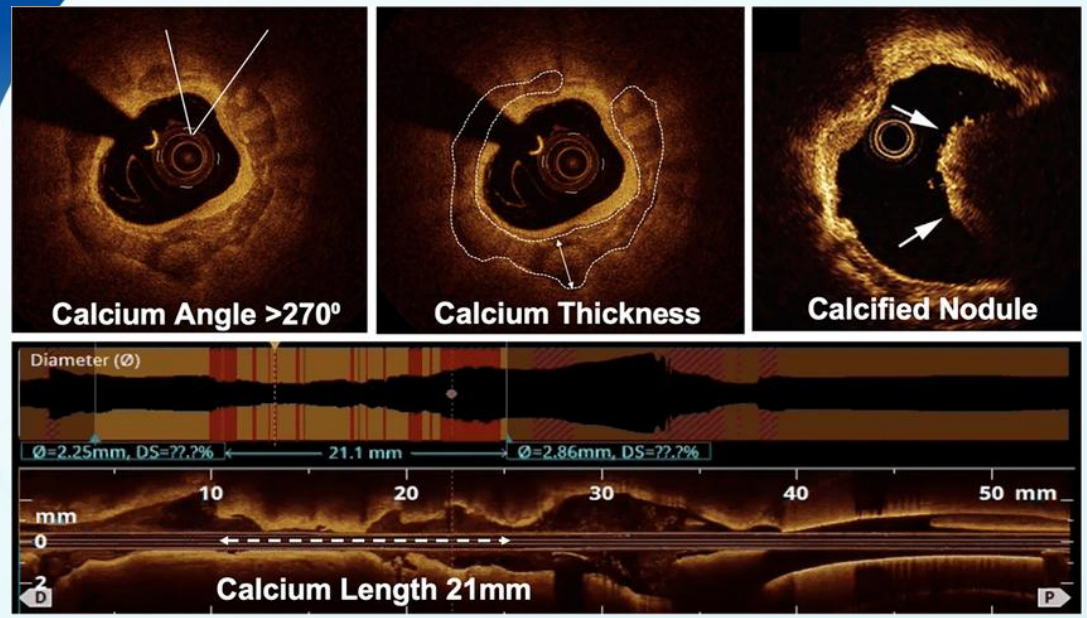
ACTP EN LESIONES SEVERAMENTE CALCIFICADAS: PAPEL DE LA LITOTRIPSIA (IVL)

DR. ESSAU DE LEON
CARDIOLOGIA INTERVENCIONISTA
PANAMA

INTRODUCCIÓN

- La cardiología intervencionista ha experimentado una evolución constante hacia el tratamiento de lesiones cada vez más complejas, siendo la calcificación coronaria severa uno de los obstáculos más significativos para el éxito procedimental y clínico a largo plazo.
- La presencia de calcio en la túnica íntima y media de las arterias coronarias dificulta el cruce de dispositivos impide una expansión adecuada de los stents farmacológicos (DES).
- El manejo de estas lesiones ha dependido de técnicas de modificación mecánica superficial, como:
- aterectomía rotacional u orbital, o el uso de balones de corte y de ultra alta presión, tecnologías con mayores complicaciones.

El Desafío del Calcio Coronario



- El calcio severo es predictor de resultados subóptimos y eventos adversos.
- Riesgos de técnicas tradicionales: Perforación, disección y fenómeno de no-reflow.
- Nuevas dispositivos como balón de litotripsia coronaria (IVL) conlleva un menor riesgo de complicaciones y fractura el calcio superficial y profundo preservando tejidos blandos

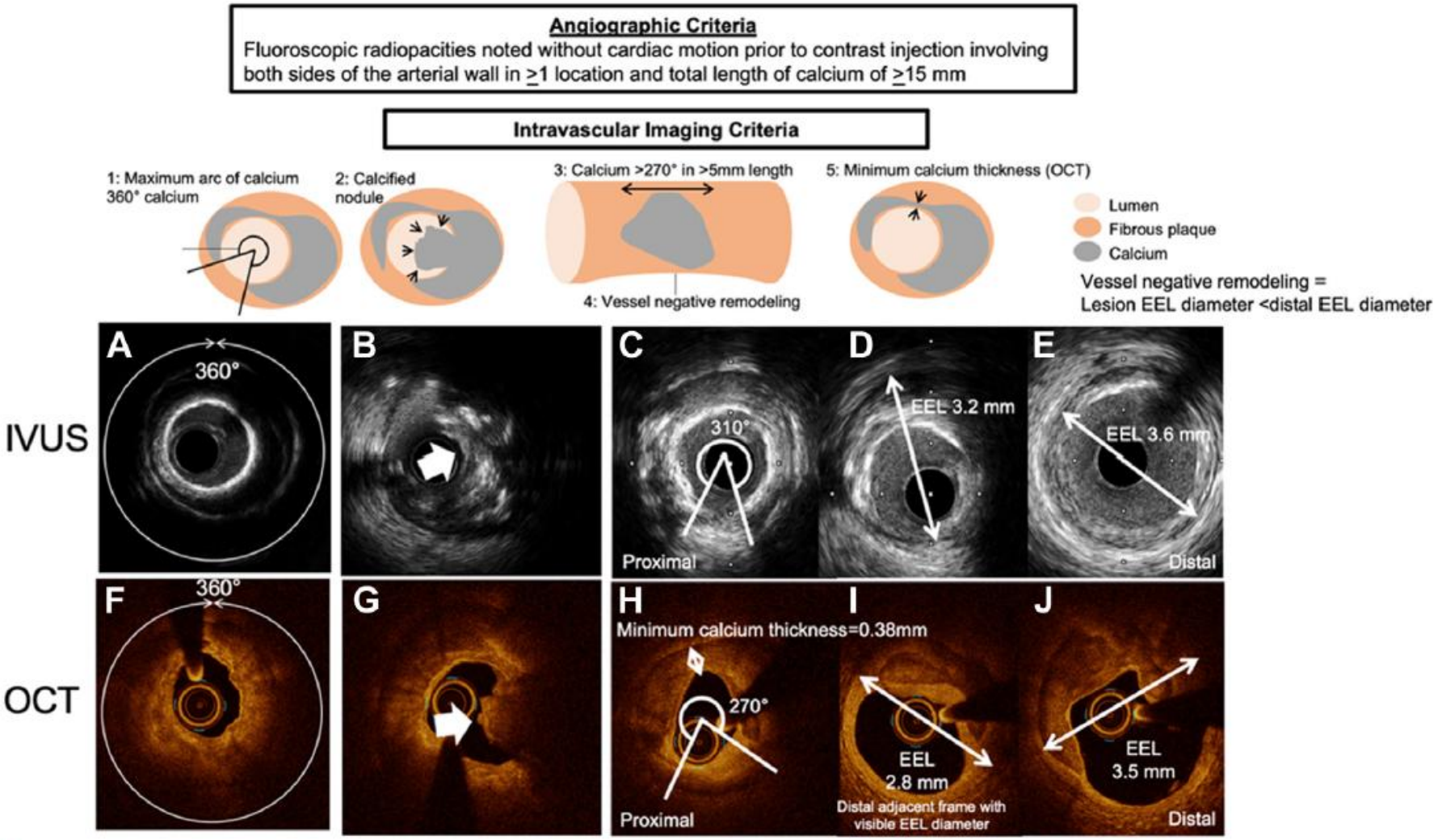


Figure 1.

Criteria for coronary calcium modification (group consensus). Angiographic criteria: fluoroscopic radiopacities noted without cardiac motion before contrast injection involving both sides of the arterial wall in at least 1 location and total length of calcium of at least 15 mm. Intravascular imaging criteria: By both intravascular ultrasound (IVUS) and optical coherence tomography (OCT), the total amount of calcium (calcium arc, thickness, and length) and negative remodeling or small vessel size are associated with stent expansion. OCT can evaluate thickness of calcium and the minimum thickness of calcium of <0.5 mm should be associated with the creation of calcium fracture without calcium modification. IVUS (**A**) and OCT (**F**) showed 360° of calcium. (**B**, **G**) Calcified nodules. (**C**) Calcium arc measured is 310°. (**D**) Frame with visible external elastic lamina (EEL) adjacent to (**C**), and the EEL diameter measured 3.2 mm. (**E**) further distal frame and EEL diameter measured 3.6 mm. Proximal EEL diameter smaller than distal EEL diameter in (**D**) indicates vessel negative remodeling. (**H**,**J**) OCT shows similar findings but with added calcium minimum thickness measured 0.38 mm.

PRINCIPIO DEL IVL

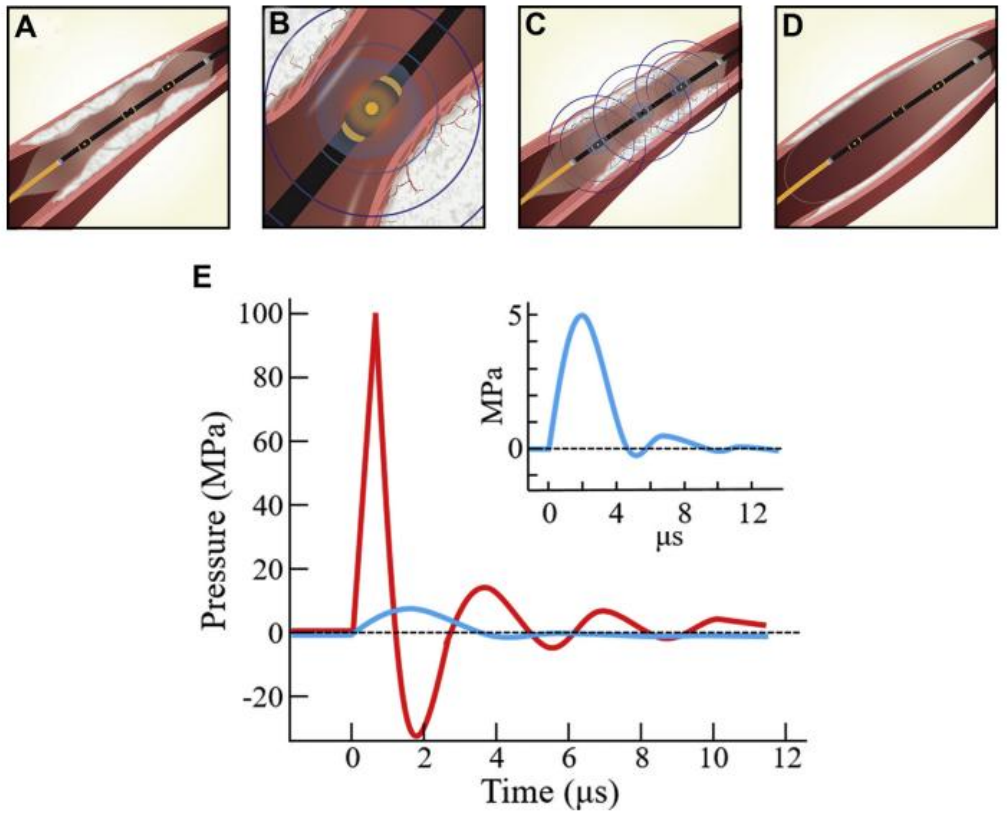
JACC: CARDIOVASCULAR INTERVENTIONS VOL. 14, NO. 12, 2021

STATE-OF-THE-ART REVIEW

Principles of Intravascular Lithotripsy for Calcific Plaque Modification

Dean J. Kereiakes, MD,[a] Renu Virmani, MD,[b] Jason Y. Hokama, PhD,[c] Uday Illindala, PhD,[c] Carlos Mena-Hurtado, MD,[d] Andrew Holden, MD,[e] Jonathan M. Hill, MD,[f] Sean P. Lyden, MD,[g] Ziad A. Ali, MD, DPhil.[h]

