**Magmaris Biotronik:**

* <https://www.magmaris.com/en/clinical-studies/biosolve-IV>
* <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5583079/pdf/jtd-09-S9-S903.pdf>
* <https://pubmed.ncbi.nlm.nih.gov/31345074/?from_term=magmaris&from_filter=ds1.y_1&from_pos=1>
* successfully tested in 184 patients enrolled in the BIOSOLVE-II and -III studies (1,2)
* gained CE-certification in June 2016
* Magmaris (Biotronik AG, Bulach, Switzerland): 95% vom Magensiums des Scafffolds innerhalb von 12 Monaten resorbiert 🡪 Gefäß behält seinen natürlichen Zustand bei 🡪 verhindert späte ST
* Device characterstics:
  + backbone: absorable MG alloy
  + radiolucent (strahlendruchlässig)
  + end markers shiftet 90°for better radiological visibility from each angel
  + DES: Sirolimus (dose of 1.4µg/mm² of scaffold surface, 90 days controlled drug release);

<https://flexikon.doccheck.com/de/Sirolimus>;

“enfaltet lokal eine [antiproliferative](https://flexikon.doccheck.com/de/Antiproliferativ) und [antiinflammatorische](https://flexikon.doccheck.com/de/Antiinflammatorisch) Wirksamkeit, welche im Vergleich zu konventionellen Metallstents die Häufigkeit von [Restenosen](https://flexikon.doccheck.com/de/Restenose) (Defintion: Wiedereinengung im Bereich einer zuvor behandelten [Stenose](https://flexikon.doccheck.com/de/Stenose) eines [Blutgefäßes](https://flexikon.doccheck.com/de/Blutgef%C3%A4%C3%9F) = **target lesion failure (TLF**)) vermindert.”

* + Nomial pressure (Def: Pressure at which the balloon is at listed size (outside the body) = 10 atm
  + Burst pressure (Def: Highest pressure at which 99.5% of balloons will not rupture) = 16 atm
* Resorption process (2-Phase):
  + Start: backbone, continue inward till only amorphous footprint left instead of struts
* History of biodegradable Mg alloy biocompatibility:
  + 2003, Heublein et al. first report with animal model
  + 2004, Di Mario et al. Lekton Magic 🡪 fast endothelialization process in animal models 🡪 AMS1 as first aborbable metallic stent (first clinical trials)
  + Vgl paper für DREAMER!!
* Biosolve IV clinial study (Safety and Performence),

<https://clinicaltrials.gov/ct2/show/NCT02817802>, <https://www.researchgate.net/publication/330666691_Safety_and_performance_of_a_resorbable_magnesium_scaffold_under_real-world_conditions_12-month_outcomes_of_the_first_400_patients_enrolled_in_the_BIOSOLVE-IV_registry>,

