Journal Pre-proof

Two-year clinical outcomes of Resorbable Magnesium Scaffold versus conventional drug-eluting stents in ST-segment Elevation Myocardial Infarction: a propensity score matching analysis

Leonidas Koliastasis, MD, Johan Bennett, MD, Panagiotis Xaplanteris, MD, Ioannis Skalidis, Antoine Guédès, MD, Fabian Demeure, MD, Bert Vandeloo, MD, Christophe Dugauquier, MD, Fabien Picard, MD, David W. Warne, MD, Thomas Pilgrim, MD, Juan F. Iglesias, MD, Quentin de Hemptinne, MD

PII: S1109-9666(23)00230-0

DOI: https://doi.org/10.1016/j.hjc.2023.12.004

Reference: HJC 874

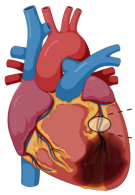
To appear in: *Hellenic Journal of Cardiology*

Received Date: 22 November 2023

Accepted Date: 20 December 2023

Please cite this article as: Koliastasis L, Bennett J, Xaplanteris P, Skalidis I, Guédès A, Demeure F, Vandeloo B, Dugauquier C, Picard F, Warne DW, Pilgrim T, Iglesias JF, de Hemptinne Q, Two-year clinical outcomes of Resorbable Magnesium Scaffold versus conventional drug-eluting stents in ST-segment Elevation Myocardial Infarction: a propensity score matching analysis, *Hellenic Journal of Cardiology*, https://doi.org/10.1016/j.hjc.2023.12.004.

BEST-MAG trial - 2y outcomes



2nd generation magnesium resorbable coronary scaffolds in STEMI
n = 30

Propensity score mathing

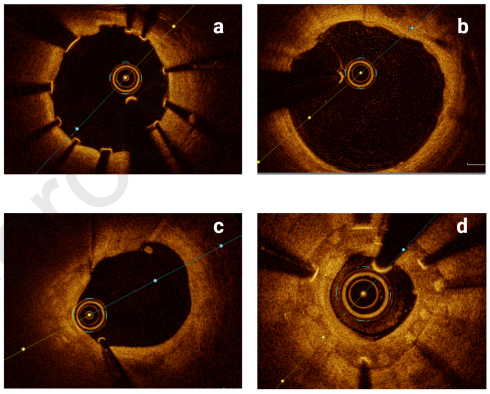
Biodegradable polymer sirolimus-eluting stent (n = 30)

Durable polymer everolimus-eluting stent (n = 30)

	Magnesium BRS	BP -SES	DP - EES	p-value*	p-value†
DOCE	20%	10%	10%	0,286	0,286
Cardiac death	0%	6,7%	6,7%	0,995	0,995
Target lesion revascularization	20%	3,3%	3,3%	0,076	0,076
Target vessel myocardial infarction	6,7%	0%	3,3%	0,996	0,682
Definite/ probable device thrombosis	3,3%	3,3%	6,7%		0,561

Magnesium BRS n=17	OCT baseline	OCT 15months	p-value
	MLA: 7.57 ± 1.48 mm^2	MLA: 4.72 ± 2.22 mm^2	<0.001

*Comparison between Magnesium BRS and BP-SES
†Comparison between magnesium BRS and DP-EES



Two-year clinical outcomes of Resorbable Magnesium Scaffold versus conventional drug-eluting stents in ST-segment Elevation Myocardial Infarction: a propensity score matching analysis

Leonidas Koliastasis MD[1*], Johan Bennett MD[2*], Panagiotis Xaplanteris MD[1], Ioannis Skalidis[3], Antoine Guédès MD[4], Fabian Demeure MD[4], Bert Vandeloo MD[5], Christophe Dugauquier MD[6], Fabien Picard MD[7], David W Warne MD[8], Thomas Pilgrim MD[9], Juan F Iglesias MD[10], Quentin de Hemptinne MD[1a]

*These two authors contributed equally to this work

[1]Department of Cardiology, CHU Saint-Pierre, Université Libre de Bruxelles, Brussels, Belgium.

[2]Department of Cardiovascular Medicine, University Hospitals Leuven, Leuven, Belgium.

[3]Department of Cardiology, University Hospital of Lausanne, Lausanne, Switzerland.

[4]CHU UCL Namur, Site de Mont Godinne, Université catholique de Louvain, Belgium.

[5]Vrije Universiteit Brussel (VUB), Universitair Ziekenhuis Brussel (UZB), Department of Cardiology, Brussels, Belgium.

[6]CHR Citadelle, Liège, Belgium.

[7]Hôpital Cochin, Assistance Publique des Hôpitaux de Paris, Paris, France.

[8]Research Center for Statistics, Geneva School of Economics and Management, University of Geneva, Switzerland.

