Intravascular lithotripsy in heavily calcified iliac lesions. First peripheral case in Argentina

Litotricia intravascular en lesiones ilíacas severamente calcificadas. Primer caso periférico en Argentina

Ana Paula Mollón[1], Ignacio Luis Paganini[1], Raúl Alberto Llano[1], Francisco Peralta Bazán[1], Guillermo Lacour[2]

ABSTRACT

Severe vascular calcification is a predictor of worst outcomes in endovascular treatment. The complications can be potentially serious. Intravascular lithotripsy is a new option to modify the plaque with low risk of distal embolization.
This is the case of a 71-year-old manwith critical limb ischemia in his left leg. He presented with a severely calcified sub-occlusion of the left iliac arterythat was treated with a peripheral intravascular lithotripsy device. A total of 10 cycles were completed in that segment. Finally, we successfully performed a drug-coated balloon angioplasty from the ostium of the common iliac artery.

Keywords: *vascular calcification, lithotripsy, shockwave, peripheral disease.*

RESUMEN

La calcificación severa vascular es un predictor de malos resultados en el tratamiento endovascular y de complicaciones potencialmente graves. La litotricia intravascular es una nueva opción para la modificación de la placa, con bajo riesgo de embolización distal.
Se comunica el caso de un paciente de 71 años con diagnóstico de isquemia crítica de miembro inferior izquierdo. Presentaba lesión subocluida severamente calcificada en arteria ilíaca izquierda, que se trató con el dispositivo de litotricia intravascular periférica, se completaron los 10 ciclos en dicho segmento. Finalmente se implantó un balón liberador de fármacos desde el ostium de la arteria ilíaca primitiva, con resultado exitoso.

Palabras clave: *calcificación vascular, litotricia, ondas de choque, enfermedad periférica.*

Revista Argentina de Cardioangiología Intervencionista 2021;12(4):228-230. https://doi.org/10.30567/RACI/202104/0228-0230

INTRODUCTION

The prevalence of severe vascular calcification increases with age, atherosclerosis, diabetes mellitus, and chronic kidney disease. (1) It is predictor of poor results because it complicates blood vessel dilatation, increases the use of stents, and the rate of restenosis. (2) Coronary calcium is a very common thing in iliac arteries and increases the rate of complications in endovascular treatments that can be potentially serious like ruptured arteries. (3) Intravascular lithotripsy (Shockwave Medical, Fremont, United States) is a new alternative for blood vessel because preparation it modifies intimal and medial calcification with a low risk of distal embolization. (1) We describe the very first case ever performed in Argentina of lithotripsy for the peripheral endovascular treatment of a patient with severe calcification of the iliac arteries.

CASE PRESENTATION

This is the case of a 71-year-old man who was a former heavy smoker with arterial hypertension, dyslipidemia, diabetes, and chronic kidney disease. The patient's past medical history included coronary artery disease surgically revascularized, and an abdominal aortic aneurysm (AAA) of 3.9 cm in diameter that remained under strict follow-up. Intermittent claudication of left lower limb after walking for 300 meters treated with daily exercise, cilostazol, atorvastatin, clopidogrel, lercardipine, losartan, and aspirin. During the confinement, the patient's symptoms became worse until he developed critical limb ischemia.

1. Clínica Cemep. Departamento de Cardioangiologia Intervencionista
2. Clínica Cemep. Cirugía vascular

✉ Corresponding author: *Ana Paula Mollón. Juncal 2166 10 B, C1125ABB CABA, Argentina. anapaulamollon@gmail.com*

The authors declared no conflicts of interest whatsoever.

