puncture sites. He was discharged 48 hours after procedure. One month later, the control duplex ultrasound was performed showing complete occlusion of the right gluteal pseudoaneurysm.

DISCUSSION

The incidence of pseudoaneurysms is difficult to calculate, as there are no large series of patients [2]. Pseudoaneurysms of the lower gluteal artery are even much less frequent than those of the upper gluteal artery[1]. Most of these pseudoaneurysms are the result of direct trauma or infection at the artery wall [1,3]. In the absence of trauma, a persistent sciatic artery aneurysm[4] or true gluteal artery aneurysms should be considered. Some cases have been described in Marfan syndrome[5], Ehlers-Danlos disease or in treatment with oral anticoagulants[6].

The most common forms of presentation are insidious or, when they are very large, compartment syndrome with symptoms related to sciatic nerve compression[1]. The rapid diagnosis and treatment are essential to prevent neurological sequelae[3].

The pulsatility of the gluteal pseudoaneurysms is not constant and we must consider the differential diagnosis with soft tissue tumors or buttock abscesses[3].

The color Duplex ultrasound must be considered as the first choice in the initial diagnosis. It is extremely useful, showing the inflow and outflow of blood (yin-yang sign). Other options to confirm the diagnosis are CT angiography and magnetic resonance image (MRI) angiography, these techniques allow a better definition of the topographic location of the pseudoaneurysm. Finally, selective arteriography is also useful combining di-

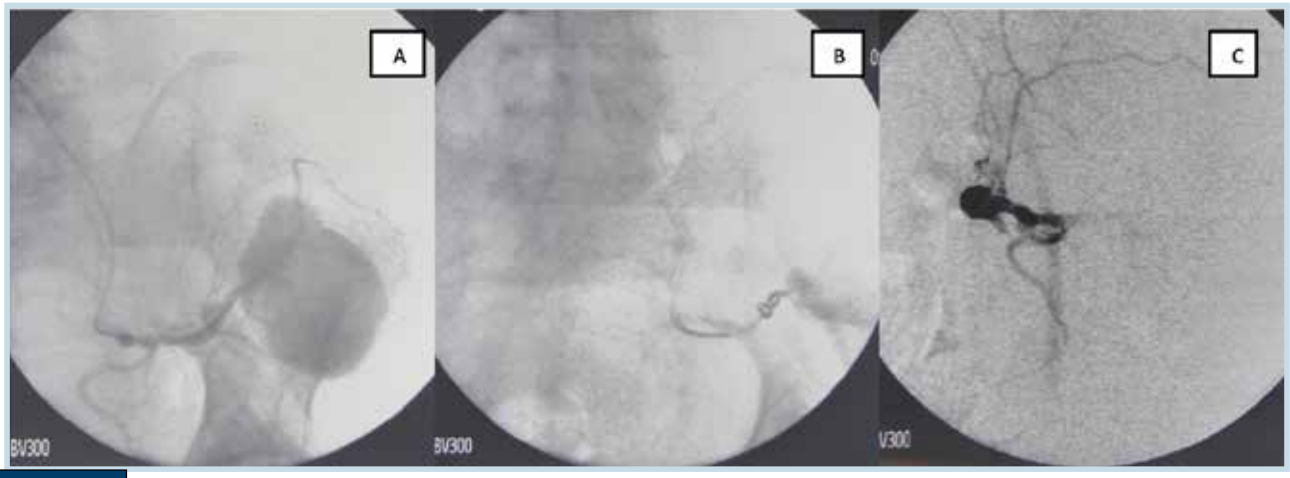

Figure 2 *Embolization was performed. We can see the intial angiography (A), the embolization with coils (B) and the final result after procedure (C).*

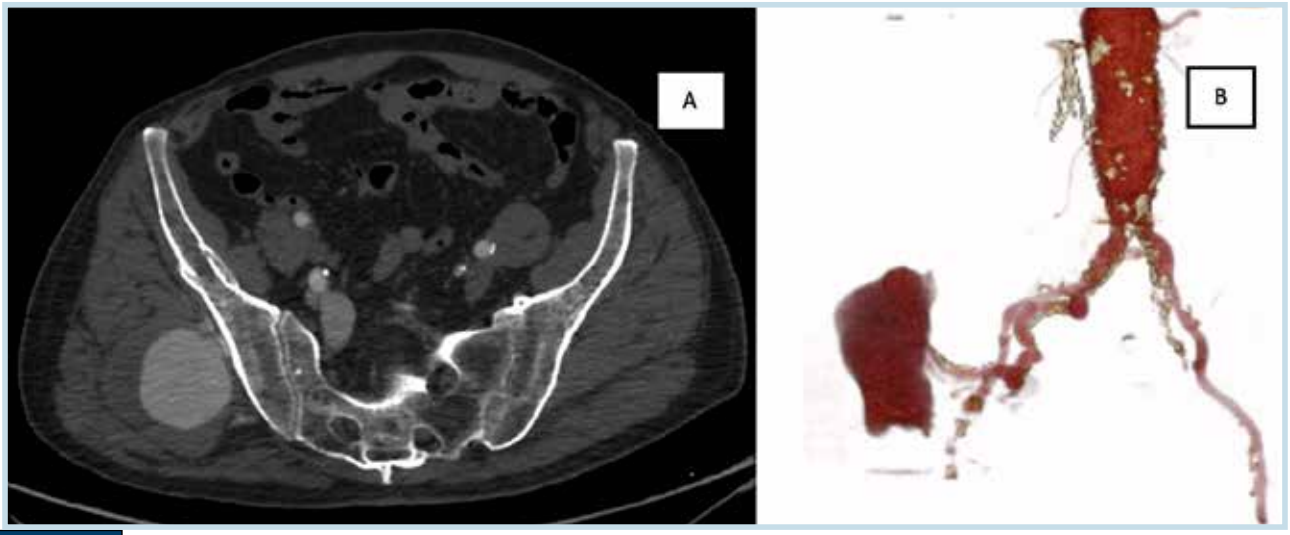

Figure 3 *Computed tomographic scan showing right superior gluteal artery pseudoaneurysm: axial slices (a) and 3D reconstruction (b).*

agnostic and therapeutic approach at the same time [1,3].

Currently, the best treatment of gluteal pseudoaneurysms is selective percutaneous embolization. Surgical treatment should be considered only in those cases which the pseudoaneurysms are in an accessibility location or when it is necessary to drain the hematoma secondary to the aneurysm, also when the aneurysm embolization has not been successful.

CONCLUSIONS

Gluteal pseudoaneurysm is a rare pathology but it should be suspected when any mass into this region is found. Color Duplex ultrasound is the first-choice diagnostic test, CT angiography and MRI angiography are the diagnostic options that allow to exactly define the topographic location of the pseudoaneurysm. The treatment of choice is selective percutaneous embolization. Open surgical treatment remains as the alternative treatment option for some selected cases.