FIGURE 1 IVL Shockwave Generation



(A) The intravascular lithotripsy (IVL) balloon catheter is positioned across the target lesion and inflated to 4 atm. **(B)** Emitter spark gap discharge produces compressive shockwaves that emanate spherically outward; vapor bubble formation is contained with the integrated balloon. **(C)** IVL shockwaves affect superficial and deep calcium. **(D)** After IVL therapy is delivered, the balloon is inflated to 6 atm prior to deflation. **(E)** Superimposed IVL **(blue)** and extracorporeal shockwave lithotripsy **(red)** waveforms. Note the contrast in positive and negative peak pressures between the two electrohydraulic lithotripsy technologies. Representative IVL waveform demonstrating positive peak pressure of about 5 MPa with minimal negative peak pressure generation **(inset)**.

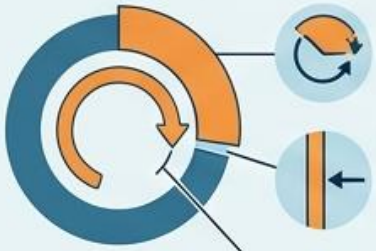
INFOGRAFÍA RESUMEN: ESTUDIO DISRUPT CAD III

DISEÑO DEL ESTUDIO DISRUPT CAD III

- Estudio IDE, global, multicéntrico, prospectivo
- 384 Pacientes
- 47 Sitios (EE.UU., Francia, Alemania, Reino Unido)
- Sub-estudio OCT: 100 Pacientes
- Datos adjudicados por Core Lab

CARACTERÍSTICAS DE LA LESIÓN (Sub-estudio OCT)

⚠ Carga de calcio muy severa



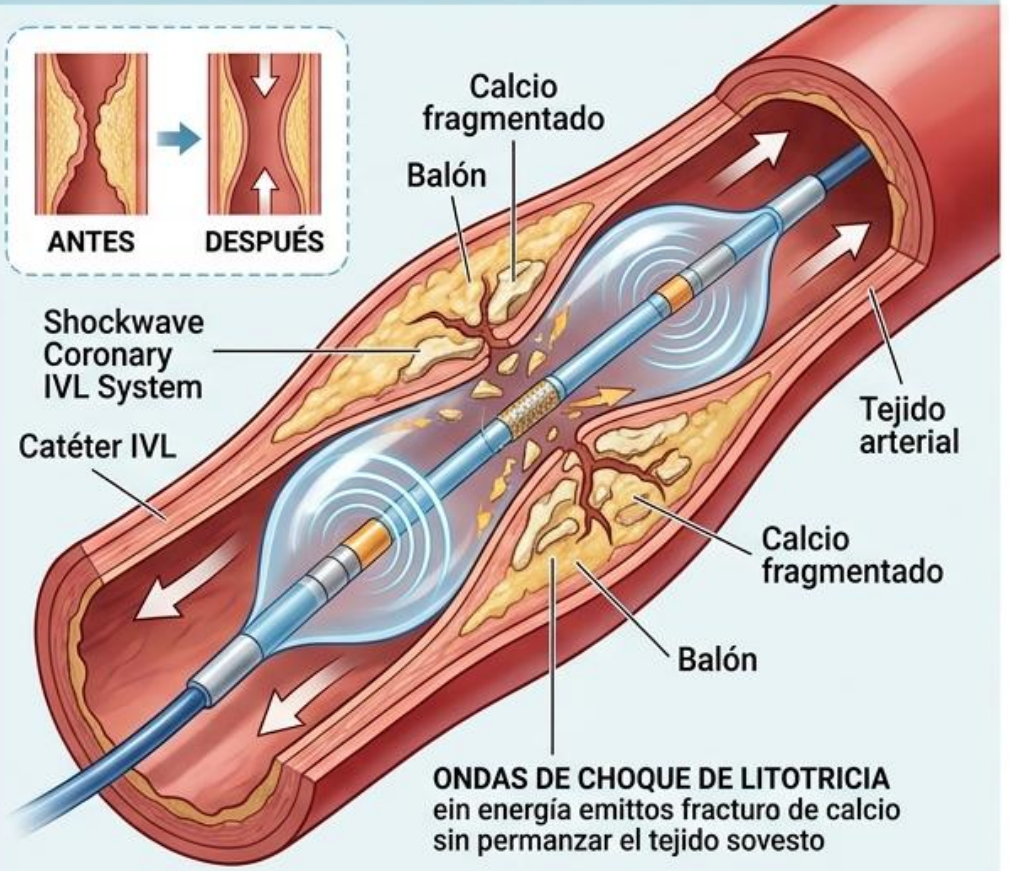
Arco de calcio promedio: **292.5°**

Grosor de calcio promedio: **0.96 mm**

Longitud de la lesión de calcio **292.5°**

Longitud de la lesión promedio: **47.9 mm**

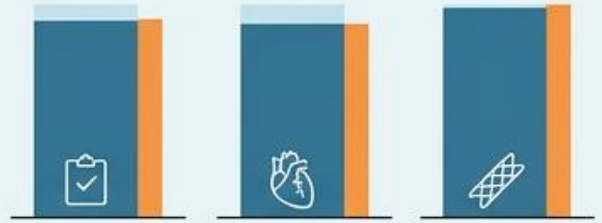
TERAPIA IVL CORONARIA EN ARTERIA CALCIFICADA



IVL superó expectativas con alta eficacia y baja tasa de eventos en lesiones severas.
— Dr. Dean Kereiakes, Co-investigador Principal.

RESULTADOS CLAVE DE EFICACIA Y SEGURIDAD (30 días)

Éxito Procesal (p<0.0001):	Libertad de MACE (p<0.0001):	Entrega exitosa de Stent:
92.4%	**92.2%**	**99.2%**



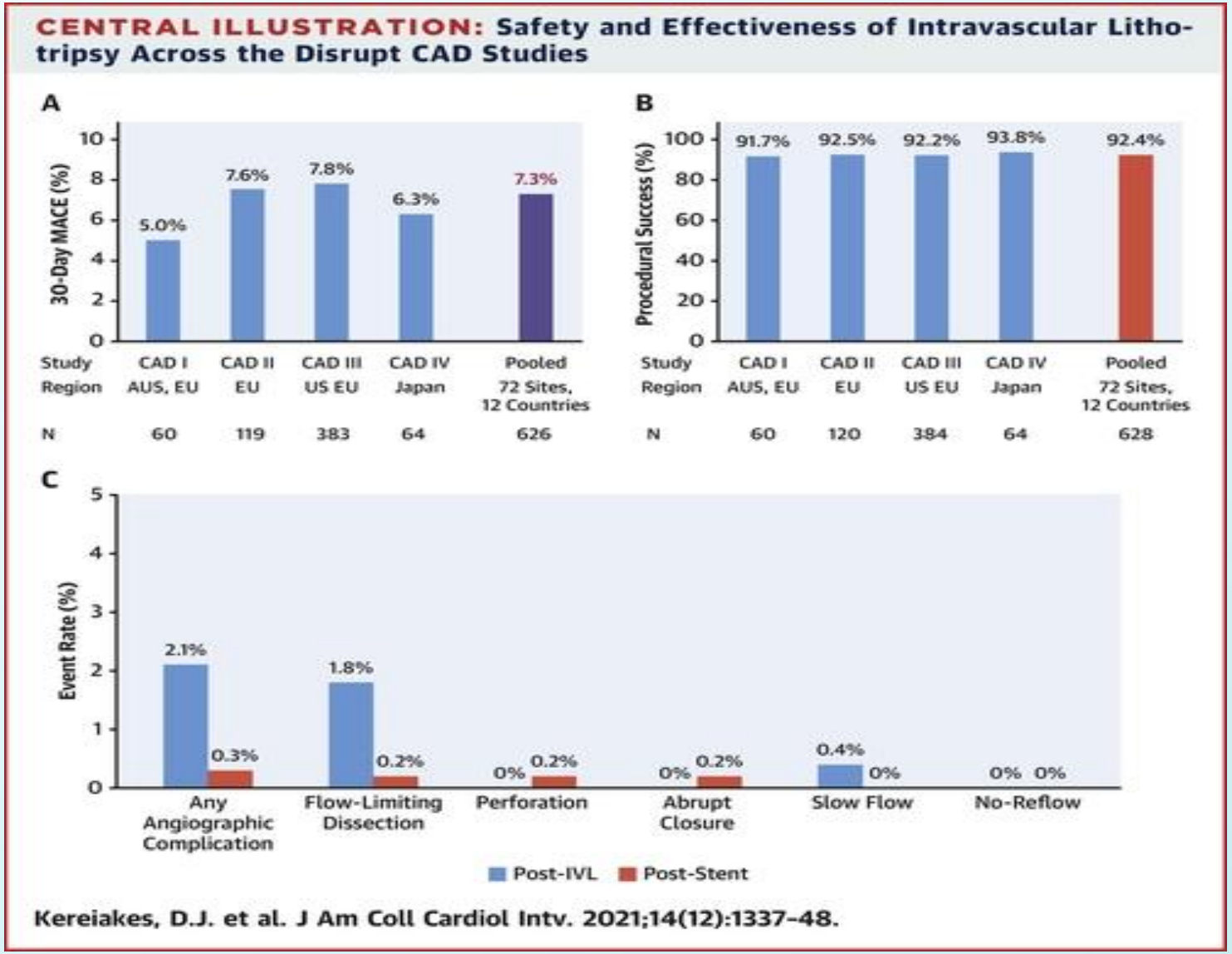
DESGLOSE DE MACE (30 días)

- Muerte Cardíaca: **0.5%**
- Infarto de Miocardio: **7.3%**
- Revascularización del Vaso Objetivo: **1.6%**

COMPLICACIONES ANGIOGRÁFICAS GRAVES

- Perforación: **0.3%**
- Disección Mayor: **0.3%**
- Cierre Abrupto: **0.3%**
- Flujo lento/No reflow: **0%**

POOL ANALISIS DISRUPT I A IV



Dean J. Kereiakes et al. *J Am Coll Cardiol Intv* 2021; 14:1337-1348.

