

Abstract sessies NVVC Voorjaarscongres
 Donderdag 20 april 2023
 15:00 – 16:30 uur

SESSIE 5: INTERVENTION II

Zaal: Cambridge 32	Voorzitters: dr. Michiel Voskuil, cardioloog, UMC Utrecht en prof. dr. José Henriques, cardioloog, Amsterdam UMC
Spreker 1:	In Cardiogenic Shock, NSTEMI Patients Have Worse Outcome than STEMI Patients <i>E.J. Peters (Amsterdam UMC, Amsterdam)</i>
Spreker 2:	Use of Multiple Inopressors Associated with 30day Mortality in AMI Related Shock <i>S. ten Berg (Amsterdam UMC, locatie AMC, Amsterdam)</i>
Spreker 3:	Greater Coronary and Myocardial Perfusion and Smaller Thrombus Burden at Initial Angiogram with Increasing Doses of Zalunfiban in Patients with ST-Elevation Myocardial Infarction <i>S.A.O.F. Rikken (St. Antonius Hospital, Nieuwegein)</i>
Spreker 4:	Outcomes after Native Vessel versus Bypass Graft PCI in Prior CABG Patients <i>I.T. Küçük (Amsterdam UMC, University of Amsterdam, Amsterdam Cardiovascular Sciences, Amsterdam)</i>
Spreker 5:	Correlation and Diagnostic Agreement of Quantitative Flow Ratio With Fractional Flow Reserve in Saphenous Vein Grafts <i>R.W. de Winter (Department of Cardiology, Amsterdam UMC, Vrije Universiteit Amsterdam, Amsterdam)</i>
Spreker 6:	Deep Learning-based Segmentation of the Coronary Artery Tree in X-ray Coronary Angiography <i>M.A. Molenaar (Amsterdam UMC, Amsterdam)</i>
Spreker 7:	Same Day Discharge After Large Bore Vascular Access in Percutaneous Coronary Intervention of Chronic Total Coronary Occlusions <i>Y.B.O. Somsen (Amsterdam UMC location Vumc, Amsterdam)</i>
Spreker 8:	MitraClip Treatment Survival Outcomes compared to Conservative and Surgical Treatment for High-surgical-risk Patients Suffering from Mitral Regurgitation <i>A. Mephtah (Maastricht UMC/ Maastricht University, Maastricht)</i>

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In Cardiogenic Shock, NSTEMI Patients Have Worse Outcome than STEMI Patients

Presenting author: E.J. Peters

Department: Department of Cardiology

E.J. Peters (Amsterdam UMC, Amsterdam); E. J. Peters (Amsterdam UMC, Amsterdam); S. ten Berg (Amsterdam UMC, Amsterdam); M. Bogerd (Amsterdam UMC, Amsterdam); M.J.C. Timmermans (Nederlandse Hart Registratie, Utrecht); A.E. Engström (Amsterdam UMC, Amsterdam); L.C. Otterspoor (Catharina Ziekenhuis, Eindhoven); A.P.J. Vlaar (Amsterdam UMC, Amsterdam); J.P.S. Henriques (Amsterdam UMC, Amsterdam); on behalf of the participating centers of the PCI Registration Committee of the Netherlands Heart Registration

Purpose:

Compared to patients with non ST-elevated myocardial infarction (NSTEMI), STEMI patients are at greater risk of developing cardiogenic shock (CS). It is however unclear whether outcome for the different etiologies of shock is similar, as literature on this topic is inconsistent. The aim of this study was to compare patient characteristics and mortality between STEMI and non-STEMI CS.

Methods:

Data from all patients undergoing percutaneous coronary intervention (PCI) in the Netherlands is prospectively registered in the Netherlands Heart Registration (NHR) database. Apart from the obligatory registration, additional data were collected for all patients with cardiogenic shock undergoing PCI between 2017 and 2021 in 14 Dutch hospitals. Details on baseline characteristics, treatment and outcome were compared for patients with STEMI and non-STEMI etiology of shock and logistic regression was performed after multiple imputation to determine the association between shock etiology and mortality.

Results:

A total of 2254 patients were identified of whom 313 (13.9%) had a non-STEMI and 1941 (86.1%) a STEMI etiology of shock. In this cohort, 30-day mortality was higher in NSTEMI patients than in patients presenting with STEMI (46.% vs. 38.2%, $p=0.005$) despite presenting with higher mean arterial pressures (78 mmHg vs. 74mmHg, $p=0.015$) and lower lactate levels (3.2 mmol/L, 6.1 mmol/L, $p<0.001$). Also, enzymatic infarct size was significantly bigger in patients presenting with STEMI CS. When adjusted for comorbidities, blood pressure and laboratory values on admission, non-STEMI etiology of CS was still independently associated with 30-day mortality (OR 1.6, 95%CI 1.22 – 2.15).