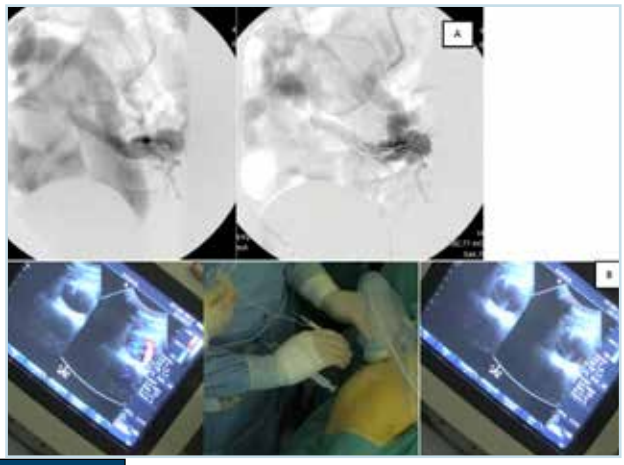

Figure 4 *Embolization with coils (A) and thrombin injection (B) was performed.*

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CASE REPORTS

A DOUBLE DOSE OF AORTIC STENOSIS: AN UNUSUAL CASE

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Abstract

Supravalvular aortic stenosis is a rare congenital anomaly (less than 0.05% of all congenital heart defects). This aortic root anomaly consists in a narrow aortic lumen immediately above the aortic valve and represents the least common form of left ventricular outflow tract obstruction. Clinical presentation is usually in the first decades of life. In most cases, the aortic valve leaflets are morphologically normal. However, aortic insufficiency due the high systolic pressure proximal to the sinotubular junction is the most commonly abnormality described. There are very few cases described in the literature with concomitant valvular and supra-valvular aortic stenosis.

Keywords: *Supravalvular aortic stenosis; aortic valve stenosis; left ventricular outflow tract obstruction*

INTRODUCTION

Supravalvular aortic stenosis (SVAS) is a rare congenital anomaly reported in less than 0.05% of all congenital heart defects. This aortic root anomaly consists in narrowing aortic lumen immediately above the aortic valve and represents the least common form of left ventricular outflow tract obstruction (LVOTO). LVOTO lesions account for approximately 6% of congenital heart disease, and SVAS occurs in 5-10% of all patients with LVOTO.[1] Clinical presentation of SVAS is usually in the first decades of life.[2] SVAS is seen in syndromic as well as non-syndromic patients. It has classically been described in association with Williams-Beuren syndrome caused by a deletion on chromosome 7q11.23 which affects the elastin gene. The sporadic form is more common than the autosomal dominant form.[2] Severity of SVAS ranges from localized ringlike thickening to diffuse involvement including pulmonary arteries, aortic arch and its branches.[3] In most cases, the aortic valve leaflets are not fused and are morphologically normal. However, aortic insufficiency due the high systolic pressure proximal to the sinotubular junction is the most commonly abnormality described.[4] There are very few cases described in the literature with concomitant valvular and supravalvular aortic stenosis. We present the case of a 62-year-old man with a double doses of aortic stenosis.

CASE REPORT

A 62-year-old man presents with complaints of fatigue to moderate physical efforts, which progressively worse over the last months. At physical examination, a panfocal mid-systolic murmur was described, with no other abnormalities reported. He had a medical history of hypertension. An echocardiogram was performed, which

revealed a thickened calcified aortic valve, with reduced opening and mild regurgitation, a peak LV/Ao gradient of 97mmHg and a mean gradient of 59mmHg, an estimated area of 0.5 cm2, moderate hipertrophy of left ventricle and ventricular septum, good biventricular function and mild mitral regurgitation. (Figure 1 A) Cardiac catheterization showed a significant narrowing of aortic lumen in the aortic root which was not previously known. (Figure 1 C) CT angiogram confirmed a supravalvular aortic stenosis, originating 17mm above the aortic valve with a length of 25mm, and a maximum luminal diameter of 10 mm, while the aortic sinuses and post-stenosis ascending aorta were wider (33 mm and 23 mm, respectively). (Figure 1 D) Genetic studies for mutations involving elastin gene were negative and acquired causes were excluded. There was no familiar history of aortopathies. The patient was submitted to aortic valve replacement with a mechanical prosthesis by patient preference and a supravalvular aortic repair with pericardium patch enlargement. (Figure 2) There were no complications, and the patient was discharged on the 5th postoperative day.

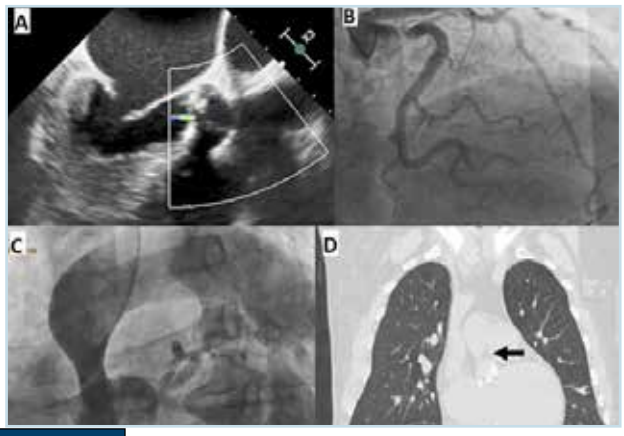

Figure 1

1- (A) Transthoracic echocardiogram shows thickened calcified aortic valve, with reduced opening and mild regurgitation, and a narrowed lumen of the aortic root. (B) Coronariography shows left coronary artery dilated and tortuous. (C) Aortography shows a significant narrowing of aortic lumen in the aortic root. (D) CT angiogram shows a supra-valvular aortic stenosis.

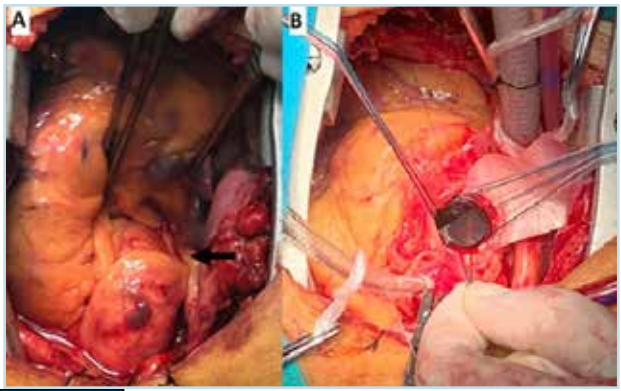

Figure 2

(A) Intraoperative view of supravalvular aortic stenosis. (B) Aortic valve replacement with a mechanical prosthesis and aortic repair with pericardium patch.

COMMENTS

Surgical intervention is associated with good long-term results in most patients. A few surgical options are available. Ross procedure, which consists of replacing the diseased aortic valve with the patient's own pulmonary valve, is usually reserved for small children. Aortic valve and aortic root replacement with coronary reimplantation (Bentall procedure) is an option for older patients.[5] A percutaneous approach with transcatheter aortic valve implantation (TAVI) with transcatheter stent placement could also be considered although it is a rarely utilised option. We opted for aortic valve replacement and aortic repair with pericardium patch. We found, intraoperatively, left ventricular hypertrophy, which is a common finding in this form of LVOTO due to pressure overload. The increased myocardial metabolic demand in this situation makes myocardial protection an even more important step during surgery. The coronary arteries are often markedly dilated and tortuous, secondary to their constant exposure to extremely high pressures proximal to the sinotubular junction (Figure 1 B). They also displayed accelerated coronary artery sclerosis. Sudden death is frequent if patients are left untreated due to the combination of left ventricular hypertrophy and premature coronary artery disease.[2] Supravalvular aortic stenosis is a rare congenital condition, and clinical presentation usually manifests in the first decades of life, not at older ages. The combination of valvular and supra-valvular aortic stenosis is infrequently reported in the literature, which makes this case unusual and particularly challenging from a diagnostic and therapeutic point of view.