IVL NODULO CALCIO VS NO NC

Outcomes of coronary intravascular lithotripsy for the treatment of calcified nodules: a pooled analysis of the Disrupt CAD studies

Ziad A. Ali[1,2,3]*, MD, DPhil; Doosup Shin[1], MD; Mandeep Singh[1], BS; Sarah Malik[1], MD; Koshiro Sakai[1], MD, PhD; Benjamin Honton[4], MD; Dean J. Kereiakes[5], MD; Jonathan M. Hill[6], MD; Shigeru Saito[7], MD; Carlo Di Mario[8], MD, PhD; Nieves Gonzalo[9], MD, PhD; Robert F. Riley[10], MD; Akiko Maehara[1,2], MD; Mitsuaki Matsumura[2], BS; Jason Hokama[11], PhD; Nick E.J. West[11], MD; Gregg W. Stone[12], MD; Richard A. Shlofmitz[1], MD

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This paper also includes supplementary data published online at: https://eurointervention.pcronline.com/doi/10.4244/EIJ-D-24-00282

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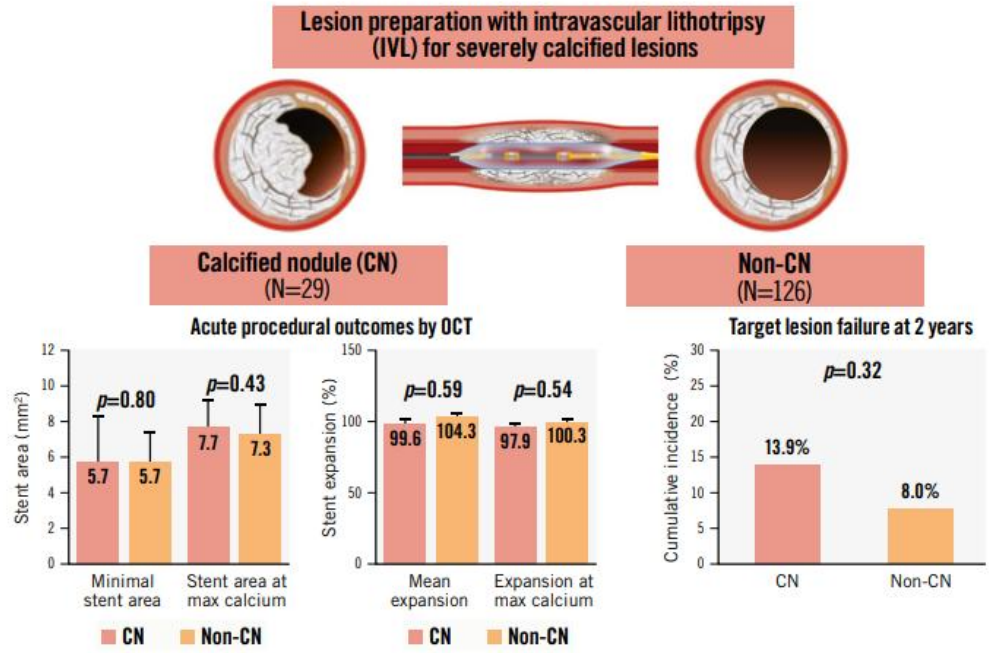
EuroIntervention — Central Illustration

Disrupt CAD III-IV OCT substudies (N=155 from 21 sites in 3 countries).



Ziad A. Ali *et al.* • *EuroIntervention* 2024;20:e1454-e1464 • DOI: 10.4244/EIJ-D-24-00282

From the Disrupt CAD III and IV studies, the individual patient-level data of 155 patients who underwent IVL-assisted PCI were pooled. Among them, a CN was identified in 18.7% (29/155) of lesions. After PCI, there were no differences in stent expansion or final minimal stent area when comparing CN lesions and non-CN lesions, despite a higher calcium burden in CN lesions. The cumulative incidence of TLF at 2 years was similar between the CN and non-CN groups. CN: calcified nodule; IVL: intravascular lithotripsy; PCI: percutaneous coronary intervention; OCT: optical coherence tomography; TLF: target lesion failure

Perfil Clínico: Registro IVL-DRAGON

Perfil de la Población

N=62

69 años

66%
Varón

Comorbilidades

Diabetes
45%

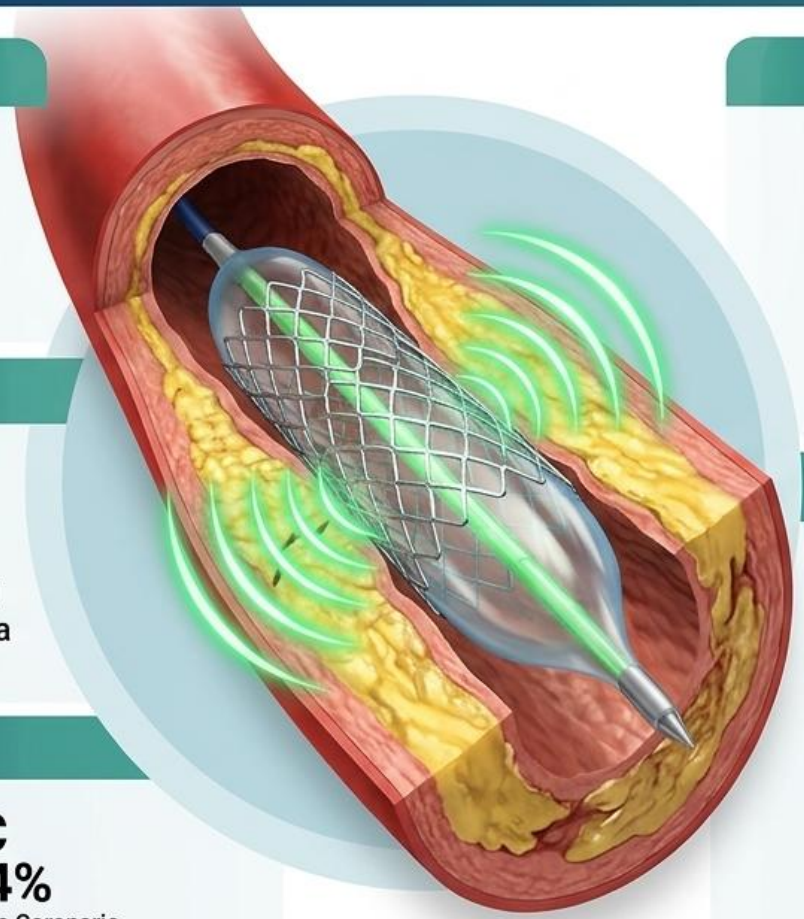
Enfermedad Periférica
26%

Enfermedad Renal Crónica
16%

Presentación Clínica

SCA
51.6%
Síndrome Coronario Agudo

SCC
48.4%
Síndrome Coronario Crónico



Presentación Clínica

51.6%
Síndrome Coronario Agudo

48.4%
Síndrome Crónico

Complejidad de la Lesión

45.2%
ISR Recurrente

45.2%
ISR Recurrente

29%
Múltiples Capas de Stent

Calcificación Grave

J. Clin. Med. 2022, 11, 1779. https://doi.org/10.3390/jcm11071779

Article
Intravascular Lithotripsy for the Treatment of Stent Underexpansion: The Multicenter IVL-DRAGON Registry

Wojciech Wańha [1,*], Mariusz Tomaniak [2], Piotr Wańczura [3], Jacek Bil [4], Rafał Januszek [5], Rafał Wolny [6], Maksymilian P. Opolski [7], Łukasz Kuźma [7], Adam Janas [8], Tomasz Figatowski [9], Paweł Gąsior [3], Marek Milewski [3], Magda Roleder-Dylewska [1], Łukasz Lewicki [10], Jan Kulczycki [11], Adrian Włodarczak [11], Brunon Tomasiewicz [12,13], Sylwia Iwańczyk [14], Jerzy Sacha [15], Łukasz Koltowski [2], Miłosz Dziarmaga [16], Miłosz Jaguszewski [3], Paweł Kralisz [7], Bartosz Olajossy [17], Grzegorz Sobieszek [17], Krzysztof Dyrbuś [18], Mariusz Łebek [19], Grzegorz Smolka [1], Krzysztof Reczuch [12,13], Robert J. Gil [4], Sławomir Dobrzycki [7], Piotr Kwiatkowski [20], Marcin Rogala [21], Mariusz Gąsior [18], Andrzej Ochała [1], Janusz Kochman [2], Adam Witkowski [3], Maciej Lesiak [14], Fabrizio D'Ascenzo [22], Stanisław Bartuś [4] and Wojciech Wojakowski [1]

Registro Multicéntrico IVL-DRAGON

Resultados del Registro

QCA Stenosis:
58.5% ➡ 11.4%
% de Reducción de Stenosis

OCT Expansion:
37.5% ➡ 86.0%
% de Expansión del Stent

IVUS Expansion:
57.0% ➡ 89.0%
% de Expansión del Stent

Tasa de Éxito: 72.6%
Éxito Procedimental Completo

Datos Agregados Multicéntricos

J. Clin. Med. **2022**, *11*, 1779. https://doi.org/10.3390/jcm11071779

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Table 3. Quantitative findings and intracoronary imaging.