<https://www.sciencedirect.com/science/article/pii/S1553838919301083>

* + post-market surveillance, prospective, single-arm, multi-centric registry aimed and targets a real-world population with few exclusion criteria (pregnancy, allergy and dialysis) and includes also complex lesions with the exception of occlusions.
  + tests clinical performance and long-term safety of Magmaris in patients with symptomatic coronary artery disease and single *de novo* native coronary artery lesions
  + Inclusion criteria are target lesion stenosis >50% and <100% and TIMI flow ≥1
  + **Primary endpoint is TLF at 12 months**
  + Clinical follow-up was scheduled at 6 and 12 months, and annually until 5 years (telephonefollow-ups were permitted)
  + **Results for first 400 patients with 425 lesions enrolled:**
    - Patient age: 29 to 86
    - 63 patients (15.8%) with non-ST evelavation myocardinal infaction (**NSTEMI** – Def.:  [Myokardinfarkt](https://flexikon.doccheck.com/de/Myokardinfarkt), bei dem es im [EKG](https://flexikon.doccheck.com/de/EKG) nicht zu länger anhaltenden [ST-Hebungen](https://flexikon.doccheck.com/de/ST-Hebung), also den typischen Infarktzeichen
      * Folgen für Therapie: Wirksamkeit einer [Reperfusionstherapie](https://flexikon.doccheck.com/de/Reperfusion) (z.B. in Form einer [Ballondilatation](https://flexikon.doccheck.com/de/Ballondilatation)) wissenschaftlich nicht belegt.
      * Nachweis**:**  [Ischämie](https://flexikon.doccheck.com/de/Isch%C3%A4mie) des [Myokards](https://flexikon.doccheck.com/de/Myokard) durch Messung des [kardialen](https://flexikon.doccheck.com/de/Kardial) [Troponins](https://flexikon.doccheck.com/de/Troponin), für EKG Kriterien siehe: <https://flexikon.doccheck.com/de/NSTEMI>
      * Low TLF
      * One scaffold thrombosis
* Implantation:
  + Image-guided to asses vessel size + detect possible calcification (decide if post-dilatation is required, if image not available: post-dilatation is mandatory! 🡪 goal: <20% final residual stenosis)
  + Magmaris not implanted if complete expansion of pre-dilatation balloon or <30% post pre-dilatation residual stenosis not achieved
  + implantation guidelines were updated to the “4P-guidelines”:
    - Patient selection: de novo lesions with a reference [vessel diameter](https://www.sciencedirect.com/topics/medicine-and-dentistry/vessel-diameter) and lesion length closely matching the available Magmaris sizes
    - Proper sizing: Magmaris should not be implanted in vessels <2.7 mm or >3.7 mm, if uncertain, quantitative lesion evaluation with [quantitative coronary angiography](https://www.sciencedirect.com/topics/medicine-and-dentistry/quantitative-coronary-angiography), [intravascular ultrasound](https://www.sciencedirect.com/topics/medicine-and-dentistry/intravascular-ultrasound) (IVUS), and/or [optical coherence tomography](https://www.sciencedirect.com/topics/medicine-and-dentistry/optical-coherence-tomography) should be performed, keeping in mind that [angiograms](https://www.sciencedirect.com/topics/medicine-and-dentistry/angiography) generally underestimate the vessel diameter by 0.25 mm
    - Pre-dilatation: mandatory, with a non-compliant balloon with a 1:1 balloon to artery ratio, residual stenosis should be <20%, and, if this is not achieved, other balloon technologies such as scoring balloons may be used
    - Post-dilatation: with a non-compliant balloon which is 0.5 mm larger than the implanted scaffold at high pressure >16 mm is recommended, but the expansion limit of Magmaris of 0.6 mm should be considered; optical coherence tomography is helpful to assess malappositions during the learning phase

**Bioresorbable scaffolds (BRS)**

* non-permanent implants avoiding caging vessels and obstructing side branches and allow vasomotion (<https://pubmed.ncbi.nlm.nih.gov/30251247/>)
* developed to provide temporary vessel support , dissolve afterwards 🡪 overcome long-term events associated with permanent DES
* The basis of metallic biodegradable scaffolds is magnesium or iron

**Drug eluting stents (DES)**

* <https://www.ncbi.nlm.nih.gov/books/NBK537349/>
* <https://flexikon.doccheck.com/de/Medikamentenfreisetzender_Stent>
* percutaneous coronary intervention (PCI) technology has revolutionized the field of cardiology.
* Definition: Vascular protheses to reopen patent coronary arteries narrowed by arteriosclerosis
* Classification by three characteristics: Scaffold, drug-delivery mechanism, therapeutic agent
* Evolved from BMS (bare metal stents)
* Antiproliferative drug coats scaffold to reduce cell proliferation inside the stent and treats the complication of early restenosis <https://pubmed.ncbi.nlm.nih.gov/16785479/>, renarrowing of the vessel)) 🡪 significant reduction of early restenosis (relative ungefährlich, da slow process)
* Correlate with long-term problem: late (>30 days) and very late (>12 months) stent thrombosis (<https://pubmed.ncbi.nlm.nih.gov/17325255/>, <https://pubmed.ncbi.nlm.nih.gov/20031649/>, <https://pubmed.ncbi.nlm.nih.gov/17510464/>)

**Poly-L-Milchsäure-Scaffolds (PLLA)-basierten BRS**

* Polymerbasierte BRS (unterschied zu Magmaris) 🡪 Resoptionszeit 3-4 Jahre

**Stent/Scaffold-Thrombosen (ST)**

* Can be caused by antiproliferative effect of DES, which slows re-endothelialization of the prosthetic material (<https://pubmed.ncbi.nlm.nih.gov/16461047/>, <https://pubmed.ncbi.nlm.nih.gov/15870416/>)
* Occurs suddenly with acute life-threatening symptoms, low incidence but high mortality (<https://pubmed.ncbi.nlm.nih.gov/19854727/>)