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CASE REPORTS

CHEST WALL RECONSTRUCTION USING CUSTOMIZED NEO-RIBS: CASE REPORT

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Abstract

Chest wall tumours are challenging subjects. In the present article we describe a case of a 51 year old female who developed an angiosarcoma eight years after radiotherapy treatment due to left breast cancer at age 41. She had resection of the anterior segments of the 3rd to 5thribs followed by chest wall reconstruction, using MatrixRib fixation system®, Marlex® mesh and latissimus dorsi muscle flap. After two years the angiosarcoma relapsed. Considering the predicted extent of the chest wall resection, a reconstruction using titanium plates was not an option, so we opted to shape neo-ribs of Methyl Methacrylate using rubber drains as a mold.

It affords very good anatomical contour of the chest wall and more physiological function than other options, although only long-term follow-up and future studies will determine the performance of this method.

Keywords: *Neo-ribs, Chest Wall Reconstruction*

INTRODUCTION

Chest Wall reconstruction is considered a very demanding and challenging procedure.

The first description of a related surgical procedure was in 1898, when Parham performed the first chest wall tumor resection with closure of the defect[1].

In 1973 with the use of Marlex® mesh and Methyl Methacrylate (MMA) the reconstruction of chest wall[1] turned very popular[2]. During the 80´s, Pairolero and colleagues [3] largely developed and popularized chest wall resection and reconstruction. Since then, several devices and materials developed, although there are still minor pitfalls, especially concerning large chest wall defects. In order to cover these defects, techniques for muscle mobilization and rotation were essential.

CASE REPORT

The authors report a case of a 51 year-old female with history of cancer on the left breast 10 years before that underwent surgery and adjuvant chemoradiotherapy.

After eight years she developed a left chest angiosarcoma probably secondary to radiotherapy. A joint surgical procedure with plastic surgery department with excision of the anterior segments of the 3rd to the 5th rib took place, followed by a chest wall reconstruction, using MatrixRib fixation system® with a Marlex® mesh, and a latissimus dorsi muscle flap.

Two years later, the patient returned to the outpatient clinic with an angiosarcoma recurrence. A chest CT showed involvement of the serratus anterior muscle, chest wall titanium plates and the intercostal muscles. A new joint procedure was proposed.

The patient was positioned on right lateral decubitus. The first step was the excision of the lesion with safety margins, including part of the serratus anterior muscle and latissimus dorsi flap. The 3rd rib was apparently not involved. We proceeded to the partial excision of the 4th plate and extended the margin to the lateral part. The 5th rib plate, which was fractured, was also partially removed as well the anterolateral segment of the 6th rib. Due to the extension of the defect, chest wall reconstruction with Matrix Rib fixation system® was not considered.

A chest wall reconstruction based on the technique described by Jean Bellamy [4] was performed using a rubber drain as a cast which was then filled with MMA, shaped and attached by a 5 mm cortex screw to each bone tip. On the 4th and 5th we used the free tip of Matrix Rib® plate to anchor the neo-rib. After MMA dried, the outer rubber drain was removed. A gore-tex® mesh was fixed to the neo-ribs using prolene sutures. At last, a myocutaneous rectus abdominalis free flap anastomosed to the circumflex axillary vessels was used to cover the defect.

The post-operative period was uneventful. The patient was extubated on day 2 and discharged 14 days after surgery.