Conclusion:

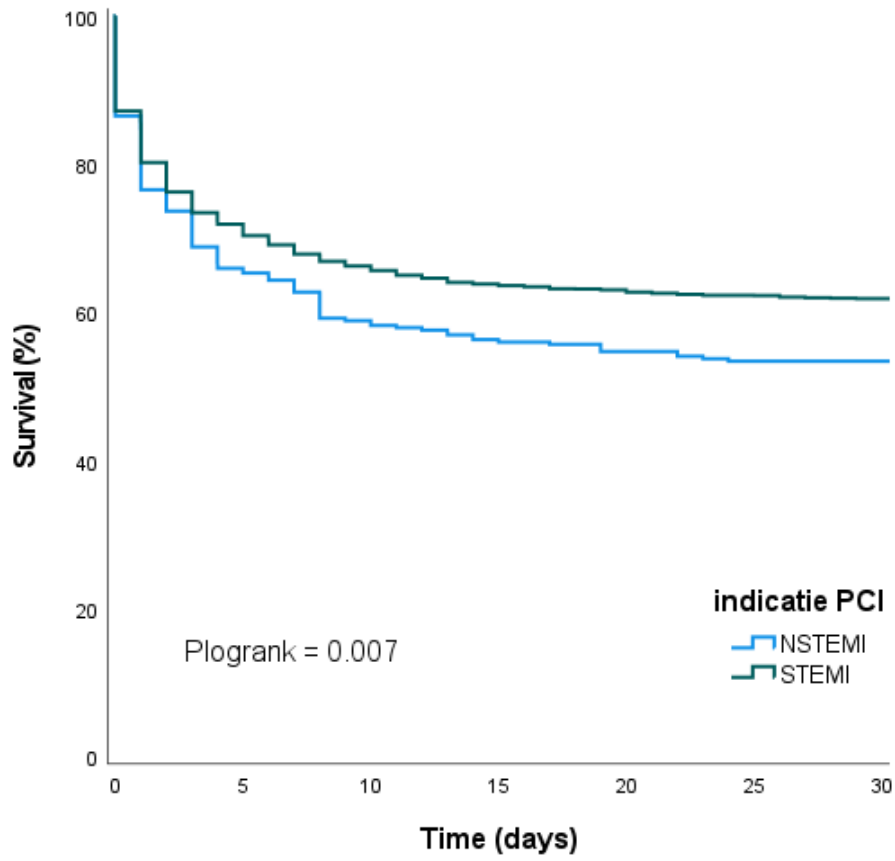
In this Dutch cohort of cardiogenic shock patients undergoing PCI, 14% presented with NSTEMI and 86% with STEMI. CS patients presenting with NSTEMI are at higher risk for worse outcome despite their usually more benign hemodynamic presentation and smaller infarct size.

Keywords:

Cardiogenic shock, Mortality, STEMI NSTEMI

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Figure:
30-Day survival in STEMI and NSTEMI cardiogenic shock



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Use of Multiple Inopressors Associated with 30day Mortality in AMI Related Shock

Presenting author: S. ten Berg
Department: Cardiology / intensive care

S. ten Berg (Amsterdam UMC, locatie AMC, Amsterdam); E. J. Peters (Amsterdam UMC, locatie AMC, Amsterdam); M. Bogerd (Amsterdam UMC, locatie AMC, Amsterdam); M.J.C. Timmermans (Nederlandse Hart Registratie, Utrecht); L.C. Otterspoor (Catharina ziekenhuis, Eindhoven); A.E. Engstrom (Amsterdam UMC, locatie AMC, Amsterdam); A.P.J. Vlaar (Amsterdam UMC, locatie AMC, Amsterdam); J.P.S. Henriques (Amsterdam UMC, locatie AMC, Amsterdam); On behalf of the participating centers of the PCI Registration Committee of the Netherlands Heart Registration

Purpose:

Inotropes and vasopressors (inopressors) are commonly used in the treatment of cardiogenic shock, despite their lack of beneficial evidence. Also, inopressors are known for their association with arrhythmias, increased cardiac ischemia and even death in settings of sepsis and cardiac surgery. In this real world data study, we aimed to demonstrate the relation between the number of administered inopressors and 30-day mortality in acute myocardial infarction (AMI) related cardiogenic shock (CS) patients.

Methods:

Between 2017 and 2021, data on patients treated with PCI complicated by CS were registered within the Netherlands Heart Registration (NHR) by 14 Dutch hospitals. Those patients were classified into groups based on the number (0 to ≥ 3) of administered inopressors initiated within the first 24 hours after PCI. Multivariable logistic regression analysis was performed to evaluate the association between the number of inopressors administered and 30-day mortality, corrected for confounders.