	Before IVL	Post IVL	*p*
Quantitative findings, n = 62 (100)			
Diameter stenosis at MLD, (%)	58.5 (47.5–69.7)	11.4 (5.8–20.7)	<0.001
Area stenosis at MLD, (%)	82.6 (72.4–90.8)	21.5 (11.1–37.2)	<0.001
MLD, (mm)	1.1(0.7–1.4)	2.6 (2.3–3.1)	<0.001
Lesion length, mm	21.2 ± 11.2	-	
OCT, n = 15 (24.2)			
Stent expansion at MSA, %	37.5 (16.0–66.0)	86.0 (69.2–90.7)	<0.001
MLA, mm^2	1.9 (1.7–2.9)	5.8 (5.5–8.0)	<0.001
MSA, mm^2	2.8 (1.8–4.0)	6.4 (5.5–8.1)	<0.001
Maximal calcium angle behind stent, °	277 (235–313)	207 (175–240)	0.004
Maximum calcium thickness, mm	0.7 (0.6–0.8)	0.6 (0.5–0.7)	0.003
Calcium length behind stent, mm	12.3 (11.1–17.3)	-	-
Malapposition,	4 (28.6)	1 (7.1)	0.146
Thrombus, n (%)	-	-	
Stent fracture, n (%)	-	-	
Tissue protrusion, n (%)	-	-	
Dissection/intramural hematoma, n (%)	-	-	
IVUS, n = 14 (22.6)			
Stent expansion at MSA, %	57.0 (31.5–77.2)	89.0 (85.0–92.0)	0.002
MLA, mm^2	2.5 (1.8–2.9)	5.1 (3.8–8.3)	<0.001
MSA, mm^2	4.1 (2.7–5.0)	8.3 (6.7–8.5)	<0.001
Plaque burden behind stent at MLA, %	71.0 (55.0–82.4)	40.0 (32.2–64.7)	0.051
Remodeling index	0.9 (0.8–0.9)	1.2 (1.0–1.4)	0.051
Dissection/intramural hematoma, n (%)	-	-	

Values are median (interquartile range) and n (%); OCT = optical coherence tomography; IVUS = intravascular ultrasound; MLD = minimum lumen diameter; MLA = minimum lumen area; MSA = minimum stent area.

JACC: CARDIOVASCULAR INTERVENTIONS VOL. 14, NO. 12, 2021

STATE-OF-THE-ART REVIEW

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IVL VS REST OF THE WORLD

TABLE 4 Angiographic Complications With Coronary Calcium Modification Technologies

	IVL	Rotational Atherectomy	Orbital Atherectomy	Laser Atherectomy
Study	Disrupt CAD I, Disrupt CAD II, Disrupt CAD III, Disrupt CAD IV (25,30,56,73)	PREPARE-CALC (77)	ORBIT II (78)	Bilodeau et al. (79)
n	60, 120, 384, 64	100	443	95
Moderate to severe Ca^{++}, %	94.2-100	100	100*	80%†
Angiography core laboratory	Yes	Yes	Yes	Yes
In-hospital MI, %	5.0-6.8‡	2.0§	9.3‡	2.1
Dissection (types D-F), %	0.0-0.3	3.0‖	0.9¶	5.3¶
Perforation, %	0.0-0.3	4.0	0.9	0.0
Abrupt closure, %	0.3	NR	0.2	0.0
Slow flow, %	0.0	2.0#	0.5	0.0
No reflow, %	0.0	–	0.0	–

Values are %, unless otherwise indicated. *Site reported. †Presence of calcium noted, but severity not specified. ‡CK-MB >3 times the upper limit of normal. §CK-MB >3 times the URL or troponin >3 times the URL. ‖Large dissection (>5 mm). ¶Includes dissection types C to F. #Includes no reflow and slow flow.

CK-MB = creatine kinase myocardial band; Disrupt CAD I = Shockwave Coronary Rx Lithoplasty Study; Disrupt CAD II = Shockwave Coronary Lithoplasty Study; Disrupt CAD III = Disrupt CAD III With the Shockwave Coronary IVL System; Disrupt CAD IV = Disrupt CAD IV With the Shockwave Coronary IVL System; IVL = intravascular lithotripsy; MI = myocardial infarction; NR = not reported; ORBIT II = Evaluate the Safety and Efficacy of OAS in Treating Severely Calcified Coronary Lesions; PREPARE-CALC = Comparison of Strategies to Prepare Severely Calcified Coronary Lesions Trial; URL = upper reference limit.

JACC: CARDIOVASCULAR INTERVENTIONS VOL. 19, NO. 5, 2026

ORIGINAL RESEARCH

CORONARY

Intravascular Lithotripsy or Mechanical Debulking in Complex Calcified Coronary Arteries

Multicenter, Prospective ROLLING STONE Study

Enrico Cerrato, MD, PhD,[a,*] Marco Pavani, MD,[a,*] Simone Zecchino, MD,[a] Massimo Leoncini, MD,[b]

Propension

30-day MACE

(3.1% IVL vs 6.8% AT; HR: 0.49; 95% CI: 0.17-1.44; *P* = 0.20)

MACE a 12 meses

IVL vs AT (6.8% vs 14.3%; HR: 0.43; 95% CI: 0.21-0.89; *P* = 0.022)

CENTRAL ILLUSTRATION Main Clinical and Angiographic Features, and Safety Endpoints of the ROLLING STONE Registry

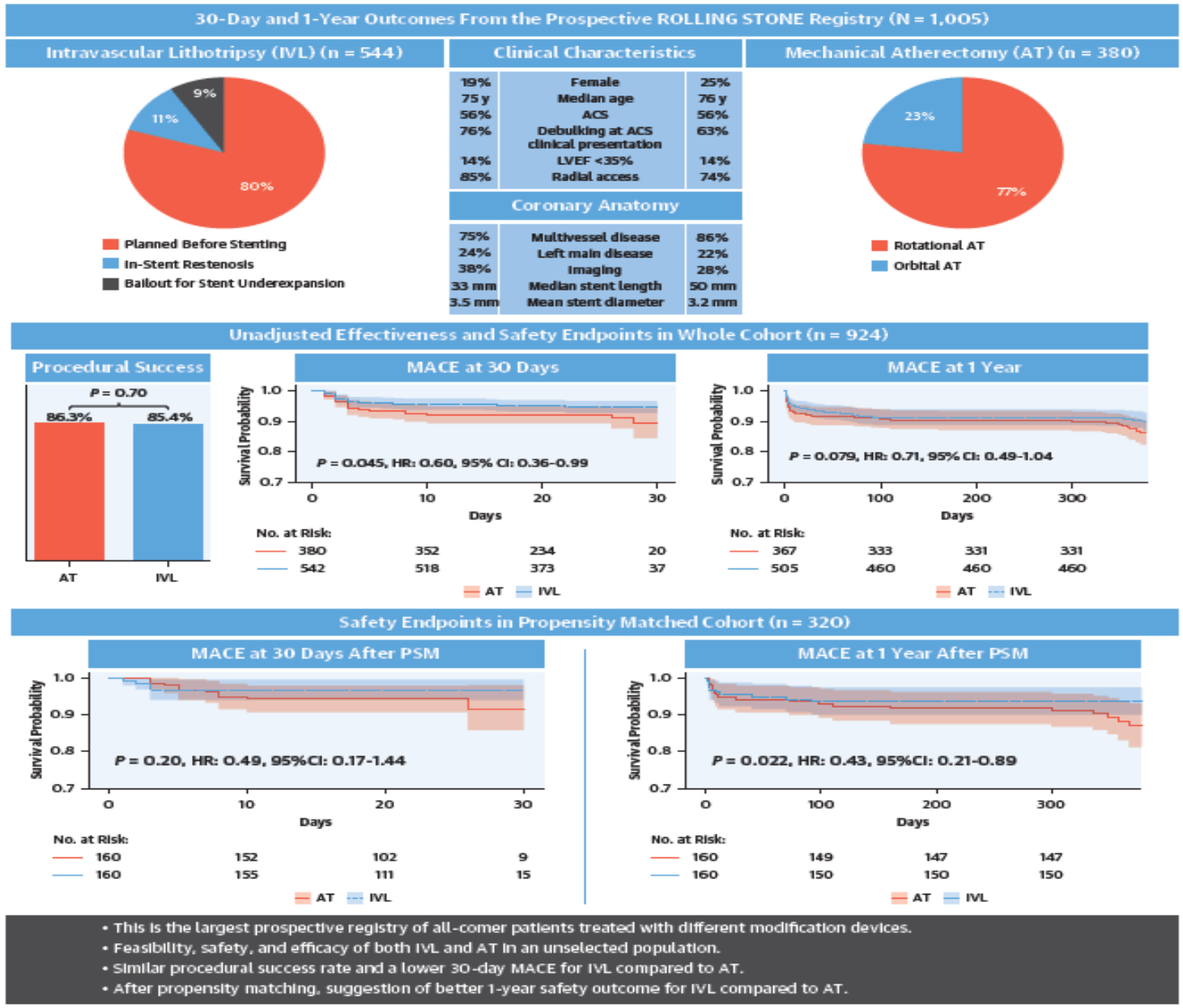
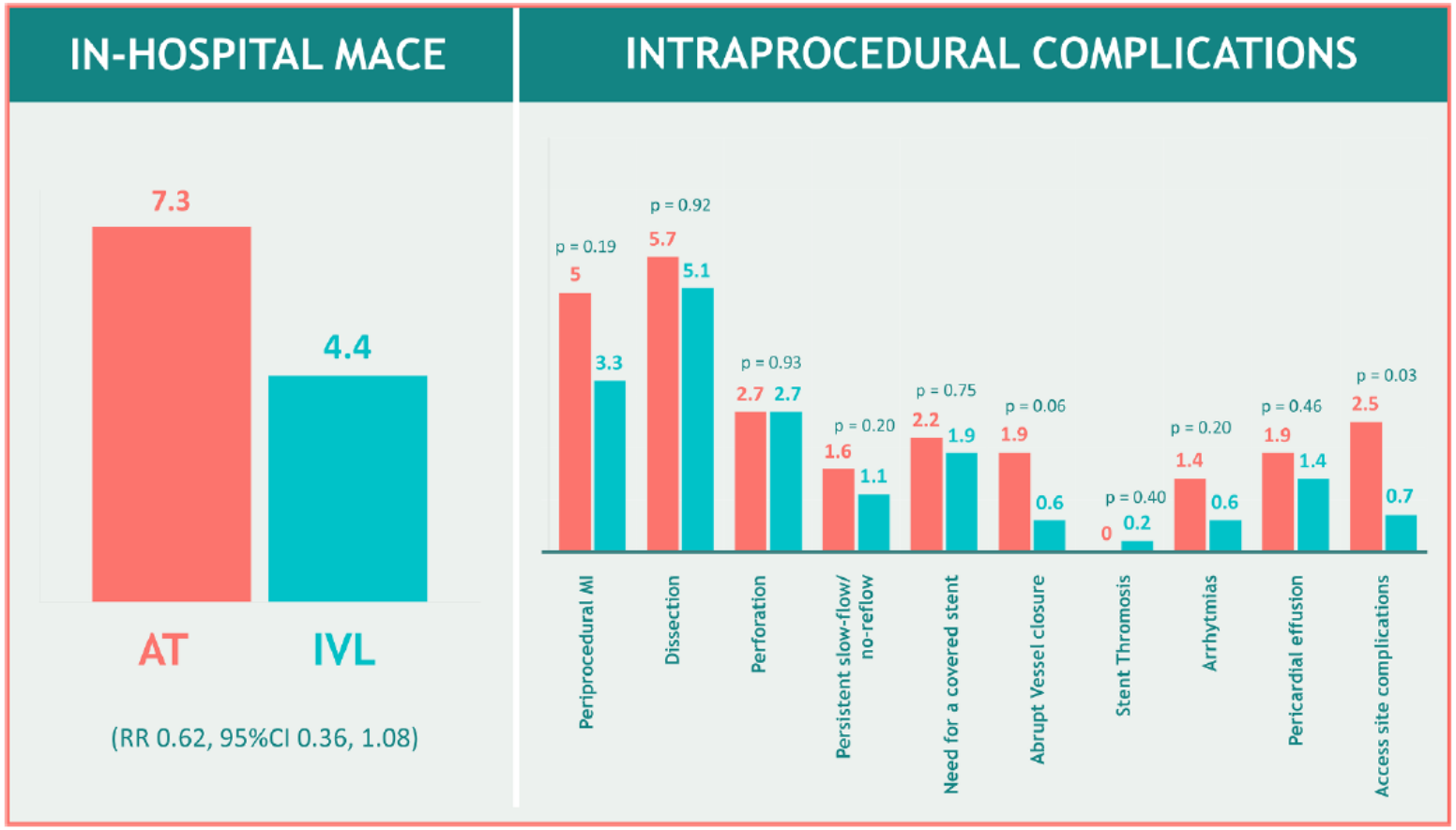