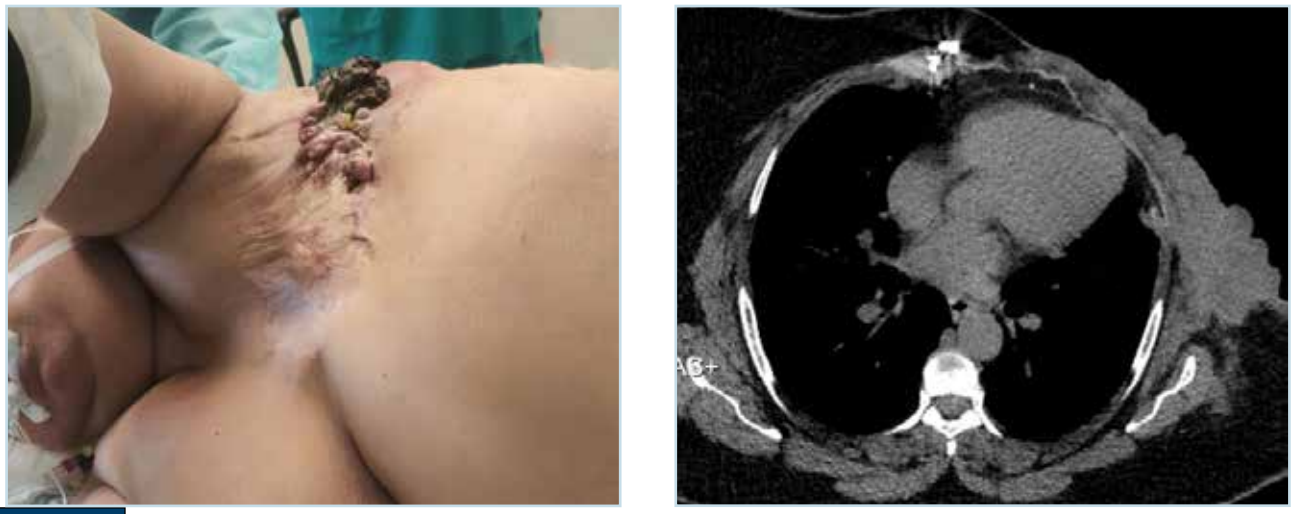

Figure 1 *Pre-operative.*

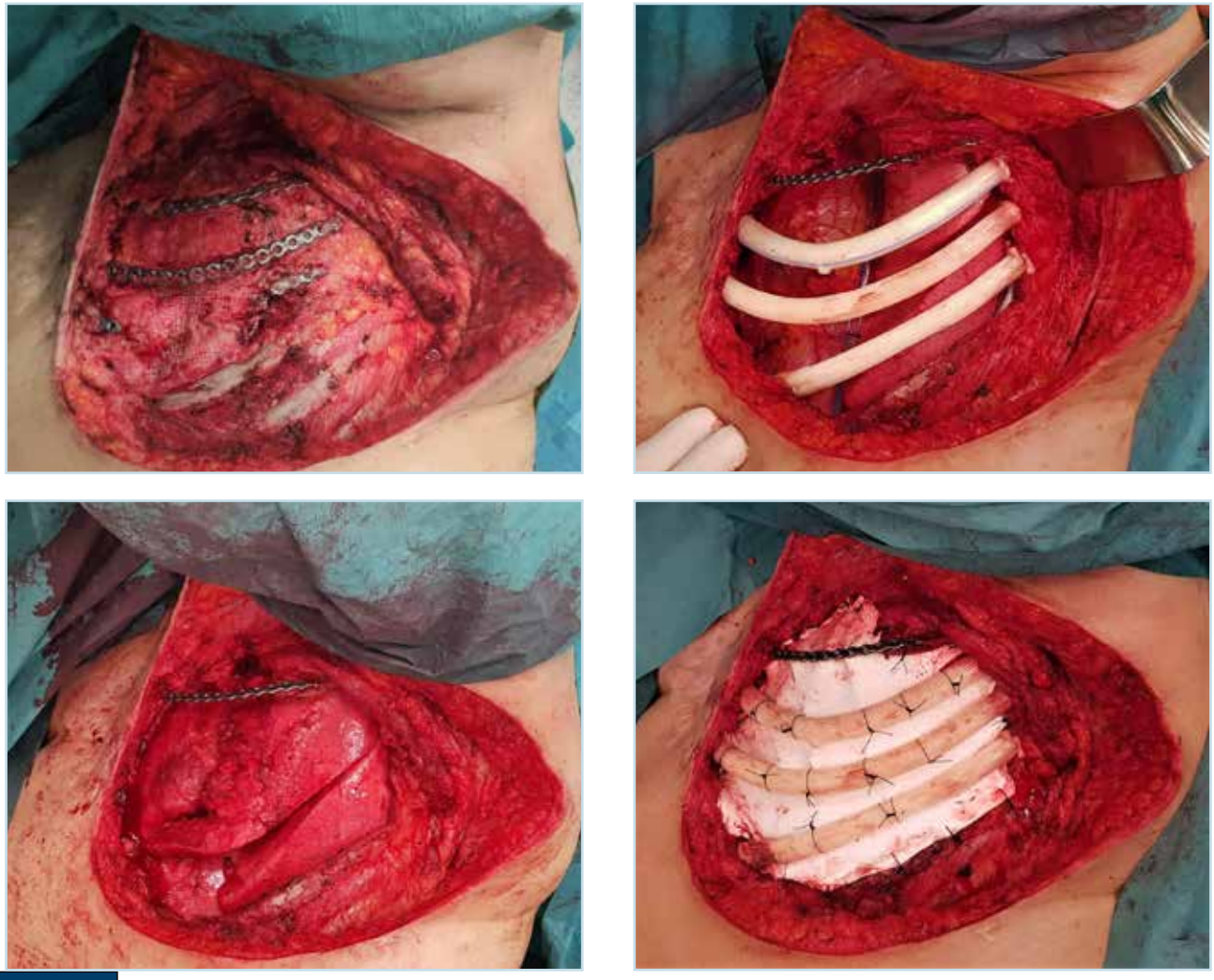

Figure 2 *Intra-operative sequence.*

Figure 3 *Post-operative.*

Pathology confirmed a margin free angiosarcoma.

DISCUSSION

It is commonly agreed that defects of 2 ribs can be managed with soft tissue reconstruction only. However, defects on the lateral chest wall larger than 5 cm or the involvement of 4 consecutive ribs demands skeletal reconstruction[4]. In our case, due to the size and location of the defect, skeletal reconstruction was mandatory.

Several materials are available, however it is still a great task to find the right option for the right patient.

The ideal prosthetic material should be radiolucent, provide adequate rigidity to prevent paradoxical movement, enough malleability so that it can be shaped and not limit chest wall physiological movements and, most importantly, it should also be inert allowing ingrowth of fibrous tissue, decreasing the risk of infection [3,6].

The so-called Marlex®sandwich technique, in which methyl methacrylate (MMA) is applied between 2 layers of Marlex® mesh, was introduced in the 1980s. This technique provides rigidity and allows shape customization, however, its rigidity may limit physiologic movements of the chest wall and high risk of infection and seroma formation has been reported[6,7].

Skeletal reconstruction using titanium plates, (as first used in this patient), is another option, providing a good contouring and strength. However, it is also associated with chest wall mobility limitation, and on a long term, especially in large defects, tends to break[3].

Customized dedicated prostheses are good but expensive solutions, not promptly available and have limitations in wide chest wall resections extending laterally to the sternum[6].

To overcome these limitations, another technique using MMA to shape neo-ribs with the use of silicone molds was described[4,6]. It reproduces the normal curves of a rib, providing more physiological shape and is readily available at reasonable prices.

Based on the above concepts of the ideal prosthetic material and taking into account the complexity of our case (redo surgery, dimension and location) we opted to use shaped ribs using MMA.

CONCLUSIONS

Chest wall reconstruction is a complex and demanding procedure in which multiple variables have to be assured.

Neo ribs, made of MMA, seem to be an excellent option, obtaining not only very good anatomical contour of the chest wall but also more physiological function. Furthermore, it is an easy technique to perform with readily available materials.

Long-term follow-up and future studies will determine the role of this method.

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CASE REPORTS

GIANT THORACIC MASS – THE STORY OF A SOLITARY FIBROUS TUMOUR

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Abstract

The tumours of the pleura are a vast and diverse field. One of the lesser known and less common tumour is the solitary fibrous tumour of the pleura, representing about 5% of these types of tumours. The authors present the case of a woman admitted in the emergency department with symptoms of dizziness and vomits. Imaging studies show a giant thoracic mass on the left hemithorax, with a biopsy indicating a solitary fibrous tumour. The patient was referred for surgery, which was performed via thoracotomy. In the postoperative period she developed an acute pulmonary oedema secondary to lung reexpansion and fluid overload, with a good response to fluid restriction and intravenous diuretics.

INTRODUCTION

Tumours of the pleura are a vast and diverse field. One of the lesser known and less common tumour is the solitary fibrous tumour of the pleura, representing about 5% of these types of tumours. Solitary fibrous tumours can arise from visceral organs or mesothelial tissues, and as such have been described many other locations.

The tumour often presents with no symptoms and is usually randomly discovered during a routine chest x-ray.

CASE REPORT

A 71 year old woman is admitted in the emergency department due to sudden dizziness and vomits. She also mentions dyspnoea which has been getting worse in the past few months.

Upon examination she had absent pulmonary sounds on the left side and an O2 saturation of 92%, as well as a type 2 respiratory insufficiency. Chest x-ray and CT scan showed a mass occupying the left hemithorax measuring 22x11 cm, collapsing the lung and apparently invading the mediastinum. (figure 1 and 2) Upon further analysis of past chest x-rays a smaller mass was already visible going back 2 years.

She was admitted into the infirmary for further study and medical treatment. A tru-cut biopsy of the mass showed as fibrous solitary tumour of the pleura. Upon clinical improvement with non-invasive ventilation, the patient was discharged and referred to the author's hospital cardiothoracic surgery department.

Preoperative study showed a FEV1 of 38%, without DLCO due to the patient's inability to perform the manoeuvre.

Still, as the removal of the mass would only improve lung capacity, the team opted to go ahead.

A left thoracotomy through the 5th intercostal space was performed and dissection from the chest wall, mediastinum and lung was performed, as the tumour did not invade any structure. (figure 3) Two vascular pedicles were identified and ligated; one originating from the left lower lobe and the other from the posterior portion of the seventh intercostal artery, and the mass was safely removed (figure 4).

The postoperative period was complicated by an acute pulmonary oedema secondary to acute lung injury after reexpansion of the lung and fluid overload. The patient was put on furosemide and methylprednisolone and made an uneventful recovery and was discharged on the eleventh postoperative day.