Received: 06/06/2021 | Accepted: 18/08/2021

The angiography of both the abdominal aorta and the lower limbs revealed the presence of a sub-occluded heavily calcified lesion in the proximal third of the left common iliac artery, severe stenoses in the distal segment and the external iliac artery with severe calcification and occlusion of the hypogastric artery **(Figure 1)**.
A coronary computed tomography angiography (CCTA) was used to study the diameters of the abdominal aortic aneurysm and the iliac axis. The study of both diameters confirmed the diagnosis. The maximum load of calcium was used in the most proximal segment of the left common iliac artery with almost total compromise of the entire lumen. **(Figure 2)**.
In view of worsening of symptoms, concomitant conditions, and the patient's anatomy the heart team decided to use an endovascular approach with intravascular lithotripsy (IVL) followed by and angioplasty with a paclitaxel-drug-coated balloon (DCB).
The IVL device (Shockwave Medical, Fremont, United States) consists of a balloon that inflates at low pressures (4 to 6 atmospheres) and uses high-speed pulsatile sonic pressure waves that run through the vessel wall and modify coronary calcium. The peripheral catheter generates cycles of 30 pulses at

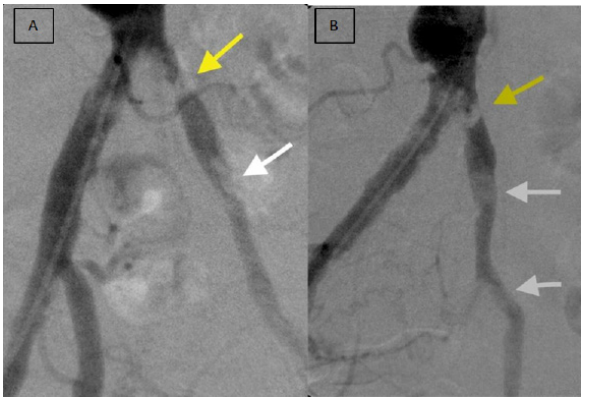

Figure 1.Digital *subtraction arteriography. A) anteroposterior projectionB) right oblique projection. The arrows are indicative of heavily calcified lesions.*

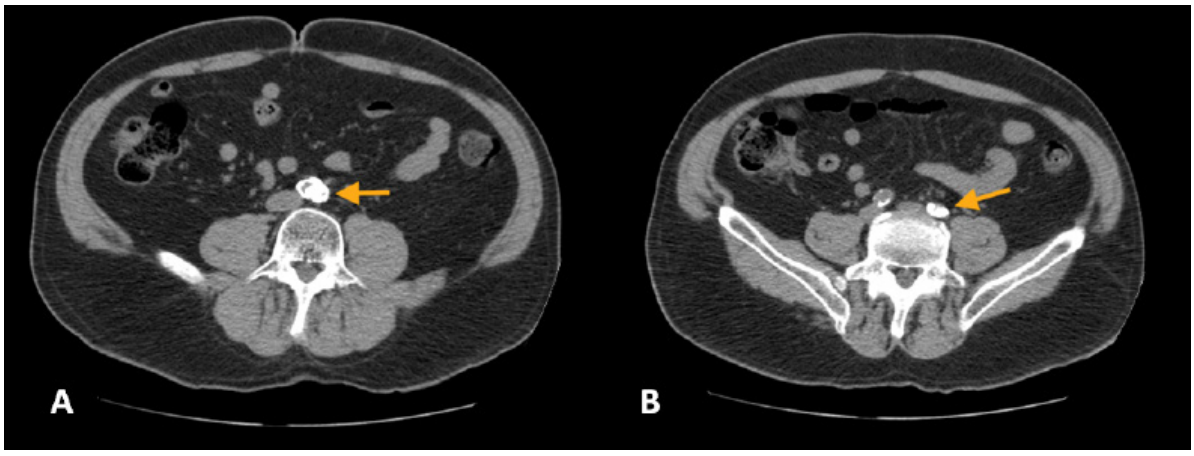

Figure 2. *Coronary computed tomography angiography without contrast in axial projections. A)Eccentric sub-occlusive lesion at left common iliac artery proximal level with coronary calcium compromising almost the entire lumen. B)Eccentric severe lesion at left common iliac artery distal level.*

