DMTS landsmøde 2023

Indsendte abstracts

Indhold

Authors: Caroline Gjerlund M.Sc. stud, Sidsel Hardt M.Sc. stud
Affiliation: Teknologi og Innovation, SDU
Contact: contact@liveequipe.com

LiveEquipe

LiveEquipe udvikler et monitorerings- og visualiseringssystem, så ryttere kan korrigere med det samme, hvis de sidder forkert. Herved forebygges skader hos såvel rytter som hest, samtidig med at hestevelfærden højnes, og den neurologiske og muskulære udvikling for rytter og hest optimeres.

Authors: Alexander Løvig Borg (MSc Stud), Christian Kruse Pedersen (MSc Stud), Kirstine Schultz Dalgaard (MSc Stud), Line Killmann Brogaard Petersen (MSc Stud), Morten Haugland (CSO Nordic NeuroStim), Erika G. Spaich (Assoc. Professor)

Affiliation: Department of Health Science and Technology; Aalborg University, Denmark

Contact: aborg19@student.aau.dk

When to electrically stimulate during hemiparetic gait training? Inertial sensors and machine learning have the answer

Approximately 80% of stroke patients suffer motor impairments, often resulting in hemiparesis (weakening of one side of the body). Among these patients, 62% experience gait issues, which subsequently have a negative impact on their quality of life. However, some of their gait function can be rehabilitated through intensive training. INCEDO, an innovation by Nordic NeuroStim, uses the nociceptive withdrawal reflex (NWR) elicited by electrical stimulation to improve gait.

This study aimed to develop a machine learning (ML) model to indentify gait phases in kinematic data and determine when to electrically stimulate to activate the NWR during gait training. We collected gait kinematics using two Inertial Measurement Units (IMUs), placed one on each ankle. Additionally, the INCEDO insole\'s force-sensitive resistor sensors were used to detect gait phases and thereby develop a supervised ML model to recognize the desired stimulation onset in the IMU data.

Eight healthy participants performed standard and simulated impaired gait tasks using the Donjoy X-ROM leg brace, while wearing the IMUs and INCEDO insole. Two ML models were developed: one using the "impaired" leg\'s IMU data, and another incorporating both IMUs. An offline test was performed to evaluate the performance of both models in determining the stimulation onset.

The ML-model trained on both IMUs demonstrated a 98% precision, while the single IMU model achieved 92%. Both underline the potential of merging ML with IMUs to robustly detect the onset of electrical stimulation during gait rehabilitation. Future work involves online tests with hemiparetic patients.

Authors: Rasmus Vorup BSc stud, Samuel Lund Jessen BSc stud, Thomas Stenholt Laursen BSc stud, Johan Andreas Balle Rubak BSc stud

Affiliation: Aarhus Universitet

Contact: johan.a.rubak@gmail.com

3D-modelling and analysis of airways based on Optical Coherence Tomography (OCT) modality.

The aim of the project is to investigate the potential opportunities, which can lead to improvement of the state-of-the-art clinical practice and analysis of abnormal airways in children. The approach of the project will be using endoscopic Optical Coherence Tomography (OCT) modality as an alternative to CT in regards of reconstructing a 3D model of the airway. The model shall be used for Computational Fluid Dynamic (CFD) analysis of the airflow in the airway. Abnormal airways can be caused by congenital malformations in children, iatrogenic imposed changes and can be secondary to cancer or other diseases in the airways. Currently abnormal airways are diagnosed by using bronchoscopy and for some cases additional CT. Due to the cost, logistic difficulties, and the use of high dosage of radiation when using CT, which should be avoided specifically in children , we seek to replace CT with OCT. Using the results of the CFD analysis we seek to provide the doctor with a better and more measurable\/quantitative result when analyzing the airway obstruction and considering if surgery is advised or not. The following are the main problems we want to address.

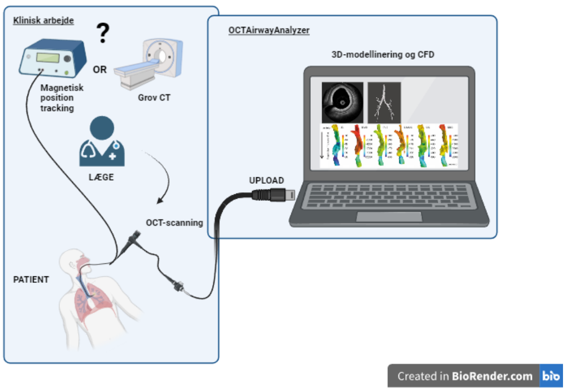
- Auto segmentation of OCT-scans using neural network

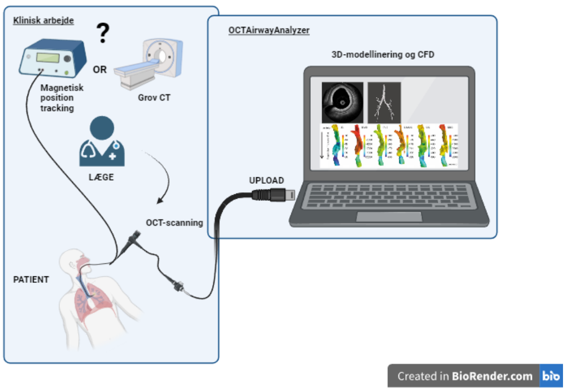
- Bend the OCT-scans according to the correct curvature of the airways.