DISCUSSION

Representing about 5% of the tumours of the pleura[1], with only between 800 and 960 cases reported[2,3]. Solitary fibrous tumours often presents no symptoms, but can present with paraneoplastic syndromes such as Doege-Potter Syndrome[4,5], and is

Figure 1 *Axial view showing the mass occupying the left hemithorax with 22x11 cm, collapsing the lung and apparently invading the mediastinum.*

Figure 2 *Coronal view of the mass compressing and distorting the mediastinum.*

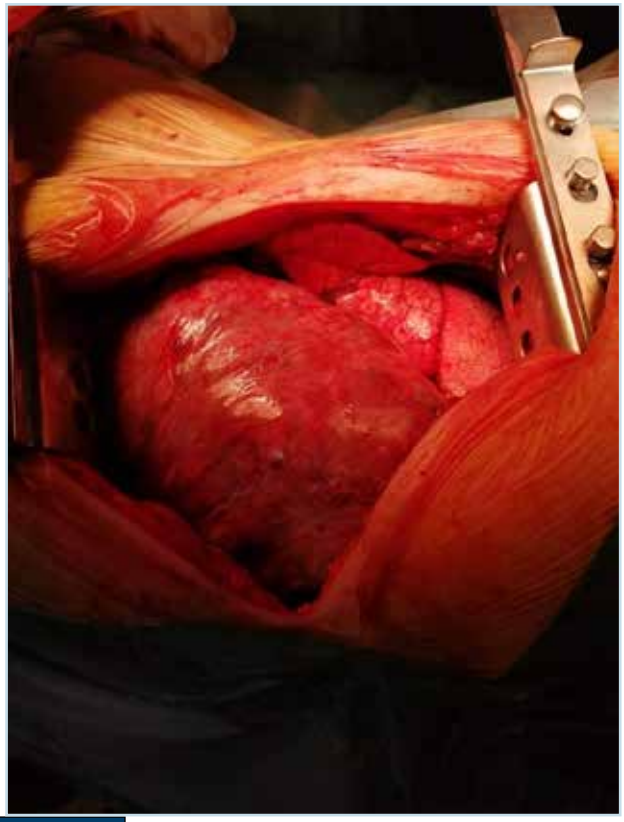

Figure 3 *Intraoperative photograph of the thoracic mass partially collapsing the left lung.*

Figure 4 *Mass compared with an 125 mm Halsted Mosquito Forceps.*

usually randomly discovered during a routine imaging exam, as was the case. The patient does mention a progressively worsening dyspnoea, which was never explored, and it was a non-related symptom that lead to the going to the ER.

A point could be raised as to the FEV1 of 38%, but after discussion with the anaesthesiologist and as the left lung was practically non-functioning, it was decided that the risk was manageable, but single lung ventilation was not possible, and that as soon as the mass was removed ventilation would improve gradually, as was proven.

Several case reports indicate the possibility of a minimally invasive approach, but limit this to small, well defined masses[1]. In the presented case, the mass was far too large for such a technique and a thoracotomy was warranted.

In the postoperative period the patient developed an acute pulmonary oedema secondary to acute lung injury after reexpansion of the lung and fluid overload. This entity is described for sudden reexpansion following pneumothorax drainage, but to the best of our knowledge not following removal of a large pleural mass.

In conclusion, solitary fibrous tumours are a rare entity, often times presenting as large thoracic masses, but are usually resectable, require a multidisciplinary approach and careful optimization pre and postoperatively.

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CASE REPORTS

REPAIR OF RUPTURED ABDOMINAL AORTIC ANEURYSM AFTER CARDIAC ARREST: A CASE REPORT

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Abstract

The management of abdominal aortic aneurysms, especially ruptured abdominal aortic aneurysms, continues to challenge vascular surgeons. A ruptured abdominal aortic aneurysm is associated with a high mortality rate. If cardiopulmonary resuscitation is required before surgical repair, mortality rates are said to be even higher. However, cardiac arrest in patients with ruptured abdominal aortic aneurysm does not accurately predict a nonsalvageable state or preclude functional survival. In these cases, agressive management may be the only hope for survival, and cardiac arrest should not as such contraindicate repair. The objective of this study is to present a successful case of repair of ruptured abdominal aortic aneurysm after cardiac arrest.

Keywords: *Abdominal aortic aneurysms, cardiac arrest, aortic repair*

INTRODUCTION

Cardiac arrest in patients with ruptured abdominal aortic aneurysm is not uncommon and associated with significantly increased mortality, but it should not constitute an absolute contraindication to aortic repair.

CASE REPORT

A 62-year-old man with medical history of hypertension presented to the Emergency Department with lower back pain and vomiting. On examination, the patient was in a pre-shock condition with tachycardia and low blood pressure, and a pulsatile epigastric mass was palpable. An acute CT scan revealed a contained ruptured infrarenal abdominal aortic aneurysm (Figure 1). During transfer to the operating room, the patient suffered cardiac arrest; cardiopulmonary resuscitation (CPR) was initiated, with return of spontaneous circulation after 10 minutes. An emergent open surgical repair with aorto-aortic inlay interposition of a vascular 22 mm diameter straight Dacron graft was performed. The patient had a blood loss of approximately 1000 mL during the intervention, and was transfused with a total of 2 units of packed red blood cells and 2 units of fresh frozen plasma. The intervention was otherwise uneventful, and he was then admitted in the intensive care unit. Immediate postoperative evolution was favorable, with possibility of extubation from mechanical ventilation within 24 hours of admission, hemodynamic stability and preserved diuresis. The patient was discharged to the vascular surgery ward on the 3rd postoperative day, where he recovered quickly and was discharged home on day 7 of admission. Six months later, on evaluation at a follow-up

Figure 1 *Contrast-enhanced axial CT of the abdomen and pelvis image showing a large infrarenal abdominal aortic aneurysm.*

appointment, he complained of intermittent claudication of the left lower limb (Fontaine Stage IIb), being otherwise well.

DISCUSSION

Despite dramatic changes in aortic aneurysm treatment and perioperative critical care, mortality in the setting of ruptured abdominal aortic aneurysm (rAAA) remains exceedingly high (1). Rapid institution of surgical therapy and intense postoperative care undoubtedly saved the lives of many patients who had rAAA. Situations exist, however, in which it may be considered futile or even unethical to perform surgery or to continue treatment in patients who have insurmountable risk, such as advanced age patients (> 80 years old) and those needing CPR before surgical repair (2). Preoperative cardiac arrest is relatively common among patients with rAAA and is a marker of advanced cardiovascular collapse. Although it has been suggested as a contraindication to aortic repair, cardiac arrest by itself is a poor predictor of subsequent short- and long-term outcomes, and it does not appear to impair long-term survival or functional status among patients (3). According to the recently published National Institute for Health and Care Excellence (NICE) Abdominal Aortic Aneurysm Guidelines, it is recommended not to use any single symptom, sign or patient-related risk factor to determine whether aneurysm repair is suitable for a person with a rAAA (4). Furthermore, despite different scoring systems and algorithms have been tested to predict futility of surgical treatment and select patients for palliation, to date, none has proven significantly accurate, and they should therefore not be used (2,4). Clearly, some patients with cardiac arrest are recoverable with resuscitation and surgery, whereas others are not. As such, aortic repair should not be withheld from patients who are otherwise reasonable candidates for intervention, provided resources for emergent aortic repair are available.