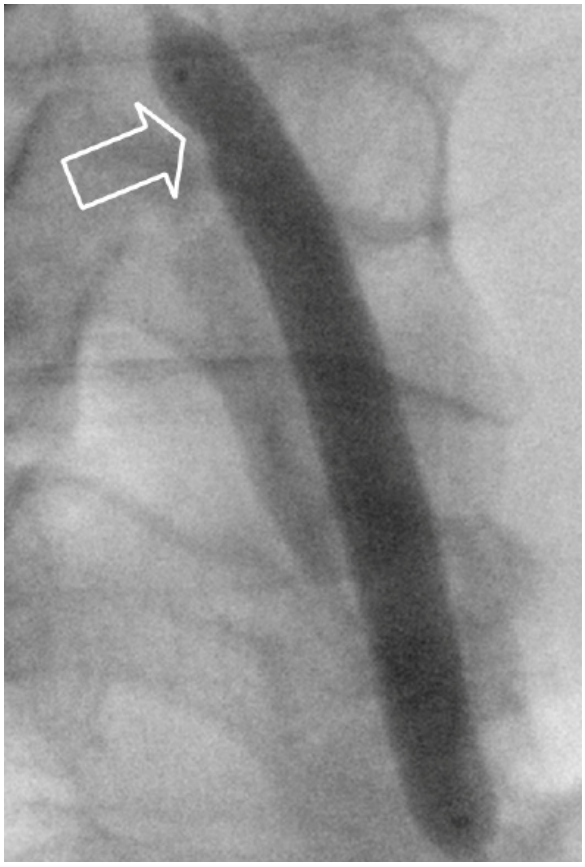

Figure 3. *Shockwave balloon during the first cycle at left common iliac artery level. The arrow shows the notch from the most severe circumferential calcification area at common iliac artery level that eventually resolved after the 8th cycle.*

a rate of 1 pulse per second with a maximum of 10 cycles. (1) A homolateral retrograde puncture was performed in the left common femoral artery to insert a 7-Fr introducer sheath (Terumo, Tokyo, Japan). The most critical lesion was crossed at proximal level using a 4-Fr vertebral hydrophilic catheter (Terumo, Tokyo, Japan) and a 0.035 in Magic guidewire (Boston Scientifics, Santa Clara, United States). Afterwards, a 4.0 mm x 80 mm 0.035 in peripheral balloon was advanced (Passeo 35 Biotronik, Berlin, Germany) that was dilated at 4 atmospheres to allow the passage of the lithotripsy balloon.
Then, the guidewire was exchanged on the balloon for a peripheral V14 0.014 in x 300 cm floppy guidewire (Boston

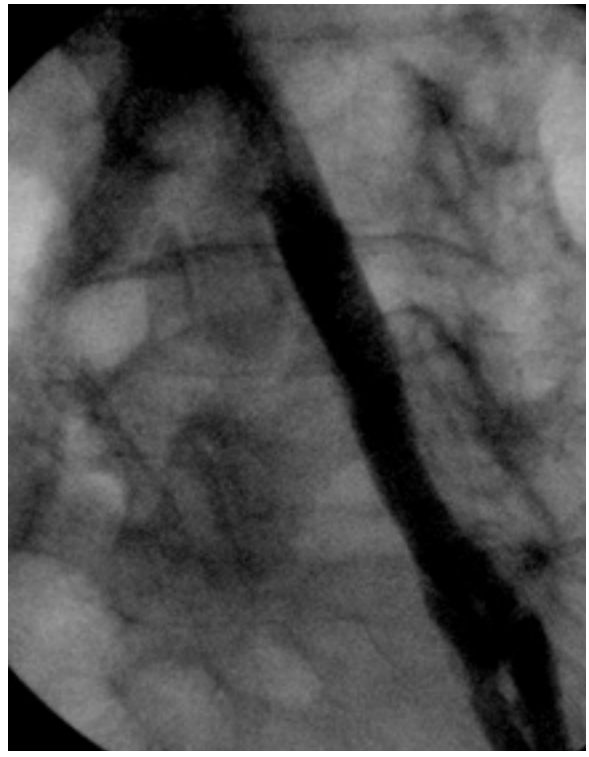

Figure 4. *Final successful result of the left iliac artery with a 20% residual lesion at proximal level.*