**Revascularization + Failure of Target Lesion/ Vessel (**<https://www.minervamedica.it/en/journals/minerva-cardioangiologica/article.php?cod=R05Y2018N05A0594>**),** Wiederherstellung der Durchblutung eines Gewebes, beziehungsweise eine Durchblutungsverbesserung, Definitionen: cdisc.org/system/files/all/standard/Draft%20Definitions%20for%20CDISC%20August%2020%2C%202014.pdf

* **Allgemein**: Any lesion or revascularization of a lesion in the target vessel other than the target lesion, respectively
* Target lesion revascularization (TLR):
  + Target Lesion:
    - Any lesion treated or attempted to be treated during the PCI with study device (stent)
    - Includes arterial segment treated with the study device plus 5 mm proximal and 5 mm distal to the treatment site
  + Target Lesion Failure (TLF):
    - composite of ischemia-driven revascularization of the target lesion, MI related to the target vessel, or cardiac death related to the target vessel
    - If it cannot be determined with certainty whether the MI or death was related to the target vessel, it is considered a TLF.
  + (**TLR**) = Any repeat percutaneous intervention of the target lesion or surgical bypass of the target vessel performed for restenosis or other complication involving the target lesion
* Target vessel revascularization (TVR):
  + Target vessel:
    - major native coronary artery (e.g., left main coronary artery) or bypass graft containing the target lesion
    - includes the arterial segments upstream and downstream to the target lesion plus major side branches.
  + Target vessel Failure (TVF):
    - composite of ischemia-driven revascularization of target vessel, MI related to the target vessel, or cardiac death related to the target vessel
    - If it cannot be determined with certainty whether the MI or death was related to the target vessel, it is considered a TVF
  + Die TVR-Rate, also die Anzahl der erneut notwendigen Revaskularisationen, ist ein Kriterium für die Qualität der Erstintervention.
  + [Revaskularisierung](https://flexikon.doccheck.com/de/Revaskularisierung) des verengten Zielgefäßes bei erneuter Stenose ([Restenose](https://flexikon.doccheck.com/de/Restenose)) nach bereits durchgeführter [PTCA](https://flexikon.doccheck.com/de/PTCA) bzw. [Stentimplantation](https://flexikon.doccheck.com/de/Stent).
* Non-target vessel revascularization
  + A vessel for which revascularization is not attempted or one in which revascularization is performed using a non-study device, respectively

**Target Lesion Characterization (vgl** <https://www.cdisc.org/system/files/all/standard/Draft%20Definitions%20for%20CDISC%20August%2020%2C%202014.pdf>**)**

**Bifurcation lesion (**<https://pubmed.ncbi.nlm.nih.gov/25983165/>**)**

* coronary artery narrowing occurring adjacent to, and/or involving, the origin of a significant side branch that you do not want to lose

**Ischemia/Reperfusion (I/R) Injury (**<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3904795/>**)**

* Ischemia **(**<https://flexikon.doccheck.com/de/Isch%C3%A4mie>, <https://pubmed.ncbi.nlm.nih.gov/25727175/>**):** 
  + pathologisch verminderte oder aufgehobene [Durchblutung](https://flexikon.doccheck.com/de/Durchblutung) eines [Gewebes](https://flexikon.doccheck.com/de/Gewebe) infolge mangelnder arterieller Zufuhr von [Blut](https://flexikon.doccheck.com/de/Blut)
* Reduction by using Mg experimentally documented
* Disorders characterized by I/R: myocardial infarction, stroke (Deutsch: Schlaganfall), and peripheral vascular disease
* Tissue injury and/or death as result of initial ischemic insult (determined primarily by magnitude + duration of the interruption in the blood supply), then subsequent damage induced by reperfusion

**Restenosis (**<https://www.sciencedirect.com/topics/medicine-and-dentistry/restenosis>, <https://www.cdisc.org/system/files/all/standard/Draft%20Definitions%20for%20CDISC%20August%2020%2C%202014.pdf>**):**