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CASE REPORTS

SURGICAL TREATMENT OF A SPONTANEOUS RUPTURE OF A MYCOTIC ANEURYSM

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Abstract

Saccular mycotic aorto-iliac aneurysms are rare but, when ruptured, they are an important life-threatening condition. We present the case of a 52 years-old male transferred from another hospital and admitted to the emergency room with a ruptured iliac artery aneurysm. He complained of persistent fever and abdominal discomfort that swiftly established as hemorrhagic shock. Image study with computed tomographic angiography revealed a ruptured left common iliac artery saccular aneurysm. The patient was instantaneously and successfully submitted to endoaneurismorraphy of the hypogastric artery, common and external iliac artery ligation and construction of an extra anatomic bypass, right to left femorofemoral bypass. Blood culture revealed a Streptococcus anginosus and the patient received appropriate targeted antibiotics. Post-operative period was uneventful and the patient discharged ten days after admission. He has now eleven months of follow up with no intercurrences. Even though surgical approach carries a relative risk of perioperative morbidity, it is a feasible and durable solution for extreme situations like the one here described..

INTRODUCTION

Firstly described by Osler in 1885, the term mycotic aneurysms (MA) was used referring to an infected aneurysm secondary to septic embolisms due to endocarditis.

MA aneurysms are rare, accounting for about 0.7% – 3.4% [6] of all aortic aneurysms. Nevertheless, they have high morbidity and mortality because of the exertion to make an early diagnosis and due to its rapid progress to the late stage, with fulminant sepsis and aneurysm rupture.

OBJECTIVE

The authors report the successful treatment of a ruptured mycotic left iliac artery aneurysm.

CASE REPORT

A 52 years-old male, without relevant medical records, was admitted at the hospital with persistent fever and abdominal discomfort that lasted for almost one week.

Upon presentation, his clinical status swiftly established as hemorrhagic shock, so he underwent computed tomographic angiography that reveled a ruptured left common iliac artery aneurysm with 90mm of maximum diameter, with extension of the aneurysmal degeneration to the internal iliac artery concomitant with a left iliopsoas abscess infiltration (Figure 1). The contact with our vascular surgery unit was established and the patient transferred.

He was admitted in the emergency room. His vital signs corroborated clinical instability: Glasgow score of 14, temperature of 38.3 Celsius, tachycardia (113 beats per minute) and hypotension (65/40 mmHg) requiring noradrenaline support.

Physical examination revealed mild left lower quadrant tenderness. Abnormal Laboratory values included a Platelets count of 57x10E3/uL and Hemoglobin of 9g/dL with normal renal function but metabolic acidosis.

We decided to perform an open surgical approach with aneurismectomy with common and external iliac artery ligation, hypogastric artery endoaneurismorraphy and concomitant ab-

scess drainage, as well as extensive debridement of the infected tissues. Subsequent extra-anatomic revascularization consisted of a right common femoral artery to left common femoral artery bypass performed with ePTFE.

Microbiology from the blood cultured demonstrated a Stretococcus anginosus and the patient received prolonged (three weeks) endo-venous antibiotic therapy (ertapenem and vancomycin), followed by oral antibiotic therapy with amoxicillin till performing six months. Despite no peri-operative vascular adverse events, the patient developed infectious colitis with Clostridium dificcille and received complementary Metronidazole with clinical resolution.

The patient has now one-year follow-up with no clinical, analytical or image signs of persistent infection. The surgical femorofemoral bypass is well functioning with bilateral, distal pulses without any kind of claudication. Postoperative computed tomographic angiography reconstruction with femorofemoral bypass is despicted in Figure 2.

DISCUSSION

MA of the aorta and iliac arteries remain a dreadful disease, with in-hospital mortality rates of 11% – 44% [7]. Aneurysm rupture and specially when associated with sepsis constitute the vast majority of deaths.

Repair of a mycotic ruptured aneurysms proved to be challenging. Ongoing infection, a hostile surgical abdomen and a frailty and instable patient further complicates the surgical approach.

Although there is still intense debate in the literature trying to define guidelines for the best treatment approach, the most definitive solution is still combining antibiotic therapy with surgical resection and extra-anatomic graft interposition. Open approach is demanding by the friable tissues with an inflammatory reaction making tissue planes difficult to demarcate, nevertheless, prosthetic material is, in general, not a viable option due to the high risk of infection and the reconstruction with a neo-aortoiliac system procedure is difficult due to the limited autogenous substitutes and reserved mainly when the infection extends to the juxtarenal or visceral segments. No studies have confirmed the superiority of rifampicin-impregnated grafts and even cryopreserved arterial homografts have lower rates of reinfection (approximately 20%), they have higher rates of aneurysmal degeneration and rupture (0% – 9%) [4].

Sorelius K et al described 1 an endovascular aortic repair for patients with mycotic aortic aneurysm. In that study, 5% of patients were converted to open repair during a mean follow-up period of 35 months, and the 5-year survival rate was 55%. Dubois M et al. [2] presented an investigation comparing the repair of MA with extra-anatomic reconstruction with an in-hospital mortality of 22.7% versus 18.9% in the in situ repair group.

Hyo-Hyun Kim et al also presented an article with MA patients submitted to in situ repair with an in-hospital mortality rate of 10.5% and a 5-year survival rate of 74.9% ± 11.5% during the 43.2-month follow-up period3. Han K et al described a cumulative survival of 100%, 100%, 83%, and 83% at 3 months, 1 year, 3 years, and 5 years regarding the treatment of six mycotic abdominal aortic and iliac aneurysm with hybrid (endovascular and open surgery) approach.

We believe that, despite other available and viable interventions described in the literature, open surgery allows for a better operative control of a septic patient with not only proceeding with total aneurysmectomy but also resection of all surrounding necrotic or infected tissues. Axilobifemoral or femorofemoral bypass is the method of reconstruction that despite, at first sight, seem like not an attractive option, it is of great usefulness in older and more debilitated patients.

Despite all that, we still agree that the decision for an open surgical approach will always be based on several factors, including the type and location of the aneurysm, the form of presentation, the patient's comorbidities, the microorganism that is isolated, the type and duration of antibiotic therapy, and the type of surgery.

Figure 1 *Postoperative computed tomographic angiography reconstruction with femorofemoral bypass.*