Scientifics, Santa Clara, United States) on which the 7.0 mm x 60 mm IVL device (Shockwave Medical, Fremont, United States) was advanced. The first 30-pulse cycle at 4 atm was performed from the ostium of the common iliac artery (Figure 3). When the cycle ended, the balloon was inflated at 6 atm for 20 seconds to achieve greater luminal gain. Another 8 cycles were completed in this lesion plus 2 cycles at the level of the ostium of the external iliac artery on another calcified lesion. Then, the IVL catheter was exchanged for an 8.0 mm x 80 mm balloon (PowerFlex Cordis Corporation) that was dilated at the level of the ostium of the common iliac artery until it reached the proximal segment of the external iliac artery at 8 atm for 60 seconds. Afterwards, an angioplasty was performed using an 8.0 mm x 80 mm DCB (IN. Pact Medtronic, Santa Rosa, United States) from the ostium of the common iliac artery with positive results. (Figure 4). The patient's clinical course improved, and he remai-

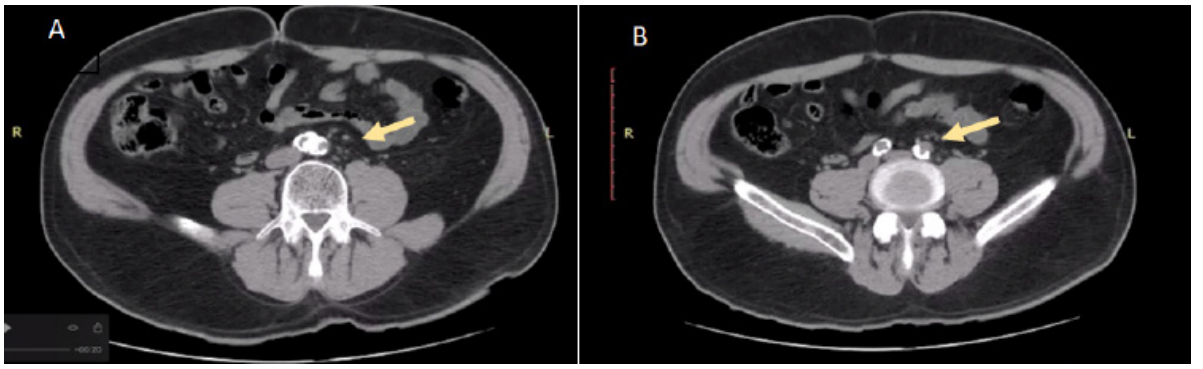

Figure 5. *Coronary computed tomography angiography without contrast in axial projections A and B after treatment. A) After lithotripsy and angioplasty, and at left common iliac artery proximal level, the modification of the calcified lesion becomes evident.B) Luminal gain at left common iliac artery distal level after lithotripsy and angioplasty.*

ned asymptomatic. A control CCTA was performed at the 1-month follow-up that confirmed the modification of the heavily calcified lesion followed by luminal gain at left common iliac artery level. (Figure 5)

DISCUSSION

Severe calcification of the iliac arteries increases the rate of distal embolization and lesions to the blood vessel. (4) Due to the complexity of the lesions at left iliac artery level following the risk of calcified emboli and considering that our patient has an AAA that, in the near future, may require the implantation of a bifurcated stent-graft at infrarenal abdominal aortic level, it was decided to use an adjuvant therapy (IVL) to treat coronary calcium with a low risk of complications. Also, this therapeutic approach minimizes the need for stenting, which may be limiting regarding the aortic endovascular treatment since it complicates the passage of the stent-graft through the iliac artery. Circumferential calcification and lumen compromise in the most critical lesion (Figure 2) would often require high-pressure inflations with the corresponding risk of dissection due to barotrauma. In this case, treatment with IVL fractured coronary calcium, facilitated proper dilatation, and effective luminal gain as former studies have already described (5). Also, it facilitated treatment with an 8.0 mm in diameter DCB with good angiographic results.