FIGURE 1 Incidence of In-Hospital MACE and Intraprocedural Complications in the ROLLING STONE Registry



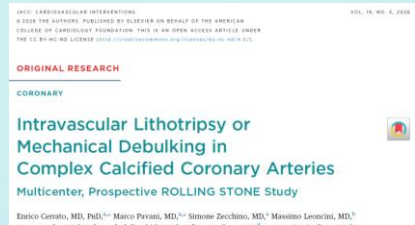
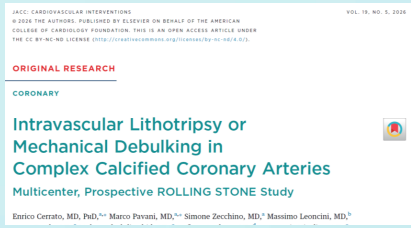

ORIGINAL RESEARCH
CORONARY
Intravascular Lithotripsy or Mechanical Debulking in Complex Calcified Coronary Arteries
Multicenter, Prospective ROLLING STONE Study

TABLE 3 30-Day and 12-Month Follow-Up Clinical Outcomes

	MACE 1 Year					MACE 30 Days				
	N	Events, N	Risk, %	HR (95% CI)	*P* Value	N	Events, N	Risk, %	HR (95% CI)	*P* Value
CV death	872	28	3.2			923	24	2.6		
AT	367	17	4.6	–		380	15	3.9	–	
IVL	505	11	2.2	0.45 (0.21-0.97)	0.041	543	9	1.7	0.40 (0.18-0.92)	0.030
Spontaneous MI	872	19	2.2			923	4	0.43		
AT	367	8	2.2	–		380	1	0.26	–	
IVL	505	11	2.2	0.96 (0.38-2.38)	0.92	543	3	0.55	1.83 (0.19-17.7)	0.60
TVR	872	44	5.0			923	8	0.87		
AT	367	17	4.6	–		380	5	1.3	–	
IVL	505	27	5.3	1.04 (0.56-1.91)	0.91	543	3	0.55	0.33 (0.08-1.40)	0.13
Stent thrombosis	872	15	1.7			923	9	0.98		
AT	367	7	1.9	–		380	5	1.3	–	
IVL	505	8	1.6%	0.80 (0.29-2.22)	0.67	543	4	0.74%	0.51 (0.14-1.91)	0.32

CV = cardiovascular; MACE = major adverse cardiac event(s); TVR = target vessel revascularization; other abbreviations as in Table 1.



Canadian Journal of Cardiology 40 (2024) 1657–1667

Clinical Research

Effectiveness and Safety of a Novel Intravascular Lithotripsy System for Severe Coronary Calcification: The CALCI-CRACK Trial

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Perfil Metodológico

- Ensayo prospectivo, multicéntrico y de un solo brazo, en lesiones calcificadas
- Determinar la eficacia y seguridad de un nuevo sistema de IVL en lesiones de alta complejidad técnica en un entorno de "mundo real en china.
- 15 centros alto volumen en china

Característica Técnica	Shockwave C2 (Shockwave Medical)	SONOSEMI
Número de emisores	2 emisores fijos	2 pares de emisores (4)
Capacidad total de pulsos	100 pulsos por catéter	Hasta 100 pulsos por catéter
Longitud del balón	12 mm	12 mm
Tamaños de diámetro (mm)	2.5, 3.0, 3.5, 4.0	2.5, 2.75, 3.0, 3.25, 3.5, 3.75, 4.0
Perfil de cruce (pulgadas)	0.43 a 0.46	0.042 a 0.46
Arquitectura del balón	Monocapa estándar	Doble capa

Criterios

INCLUSION

- Edad 18 a 80 años
- Isquemia asintomática, angina estable o inestable o IAM antiguo
- Vasos diana 2.5 a 4 mm y longitude 40 mm
- Lesion diana de 70% o 50% con isquemia
- Calcificacion severa por fluroscopia definida como:

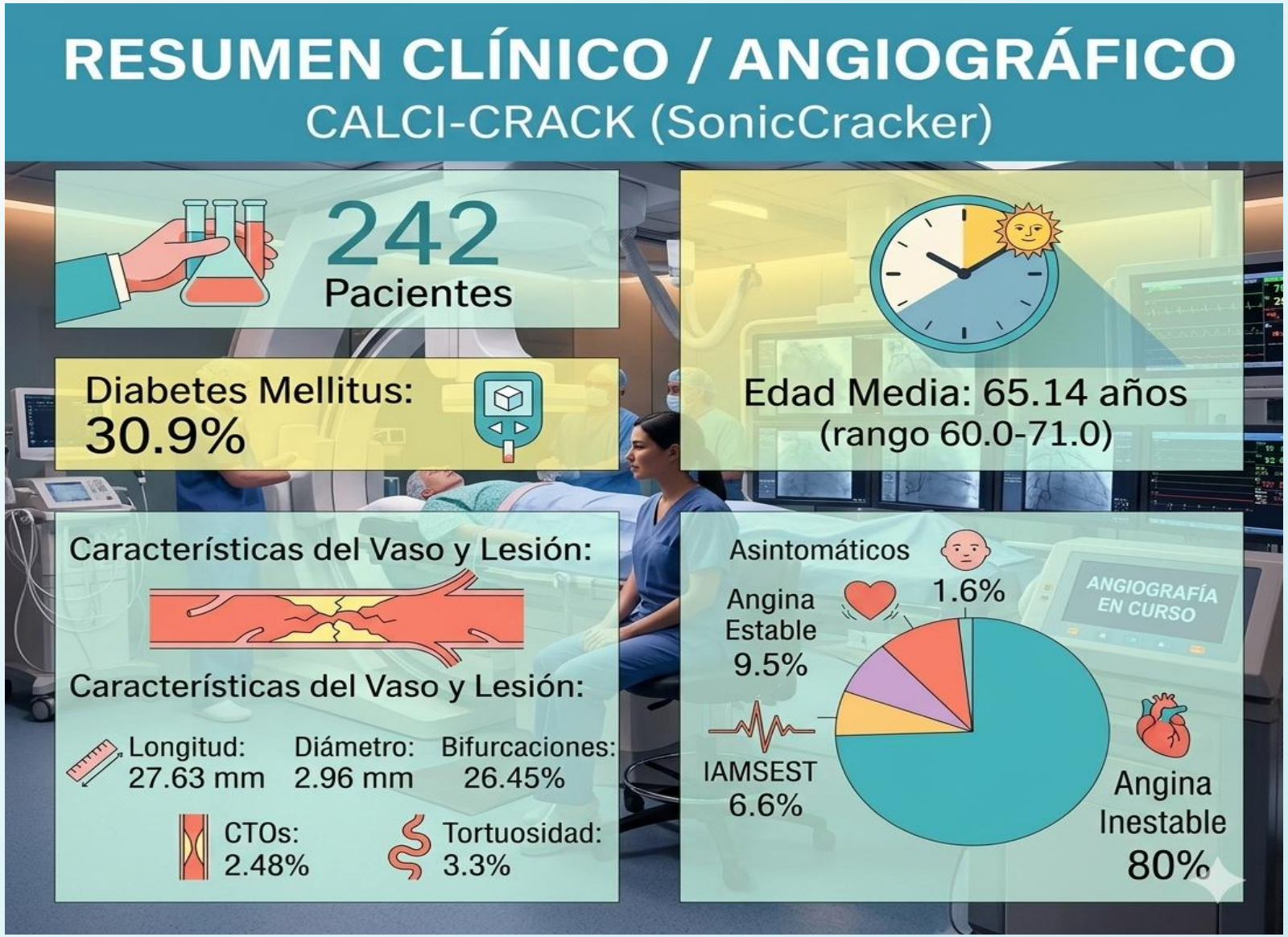
Calcificación evidendente con y sin movimiento cardiaco o calcificación en ambos lados del vaso

EXCLUSION

- Diseccion del vaso al basal o al utilizer guia.
- Procedimiento con balón de corte, scoring o aterotomia o laser
- Contraindicaciones para PCI o antiplaquetarios.
- Lesion inaccessible
- Tronco coronario

RESUMEN CLÍNICO / ANGIOGRÁFICO

CALCI-CRACK (SonicCracker)



RESUMEN DE PROCEDIMIENTO IVL: ÉXITO CLÍNICO Y ANGIOGRÁFICO

ENTREGA Y MANEJO DE CALCIFICACIÓN

ENTREGA EXITOSA DE BALÓN IVL (240/242 PACIENTES)