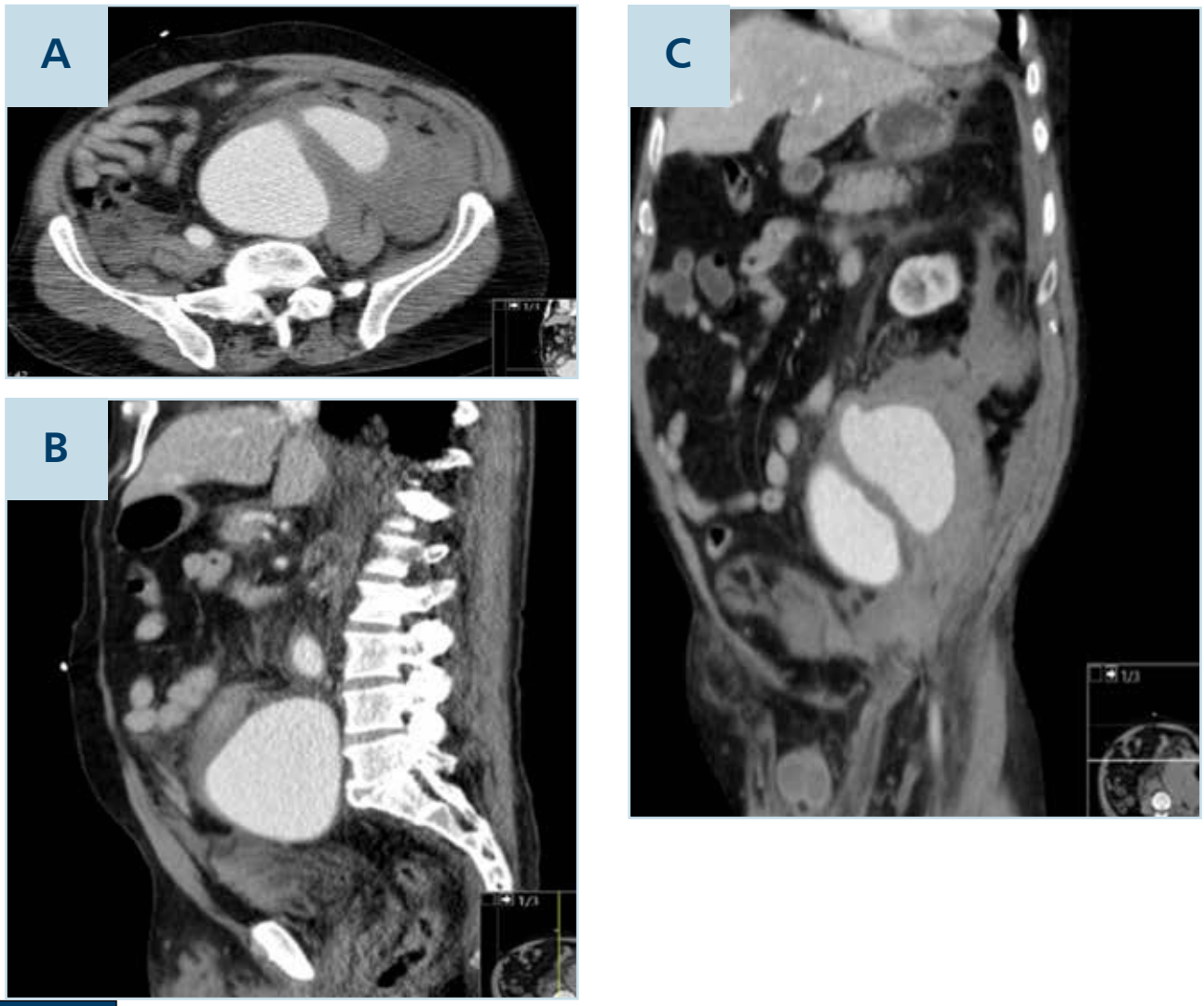

Figure 2 *Computed tomographic angiography at admission showing a mycotic aneurysm of the common iliac artery with rupture in axial (A), sagittal (B) and coronal (C) planes.*

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IMAGES IN SURGERY

A DECEITFUL RIGHT ATRIAL MASS

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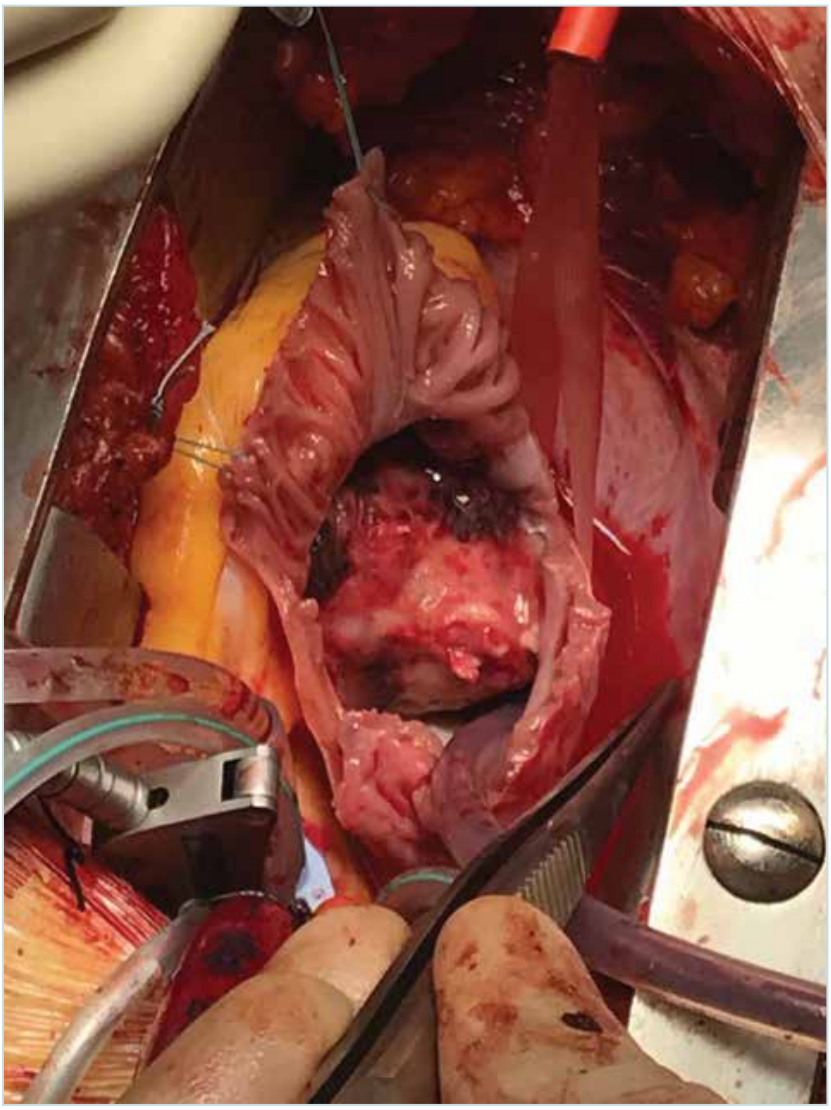
This large atrial mass was removed from a 33-year-old patient admitted to the emergency department for severe venous congestion. Its hard texture, grayish discolouration and wall infiltration prompted radical excision and partial atrial reconstruction. Histopathology was compatible with a thrombus, discarding malignancy.



IMAGES IN SURGERY

PULMONARY LYMPHANGIOLEIOMYOMATOSIS IN THE OPERATING ROOM

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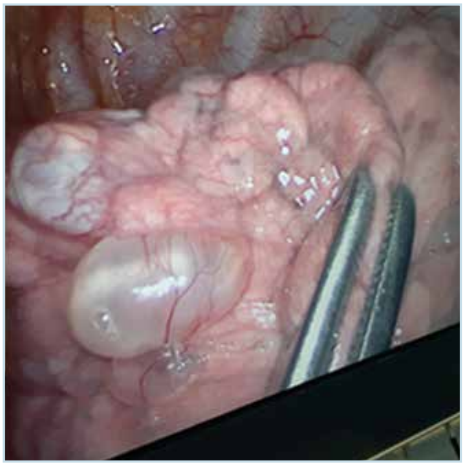
A 40 years-old woman with a previous history of a right pneumothorax in 2013 had a left pneumothorax with persistent air leak in 2020. The computerized tomography scan of the chest described diffuse emphysematous changes with multiple "small bullae" in the upper lobes. She was submitted to mechanical and chemical pleurodesis with a wedge apical resection by uniportal video-assisted thoracic surgery. Pathological findings confirm the diagnosis of pulmonary lymphangioleiomyomatosis.