- Constructing a 3D model and possibility for creating simple virtual surgery

- CFD-analysis before and after virtual surgery

- All functionalities in a friendly product





Authors: Johannes H. Jedrzejczyk (MD, PhD-fellow), Marcell J. Tjørnild (MD, PhD), Jens T. Væsel (MD), Alexander E. Kaspersen (MD), Dennis O. Ammitzskov (MD), Stine Krogh (BSc. Med.), Søren N. Skov (MSc, PhD), J. Michael Hasenkam (MD, DMSc)

Affiliation: Hjerte-, lunge- karkirugisk afdeling, AUH, Palle Juul-Jensens Boulevard 69

Contact: Johjed@clin.au.dk

Reconstruction of the Entire Posterior Mitral Valve Leaflet Using 2-ply Vacuum Pressed Porcine Small Intestinal Extracellular Matrix: Acute in vivo Evaluation

Objective:

To create a standardized patch design using MRI scans of healthy pigs and use it to investigate reconstruction of the entire posterior mitral valve with 2-ply vacuum pressed porcine small intestinal submucosa extracellular matrix.

Materials & Methods:

Five healthy pigs underwent MRI scans. Reconstruction of the entire posterior mitral valve was performed in an acute 80-kg porcine model (n = 7). The posterior mitral valve leaflet and associated chordae tendineae were reconstructed with 2-ply vacuum pressed porcine small intestinal submucosa extracellular matrix. Pressure measurements and echocardiography were performed before and after intervention.

Results:

The reconstructed mitral valve was fully competent without any signs of regurgitation. The peak left atrial pressure for baseline and reconstruction was 9.9 ± 1.1 mmHg vs 9.9 ± 1.0 mmHg, $p = 0.676$, and the mean pressure difference across the mitral for baseline and reconstruction was 4.5 ± 2.3 mmHg vs 4.1 ± 2.3 mmHg, $p = 0.063$.

Conclusion:

Reconstruction of the entire posterior mitral valve using 2-ply vacuum pressed porcine small intestinal submucosa extracellular matrix was possible in an acute 80-kg porcine model. The reconstructed mitral valve was fully competent; no signs of mitral valve regurgitation, stenosis, or systolic anterior motion were found.

Authors: Rasmus Ellerup Kraghede (MD PhD stud), Karen Juel Christiansen (RN), Alexander Emil Kaspersen (MD), Michael Pedersen (MD PhD), Johanne Juel Petersen (BSc), J. Michael Hasenkam (MD DMSc), Louise Devantier (MD PhD)

Affiliation: Klinisk Institut, Aarhus Universitet.

Contact: rakrag@clin.au.dk

Consequence of open versus closed tracheostomy immediately after decannulation

Background

Decannulation of tracheostomy after prolonged mechanical ventilation therapy leaves an open channel which unsealed leads to reduced pulmonary function, coughing ability, and voice quality. Current practice is to seal the tracheostoma with a bandage which leaks air and is easily blown off. Recently, a new concept was introduced enabling intratracheal sealing of the tracheotomy which potentially solves the issues of air leakage and pulmonary dysfunction. This study aimed to investigate the feasibility of intratracheal tracheostomy sealing.

Material and methods

Fifteen patients who underwent tracheostomy at the intensive care unit at Aarhus University Hospital,were included. A temporary intratracheal tracheostomy sealing disc was inserted at the time of decannulation and spirometry with measurement of forced vital capacity (FVC), forced expiratory volume in first second (FEV1), and peak expiratory flow (PEF) was performed. Voice recordings were obtained and assessed using an equal appearing interval scale.

Results

Mean FVC with 95% confidence interval (CI) was 915 (633-1323) ml at baseline which increased to 1386 (1080-1777) ml after insertion of the sealing disc, $p<0.001$. Mean FEV1 with 95% CI was 736 (505-1074) ml at baseline and increased to 958 (702-1307), $p<0.001$, while PEF did not increase significantly. The overall voice quality increased from a mean value ± standard deviation of 2 ± 1 to 4 ±1, $p<0.001$.

Conclusion

This feasibility study disclosed improved FVC, FEV1, and voice quality for decannulated patients immediately after insertion of an intratracheal tracheostomy sealing disc.

We consider this new potential treatment promising for optimization of respiratory function after decannulation.

Authors: Anna Ramella (PhD stud)
Affiliation: Politecnico di Milano
Contact: anna.ramella@polimi.it

Patient-specific numerical simulations of the TEVAR procedure

Thoracic Endovascular Aortic Repair (TEVAR) is a minimally invasive medical procedure used to treat thoracic aortic conditions. Since receiving FDA approval, it has demonstrated better patient outcomes compared to open surgical repair. Computational modeling plays a crucial role in analyzing stent-graft behavior post-TEVAR, offering valuable insights into device performance.

This study employs a high-fidelity validated finite element (FE) methodology to simulate the TEVAR procedure using commercial stent-grafts on patient-specific aortic anatomies, comparing simulation results with short-term postoperative CT data.

FE models of Valiant Captivia stent-grafts were created, and material parameters were calibrated through experimental crimping tests. The TEVAR procedure was validated in idealized aortic model.