99.17%

Entrega exitosa del catéter **de litotricia intravascular**

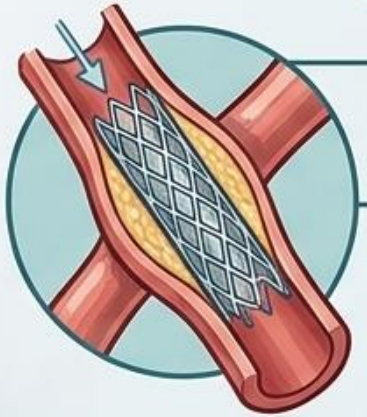
MANEJO ADECUADO DE CALCIFICACIÓN | **CON 1 SOLO BALÓN IVL (88.84%)**

PROMEDIO DE PULSOS: **48.18 ± 25.43**

PRESIÓN MÁXIMA MEDIA: **5.10 ± 1.83 atm**

SIN ROTURA DE BALÓN

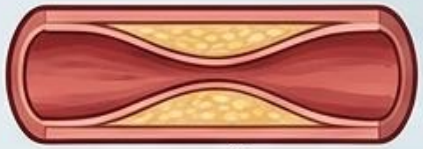
RESULTADOS POST-STENT



IMPLANTACIÓN DE STENT

EN 99.17% DE PACIENTES

ESTENOSIS RESIDUAL DESPUÉS DEL STENT

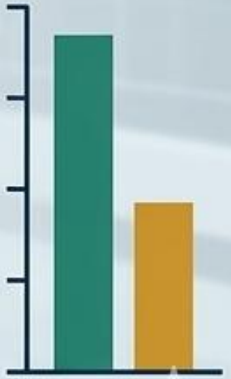


CASO TÍPICO:

CASO VARIADO:

CASO TÍPICO: 1.75%

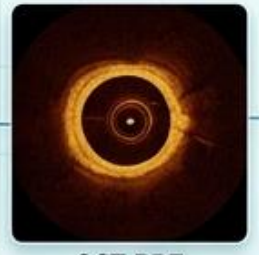
CASO VARIADO: 4.80%



99.17% Éxito de Entrega | 88.84% Un solo Balón | 99.17% Implante Stent | Estenosis < 5%

RESUMEN DE PROCEDIMIENTO: LITOTRICIA INTRAVASCULAR CORONARIA

1 PRE-LITOTRICIA

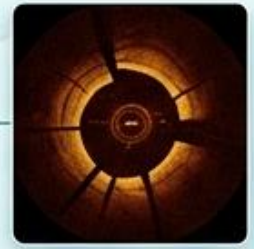


OCT PRE

ÁREA LUMINAL (MLA):
1.55 ± 0.55 mm²

ESTENOSIS:
87.91 ± 5.66%

2 LITOTRICIA IVL

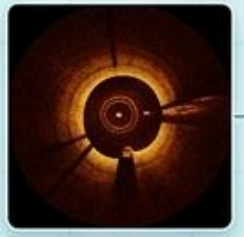


OCT POST IVL

93.55%
FRACTURAS
(87/93 pacientes)
87.10%
FRACTURAS MÚLTIPLES

ÁREA POST-IVL:
3.05 ± 0.84 mm²

3 POST-STENT



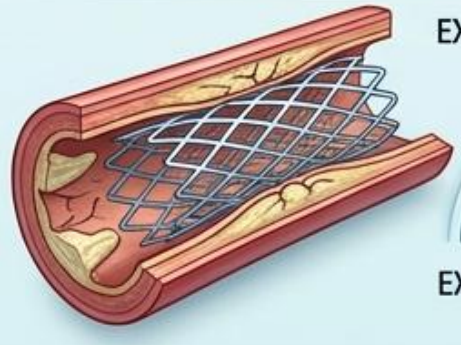
OCT FINAL

POST-STENT

ÁREA FINAL:
4.91 ± 1.22 mm²

RESULTADOS CLAVE

MEJORA DE ESTENOSIS



EXPANSIÓN DEL STENT:
71 ± 12%

EXPANSIÓN DEL STENT:
VISUALIZAD

RESULTADOS DE EFICACIA Y SEGURIDAD CLÍNICA: LITOTRICIA INTRAVASCULAR CORONARIA

EFICACIA PRIMARIA Y PROCEDIMENTAL

95.04%
ÉXITO DEL PROCEDIMIENTO
(FAS)

230/242 PACIENTES
Límite Inferior IC 95%: 91.50%
91.50% → ***P*< 0.001**
SUPERÓ META DEL 83.4%

99.58%
ESTENOSIS RESIDUAL ≤ 30%

239/240 PACIENTES:
ÉXITO CASI TOTAL

ÉXITO ANGIOGRÁFICO:
98.35% (FAS)

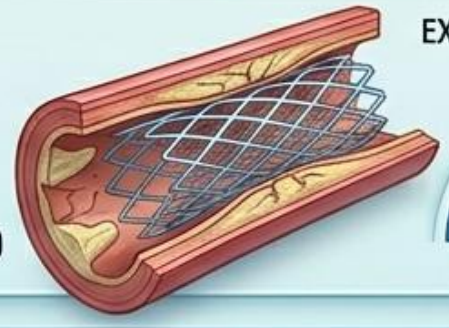
SEGURIDAD Y RESULTADOS SECUNDARIOS

MACE INTRAHOSPITALARIO
(Eventos Adversos)

FAS: 4.13%
(10/242)