* recurrence of a treated [coronary artery](https://www.sciencedirect.com/topics/medicine-and-dentistry/coronary-artery) stenosis over time
* manifests itself clinically over the 1- to 6-month period following PCI
* Re-narrowing of the vessel following the treatment of a prior stenosis

**Myocardianl Infarction (MI)** <https://www.cdisc.org/system/files/all/standard/Draft%20Definitions%20for%20CDISC%20August%2020%2C%202014.pdf> (Chapter 4),**:**

* Universal Definition **(**<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6124376/>**)**
  + Must be: rise or fall (or both) in a blood test sensitive to heart muscle damage (troponin I or T) with at least one value above the 99th percentile of the upper reference limit along with clinical evidence for a diagnosis of AMI
  + clinical evidence includes symptoms of ischemia and new wall motion abnormalities on cardiac testing or a combination of these
* Society for Cardiovascular Angiography and Interventions (SCAI) Definition (<https://www.ahajournals.org/doi/pdf/10.1161/JAHA.114.001086>)
  + Criteria similar to CABG
  + biomarkers elevation ≥109 upper reference limit (URL) for creatine kinase MB (CKMB) and/or ≥709URL for troponin
  + 🡪 Folge: reduce the frequency of this event + MI is often a component of the primary endpoint of clinical trials, so if MI is a less-frequent event, then trial costs may increase

**Transient ischemic attack (TIA, Mini-Stroke)** <https://www.medicinenet.com/script/main/art.asp?articlekey=15553>,

* neurological event with the signs and symptoms of a [stroke](https://www.medicinenet.com/stroke_symptoms_and_treatment/article.htm)
* go away within a short period of time
* caused by temporary lack of adequate blood and oxygen (ischemia) to the brain 🡪 caused by the narrowing (or, less often, ulceration) of the carotid arteries (the major arteries in the neck that supply blood to the brain

**Coronary artery by-pass graft (CABG):** <https://www.msdmanuals.com/de-de/profi/herz-kreislauf-krankheiten/kardiovaskul%C3%A4re-tests-und-verfahren/koronararterielle-bypass-operation-cabg>,

<https://www.ncbi.nlm.nih.gov/books/NBK507836/>

* Angewandt, wenn Angioplastie mit Stent-Einführung nicht möglich
* Betrifft native Koronarterien mit hochgradigen Stenosen oder Verschluss
* Im Rahmen des Eingriffes wird an einem oder mehreren betroffenen [Koronargefäßen](https://flexikon.doccheck.com/de/Koronargef%C3%A4%C3%9F) ein Umgehungskreislauf ([Bypass](https://flexikon.doccheck.com/de/Bypass)) angelegt, um die durch Engstellen reduzierte Herzdurchblutung hinter der Stenose zu verbessern
* Arterien verwendet, da Venen weniger gut geeignet sind

**Electrodiagramm (ECG/EKG)** <https://www.medicinenet.com/script/main/art.asp?articlekey=3212>

* recording of the electrical activity of the [heart](https://www.medicinenet.com/heart_how_the_heart_works/article.htm)

**Angiography (**<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4777042/>**)**

* gold standard test for identifying the presence and extent of atherosclerotic coronary artery disease (CAD)
* invasive procedure
* Complications range widely (to life threatening situations that may cause irreversible damage)
* Gefäße mit Hilfe diagnostischer Bildgebungsverfahren wie Röntgen, Magnetresonanztomografie (MR-Angiografie) oder Computertomografie (CT-Angiografie) dargestellt

**AE –** Adverse Event **SAE –** Serious Adverse Event **ADE –** Adverse Drug Event **SADE –** Serious Adverse Device Event **USADE -** Unanticipated Serious Adverse Device Effects **ASADE -** Anticipated Serious Adverse Device Effects

