THE 30TH ANNIVERSARY OF MODERN CARDIOLOGY IN LATVIA

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We have spent the past year under the burden of COVID-19. Has it taken toll on people's cardiac health and on cardiology? Currently, we do know that cardiovascular diseases are the most common co-morbidities in COVID-19 patients correlating with a harsher course and worse prognosis of the disease. On the other hand, cardiovascular diseases still are the leading cause of death in Latvia and in Europe, with a high incidence and prevalence in the total population. The number of patients with cardiovascular diseases still is significantly higher than the number of SARS-CoV-2 infected people,

Fig. 1.
The 1st Heart Team after 30 years. From the left: Guntra Kucika, Andrejs Ērglis, Iveta Mintāle, Ilja Zakke, Romans Lācis, Andis Dombrovskis, 2020. Photo: Kaspars Teilāns

therefore we must not leave behind the first ones taking care of the latter. Living in this new reality, we have acquired the cornerstones of infection prevention: hand washing, physical distancing and using personal protective equipment; but we also have experienced significant changes in the way how health care is organised, especially the planned health care services. In 2020, for the 1st time, we performed almost 500 PCIs less than in 2019 at Pauls Stradiņš Clinical University Hospital, Latvian Centre of Cardiology, which had cast a shadow on the 30th anniversary of the 1st balloon angioplasty in Latvia.

THE 1ST PCI IN LATVIA

Just one month before the independence of Latvia was regained on 4 April 1990, two at that time young doctors – Andrejs Ērglis and Andis Dombrovskis – using a small balloon, widened an atherosclerotic narrowing of the right coronary artery in a female patient who complained about chest pain under physical activity. Quoting Niel Armstrong, our small balloon was like "one small step for man, one giant leap for mankind" because under the leadership of Prof. Uldis Kalniņš and with the help of our compatriot Dr. Andris Saltups from Australia, we founded modern cardiology. We initiated evidence-based diagnostics and treatment of cardiovascular disease, which later developed into team science and aspiring towards precision medicine (Figs. 1, 2).

By growing clinical experience and actively performing scientific research, the angioplasty procedure has gone through major evolution during the last 30 years. Thanks to new technological solutions, such as stents and bioresorbable scaffolds, and improvements of the techniques, for example, initial modification of the atherosclerotic plaque using special balloons and performing it all under additional intravascular imaging procedures, today balloon angioplasty has grown into minimally invasive micro-surgery called PCI or percutaneous coronary intervention, aimed to restore the impaired blood supply to the heart muscle or, in other words, to perform revascularisation of the arteries narrowed or fully blocked due to atherosclerosis.