PPS: 3.73%

MEJORA DE ESTENOSIS



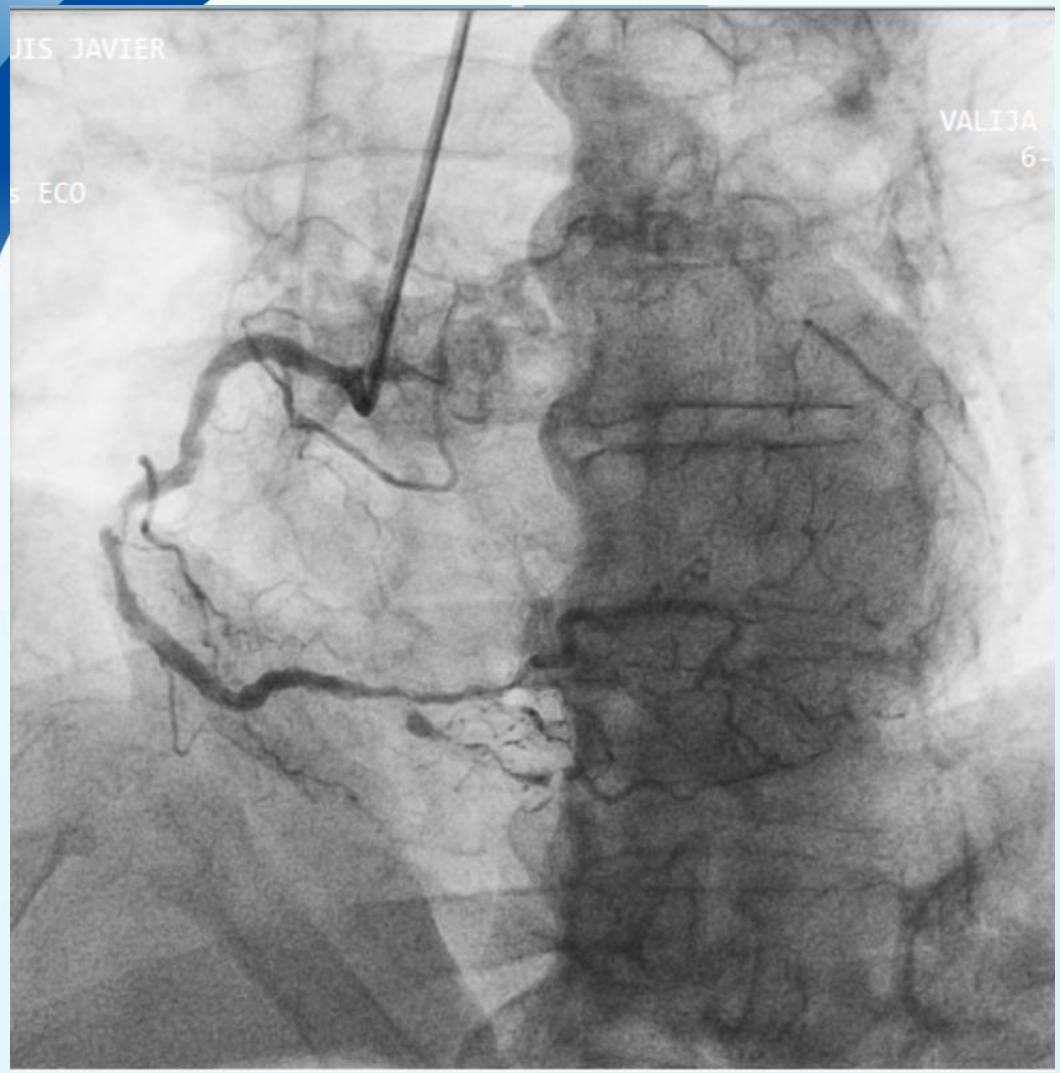
EXPANSIÓN DEL STENT:
71 ± 12%

RESUMEN: PROTOCOLO SEGURO Y EFECTIVO, LOGRANDO EXPANSIÓN LUMINAL ÓPTIMA Y BAJA TASA DE EVENTOS ADVERSOS

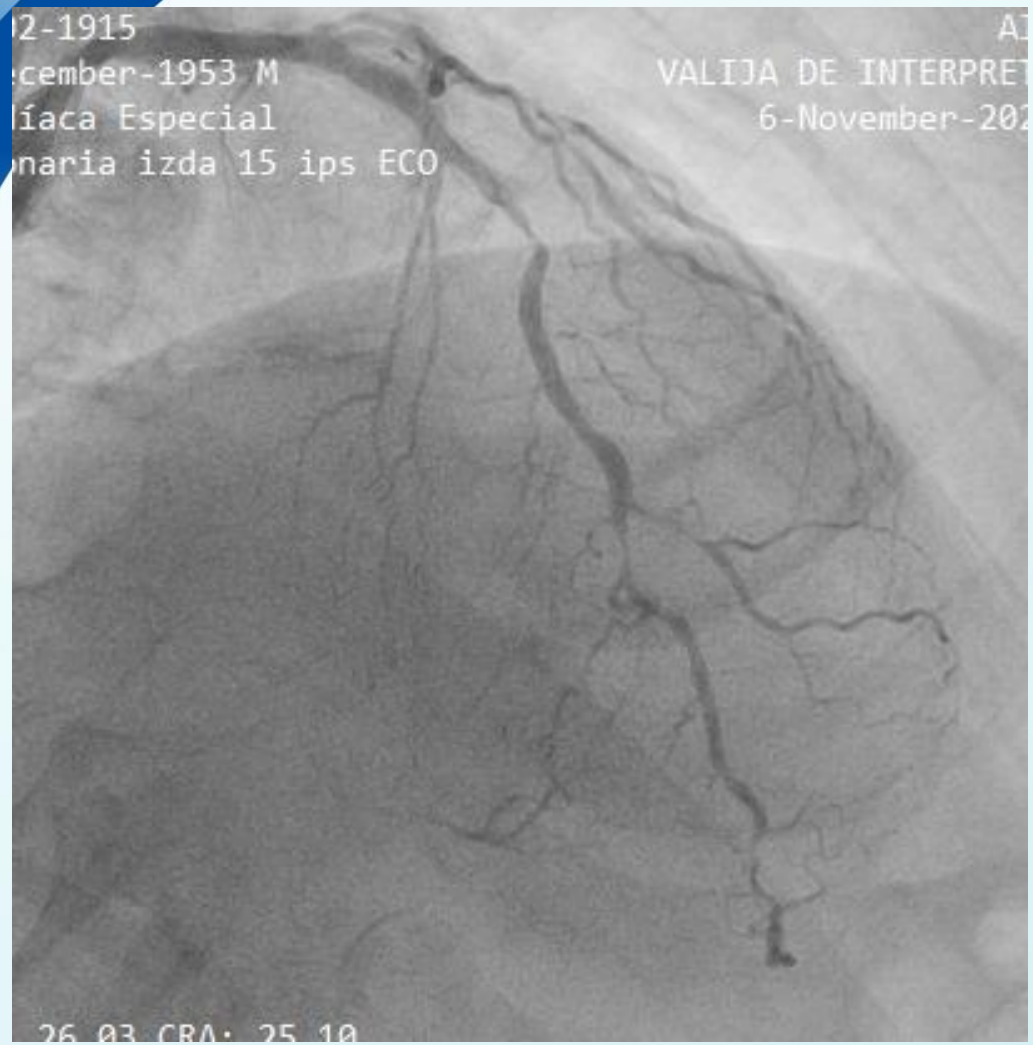
Componente de Seguridad (30 días)	DISRUPT CAD III	CALCI-CRACK
Libertad de MACE (%)	92.2%	95.2%
MACE Total (%) 30d/6 m	7.8%	4.1% /4.55%
Muerte Cardiovascular (%) 30 días/6 meses	0.5%	0%/0%
Infarto de Miocardio (IM) (%)	7.3%	3.7%/3.7%
Falla de la Lesión Objetivo (TLF) (%) 30d/6m	1.6%	1.2%/1.6%

Complicación Angiográfica	DISRUPT CAD III	CALCI-CRACK
General	0.3%	0.42%
Perforación final (%)	0.3%	0%
Disección grave (Tipo D-F) (%)	0.3%	0%
Oclusión abrupta (%)	0.3%	0.42%
Fenómeno de Slow Flow (%)	0%	0%
Fenómeno de No-Reflow (%)	0%	0%
Rotura del balón (%)	No reportado sistemáticamente	No reportado

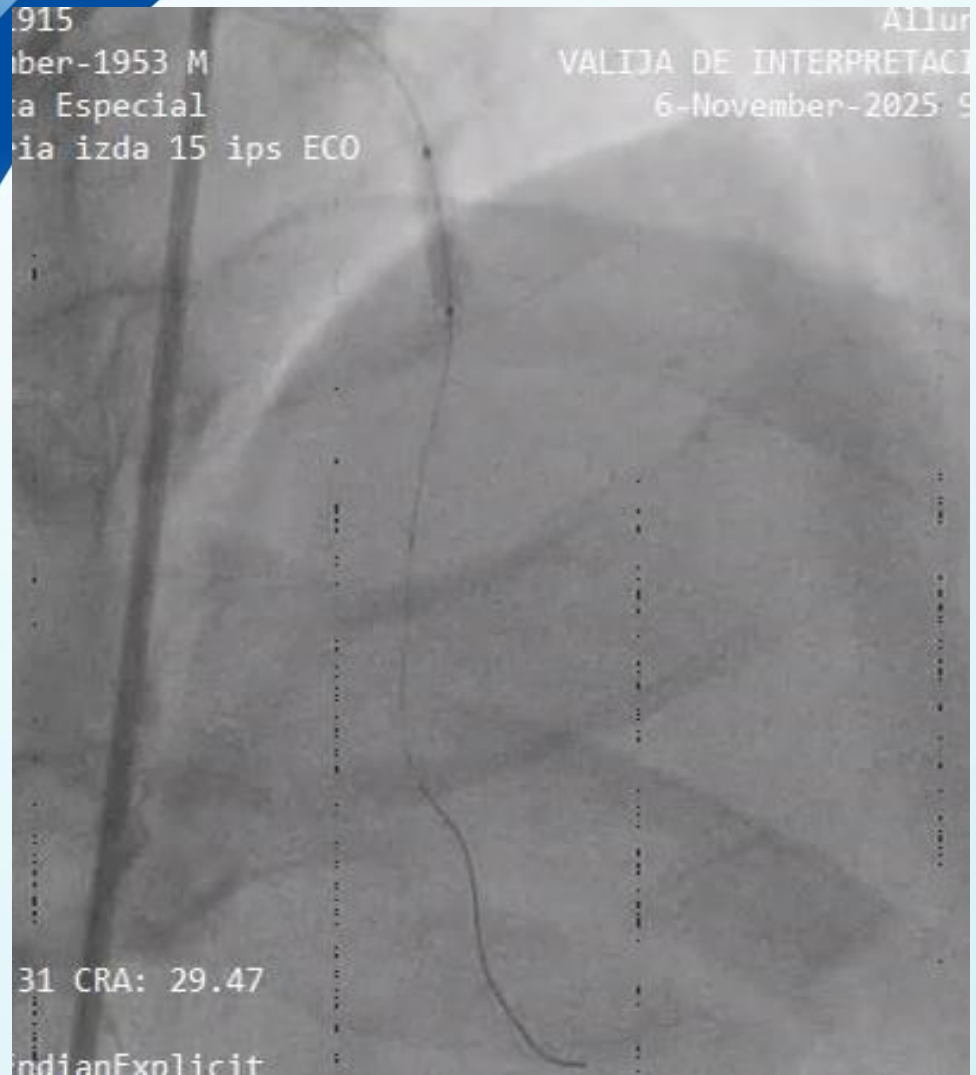
CORONARIA DERECHA



LESION CULPABLE EN DA



IVL DA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VALIJA DE INTERPRETACI
6-November-2025
31 CRA: 29.47
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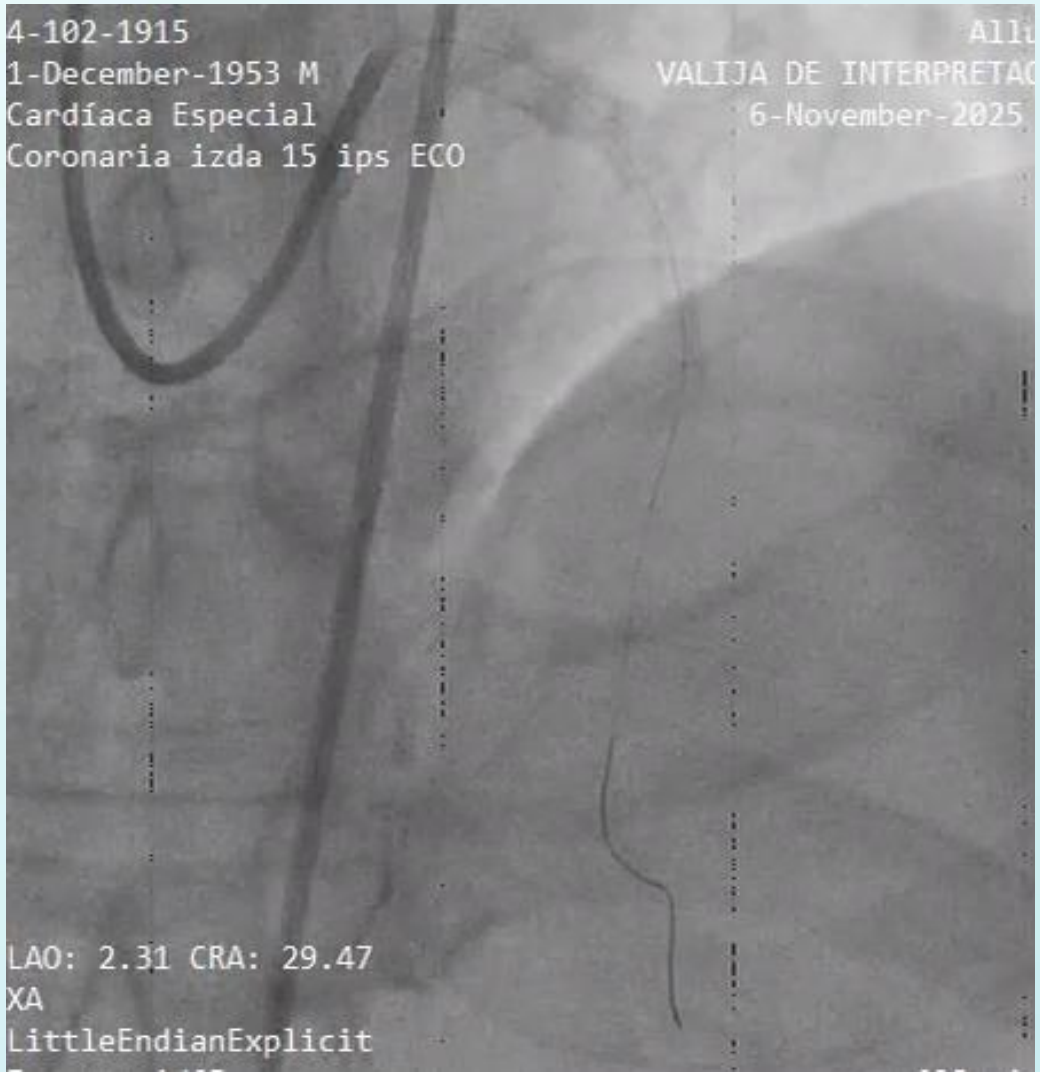
4-102-1915
1-December-1953 M
Cardíaca Especial
Coronaria izda 15 ips ECO
VALIJA DE INTERPRETAC
6-November-2025
LAO: 2.31 CRA: 29.47
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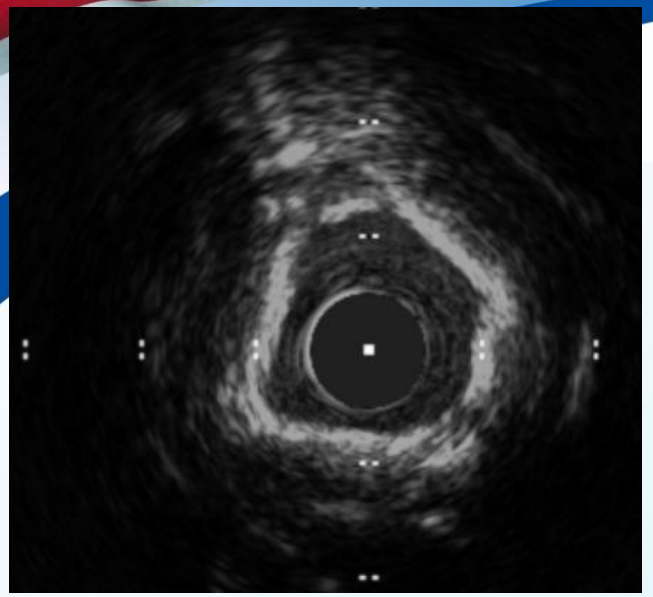
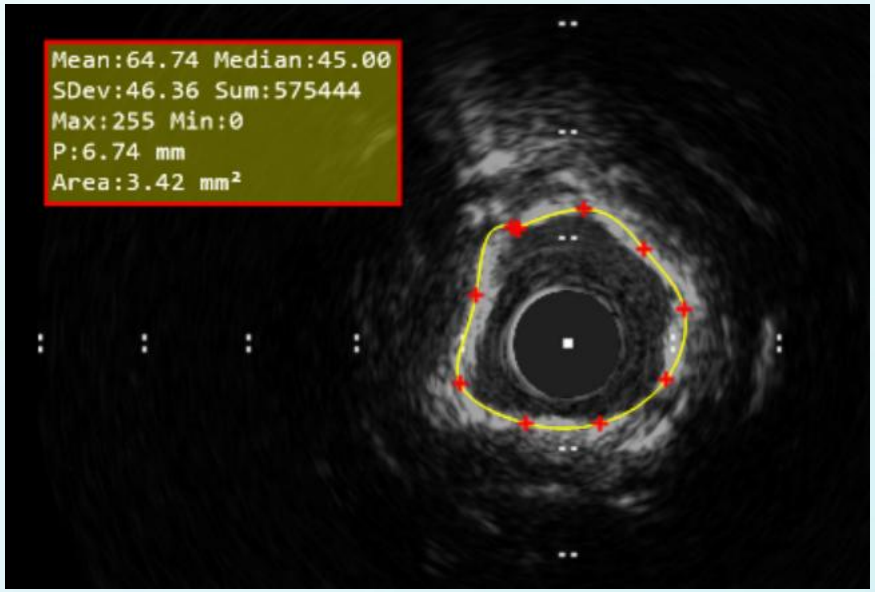
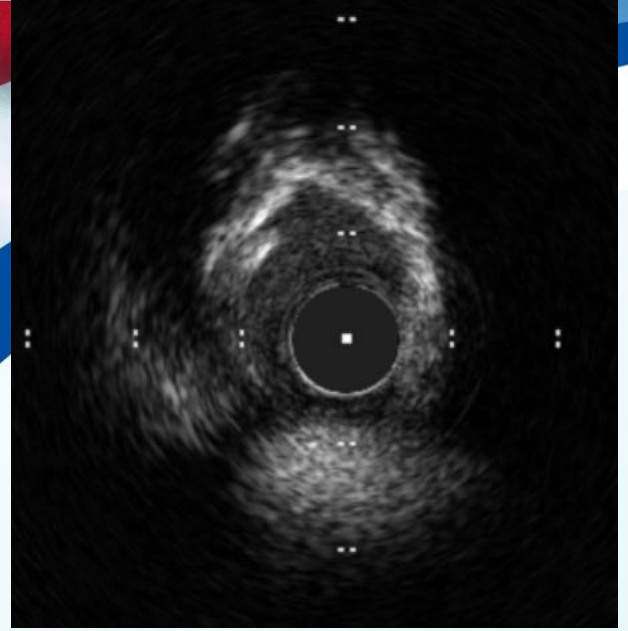
ANGIOGRAFIA FINAL