Patient-specific anatomies were segmented from preoperative CT scans, while postoperative CT images were used to determine device size and landing zones. The simulations were performed using the LS-Dyna solver. Fig.1-a,b reports the segmented aortic anatomies and TEVAR simulation outcomes.

By comparing the simulation results with the stent segmented from postoperative CTs, an error (evaluated on the stent strut opening area) below 10% was achieved (Fig.1-c).

Following V&V40 guidelines, the methodology ensures the replication of accurate stent-graft models. The comparison between simulation results and postoperative CT images indicates that the numerical model can predict short-term TEVAR outcomes with good accuracy, despite biological and clinical data uncertainties. This suggests the model\'s potential for preprocedural planning, aiding clinicians in understanding the procedural outcomes before intervention. Ultimately, these simulations contribute to enhancing the safety and efficacy of TEVAR, benefitting patient care and treatment outcomes.

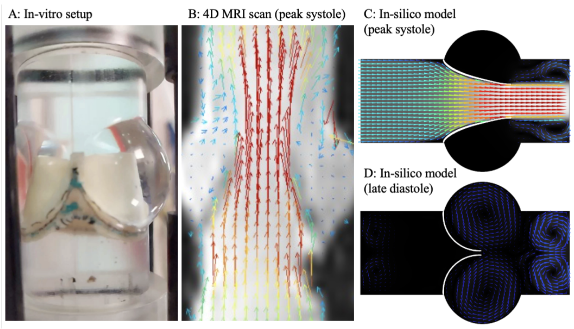
Authors: Akos Banfalvi, Steffen Ringgaard, Peter Johansen, Monica Colombo

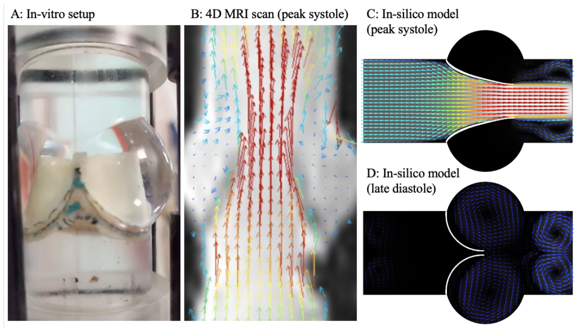
Affiliation: Department of Mechanical and Production Engineering, Department of Clinical Medicine, Department of Electrical and Computer Engineering, Department of Mechanical and Production Engineering

Contact: 202102203@post.au.dk, steffen@clin.au.dk, pj@ece.au.dk, mc@mpe.au.dk

Assessing Aortic Root Flow Disturbances after Transcatheter Implantation: A Digital Twin Analysis Using 4D MRI

Transcatheter Aortic Valve Implantation (TAVI) is a generally accepted standard care for aortic valvular abnormalities, including aortic stenosis, the calcification of the aortic leaflets. This minimally invasive procedure in which a new valve is implanted changes the blood flow conditions. The diagnosis of these new flow-conditions is essential for further development. Fluid-Structure Interaction (FSI) emerged as alternative approach for assessing the local hemodynamics. This work aims to build a reliable computational model by integrating the related experimental data as boundary conditions acquired from a flow-loop (Figure 1.A) as well the Magnetic Resonance Imaging (MRI) data (Figure 1.B). MRI provides insightful data about the internal structure and the geometry of the leaflets. Moreover, it can be used for qualitative and quantitative validation of the numerical model. FSI-derived aortic bulk flow well compared with in-vitro blood flow pattern (Figure 1.B-C). 4D-Flow analysis confirmed both direction and magnitude of the velocity flow jet impinging onto the aortic wall, as well as both location and extension of the secondary flows and vortices developing during systolic ejection. The vector plots distinctly reveal a fast-moving jet of blood at the valve opening during systole, while circulatory flows occur within the sinus during diastole (Figure 1.D). The realistic replication of leaflet deformation indicates that the computational model captures the biomechanical interactions within the aortic root effectively. Combining this method with the utilization of MRI scans, and comparing the results of the flow-field, can strengthen the experimental-computational twin to translate to the analysis of the in-vivo results.





Authors: Christoffer Vase Ovargaard MSc stud, Kaare Mikkelsen PhD Adjunkt, Andreas Kabel BSc.med, Andrew Phair MD PhD strud

Affiliation: Institut for Elektro- og Computerteknologi- Aarhus universitet

Contact: 201808251@post.au.dk

Super Resolution in Coronary Magnetic Resonance Angiography

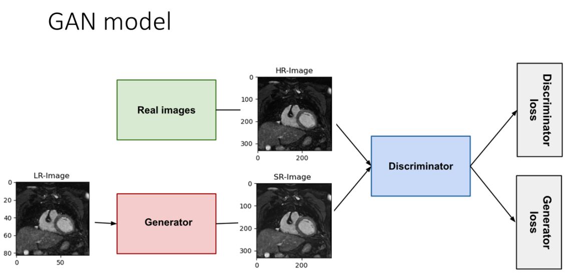
Coronary artery disease (CAD) remains the lead cause of death worldwide. Diagnosis of CAD is typically performed using either invasive coronary X-ray angiography and coronary CT angiography (CCTA). However, these incur risks of coronary artery dissection and exposure to ionising radiation, respectively.