**Cardiac enzyme assessment (**<https://www.ncbi.nlm.nih.gov/books/NBK545216/>**)**

* cardiac enzyme test is a tool used by doctors to determine if someone is having or has already had a heart attack.
* checks for levels of enzymes that are released by the heart muscle when it is injured, such as during a heart attack
* Results are expressed in nanograms per milliliter (ng/ml). This notes how much of the enzyme is present in your body.
* *Creatine kinase* (**CK**): In a healthy adult, the serum CK level varies with a number of factors (gender, race and activity), but normal range is 22 to 198 U/L (units per liter). Higher amounts of serum CK can indicate muscle damage (<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3263635/#B14>)
* A significant concentration of **CK–MB** isoenzyme is found almost exclusively in the myocardium, and the appearance of elevated CK–MB levels in serum is highly specific and sensitive for myocardial cell wall injury. Normal reference values for serum CK–MB range from 3 to 5% (percentage of total CK) or 5 to 25 IU/L. (<https://www.ncbi.nlm.nih.gov/books/NBK352/#:~:text=A%20significant%20concentration%20of%20CK,5%20to%2025%20IU%2FL.>)
* **Troponin** levels increase within 3 to 4 hours after the onset of damage and remain high for up to 4 to 7 days (troponin I) or 10 to 14 days (troponin T) (<https://www.ncbi.nlm.nih.gov/books/NBK241529/>)

**Serum creatinine assessment (**<https://www.ncbi.nlm.nih.gov/books/NBK507821/>**)**

* measures the level of creatinine in the blood
* Creatinine is a waste product that forms when creatine, which is found in your muscle, breaks down.
* Creatinine levels in the blood can provide your doctor with information about how well your kidneys are working 🡪 High levels of creatinine may indicate that your kidney is damaged and not working properly

**Concomitant Medication Procedure (con-meds) (**<https://www.imarcresearch.com/blog/con-meds-why-are-they-important>**):**

* two or more [drugs](https://en.wikipedia.org/wiki/Drug) used or given at or almost at the same time (one after the other, on the same day, etc.)

**Anti-Platelet (**<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4952969/>**) - Thrombozytenaggregationshemmer**

* inhibit [thrombus](https://en.wikipedia.org/wiki/Thrombus) formation
* decreases the ability of blood clots to form by interfering with the platelet activation process in primary [hemostasis](https://en.wikipedia.org/wiki/Hemostasis)

**ASA (**<https://pubmed.ncbi.nlm.nih.gov/18160361/#:~:text=Given%20that%20percutaneous%20coronary%20stent,for%20patients%20undergoing%20stent%20implantation.>**):**

* Acetylsalicylic Acid – Aspirin
* Aspirin blocks an enzyme called cyclooxygenase. That makes your body less likely to produce chemicals that can help cause [inflammation](https://www.webmd.com/women/ss/slideshow-what-is-inflammation). (<https://www.webmd.com/heart-disease/guide/aspirin-therapy#1>)

**Heparin (**<https://pubmed.ncbi.nlm.nih.gov/26672027/>**)**

* valuable anticoagulant and antithrombotic
* he goal of heparin therapy in acute coronary syndromes is to retard the progression of intracoronary thrombus and thus prevent myocardial infarction and death. The progression of this condition when a patient is on aspirin alone, provides some guide as to the duration of heparin therapy that would be beneficial (<https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(05)73971-4/fulltext#:~:text=The%20goal%20of%20heparin%20therapy,therapy%20that%20would%20be%20beneficial.>)

**CEC = Clinical Endpoint Committees** (<https://premier-research.com/blog/perspectives-clinical-endpoint-committees-trial-needs-one/#:~:text=CECs%3A%20What%20Are%20They%20and%20Why%20Does%20Your%20Trial%20Need%20One%3F,-By%20Premier%20Research&text=Also%20called%20Endpoint%20Adjudication%20Committees,for%20safety%20and%20efficacy%20endpoints.>):

* synonym: Endpoint Adjudication Committees
* goal of a CEC is to standardize outcomes and optimize data quality, ultimately driving study success
* more info see link

**References**

1. Haude M, Ince H, Kische S, Abizaid A, Tolg R, Alves Lemos P, van Mieghem NM, Verheye S,

Birgelen C von, Christiansen EH, Wijns W, Garcia-Garcia HM, Waksman R. 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.

2. Haude M, Ince H, Kische S, Abizaid A, Tolg R, Alves Lemos P, van Mieghem NM, Verheye S,

Birgelen C von, Christiansen EH, Barbato E, Garcia-Garcia HM, Waksman R. Safety and clinical

performance of a drug eluting absorbable metal scaffold in the treatment of subjects with de

novo lesions in native coronary arteries: Pooled 12-month outcomes of BIOSOLVE-II and

BIOSOLVE-III. *Catheter Cardiovasc Interv*.2018.