Results:

A total of 2328 consecutive CS patients were included (mean age 66 ± 12 years, 27% female). In this cohort, 517 (23%) patients did not receive any inopressors post PCI. One, two and \geq three inopressors were administered in 776 (35%), 627 (28%) and 304 (14%) patients respectively. The overall 30-day mortality was 39% and was associated with the number of inopressors administered (percentage of death per number of inopressors administered, 0; 19%, 1; 34%, 2; 48%, 3; 62%). Even after multivariate adjustment for initial lactate and mean arterial pressure, age, a medical history of diabetes and post-TIMI flow, administration of one inopressor was not associated (OR 1.43, 95% CI 0.88-2.4), but administration of two (OR 2.01, 95% CI 1.23-3.36) and $>$ three inopressors (OR 3.86, 95% CI 2.21-6.86) remained independently associated with 30-day mortality.

Conclusion:

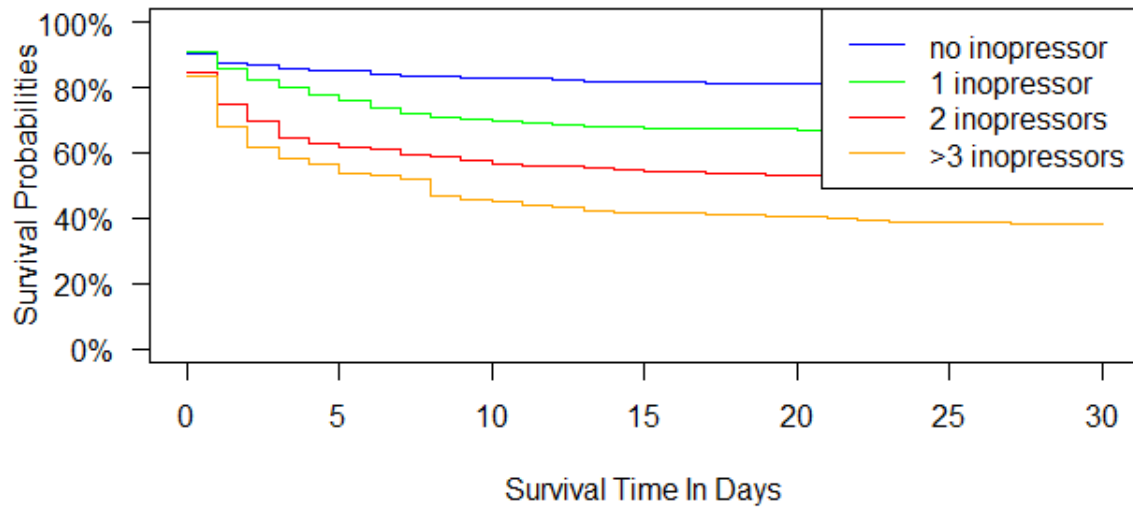
In CS patients complicating AMI, administration of two or more inopressors within 24 hours after PCI was independently associated with 30-day mortality compared to no inopressors. Again, despite frequent use of inopressors in CS patients, the impact and effects should be questioned.

Keywords:

Cardiogenic shock, PCI, Inotropes

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Figure:



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Greater Coronary and Myocardial Perfusion and Smaller Thrombus Burden at Initial Angiogram with Increasing Doses of Zalunfiban in Patients with ST-Elevation Myocardial Infarction

Presenting author: S.A.O.F. Rikken
Department: Cardiology

S.A.O.F. Rikken (St. Antonius Hospital, Nieuwegein); S.A.O.F. Rikken (St. Antonius Hospital, Nieuwegein); W.L. Bor (St. Antonius Hospital, Nieuwegein); K.L. Zheng (St. Antonius Hospital, Nieuwegein); A.P. Hack (St. Antonius Hospital, Nieuwegein); A. Selvarajah (Isala Hospital, Zwolle); O.S. Bentur (Allen and Frances Adler Laboratory of Blood and Vascular Biology, New York); C.M. Gibson (Boston Clinical Research Institute, Boston); C.B. Granger (Duke University School of Medicine, Durham); B.S. Coller (Allen and Frances Adler Laboratory of Blood and Vascular Biology, New York); A.W.J. van 't Hof (Maastricht University Medical Center+, Maastricht); J.M. ten Berg (St. Antonius Hospital, Nieuwegein)

Purpose:

Zalunfiban (RUC-4) is a novel, subcutaneously administered glycoprotein IIb/IIIa inhibitor designed for pre-hospital treatment to initiate reperfusion in the infarct-related artery (IRA) before primary percutaneous coronary intervention in patients with ST-elevation myocardial infarction (STEMI). Whether zalunfiban can improve reperfusion in the IRA at initial angiogram in patients with STEMI is unknown.

Methods:

This was a post hoc analysis from the open-label phase IIa study which investigated the pharmacodynamics, pharmacokinetics and tolerability of three increasing doses – 0.075, 0.090 and 0.110 mg/kg - of zalunfiban in STEMI patients. This analysis explored dose-dependent associations between zalunfiban and angiographic indices of the IRA, including coronary and myocardial blood flow and thrombus burden. Zalunfiban was administered in the cardiac catheterization laboratory prior to vascular access, ~10-15 minutes before initial angiogram.