AORTIC ARCH VARIANT AND COMMON CAROTID ARTERY AGENESIS

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An 83-year-old woman with a history of ileocecal appendix cancer underwent a staging thoracic-abdominal-pelvic computed tomography. Two extremely rare anatomic variants were identified: the right vertebral artery presented an anomalous origin from the aortic arch distal to the left subclavian artery and a retro-esophageal course; right common carotid artery agenesis.

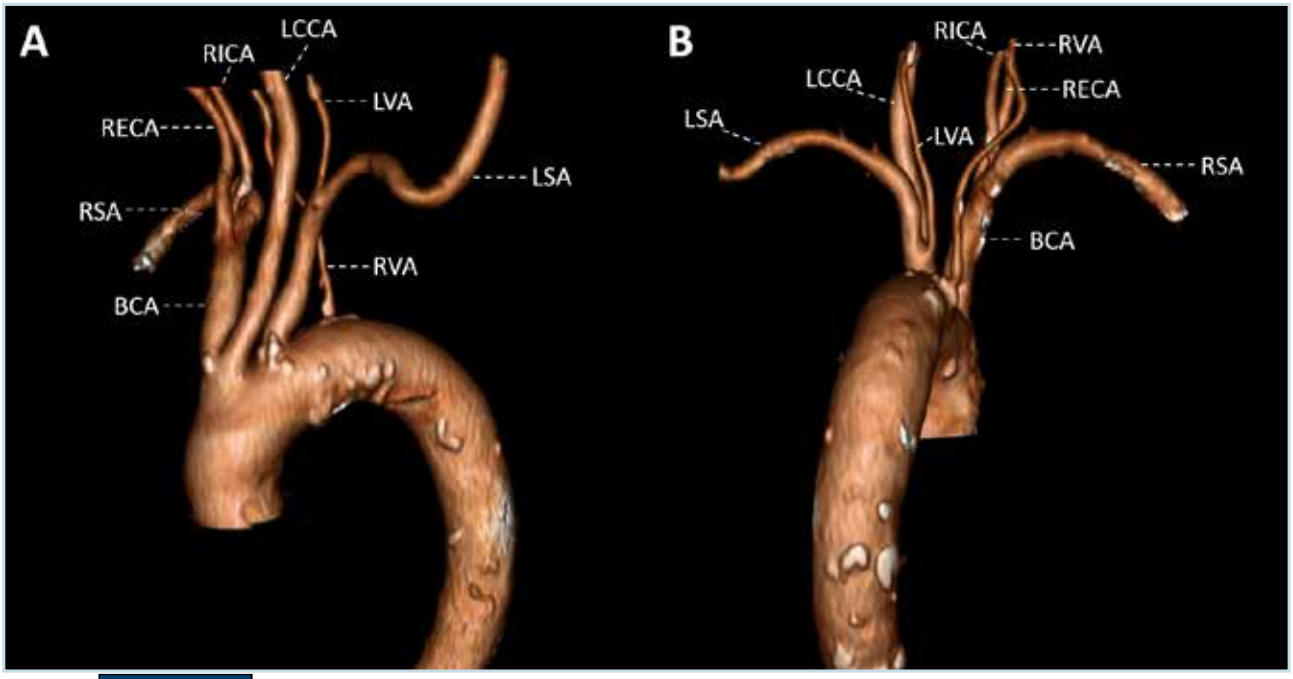

Figure 1

A and B. Computed tomography volume-rendered images show the vessels arising from the aortic arch: common trunk for left common carotid artery (LCCA) and brachiocephalic artery (BCA), left subclavian artery (LSA), and right vertebral artery (RVA). The right external carotid artery (RECA) and the right internal carotid artery (RICA) present independent origins from the BCA; the right subclavian artery (RSA) arises from the BCA after the emergence of the RICA. The left vertebral artery (LVA) arises from the left subclavian artery (LSA). Calcified atheromatous plaques are seen on the aorta and branch vessels. The presence of a common trunk for LCCA and BCA is a common anatomic variant.

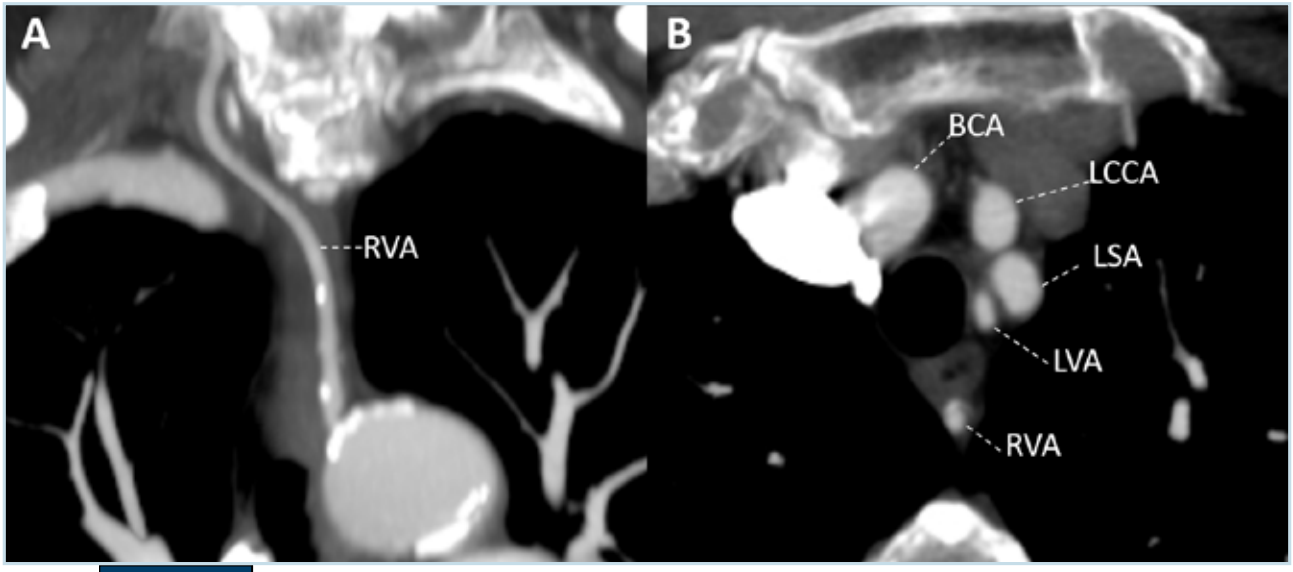

Figure 2

Coronal and axial computed tomography images. A. Coronal computed tomography image shows the origin and proximal course of the right vertebral artery (RVA), from origin to cervical foramina; calcified atheromatous plaques are seen on the aorta and RVA. B. Axial computed tomography image shows 5 epiaortic vessels: brachiocephalic artery (BCA); left common carotid artery (LCCA), left subclavian artery (LSA), left vertebral artery (LVA), and right vertebral artery (RVA), the latter with a retro-esophageal course.