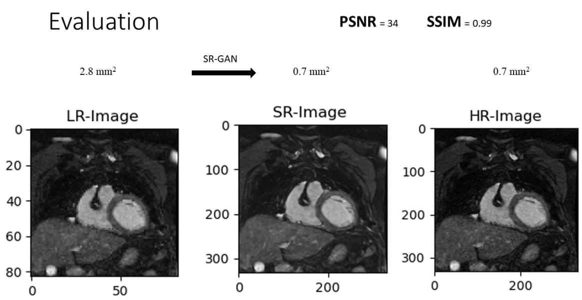
An alternative investigation is coronary magnetic resonance angiography (CMRA), which is non-invasive and does not utilise ionising radiation. However, CMRA is at present not used clinically due to the long scan times and low image quality as compared to CCTA.

This work aims to use Super Resolution (SR) to overcome these challenges, by enhancing rapidly-acquired, low-quality images to high-quality images acceptable for diagnostic use. The aim of this study is to implement deep learning-based frameworks of generative adversarial networks (GANs) to perform this image enhancement.

We took a set of CMRA scans from 50 patients at a resolution of either 0.9mm3 or 0.7mm3 and down-sampled it by a scaling factor of 4 using bicubic and 2D-Fourier down sampling. This data was then used to train the GAN. The images produced are shown in Figure 1.

Peak signal to noise ratio (PSNR) and structural index similarity (SSIM) are to be calculated to measure the difference between the generated image and the original (Figure 2). In addition, SR CMRA will be compared to conventional CMRA to determine the diagnostic confidence and accuracy of SR-CMRA. If successful, this would allow for a possible 2 to 4 fourfold improvement in scan time of CMRA, facilitating translation into clinical practice.





Authors: Luca Bontempi (MSc stud), Francesco Migliavacca (Full Professor), Monika Colombo (Assistant Professor), Peter Johansen (Associate Professor)

Affiliation: Department of Mechanical and Production Engineering (Aarhus University), Department of Chemistry, Materials and Chemical Engineering (Politecnico di Milano)

Contact: luca.bontempi@mail.polimi.it

Aortic annuloplasty: validation of a flow-loop experimental study with an FSI computational model

In the last decade, improvements in the understanding of the mechanisms of valve diseases, the development of a classification system for aortic insufficiency and advances in surgical procedures have allowed for more effective and reproducible techniques of aortic valve repair, such as annuloplasty procedure.

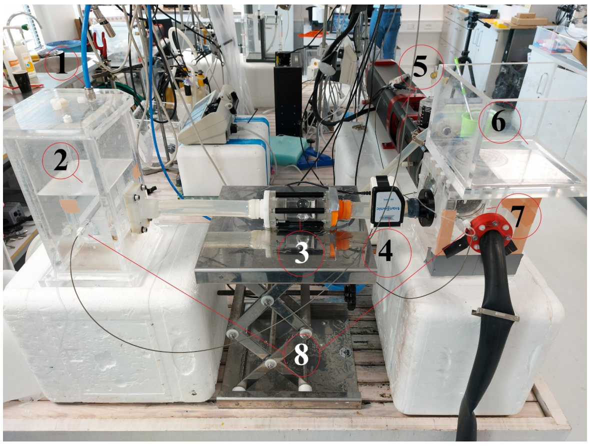
Annuloplasty aims to prevent the need for valvuloplasty in aortic valve conditions like regurgitation, caused by congenital bicuspid aortic valve or aortic root dilation, thereby reducing the risks associated with complex device implantation and subsequent patient follow-up, including anti-coagulant treatment.

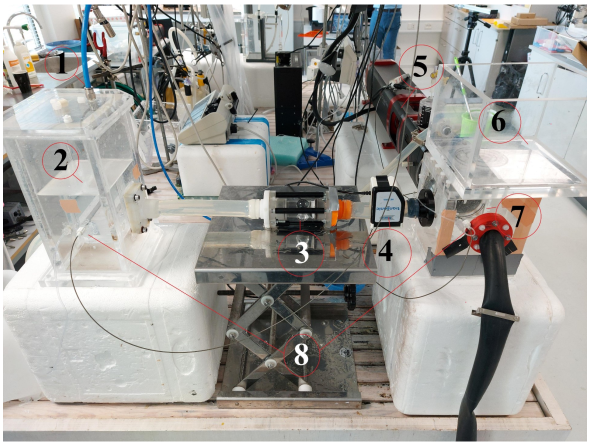
The aim of this project is to validate an aortic annuloplasty test-bench flow-loop through computational fluid-structure interaction (FSI) analysis of the entire aortic root under physio-pathologic and post-operation conditions.

The experimental work conducted at CAVE Lab (Aarhus University) involves setting up the experimental apparatus (see Figure) and collecting sensor-based data from the flow-loop. Porcine aortic roots will be used in the experiments, wherein pulsatile flow will be maintained.

The computational work, carried out in collaboration with Politecnico di Milano, focuses on developing an FSI model to simulate reliable post-annuloplasty conditions, coupling deformable aortic wall domain and haemodynamics behaviors. The simulations will be performed using Ansys® LS-Dyna software, utilizing as boundary conditions either sensor-based or 4D-MRI data of the experimental mock circuit, obtained from Aarhus University Hospital.

The objective is to assist surgeons in determining the appropriate procedure and location of the annuloplasty rings, as well as the correct geometrical and mechanical properties of the device.