Results:

24 out of 27 STEMI patients were evaluable for angiographic analysis (0.075 mg/kg [n=7], 0.090 mg/kg [n=9], and 0.110 mg/kg [n=8]). TIMI flow grade 2 or 3 was seen in 1/7 patients receiving zalunfiban at 0.075 mg/kg, in 6/9 receiving 0.090 mg/kg, and in 7/8 receiving 0.110 mg/kg (ptrend = 0.004, Figure 1). Similarly, greater myocardial perfusion was observed in patients receiving higher doses (ptrend = 0.005). Consistent with the dose-dependent trends in greater coronary and myocardial perfusion, lower thrombus burden was observed more frequently in patients receiving the highest dose of zalunfiban (ptrend = 0.02).

Conclusion:

Higher doses of zalunfiban given prior to vascular access were associated with greater patency of the IRA, greater myocardial perfusion, and lower thrombus burden.

Keywords:

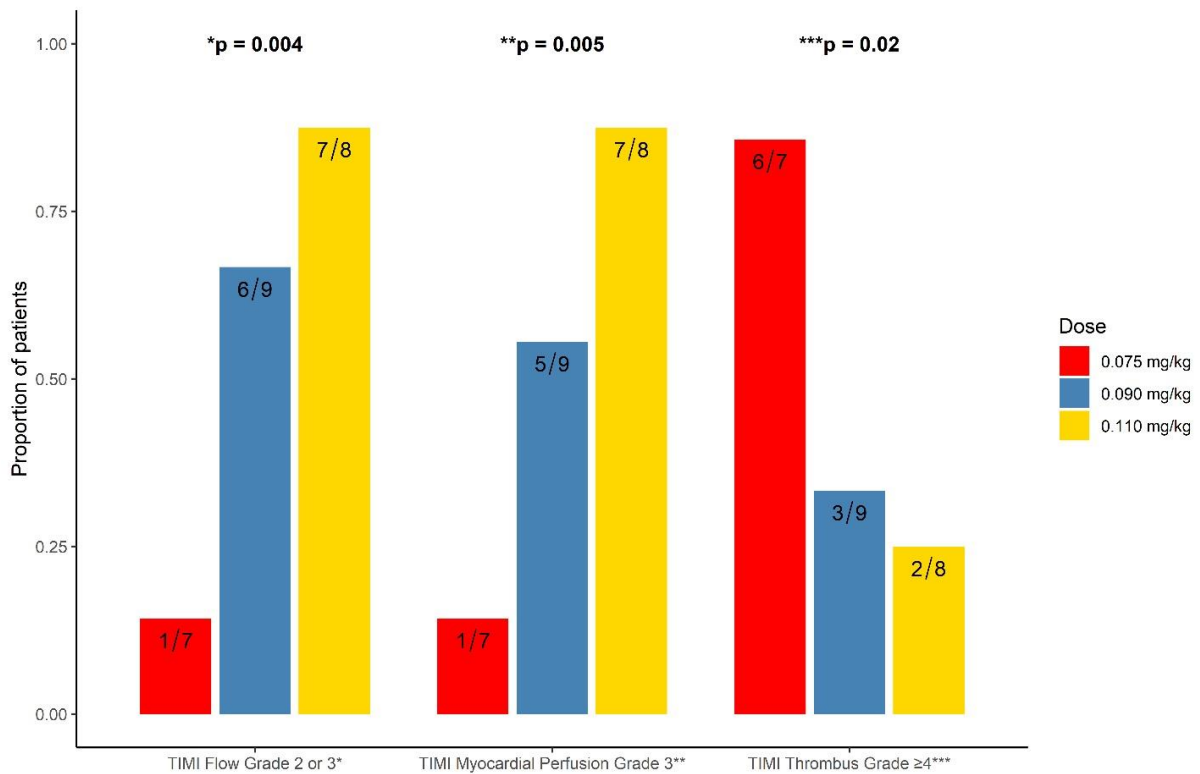
Glycoprotein IIb/IIIa inhibitor, STEMI, zalunfiban

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Figure:

Dose-dependent effects of zalunfiban on three angiographic indices.
TIMI; Thrombolysis In Myocardial Infarction.

Dose-dependent effects per angiographic outcome of interest were assessed with the Cochran-Armitage test.



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Outcomes after Native Vessel versus Bypass Graft PCI in Prior CABG Patients

Presenting author: I.T. Küçük
Department: Cardiology

I.T. Küçük (Amsterdam UMC, University of Amsterdam, Amsterdam Cardiovascular Sciences, Amsterdam); F.J. Beerkens (Mount Sinai, New York); A. van Veelen (Amsterdam UMC, Amsterdam); R.A.F. de Lind van Wijngaarden (Amsterdam UMC, Amsterdam); M.J.C. Timmermans (NHR, Utrecht); R. Mehran (Mount Sinai, New York); G. Dangas (Mount Sinai, New York); R. Klautz (Amsterdam UMC, Amsterdam); J.P.S. Henriques (Amsterdam UMC, Amsterdam); B.E.P.M. Claessen (Amsterdam UMC, Amsterdam)

Purpose:

To investigate explanatory risk factors for native versus graft vessel PCI in patients with prior CABG and outcomes from a large nationwide prospective registry.