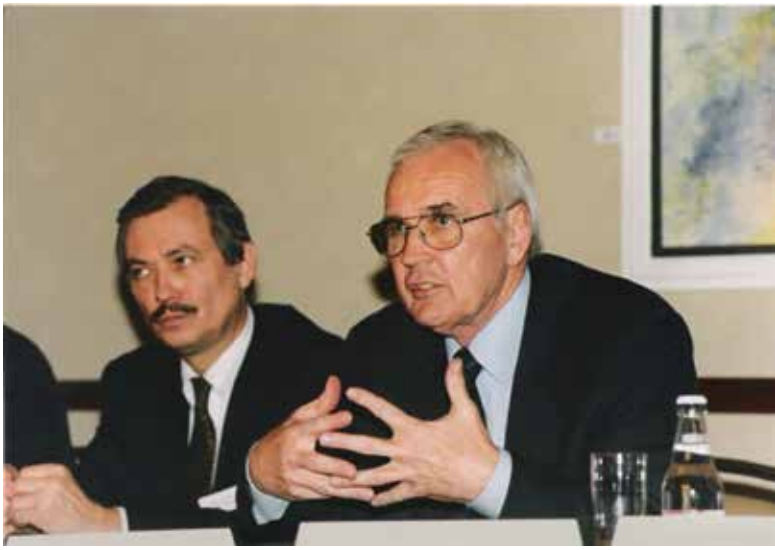

Fig. 2.
Prof. Uldis Kalniņš (1946–2004) and Dr. Andris Saltups, in circa 1999

REVASCULARISATION IN ACUTE MYOCARDIAL INFARCTION PATIENTS

Similarly as the German cardiologist Andreas Grüntzig did it for the 1st time ever in 1977 in Switzerland, we also performed our 1st PCI in a female patient with stable angina. However, initially the greatest scientific evidence and procedure benefits were in patients with acute myocardial infarction, when the blood supply to the heart is suddenly interrupted because the atherosclerotic plaque is unstable, ruptures and leads to arterial lumen thrombosis. Timely-performed PCI both improves the quality of life and reduces mortality. That is why, during the 1st decade of modern cardiology, we put much effort into creating a network of invasive cardiology in Latvia and in improving the treatment strategy for myocardial infarction patients. Under the leadership of Prof. Uldis Kalniņš, we conducted a retrospective study analysing the efficacy and quality of diagnostics and treatment of patients hospitalised with the diagnosis of myocardial infarction in Latvia, in a 1-year period. Only 26% of the patients received pharmacological reperfusion or thrombolysis, and 1% of the patients had mechanical revascularisation using PCI. The hospital mortality rate for patients after myocardial infarction was 22%. Taking into consideration the significant deficiencies identified, in 2003, the Latvian Society of Cardiology

published the 1st guidelines for the acute coronary syndrome, and invasive cardiology centres were extended up to four hospitals in Rīga, Liepāja and Daugavpils with 24/7 units at the two largest hospitals in Rīga (currently also in Daugavpils city). In 20 years, the hospital mortality in myocardial infarction patients has reduced to 10% because the scope of revascularisations has grown nationwide from 27% in 2001 to almost 90% in recent years[1].

COMPLEX CORONARY LESIONS: PCI OR SURGERY?

While PCI undoubtedly is the leading procedure in treating patients with acute myocardial infarction for already almost 20 years, the road to scientifically proven indications for patients with a stable coronary artery disease has been very long, especially for patients with complex coronary lesions, such as left main lesions, calcified lesions, bifurcations, chronic total occlusions.

The left main coronary artery (LM) is the most important section in the overall vascular network of the heart. Sometimes it is called the "artery of life" because its lesions are associated with harsh symptoms, but its total occlusion usually is fatal for the patient. In such a case, in addition to lifestyle changes and drug therapy, revascularisation is a must, to alleviate ischemic symptoms, improve quality of life and reduce mortality. 20 years ago, the European and American guidelines recommended coronary artery bypass grafting (CABG) as the only treatment method, but PCI was contraindicated (Class III indications). The newest guidelines of 2018 for patients with lesions in the left main coronary artery recommend both CABG and PCI as Class I indications under certain angiographic risk (Syntax score 0–22). Latvia played a recognised role when the recommendations changed.

Lesions of the left main coronary artery has been one of the main subjects of our scientific research for almost 20 years. At first, we conducted the 1st study globally, where comparison was made between PCI with implantation of a bare metal stent (BMS) or a first-generation drug-eluting stent (DES) in unprotected LM lesions. Out of 103 patients, 2 patients died within the 6-month follow-up period (mortality rate 1.9% in each group), there were no thrombosis events, 70% survived in the BMS group and 87% survived in the DES group (p = 0.036) without significant cardiac events. However, this study was not a simple comparison of two stents. Firstly, we showed that the PCI method is safe also for patients with LM lesions. Secondly, our results can be extrapolated only for the specific technique that we used in this study. Before the implantation of BMS and DES, we initially evaluated the atherosclerotic plaque using intravascular ultrasound imaging, accurately identifying its structure and dimensions, and afterwards we modified the plaque using a special cutting balloon [2]. During the following years, we included more than 1000 patients in the real-world register of LM lesions. The technique used in the randomised study increased life expectancy in comparison to PCI performed only under angiographic control without the support of intravascular imaging methods and without the modification of atherosclerotic plaque using a cutting balloon. Further on we took part in international randomised studies (SYNTAX, EXCEL, NOBLE), where PCI was compared to CABG [3]. The results of the studies changed the guidelines. PCI became an equivalent alternative for patients with LM lesions and low angiographic risk (SYNTAX score 0–22), although under high angiographic risk (SYNTAC score > 32) only CABG has recommendations.

