

Current cardiovascular research at the Charles University: the ‘PRAGUE’ trials and beyond

Petr Widimsky^{1*}, Ales Linhart², Richard Rokyta³, and Josef Stasek⁴

¹Cardiocenter, Third Faculty of Medicine, Charles University, Ruska 87, 100 00 Prague 10, Czech Republic;

²Department of Cardiology, First Faculty of Medicine, Charles University, Prague, Czech Republic;

³Complex Cardiovascular Center, Faculty of Medicine in Pilsen, Charles University, Czech Republic; and

⁴1st Department of Internal Medicine - Cardioangiology, Faculty of Medicine, Charles University, Hradec Králové, Czech Republic

Introduction

In the first article of this issue, Professor Pavel Gregor presented historical overview of cardiovascular research in the Czech Republic. He included research done in the previously existing states in the region of modern (since 1993) Czech Republic: Czechoslovakia (1918-92) and Czech Kingdom as part of the large central European Austro-Hungarian Empire (1620-1918). In this article, we summarize the current (since 2000) cardiovascular research at the Charles University with focus on the series of original academic clinical trials bearing the acronym ‘PRAGUE’ trials. This acronym was originally constructed for the first trial named simply as the ‘PRAGUE’ study—as in that time we did not plan subsequent trials.

Five medical faculties of the Charles University

The Charles University was founded in 1348 as the first university in Central, East and North Europe (followed in the 14th century by Krakow and Heidelberg). The medical faculty was founded at the same time and was one of the four university faculties. Currently, university has 17 faculties and 5 of them are medical faculties. In the Czech Republic, a total of 8 medical faculties exist (and one of the three remaining is rather small), thus the Charles University is responsible for two-thirds of medical education and clinical research in the country. *Table 1* shows the current structure and staff of cardiovascular unit within these five medical faculties. In the past, there was almost no cardiovascular research cooperation between these five medical faculties. However, the PRAGUE trials and the Charles University

institutional research support changed this dramatically, so today a close cooperation between all five medical faculties in cardiovascular research takes place. Four of them are also formally joined under the umbrella of the below described project.

Cardiovascular research program ‘PROGRES Q38’

The Charles University initiated in 2005 a new research infrastructure with the aim to stimulate inter-disciplinary and inter-faculty research. The first such project in cardiovascular field was running between 2005 and 2011, second between 2011 and 2015 and the third one is the currently running cardiovascular research program ‘Progres Q38’. In this program four medical faculties are involved: Third Faculty of Medicine (main Q38 program coordinator: Petr Widimsky, local coordinator: Zuzana Motovska), First Faculty of Medicine (coordinator: Ales Linhart), Second Faculty of Medicine (coordinator: Josef Veselka) and Medical Faculty in Pilsen (coordinator: Richard Rokyta). The fifth medical faculty (Hradec Kralove) is not formally part of this program, however participates in several projects with the other four faculties. *Table 2* shows the most important published papers with participation of at least two medical faculties of the Charles University during the last 8 years (i.e. the second and third cardiovascular research programs of the Charles University).

The PRAGUE trials

The astonishing drop in STEMI mortality in Czech university hospitals (from 11% in 1994 to 4% in 1996) triggered a great deal of enthusiasm in the teams (including nurses and other related professionals), and we started to discuss whether the clear benefit from primary angioplasty could also be offered to STEMI patients presenting to other hospitals that did not have PCI facilities. This led us to the idea of the first

*Corresponding author. Email: petr.widimsky@lf3.cuni.cz

Table 1 Cardiovascular research in five medical faculties of the Charles University

	University departments primarily involved in cardiovascular research	Number of professors/ assoc. profs./assist. profs. with PhD	Main research areas with international publications of original results
First Faculty of Medicine (Prague - Nove Mesto)	Cardioangiology (head: Ales Linhart) Cardiovascular Surgery (head: Jaroslav Lindner)	5 professors 14 associated professors 16 assistant professors with PhD (total n = 35)	Acute cardiac care (sudden cardiac death), ECMO Interventional cardiology Cardiomyopathies and myocarditis Rare metabolic cardiac diseases Pulmonary hypertension Peripheral vascular diseases
Second Faculty of Medicine (Prague - Motol)	Cardiology (head: Josef Veselka) Cardiovascular Surgery (head: Vilem Rohn) Pediatric Cardiology (Jan Janousek)	2 professors 3 associated professors 3 assistant professors with PhD (total n = 8)	Hypertrophic cardiomyopathy Carotid artery disease Coronary artery disease
Third Faculty of Medicine (Prague - Vinohrady)	Cardiology (head: Petr Widimsky) Cardiac Surgery (head: Petr Kacer) Vascular Surgery (Peter Balaz)	7 professors 5 associated professors 12 assistant professors with PhD (total n = 24)	Acute coronary syndromes (incl. antithrombotic therapy, primary PCI, Takotsubo syndrome, etc.) Cardiac arrhythmias (atrial fibrillation, physiologic stimulation) Valvular disease (TAVI) Acute ischaemic stroke (endovascular intervention, cardioembolic stroke) Hypertrophic cardiomyopathy
Faculty of Medicine in Pilsen	Cardiology (head: Richard Rokyta) Dept. of Internal Med II (head: Jan Filipovsky) Physiology (head: Milan Stengl)	5 professors 9 associated professors 5 assistant professors with PhD (total n = 19)	Acute coronary syndromes Cardiogenic shock Cardiac arrhythmias Experimental cardiology with emphasis on cardiovascular system in sepsis Arterial hypertension Preventive cardiology
Faculty of Medicine in Hradec Kralove	Cardioangiology (head: Josef Stasek) Cardiac Surgery (head: Jan Vojacek)	2 professors 8 associated professors 8 assistants with PhD (total n = 18)	Cardiac surgery Valvular disease Hypertension