Methods:

We identified all patients who underwent PCI with a history of prior CABG from the Netherlands Heart Registration between 2017-2021. The primary endpoint of major adverse cardiac events (MACE) was a composite of all-cause death and target vessel revascularization (TVR) at one-year post PCI. Key secondary endpoint was a composite of all-cause death, myocardial infarction (MI), and TVR at 30 days.

Results:

Out of a total of 154,146 patients who underwent PCI during the study period, 12,822 (8.3%) had a prior CABG. ACS most strongly predicted the choice of bypass graft intervention, while chronic total occlusion (CTO) was predictive of a native vessel intervention. The primary outcome of MACE at one-year post PCI occurred more frequently in those undergoing bypass graft PCI compared with native vessel PCI, driven by both all-cause death and TVR. There was no difference in the incidence of the key secondary endpoint between bypass graft PCI and native vessel PCI.

Conclusion:

In this nationwide prospective registry, ACS is associated with PCI of a bypass graft and CTO with native vessel PCI in prior CABG patients. Clinical outcomes after 1 year were worse after PCI in bypass graft interventions compared with native vessel interventions.

Keywords:

CABG, PCI, Graft

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Figure:

* MACE is a composite of all-cause death and target vessel revascularization. OR is adjusted for age, diabetes, CKD, multivessel disease, CTO, prior MI, OHCA, and ACS.

† Key secondary endpoint is a composite of all-cause death, MI, and target vessel revascularization. OR is adjusted for age, diabetes, CKD, multivessel disease, CTO, prior MI, OHCA, and ACS.

OR denotes odds ratio; CI confidence interval; MACE major adverse cardiac events; Y year; TV target vessel; CKD chronic kidney disease; CTO chronic total occlusion; MI myocardial infarction; OHCA out of hospital cardiac arrest; and ACS acute coronary syndrome

	OR	P-value	95% CI
MACE <1Y*			
TV including a graft	1,302	<0,001	1,137 – 1,492
Key secondary endpoint†			
TV including a graft	0,799	0,055	0,636 – 1,005
Intervention with TV including a graft			
Age (per 1Y increase)	1,033	<0,001	1,027-1,039
Diabetes	1,155	0,004	1,049-1,273
CKD	1,093	0,084	0,988-1,209
Multivessel disease	1,145	0,034	1,011-1,297
CTO	0,441	<0,001	0,353-0,550
Prior MI	1,172	<0,001	1,067-1,287
OHCA	1,064	0,709	0,767-1,477
ACS	2,270	<0,001	2,063-2,498

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Correlation and Diagnostic Agreement of Quantitative Flow Ratio With Fractional Flow Reserve in Saphenous Vein Grafts

Presenting author: R.W. de Winter
Department: Cardiology

R.W. de Winter (Department of Cardiology, Amsterdam UMC, Vrije Universiteit Amsterdam, Amsterdam); R.W. de Winter (Department of Cardiology, Amsterdam UMC, Amsterdam); Y.B.O. Somsen (Department of Cardiology, Amsterdam UMC, Amsterdam); P.A. van Diemen (Department of Cardiology, Amsterdam UMC, Amsterdam); R.A. Jukema (Department of Cardiology, Amsterdam UMC, Amsterdam); R. Hoek (Department of Cardiology, Amsterdam UMC, Amsterdam); M.P. Jonker (Department of Cardiology, Amsterdam UMC, Amsterdam); A.C. van Rossum (Department of Cardiology, Amsterdam UMC, Amsterdam); R.A. Kooistra Medis Medical Imaging, Leiden); J. Janssen (Medis Medical Imaging, Leiden); S. Porouchani (Department of Cardiology, Amsterdam UMC, Amsterdam); A. Wilgenhof (Department of Cardiology, Amsterdam UMC, Amsterdam); I. Danad (Department of Cardiology, Amsterdam UMC, Amsterdam); N.J. Verouden (Department of Cardiology, Amsterdam UMC, Amsterdam); J.H. Reiber (Medis Medical Imaging, Leiden); A. Nap (Department of Cardiology, Amsterdam UMC, Amsterdam), P. Knaapen (Department of Cardiology, Amsterdam UMC, Amsterdam)

Purpose:

The applicability of quantitative flow ratio (QFR), a non-hyperemic, invasive coronary angiography-derived computation of fractional flow reserve (FFR), has not been studied in coronary artery bypass grafts. We sought to explore the correlation and diagnostic agreement between QFR and FFR in saphenous vein grafts (SVGs).

Methods:

A total of 131 prospectively included patients (mean age 73±8 years, 86% male) with prior coronary artery bypass grafting underwent invasive coronary angiography and functional assessment with FFR in 151 non-occluded SVGs. QFR dedicated angiography images of the SVGs were recorded. QFR computation was performed offline and a threshold ≤ 0.80 was used to define functional significance.