[9]Department of Cardiology, Inselspital, Bern University Hospital, Bern, Switzerland.

[10]Department of Cardiology, Geneva University Hospitals, Geneva, Switzerland.

[a]**Address for correspondence**

Quentin de Hemptinne, MD, PhD

322 rue Haute, 1000, Brussels, Belgium

tel: +32 468 37 73 97

email: quentin.dehemptinne@stpierre-bru.be

Conflict of interest: The authors have no conflicts of interest to declare

Sources of funding: None

Disclosures: None

Key words: STEMI, resorbable magnesium scaffold, Magmaris, primary PCI

Word count (text only): 584

Clinicaltrials.org registration number: NCT03955731

Abbreviations: DOCE: device-oriented composite endpoint, PCI: percutaneous coronary intervention, BRS: bioresorbable coronary scaffold, STEMI: ST-segment myocardial infarction, TLR: target lesion revascularization

Scaffolding the coronary vessels and protecting the vulnerable or ruptured plaque without a permanent metallic endoprosthesis is an appealing concept that was materialized with bioresorbable coronary scaffolds (BRS) (1). Magmaris™ (Biotronik AG, Bülach, Switzerland) is the second generation of drug-eluting, fully-resorbable, magnesium-alloy-based scaffolds demonstrating promising results in stable coronary disease (2). Data are scarce concerning the outcomes of BRS implantation for ST-segment elevation myocardial infarction (STEMI), but theoretically they could offer an advantageous alternative mostly because of the preservation of the vessel mechanical and hydraulic properties after resorption, while treating the acute event (3). The BEST-MAG trial was a propensity-matched study that compared the 1-year clinical outcomes of the Magmaris™ BRS versus contemporary drug eluting stents (DES) in the setting of STEMI (4). Thirty patients who fulfilled the eligibility criteria were prospectively enrolled based on a prespecified intra-coronary imaging guided protocol. Primary PCI was performed with magnesium BRS and propensity score matching analysis was applied with the two groups of BIOSTEMI trial (biodegradable polymer DES, n=648; durable polymer DES, n=651) (5). Numerically higher rates of target lesion revascularization (TLR) were observed at one-year follow-up, not reaching statistical significance (4). We herein report the 2-year results of the study.

Clinical and procedural characteristics of the matched population have been published previously at the 1-year outcomes (4). Optical coherence tomography (OCT) was performed in all patients at baseline and at 15 months in 17 of the magnesium BRS group. The primary device-oriented composite endpoint (DOCE) of cardiac death, target vessel myocardial re-infarction (attributable to the culprit lesion) and ischemic-driven TLR occurred in 20% in the BRS group vs 10% in both the DES groups (p=0,286) at 2 years. The secondary endpoint of definite/probable device thrombosis

occurred in the 3,3% of BRS and 6,7% in the biodegradable polymer DES (p=0,561) (**Graphical abstract**). In the 15-month follow-up OCT of the magnesium BRS group minimal lumen area decreased from 7.57 ± 1.48 mm2 to 4.72 ± 2.22 mm2 (p < 0,001). BRS struts were evident in all 17 patients and measurements are presented in **Table 1**.

The 2-year results of the BEST-MAG trial are in line with the 12-month results showing a trend towards more TLRs in the magnesium BRS group that does not reach statistical significance. DOCE seems to appear after 1 year and was mainly driven by an increase in TLR. Joner et al. showed that 94.8% of the magnesium is resorbed in 12 months and only amorphous calcium phosphate remains in the vessel wall of animal models (6). On the contrary visible struts were present in all followed-up patients of our trial. In the same context, the MAGSTEMI trial was the first to investigate Magmaris™ BRS in STEMI and resulted in higher late-lumen-loss and restenosis rates for the BRS, although not powered for these outcomes (7). The three year results consistently demonstrated higher TLR rates for magnesium scaffolds, however the events were clustered during the first year similarly to our findings (8). These unfavorable outcomes might be mitigated by the introduction of a third-generation thinner-strut magnesium BRS. The device demonstrated favorable safety profile and 38% improved performance compared to its precursor in the 12-month results of the BIOMAG-I trial (9). Large scale clinical trials will be needed to evaluate the efficacy and efficiency of this novel magnesium BRS and ascertain if it has a potential role in acute coronary syndromes, and specifically in STEMIs. The major limitation of the trial is its small patient sample that results in it being underpowered and, thus, only hypothesis generating.