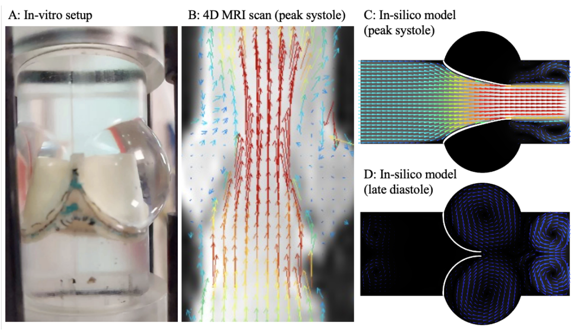
Authors: Akos Banfalvi (MSc Student), Steffen Ringgaard (Lecturer), Peter Johansen (Associate Professor), Monica Colombo (Assistant Professor)

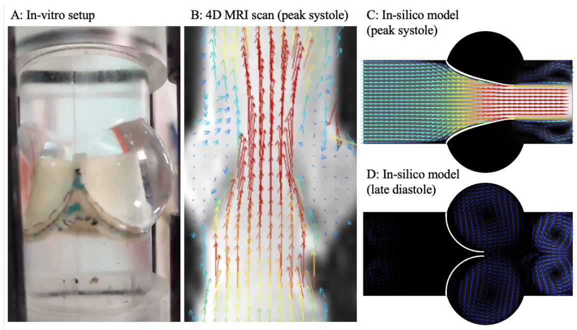
Affiliation: Department of Mechanical and Production Engineering, Department of Clinical Medicine, Department of Electrical and Computer Engineering, Department of Mechanical and Production Engineering

Contact: 202102203@post.au.dk, steffen@clin.au.dk, pj@ece.au.dk, mc@mpe.au.dk

Assessing Aortic Root Flow Disturbances after Transcatheter Implantation: A Digital Twin Analysis Using 4D MRI

Transcatheter Aortic Valve Implantation (TAVI) is a generally accepted standard care for aortic valvular abnormalities, including aortic stenosis, the calcification of the aortic leaflets. This minimally invasive procedure in which a new valve is implanted changes the blood flow conditions. The diagnosis of these new flow-conditions is essential for further development. Fluid-Structure Interaction (FSI) emerged as alternative approach for assessing the local hemodynamics. This work aims to build a reliable computational model by integrating the related experimental data as boundary conditions acquired from a flow-loop (Figure 1.A) as well the Magnetic Resonance Imaging (MRI) data (Figure 1.B). MRI provides insightful data about the internal structure and the geometry of the leaflets. Moreover, it can be used for qualitative and quantitative validation of the numerical model. FSI-derived aortic bulk flow well compared with in-vitro blood flow pattern (Figure 1.B-C). 4D-Flow analysis confirmed both direction and magnitude of the velocity flow jet impinging onto the aortic wall, as well as both location and extension of the secondary flows and vortices developing during systolic ejection. The vector plots distinctly reveal a fast-moving jet of blood at the valve opening during systole, while circulatory flows occur within the sinus during diastole (Figure 1.D). The realistic replication of leaflet deformation indicates that the computational model captures the biomechanical interactions within the aortic root effectively. Combining this method with the utilization of MRI scans, and comparing the results of the flow-field, can strengthen the experimental-computational twin to translate to the analysis of the in-vivo results.





Authors: Benjamin í Dali, Lasse Buch Møberg
Affiliation: Finlandsvej 21
Contact: Benjaminídali@hotmail.com

Development, manufacturing and test of silicone heart valve

Background: Heart valve disease is a significant clinical burden, with more than 200.000 annually performed aortic valve replacements world wide. A typical replacement is a mechanical heart valve or a bio prosthetic valve, which both have their limitations in regard to hemodynamics or durability and degradation, respectively.

Therefore this study aim to create a polymeric heart valve with hemodynamic performances that will be compared to the ISO 5840-2 which govern cardiac implants.

The polymeric heart valve designed is proprietary to the Cardiovascular Experimental Laboratory (CAVE Lab) in vitro flow loop at Aarhus University. The in vitro flow loop is outfitted with a acrylic sinus of Valsalva model, which will define key dimensions for the heart valve.

Method: The geometry of the valve model was made in CAD and then optimized on three geometric parameters to increase the geometric orifice area (GOA) through the finite element method (FEM). The geometry was then manufactured in silicone shore 40A by compression moulding with 3D printed moulds. The valves are then tested in a vitro flow loop in the CAVE lab, during which flow, pressure and opening areas were measured. A 4D-MRI scan is then done of the valve, which gives insights into the flow patterns and geometries of the valves. The valve is then evaluated in regard to ISO 5840-2.

Results: From the in vitro flow tests, none of the valves exceeded the minimum criteria from ISO 5840-2 stating an effective orifice area (EOA) > 1.7 cm2 and a regurgitation fraction (RF) < 15%. Two valves showed notable values: The 0.3 mm thick optimized valve with an EOA of 1.46cm2 and RF of 17.8% and the 0.6 mm thick optimized valve with an EOA of 1.61 cm2 and RF of 21.9%.

Discussion Slight differences between the ideal testing environment, stated by the ISO5840-2, and this studies test environment, made comparing the produced valves to the minimum requirements of the ISO 5840-2 limited. Also, limitations put on the test setup by virtue of the MRI might have affected the final results in a way that is difficult to determine.