Why has PCI not reached the efficacy of surgical therapy for patients with high angiographic risk? As opposed to CABG, the outcomes of PCI are significantly affected by the LM anatomy. PCI can become especially complex, when the narrowing is localised at the distal bifurcation of LM or where LM divides into the main branch – left anterior descending artery (LAD) and the side branch – circumflex artery (Cx). Together with the colleagues from the Nordic countries, we have protractedly studied the properties of PCI in bifurcation lesions specifically and have concluded that overall the best solution is the one-stent technique [4]; however, often such a narrowing must be treated by implanting two stents both in the main and the lateral branch. In such a case, there is a high risk of recurrent narrowing, especially in the side branch. Possibly, if we implanted bioresorbable scaffolds (BVS) instead of a metal

stent in the side branch, which support the artery only temporarily and gradually resolve, freeing the coronary artery from a metal foreign body, maintaining normal physiology and the anatomic entirety of a blood vessel as the result. However, studies show that inappropriate implantation of BVS is related to high complication risk, thus now it is allowed only within clinical studies. Our experience shows that safe implantation of BVS is possible using the iPSPi strategy based on 20 years of experience and adaptation to today's conditions [5]:

i – imaging – evaluation of the atherosclerotic lesion using imaging methods, mostly intravascular ultrasound;

P – plaque Pretreatment – modification of the atherosclerotic plaque using a cutting balloon or rotablator;

S – appropriate vessel Sizing – implantation of a stent or bioresorbable scaffolds of appropriate size;

P – appropriate Post-dilatation – post-dilatation of the stent to ensure optimal expansion;

i – imaging – evaluation of the stent outcome using imaging methods, mostly optical coherence tomography.

We showed the efficacy of the new iPSPi strategy also in LM bifurcation lesions. Performing intravascular ultrasound (IVUS) guided and optical coherence tomography (OCT) optimised implantation of two "stents" (DES in the main branch and BVS in the side branch), the risk of recurrent revascularisation is reduced when there is a lower cholesterol level, use of a cutting balloon to modify plaque in the side branch, larger diameter of the bioresorbable stent in the side branch, and use of intravascular ultrasound (Fig. 3).

THE HEART TEAM AND STRUCTURAL DISEASES

Although in 30 years, as invasive cardiology has been developing, we have partially stolen the job from heart surgeons, our mutual collaboration has not been affected; it has significantly improved, since we have launched the Heart Team – a team of various specialists, with a patient being at the very heart of the team. As a team, we decide upon the best treatment method, and we have initiated new minimally invasive treatment methods not only for patients