Results:

QFR was successfully computed in 142 (94%) SVGs. QFR computation could not be performed in 9 bypass grafts due to panning (2%), poor contrast opacification (2%), foreshortening (1%), vessel overlap (1%) and hindered pathline/contour detection caused by sternal wires (1%). FFR showed obstructive disease in 49 (33%) SVGs, whereas QFR was ≤ 0.80 in 54 (36%) bypass grafts. We found a significant correlation between QFR and FFR ($r=0.71$, $p<0.001$, ICC 0.83, $p<0.001$). QFR exhibited a sensitivity and specificity of 84% and 83%, respectively, resulting in a diagnostic accuracy of 83% to diagnose FFR-defined significant vein graft disease. Lastly, QFR demonstrated an area under the receiver operating curve of 0.90 (95% CI 0.85-0.95).

Conclusion:

This study shows the potential applicability of contemporary QFR computation in venous bypass grafts with a moderate correlation and good diagnostic accuracy compared to functional assessment using FFR.

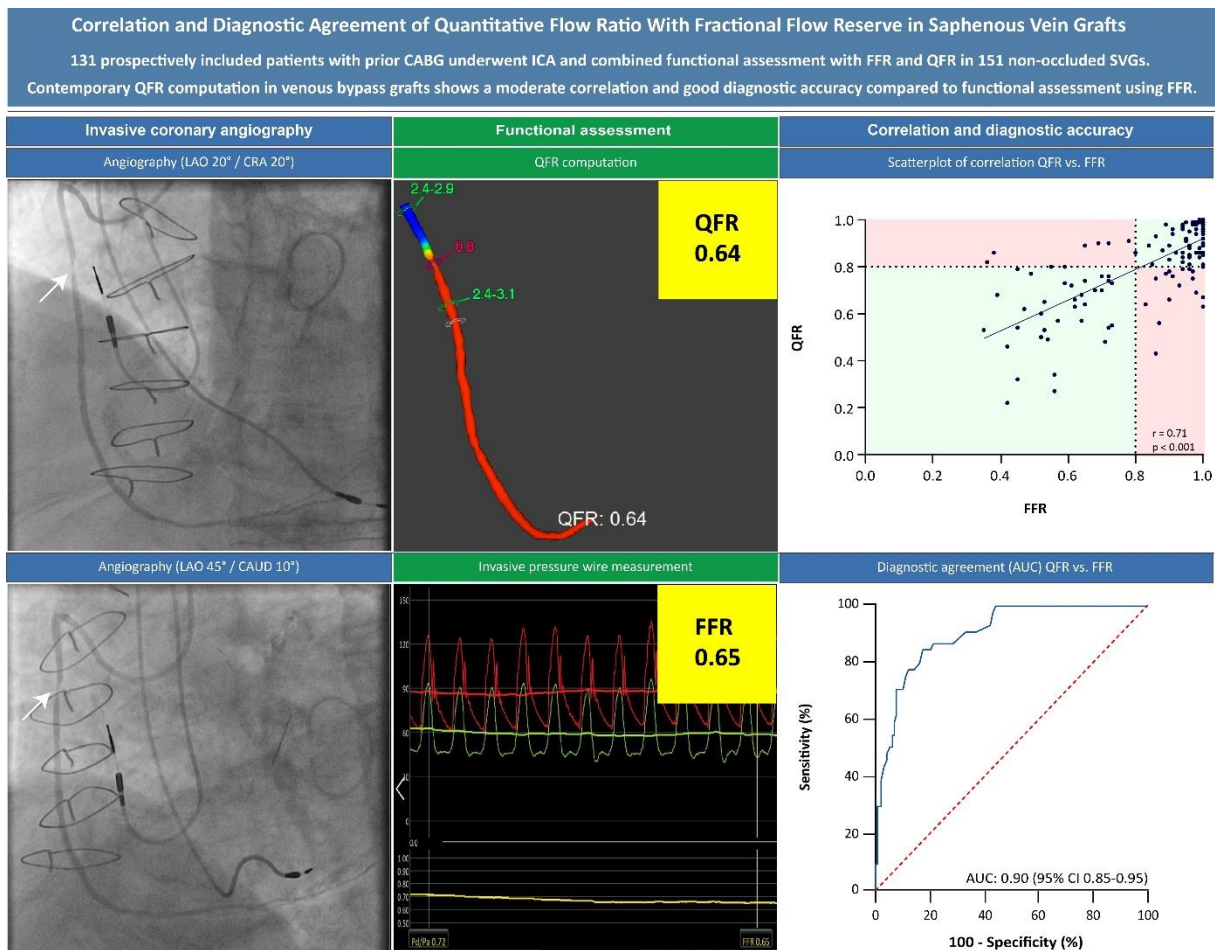
Keywords:

fractional flow reserve, quantitative flow ratio, saphenous vein grafts

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Figure:

Central illustration. This study shows the potential applicability of contemporary QFR computation in saphenous vein grafts with a moderate correlation and good diagnostic accuracy compared to functional assessment using FFR.