Conclusion: This study made an MRI-compatible and easy-to-manufacture silicone heart valve that can be produced at AU. The valves did not uphold the minimum criteria for hemodynamics issued in ISO5840-2, so for usage of the valve in future studies, further alterations on the valve is needed.

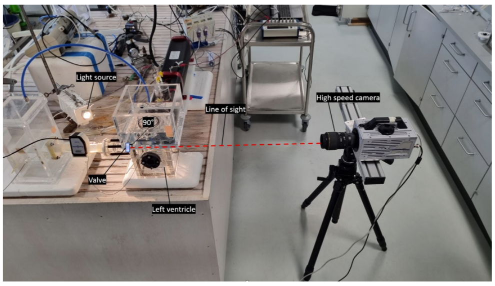


Figure J.40: *Picture of the experimental setup of the high-speed imaging*

Authors: Colombo Monika (Assistant Professor), Steffen Ringgaard (Associate Professor), Won Yong Kim (Clinical Professor), and Peter Johansen (Associate Professor)

Affiliation: Department of Mechanical and Production Engineering, Aarhus University

Contact: mc@mpe.au.dk

ADVANCING CARDIOVASCULAR RESEARCH: A TRIANGLE BETWEEN IN-SILICO SIMULATIONS, FLOW-LOOP IN-VITRO ANALYSIS, AND 4D-FLOW MRI VALIDATION

Innovative approaches are needed for understanding and treating complex cardiovascular diseases. In this context, the amalgamation of in-silico methods, flow-loop experiments and 4D imaging emerges as a transformative paradigm in cardiovascular research. Each approach, taken individually, presents many drawbacks. However, the combination of the approaches may drive the optimization of surgical approaches.

The flow-loop allows simulating both physiological and pathological conditions with controlled laboratory set-up. The sensor measurements provide a good estimation of the fluid dynamics at portions of interest. However, the system is often constrained and simplified, and it is not so immediate to test multiple, arbitrary scenarios.

Contrarily, in-silico approaches such as computational fluid dynamics offer a comprehensive platform for predicting disease progression and designing medical devices, reducing the reliance on costly and invasive experiments. Moreover, patient-specific applications can be easily implemented. The validation, though, of the local flow-dynamics generated in the in-silico analyses represents the main obstacle.

Complementing these approaches is the advent of 4D-magnetic resonance imaging, which offers unprecedented insights into cardiac and vascular function over time. Despite the low resolution and the imaging artefacts in presence of implantable metallic devices, the ability to provide blood flow patterns and cardiac motion has the potential to revolutionize diagnosis, treatment planning, and patient monitoring.

Together, these techniques empower researchers and clinicians to gain a deeper understanding of cardiovascular physiology, enhancing treatment outcomes. In this work, we specifically show how that applies to the study of transcatheter aortic valve implantation and aortic annuloplasty.

Authors: Rahima Khouani (MSc stud), Stefine Marie Hagen Varde (MSc stud), Peter Johansen (Lektor)
Affiliation: Elektro- og Computerteknologi, aarhus university
Contact: 201807197@post.au.dk

DMTS
The Danish Society for Biomedical Engineering

In vitro model of right heart and pulmonary circulation

Purpose:

The presented in-vitro model of the right heart and pulmonary circulation provides a systematic and repeatable method to study various aspects of pulmonary diseases – including pulmonary embolism (PE). As a proof of concept of the in-vitro model\'s capabilities, a study was conducted to explore where the embolism created occlusion, as well as the correlation between the obstruction site of a PE and the observed increase in pressure.

Methods:

In-vitro model is designed with a transparent physiologically representative phantom made of Elastic 50A on an SLA printer, placed in a compliance chamber. For the proof of concept, in total, 12 emboli were prepared from porcine blood and inserted into the in-vitro model. Each pressure measurement was divided into 4 phases, including pre- and post-occlusion of the emboli in the phantom. The degree of obstruction was quantified, using the pulmonary artery obstruction index (PAOI).

Results:

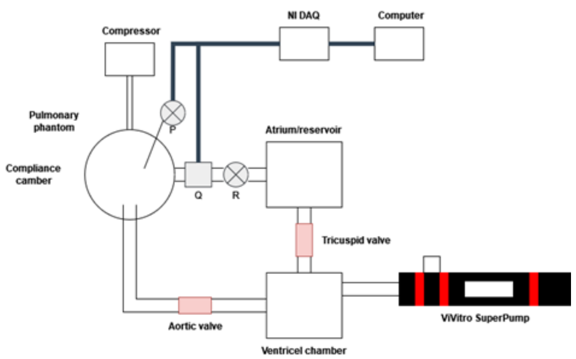
The in-vitro model can deliver a mean pulmonary arterial systolic pressure (PASP) of 11.79 ± 3.89 mmHg and an average systemic flow of 6.75 L\/min within a range of [-66; 340] ml\/s.