Acknowledgements: Figure created with BioRender.com

References

1. Serruys PW, Chevalier B, Sotomi Y, Cequier A, Carrie D, Piek JJ, et al. Comparison of an everolimus-eluting bioresorbable scaffold with an everolimus-eluting metallic stent for the treatment of coronary artery stenosis (ABSORB II): a 3 year, randomised, controlled, single-blind, multicentre clinical trial. Lancet. 2016;388(10059):2479-91.
2. Haude M, Ince H, Kische S, Abizaid A, Tolg R, Alves Lemos P, et al. Sustained safety and clinical performance of a drug-eluting absorbable metal scaffold up to 24 months: pooled outcomes of BIOSOLVE-II and BIOSOLVE-III. EuroIntervention. 2017;13(4):432-9.
3. Bennett J, Ielasi A, Torzewski J, de Hemptinne Q, Cerrato E, Lanocha M, et al. The Resorbable Magnesium Scaffold Magmaris in Acute Coronary Syndrome: An Appraisal of Evidence and User Group Guidance. Cardiovasc Revasc Med. 2022;39:106-13.
4. de Hemptinne Q, Xaplanteris P, Guedes A, Demeure F, Vandeloo B, Dugauquier C, et al. Magmaris Resorbable Magnesium Scaffold Versus Conventional Drug-Eluting Stent in ST-Segment Elevation Myocardial Infarction: 1-Year Results of a Propensity-Score-Matching Comparison. Cardiovasc Revasc Med. 2022;43:28-35.
5. Iglesias JF, Muller O, Heg D, Roffi M, Kurz DJ, Moarof I, et al. Biodegradable polymer sirolimus-eluting stents versus durable polymer everolimus-eluting stents in patients with ST-segment elevation myocardial infarction (BIOSTEMI): a single-blind, prospective, randomised superiority trial. Lancet. 2019;394(10205):1243-53.
6. Joner M, Ruppelt P, Zumstein P, Lapointe-Corriveau C, Leclerc G, Bulin A, et al. Preclinical evaluation of degradation kinetics and elemental mapping of first- and second-generation bioresorbable magnesium scaffolds. EuroIntervention. 2018;14(9):e1040-e8.
7. Sabate M, Alfonso F, Cequier A, Romani S, Bordes P, Serra A, et al. Magnesium-Based Resorbable Scaffold Versus Permanent Metallic Sirolimus-Eluting Stent in Patients With ST-Segment Elevation Myocardial Infarction: The MAGSTEMI Randomized Clinical Trial. Circulation. 2019;140(23):1904-16.
8. Ortega-Paz L, Brugaletta S, Gomez-Lara J, Alfonso F, Cequier A, Romani S, et al. Magnesium-based resorbable scaffold vs permanent metallic sirolimus-eluting stent in patients with ST-segment elevation myocardial infarction: 3-year results of the MAGSTEMI randomised controlled trial. EuroIntervention. 2022;18(5):e389-e96.
9. Haude M, Wlodarczak A, van der Schaaf JR, Torzewski J, Ferdinande B, Escaned J, et al. A new resorbable magnesium scaffold for de novo coronary lesions (DREAMS 3): one-year results of the BIOMAG-1 first-in-human study. EuroIntervention. 2023.

Tables

MSA after PCI	MLA in FU	Number of visible struts	Lumen loss	Endpoint
11,39 mm^2	9,2 mm^2	3	19,2%	

9,3 mm^2	6,42 mm^2	4	30,9%	TLR
9,79 mm^2	5,17 mm^2	3	47,2%	
10,33	7,13	4	30,9%	
7,06	4,29	3	39,2%	
6,96	1,65	4	76,3	TLR
5,35	3,76	3	29,7	
7,45	1,01	2	86,4	TLR
8,8	3,51	2	60,1	
6,24	2,75	3	55,9	
9,35	5,97	3	46,1	
8,03	6,68	2	16,8	
6,68	4,24	4	36,5	
7,64	3,14	4	58,9	
6,8	2,91	3	57,2	
7,44	5,48	3	26,3	
6,43	2,25	3	65%	TLR

Table 1. Optical coherence tomography main results in 15-month follow-up in 17 patients treated with resorbable magnesium scaffold.

FU: follow-up, MLA: minimal lumen area, MSA : minimal stent area, PCI: percutaneous coronary intervention, TLR: target lesion revascularization

Figure Legends

Graphical abstract: Graphical display of the BEST-MAG trial 2-year outcomes

BRS: bioresorbable coronary scaffold, BP-SES: biodegradable polymer sirolimus-eluting stent, DP-EES: durable polymer everolimus-eluting stent

a. OCT image after primary angioplasty with magnesium scaffolds.
b. OCT image of 15-month follow-up that shows partially resorbed scaffold with some remaining struts and preserved lumen area.
c. OCT image of acute coronary syndrome showing strut remnants in the lumen (13 hour) and mixed ruptured plaque (10 hour).
d. OCT image showing visible remaining struts of the magnesium scaffold and neointimal hyperplasia resulting in significant lumen loss.