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Deep Learning-based Segmentation of the Coronary Artery Tree in X-ray Coronary Angiography

Presenting author: M.A. Molenaar
Department: Cardiology

M.A. Molenaar (Amsterdam UMC, Amsterdam); M.A. Molenaar (Amsterdam UMC); J.L. Selder (Amsterdam UMC); J.O. Bescós (Philips, Best); M.S. van Mourik (Philips, Best); Y. Zhao (Philips, Best); M.J. Schuurin (Amsterdam UMC); B.J. Bouma (Amsterdam UMC); S.A.J. Chamuleau (Amsterdam UMC); C.J. Verouden (Amsterdam UMC)

Purpose:

Visual assessment of stenosis grade in invasive coronary angiography (ICA) is highly operator-dependent due to vessel foreshortening, vessel overlap and poor image quality by low-dose x-ray radiation. Deep learning may assist in stenosis assessment. To enable stenosis assessment first robust coronary artery detection is needed as a prerequisite. Therefore, the aim of this study was to evaluate a deep learning algorithm to segment coronary arteries on ICA.

Methods:

ICA studies of patients who underwent ICA or percutaneous coronary intervention in a tertiary center between 2015-2017 were retrospectively collected. ICA cine runs were manually selected for each study in a way that all the major coronaries were clearly visible with minimum overlap in one of the cines runs and stenosis grade could be assessed (stenosis degree >50%). If the patient did not have any significant stenosis, ICA cine runs that would suffice to assess the coronary anatomy were selected. One ICA cine frame was selected per run with vessels filled with contrast agent and preferably in end-diastolic phase. Contrast-filled coronary arteries included in the Synergy between PCI with Taxus and Cardiac Surgery (SYNTAX) score were segmented using dedicated software. The nnU-Net segmentation method was used to train a convolutional neural network (CNN) to segment the coronary artery tree. Performance was evaluated on the unseen test set (20% of images) by visual inspection and the dice similarity coefficient (DSC), a metric of segmentation performance between 0 (poor) and 1 (excellent).

Results:

A total of 338 patients were included of which 1060 images (848 training set, 212 test set) were segmented. The deep learning method segmented the coronary artery tree in the test set with a mean DSC of 0.85. Discrepancy between the automated and manual segmentation were attributable to incorrect identification of the catheter as coronary artery and segmentation of low-contrast regions (Figure 1).

Conclusion:

By using deep learning it is possible to segment the coronary tree accurately in ICA. Further efforts are needed to automatically detect the separate coronary segments, lesions and lesion grade and eventually to perform objective and reproducible quantitative coronary angiography.

Keywords:

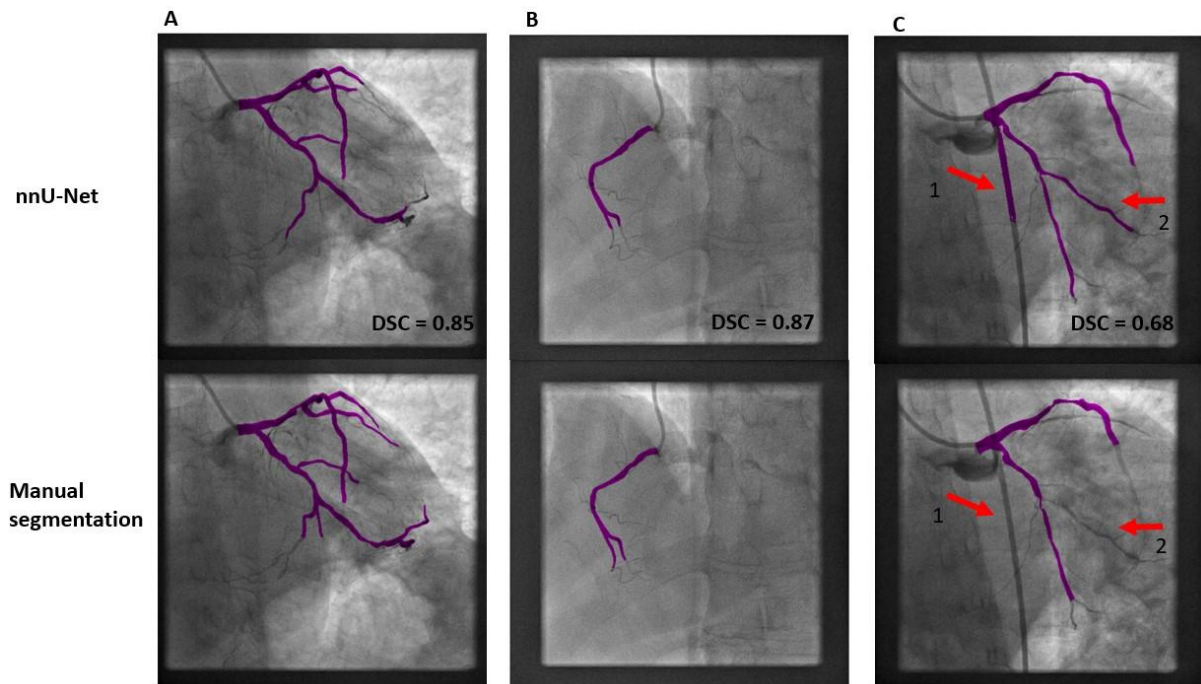
Coronary angiography, Coronary artery disease, Deep learning

Figure:

Figure 1: Representative examples of automatic identification of the coronary arteries in invasive coronary angiography images. In the first and second row examples of automated segmentation (nn-UNet) and corresponding manual segmentation are shown, respectively.