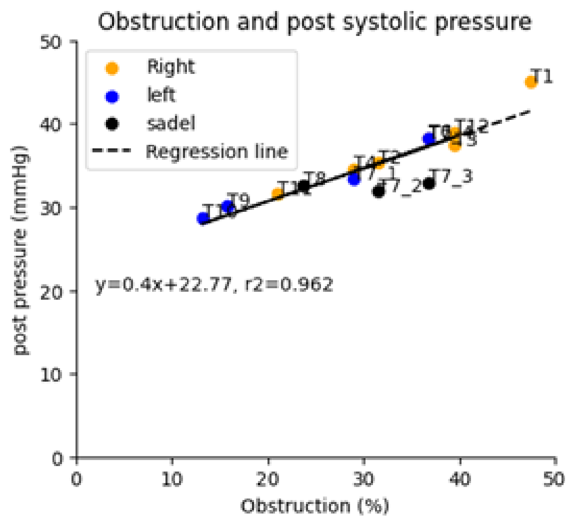
In around 71% of the time the emboli obstructed the segmental arteries in the lower lobe.

We found a positive correlation between PAOI and post PASP (r^2=0.96). The pre-mean PASP was 26.95 ± 3.09 mmHg and the post mean PASP was 34.96 ± 4.15 mmHg.

Conclusion:

We present an in-vitro model of the right heart and pulmonary circulation that can produce physiologically consistent bulk hemodynamic responses for systematic and repeatable experiments.

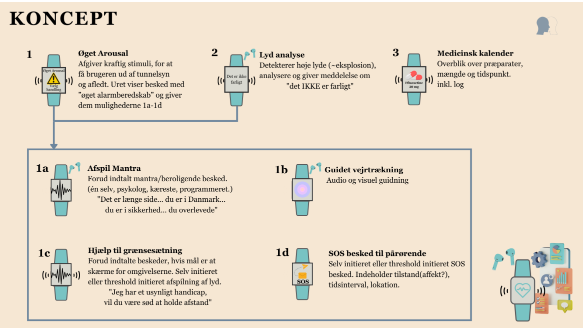


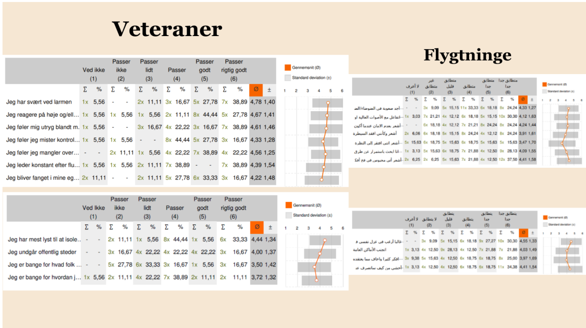


Authors: Camilla Bøgh Erlang (BSc stud)
Affiliation: aarhus universitet
Contact: camillaberlang@gmail.com

Mental Assistant - help to selfhelp

Mental illness accounts for ~25% of the disease burden in Denmark and costs society DKK 110bn annually. On19.08.22, the waiting time in psychiatry was over 60 weeks. The consequence is more difficult conditions and greater complexity, which means increased costs. Around 50,000 have PTSD, of which 16,728 are veterans, i.e. around 20% of all deployed soldiers get\/have PTSD. PTSD affects all aspects of a person\'s functioning and well-being. Several of the PTSD-sufferers we have spoken to, need better tools for controlled exposure and to help them feel their body and its signals. To train the brain and body to react more appropriately.Therefore, new tools are needed to help PTSD-sufferers, to help themselves. The primary market is helping veterans and refugees suffering from PTSD, but the concept has broad applications.The concept is based on the mindset that "everyone should have the opportunity to have a service dog", just without the large financial and mental resources it requires.By offering controlled exposure and support when the need arises, wherever it arises. Before, but also during hyper-arousal, where the frontal lobe(logic brain) “shuts down” and the amygdala(fight\/flight) takes over, it’s expected that the length and complexity of treatment and disease progression will improve.This also affects the long-term-effects of fewer comorbidities. More people will be able to take care of themselves and therefore create more value for society. We want to support the solution of a significant challenge by getting mentally vulnerable people back into the labour market and improving their quality of life.





Veteraner

	Ved ikke (1)		Passer ikke (2)		Passer lidt (3)		Passer (4)		Passer godt (5)		Passer rigtig godt (6)			
	Σ	%	Σ	%	Σ	%	Σ	%	Σ	%	Σ	%	Ø	±
Jeg har svært ved larmen	1x	5,56	-	-	2x	11,11	3x	16,67	5x	27,78	7x	38,89	4,78	1,40
Jeg reagere på høje og/ell…	1x	5,56	1x	5,56	1x	5,56	2x	11,11	8x	44,44	5x	27,78	4,67	1,41
Jeg føler mig utryg blandt m.	1x	5,56	-	-	3x	16,67	4x	22,22	3x	16,67	7x	38,89	4,61	1,46
Jeg føler jeg mister kontrol…	1x	5,56	1x	5,56	-	-	8x	44,44	5x	27,78	3x	16,67	4,33	1,28
Jeg føler jeg mangler over…	-	-	2x	11,11	1x	5,56	4x	22,22	7x	38,89	4x	22,22	4,56	1,25
Jeg leder konstant efter flu…	1x	5,56	1x	5,56	2x	11,11	7x	38,89	-	-	7x	38,89	4,39	1,54
Jeg bliver fanget i mine eg…	2x	11,11	-	-	2x	11,11	5x	27,78	6x	33,33	3x	16,67	4,22	1,48