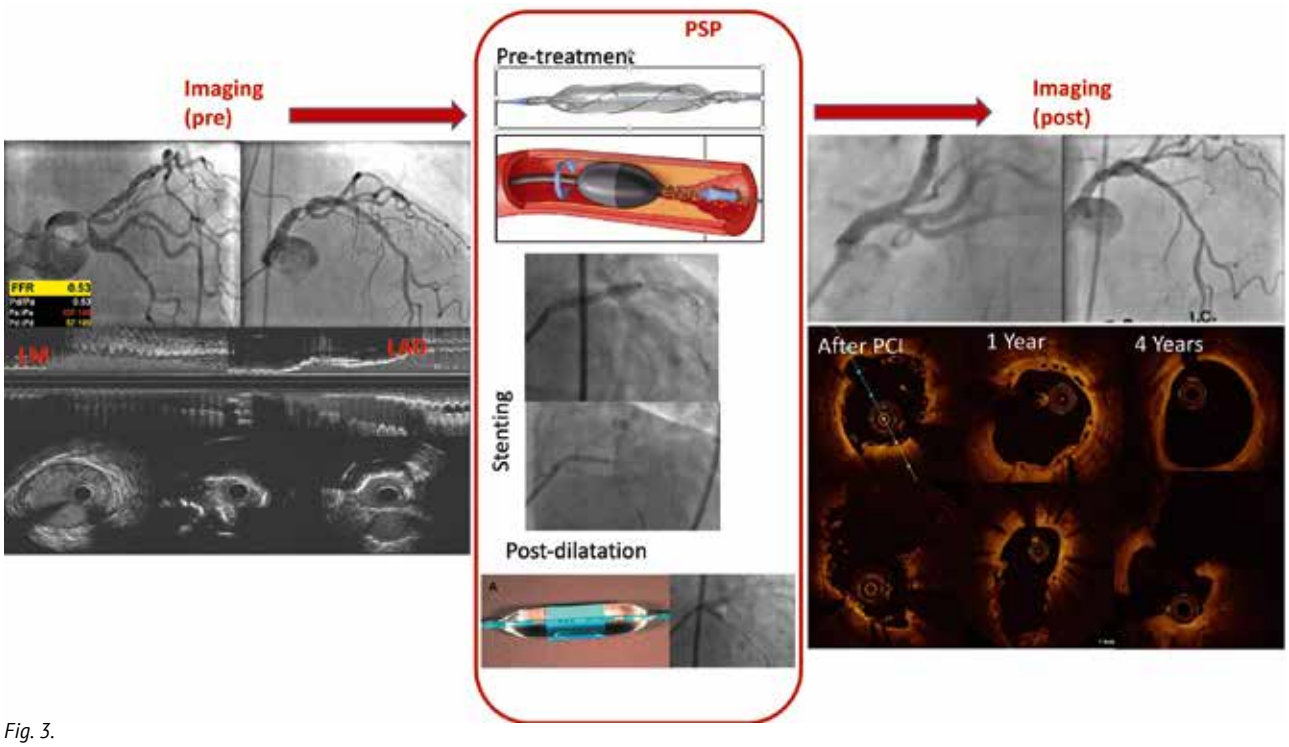

Fig. 3.
iPSPi strategy for lesions in the left main coronary artery. On the left, left main coronary artery lesion, angiography and intravascular ultrasound images. In the center – pre-treatment of plaque, stent implantation and post-dilatation. On the right, the outcome of PCI in angiography and optical coherence tomography immediately after stent implantation, after 1 year, and after 4 years

with coronary artery disease but also for patients with structural heart diseases, heart failure, etc.

Ten years ago, we performed the 1st transcatheter aortic valve implantation in Latvia, which today has become a standard treatment for patients with critical aortic valve stenosis and high surgical risk. Furthermore, now our scientific interest is more related to the treatment of the mitral and tricuspid valve pathology. Recently we finished the MAVERIC study, where, for the 1st time in the human population, we used the ARTO system (MVRx Inc., San Mateo, California), which consists of a suture between two percutaneously inserted anchors in the interatrial septum and in the coronary sinus. By tightening the suture, the mitral annular anteroposterior diameter decreases, thus improving the coaptation of the mitral valve leaflets and reducing the mitral regurgitation [6, 7]. In the previous year, we started percutaneous repair of the tricuspid valve within the STTAR study, but in the animal laboratory, we are studying a new option for mitral valve repair using the Double Helix Annuloplasty System (Fig. 4).

Invasive cardiology has undergone a long and intensive phase in terms of medicine and science, which allows us to take the next step towards precision medicine. We are proud of our achievements, but also have a clear view of the existing problems and future challenges. Thank you, colleagues, for your effort!

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