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A/B. Good agreement between automated and manual segmentation. C. Discrepancy between the automated and manual segmentation: the catheter is incorrectly identified as coronary artery (1) and segmentation of a low-contrast region (2). DSC = similarity coefficient.



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Same Day Discharge After Large Bore Vascular Access in Percutaneous Coronary Intervention of Chronic Total Coronary Occlusions

Presenting author: Y.B.O. Somsen
Department: Cardiology

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Purpose:

Same day discharge (SDD) in patients undergoing percutaneous coronary intervention (PCI) of a chronic total coronary occlusion (CTO) appears safe, feasible, and carries economic advantage. However, SDD may be hampered by the application of large bore dual arterial access, due to its association with vascular complications. On the contrary, increasing French size augments therapeutic options and is therefore considered fundamental in complex CTO PCI. The present study investigated the feasibility of SDD in patients undergoing CTO PCI with large bore dual arterial access.

Methods:

Between 2013 and 2018, a total of 683 patients were prospectively enrolled in a single-center CTO registry and underwent single-vessel CTO PCI. Large bore arterial access was defined as the application of 7 and/or 8 French sheaths in at least one access site. Technical success was defined as Thrombolysis in Myocardial Infarction flow grade 3 and residual stenosis <30%. Vascular access complications were defined as a composite of clinically significant bleeding and/or hematoma, urgent transfusion, dissection, pseudoaneurysm, arteriovenous fistula formation, and thrombosis.

Results:

Mean age was 66 ± 11 years; 83% were male. Large bore arterial access was applied in 87%; the most common set-up was radial-femoral (68%) and bifemoral (23%) access. In 432 (62%) patients, SDD was achieved. Patients within the SDD group were younger and had lower rates of prior MI, prior CABG, renal insufficiency, and peripheral artery disease. A high Japanese CTO score (≥ 2) was less common in patients with versus without SDD (58% vs. 72%, $p < 0.001$). In addition, technical success rate was higher in the SDD group (96% vs. 89%, $p < 0.001$). Vascular access complications were found in 22 (3,2%) cases, with 17 (77,2%) occurring in the non-SDD group. Local access site bleeding was found to be the most common complication (82,4% of total vascular access complications). Finally, multivariable analysis showed that female gender (OR 2.22, 95% CI: 1.30 – 3.78) and local access site bleeding (OR 12.0, 95% CI: 4.37 – 33.21) were significantly associated with a lower probability of SDD.

Conclusion:

Our study demonstrates the feasibility of SDD in the majority of patients undergoing CTO PCI with large bore dual arterial access, with high rates of technical CTO PCI success and acceptable vascular access complication rates. Care should be taken to avoid local access

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site bleeding since this hinders SDD.

Keywords:

Chronic Total Coronary Occlusion, Large Bore Vascular Access, Same Day Discharge

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MitraClip Treatment Survival Outcomes compared to Conservative and Surgical Treatment for High-surgical-risk Patients Suffering from Mitral Regurgitation

Presenting author: A. Mephtah
Department: Cardiology

A. Mephtah (Maastricht UMC/ Maastricht University, Maastricht); A. Mephtah (Maastricht UMC, Maastricht)

Purpose:

Approximately 25% of all native valvular diseases are composed of Mitral regurgitation (MR). Advanced MR shares an independent association with reduced survival outcomes. We made an examination of survival outcomes after treatment of patients that had priorly been discussed by a dedicated Mitral Valve team as there is a lack of definition when comparing the surgical or conservative treatment with the MitraClip treatment. All was done in a large multicenter real-life setting.

Methods:

: In a retrospective manner, a total 1676 patients were included which were all discussed by the dedicated heart team. From these patients 687 were allocated to a conservative treatment, 529 were allocated to an operational intervention and 187 patients were allocated to a catheter intervention. From this last allocation, 154 patients were treated with a MitraClip treatment.

Results:

The data had just recently been collected and is therefore yet to be analyzed. One of the main outcomes that will serve our focus will be the baseline characteristics and especially mortality.

Conclusion:

Based on the preliminary results, there are signals to suspect that further analysis might suggest a lower mortality hazard for MitraClip intervention in a high-risk population with symptomatic mitral regurgitation when compared with matched patients that underwent conservative or surgical treatment.

Keywords:

MitraClip, Mitral Regurgitation, mitral valve