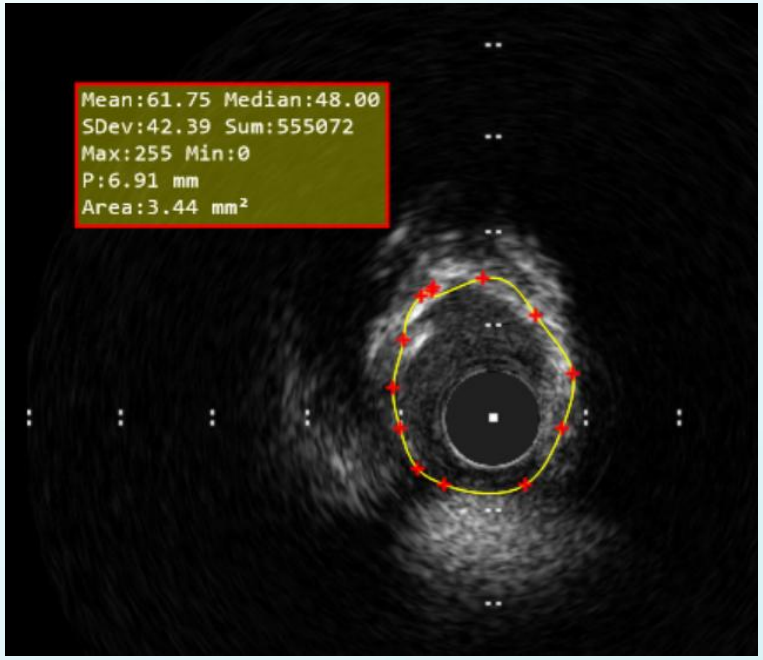


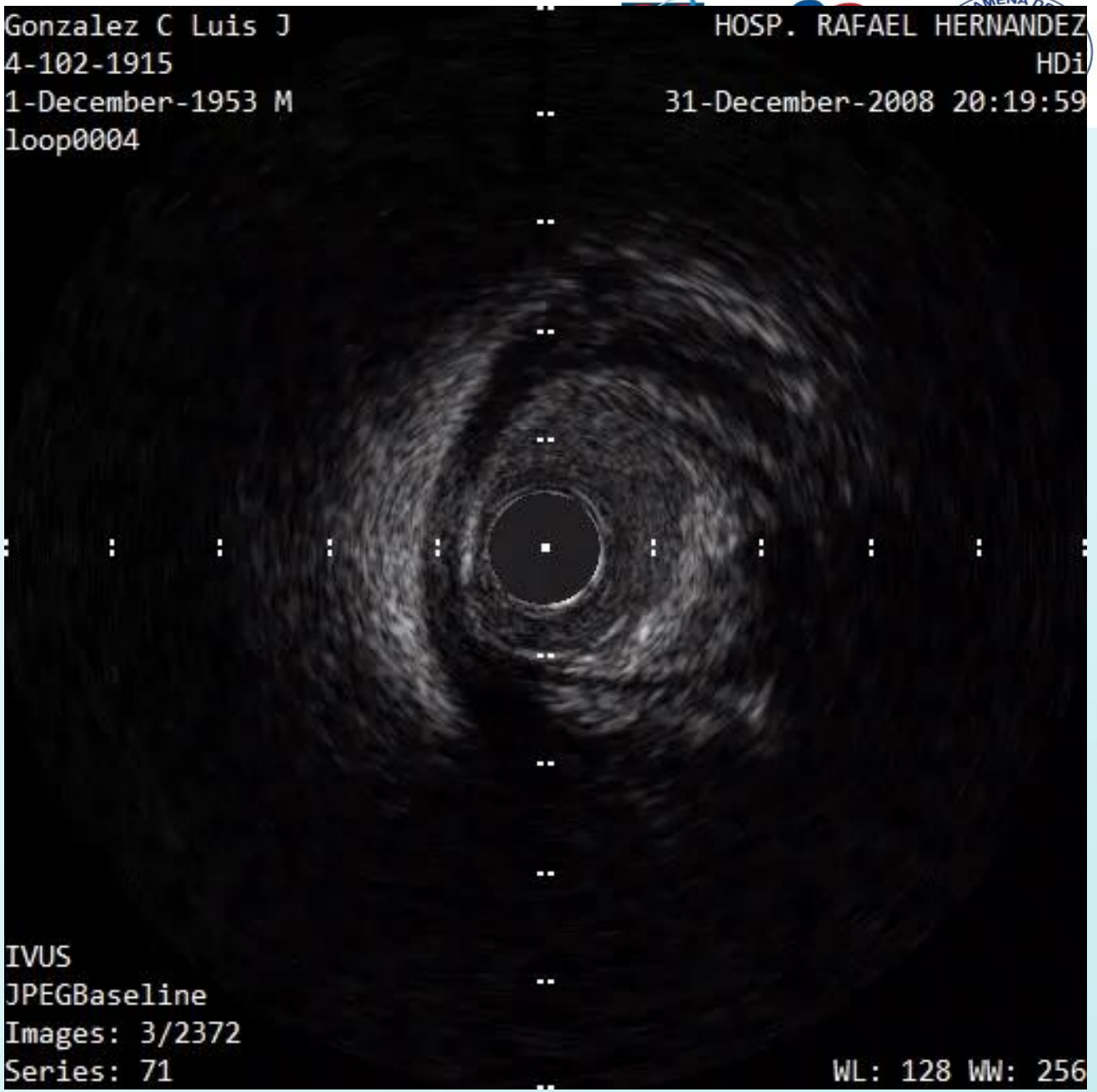
LESION CALCIFICADA





POST IVL


Mean:61.75 Median:48.00
SDev:42.39 Sum:555072
Max:255 Min:0
P:6.91 mm
Area:3.44 mm²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Images: 3/2372
Series: 71
WL: 128 WW: 256

CONCLUSION

- ES UNA TECNOLOGIA QUE HA REVOLUCIONADO EL TRATAMIENTO DE LAS LESIONES CORONARIAS CALCIFICADAS
- PERFIL DE SEGURIDAD E EFICACIA MUY ALTO
- DISMINUYE LOS EVENTOS CARDIOVASCULARES (MACE) RELACIONADOS A POBRE PREPARACION DE LA PLACA
- CURVA DE APRENDIZAJE CORTA Y MANEJO INTUITIVO
- HERRAMIENTA UTIL EN LA SUBEXPANSION DE STENT

GRACIAS