Severe calcification is associated with a decreased long-term patency of endovascular treatment; (6) in the iliac territory stent implantation is the most widely used strategy and can even generate suboptimal expansion (3, 7). Intimal calcification is a common trait of atherosclerosis while medial calcification is more common in patients with kidney failure, diabetes mellitus, and old age (1, 6). Our patient's past medical history puts him at risk in both locations. Several tools have become available like atherotomes, specific balloons (noncompliant, scoring, cutting) to modify the calcium plaque, allow optimal dilatation, and improve the vessel elasticity. However, these techniques have been associated with a higher risk of complications and only allow treating calcium at tunica intimal level. (2) The IVL uses pulsatile sonic waves that fracture the vascular calcium located both at the tunica intima and the intima media layers. (3) The endovascular management of complex lesions for the management of vascular disease has a high incidence rate of restenosis compared to the management of simple lesions (8). That is why the availability of new tools can improve the results. Given the low rate of complications reported, especially emboli, compared to atherotomes (7), and the impossibility of using distal filters via retrograde access we decided to choose this method as our best option. The fracture of this volume of calcium facilitates proper dilatation, an effective luminal gain, and a lower risk of barotrauma as reported in the medical literature. (5) The easiness of use since it is a balloon-mediate therapy that requires no filters allowed us to treat the patient efficiently with good results and without complications.

The main limitation here is that it is a case report of a new therapy of intravascular treatment for heavily calcified lesions in the peripheral territory. Similar therapies need to be compared such as atherectomy in its different versions before assessing the results obtained.

The use of IVL was easy, safe, and effective for the management of lesions with severe calcification and could reduce the need for stenting in the peripheral arterial territory of the lower limbs.

REFERENCES

1. *Kassimis G, Didagelos M, De Maria GL, et al. Shockwave Intravascular Lithotripsy for the Treatment of Severe Vascular Calcification. Angiology 2020;71(8):677-88.*
2. *Madhavan MV, Shahim B, Mena-Hurtado C, Garcia L, Crowley A, Parikh SA. Efficacy and safety of intravascular lithotripsy for the treatment of peripheral arterial disease: An individual patient-level pooled data analysis. Catheter Cardiovasc Interv 2020;95(5):959-68.*
3. *Armstrong EJ, Soukas PA, Shammas N, et al. Intravascular Lithotripsy for Treatment of Calcified, Stenotic Iliac Arteries: A Cohort Analysis From the Disrupt PAD III Study. Cardiovasc Revasc Med 2020;21(10):1262-8.*
4. *Jongkind V, Akkersdijk GJ, Yeung KK, Wisselink W. A systematic review of endovascular treatment of extensive aortoiliac occlusive disease. J Vasc Surg 2010;52(5):1376-83.*
5. *Rosseel L, De Backer O, Sondergaard L, Bieliauskas G. Intravascular iliac artery lithotripsy to enable transfemoral thoracic endovascular aortic repair. Catheter Cardiovasc Interv 2020;95(3):E96-E9.*
6. *Rocha-Singh KJ, Zeller T, Jaff MR. Peripheral arterial calcification: prevalence, mechanism, detection, and clinical implications. Catheter Cardiovasc Interv 2014;83(6):E212-20.*
7. *Lee MS, Martinsen BJ, Hollowed J, et al. Acute procedural outcomes of orbital atherectomy for the treatment of iliac artery disease: Sub-analysis of the CONFIRM registries. Cardiovasc Revasc Med 2018;19(5 Pt A):503-5.*
8. *Price LZ, Safir SR, Faries PL, McKinsey JF, Tang GHL, Tadros RO. Shockwave lithotripsy facilitates large-bore vascular access through calcified arteries. J Vasc Surg Cases Innov Tech 2021;7(1):164-70.*