

Effects of PTCA on in vitro cultured coronary arterial segments

Citation for published version (APA):

Heuvel, van den, L. H., van Leeuwen, M. Y., Rutten, M. C. M., Vosse, van de, F. N., & Pijls, N. H. J. (2004). *Effects of PTCA on in vitro cultured coronary arterial segments*. Poster session presented at Mate Poster Award 2004 : 9th Annual Poster Contest.

Document status and date:

Published: 01/01/2004

Document Version:

Publisher's PDF, also known as Version of Record (includes final page, issue and volume numbers)

Please check the document version of this publication:

- A submitted manuscript is the version of the article upon submission and before peer-review. There can be important differences between the submitted version and the official published version of record. People interested in the research are advised to contact the author for the final version of the publication, or visit the DOI to the publisher's website.
- The final author version and the galley proof are versions of the publication after peer review.
- The final published version features the final layout of the paper including the volume, issue and page numbers.

[Link to publication](#)

General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal.

If the publication is distributed under the terms of Article 25fa of the Dutch Copyright Act, indicated by the "Taverne" license above, please follow below link for the End User Agreement:

www.tue.nl/taverne

Take down policy

If you believe that this document breaches copyright please contact us at:

openaccess@tue.nl

providing details and we will investigate your claim.

Effects of PTCA on *in vitro* cultured coronary arterial segments

L.H. van den Heuvel ¹, M. Y. van Leeuwen ¹, M.C.M. Rutten ¹, F. N. van de Vosse ¹, N.H.J. Pijls ^{1,2}

¹ Cardiovascular Biomechanics, Eindhoven University of Technology, Eindhoven

² Department of Cardiology, Catharina Hospital, Eindhoven

Introduction

Percutaneous transluminal coronary angioplasty (PTCA) is an important procedure for restoring blood flow in stenosed coronary arteries. Although already applied clinically for more than 40 years the effects of PTCA on the behaviour of the arteries after the intervention are still unknown. Within 6 months after PTCA an exaggerated response to injury results in restenosis in 40% of the PTCA-treated arteries.

Aim

To determine the differences in viability, the number of proliferating cells and morphology in *in vitro* cultured coronary arterial segments treated with PTCA and untreated coronary arterial segments in the first week after treatment.

Methods

An *in vitro* model was developed in which coronary arterial segments can be conditioned and perfused under physiological conditions and mechanical loads, including an axial strain of 5% (Fig 1). The setup has been equipped with orifices to perform interventional procedures, like PTCA.

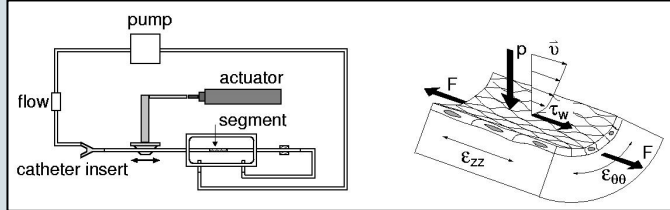


Figure 1 The *in vitro* model (I): the arterial segment is emerged in culture medium and clamped to the axial actuator that, together with a pump, applies the *in vivo* mechanical loads; Pressure p , flow v and axial force F result in circumferential strain $\epsilon_{\theta\theta}$, shear stress τ_w and axial strain ϵ_{zz} (r). The complete setup is placed in an incubator.

Six segments of porcine left anterior descending coronary arteries (LAD) were processed for measuring viability and the number of proliferating cells directly after excision ($t=0h$) and after 168h of culturing in the *in vitro* model. One part of the cultured LAD was treated with PTCA. A balloon was inserted and inflated for 2 minutes at 1 MPa resulting a circumferential strain up to 20%. The other part of the LAD remained untreated. Viability was determined by measuring the mitochondrial activity using a MTT assay. Proliferating cells were identified by using BrdU incorporation in newly formed DNA. With immunohistochemistry techniques the cells with new DNA were visualized. Also, samples were collected for histological analysis using Masson's Trichrome Staining (MTS).

Results

The differences in viability, number of proliferating cells and morphology are shown in fig 2 and 3.

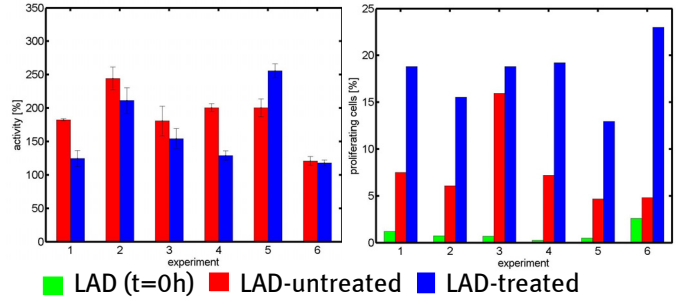


Figure 2 Mitochondrial activity of the untreated and treated LAD coronary arterial segments $t=168h$ proportional to $t=0h$ (I) and the number of proliferating cells proportional to the total number of cells present in a cross section of the arterial segment (r).

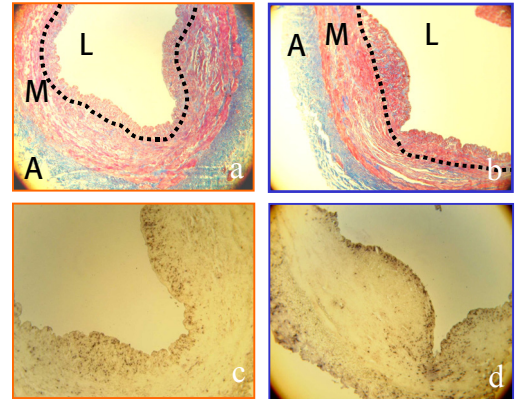


Figure 3 Cross sections of untreated (a&c) and treated (b&d) arterial segments stained with MTS (a&b) with L=lumen, M=media and A=adventitia, and BrdU (c&d) with dark brown spots indicating new cells.

Conclusions

- Treated LADs show signs of neo-intima formation
- The newly formed cells in the treated LADs are located in the boundary area of media and intima
- Treated LADs show significantly more proliferation than the untreated LAD
- Untreated LADs tend to have more mitochondrial activity than the treated LADs but not significantly