	Ved Ikke (1)		Passer ikke (2)		Passer lidt (3)		Passer (4)		Passer godt (5)		Passer rigtig godt (6)			
	Σ	%	Σ	%	Σ	%	Σ	%	Σ	%	Σ	%	Ø	±
Jeg har mest lyst til at isole..	-	-	2x	11,11	1x	5,56	8x	44,44	1x	5,56	6x	33,33	4,44	1,34
Jeg undgår offentlig steder	-	-	3x	16,67	4x	22,22	4x	22,22	4x	22,22	3x	16,67	4,00	1,37
Jeg er bange for hvad folk …	-	-	5x	27,78	6x	33,33	3x	16,67	1x	5,56	3x	16,67	3,50	1,42
Jeg er bange for hvordan j…	1x	5,56	2x	11,11	4x	22,22	7x	38,89	2x	11,11	2x	11,11	3,72	1,32

Flygtninge

	لا أعرف (1)		غير متطابق (2)		متطابق قليل (3)		متطابق (4)		متطابق جدا (5)		متطابق جدا جدا (6)			
	Σ	%	Σ	%	Σ	%	Σ	%	Σ	%	Σ	%	Ø	±
…أجد صعوبة في الضوضاء/الض	-	-	3x	9,09	5x	15,15	11x	33,33	6x	18,18	8x	24,24	4,33	1,27
…انفاعل مع الأصوات العالية او	1x	3,03	7x	21,21	4x	12,12	6x	18,18	5x	15,15	10x	30,30	4,12	1,63
…أشعر بعدم الامان عندما أكون	-	-	6x	18,18	4x	12,12	7x	21,21	8x	24,24	8x	24,24	4,24	1,44
أشعر وكأنني افقد السيطرة	2x	6,06	6x	18,18	5x	15,15	8x	24,24	4x	12,12	8x	24,24	3,91	1,61
…أشعر انني افتقر إلى النظرة	5x	15,63	6x	18,75	5x	15,63	6x	18,75	5x	15,63	5x	15,63	3,47	1,70
…انا ابحث باستمرار عن طرق	1x	3,13	5x	15,63	6x	18,75	7x	21,88	4x	12,50	9x	28,13	4,09	1,55
…أشعر أني محبوس في فخ أفكا	2x	6,25	2x	6,25	5x	15,63	7x	21,88	4x	12,50	12x	37,50	4,41	1,58

	لا أعرف (1)		لا يتطابق (2)		يتطابق قليل (3)		يتطابق (4)		يتطابق جدا (5)		يتطابق جدا جدا (6)			
	Σ	%	Σ	%	Σ	%	Σ	%	Σ	%	Σ	%	Ø	±
…غالبا أرغب في عزل نفسي و	-	-	3x	9,09	5x	15,15	6x	18,18	9x	27,27	10x	30,30	4,55	1,33
اتجنب الأماكن العامة	1x	3,13	4x	12,50	9x	28,13	4x	12,50	7x	21,88	7x	21,88	4,03	1,49
…افكر كثيرا واخاف مما يعتقده	3x	9,38	5x	15,63	4x	12,50	6x	18,75	6x	18,75	8x	25,00	3,97	1,69
…أخشى من كيف سانصرف عن	1x	3,13	4x	12,50	4x	12,50	6x	18,75	6x	18,75	11x	34,38	4,41	1,54

Authors: Alexander Emil Kaspersen, MD, Susanne J. Nielsen, RN PhD, Ivy Susanne Modrau, MD, Alexandra Heimisdottir, MD, Tomas Gudbjartsson, MD PhD, Anders Jeppsson, MD PhD

Affiliation: Department of Cardiothoracic and Vascular Surgery, Aarhus University Hospital

Contact: alemka@clin.au.dk

DMTS
The Danish Society for Biomedical Engineering

Preoperative anemia is associated with increased long-term mortality risk in patients undergoing coronary artery bypass grafting

Background: Anemia is associated with inferior early outcome after cardiac surgery. However, the association between preoperative anemia and long-term mortality after coronary artery bypass grafting (CABG) has not previously been investigated.

Methods: In this observational, nationwide cohort study, including patients from the SWEDEHEART registry, all patients who underwent first-time isolated CABG in Sweden 2009-2015 were eligible. Exclusion criteria were a missing preoperative hemoglobin value (n=2,879) or death within the first 30 days after surgery (n=218). The WHO definition of anemia was used (hemoglobin concentration <130 g\/L for males, <120 g\/L for females). Kaplan-Meier curves and multivariable Cox regression models adjusted for age, sex, renal function, previous bleeding, heart failure, previous stroke, previous myocardial infarction, left ventricular ejection fraction, diabetes, atrial fibrillation, peripheral vascular disease, pulmonary disease, hypertension, and history of cancer, were utilized to compare anemic and non-anemic patients.

Results: Of 16,041 patients included, 3,308 (20.6%) had anemia, 19.5% among males and 25.7% among females. The incidence of all-cause death during follow-up in anemic and non-anemic patients was 4.6 and 1.7 per 100 patient years, respectively. The overall unadjusted hazard ratio (HR) of mortality with 95% confidence interval was 2.73 (2.43-3.07) for preoperative anemia. When adjusted, the HR was 1.53 (1.35-1.73). Furthermore, the sex-specific adjusted HRs for males and females were 1.62 (1.40-1.86) and 1.23 (0.93-1.61), respectively.

Conclusion: Preoperative anemia is independently associated with an increased long-term mortality after CABG, more strongly for males than females. These results suggest closer surveillance postoperatively for patients with preoperative anemia.