'PRAGUE' randomized trial. The acronym 'PRAGUE' was intentionally constructed to fit with the name of our beautiful city and with the name of this first study: 'PRIMARY Angioplasty for patients with acute myocardial infarction, transported from the General non-PCI hospitals to catheterization Units with or without Emergency thrombolysis'. At that time, we did not consider more 'PRAGUE' trials for the future and therefore this first study does not have a sequential number—it is called simply 'PRAGUE' study. We (four founders of the PRAGUE Study Group on *Figure 1*) applied for a research grant from the Czech Ministry of Health in the 1996-97 period, but the application was rejected due to its 'low scientific priority' and I was invited to the Scientific Board of this Ministry in 1997 to explain this 'crazy idea of transporting acutely ill patients from one hospital to another'. Despite these limitations, due to the enthusiasm of all teams we decided to proceed with the

study as planned with the important support of the Czech Society of Cardiology and of the General Health Insurance Company (VZP). The results of this first study were encouraging, but we had to design a second larger study, to prove that this concept should be implemented nationwide in the whole country. This was the 'PRAGUE-2' study and this study really started the entire series of subsequent clinical studies with the 'PRAGUE-n' label (*Table 3*).

After a small, prematurely terminated PRAGUE-3 trial (primary PCI in STEMI late-comers) we decided to expand our activities beyond STEMI—to also include cardiac surgery. The leader of all cardiac surgery PRAGUE trials was professor Zbynek Straka (*Figure 2*, *1961, †2017). The PRAGUE-4 trial was a cardiac surgery trial comparing off-pump (beating heart) coronary artery bypass graft (CABG) vs. classic CABG performed with extracorporeal circulation (on-pump, cardiac arrest during the surgery). Off-pump

Table 2 The most important published original papers presenting data from the academic research projects of five medical faculties of the Charles University during the last 8 years

Authors	Title	Journal
Widimsky P, Koznar B, Peisker T, Vasko P, Rohac F, Vavrova J, Kroupa J, Stetkarova I.	Feasibility and safety of direct catheter-based thrombectomy in the treatment of acute ischaemic stroke. Cooperation among cardiologists, neurologists and radiologists. Prospective registry PRAGUE-16.	<i>EuroIntervention.</i> 2017; 13: 131-136.
Widimsky P, Petr R, Tousek P, Maly M, Linkova H, Vrana J, Hajsl M, Budesinsky T, Lisa L, Kocka V.	One-Year Clinical and Computed Tomography Angiographic Outcomes After Bioresorbable Vascular Scaffold Implantation During Primary Percutaneous Coronary Intervention for ST-Segment-Elevation Myocardial Infarction: The PRAGUE-19 Study.	<i>Circ Cardiovasc Interv.</i> 2015 Dec; 8: e002933.
Widimsky P, Rohác F, Stásek J, Kala P, Rokyta R, Kuzmanov B, Jakl M, Poloczek M, Kanovsky J, Bernat I, Hlinomaz O, Belohlávek J, Král A, Mrázek V, Grigorov V, Djambazov S, Petr R, Knot J, Bílková D, Fischerová M, Vondrák K, Maly M, Lorencová A.	Primary angioplasty in acute myocardial infarction with right bundle branch block: should new onset right bundle branch block be added to future guidelines as an indication for reperfusion therapy?	<i>Eur Heart J.</i> 2012; 33: 86-95.
Motovska Z, Hlinomaz O, Kala P, Hromadka M, Knot J, Varvarovsky I, Dusek J, Jarkovsky J, Miklik R, Rokyta R, Tousek F, Kramarikova P, Svoboda M, Majtan B, Simek S, Branny M, Mrozek J, Cervinka P, Ostransky J, Widimsky P; PRAGUE-18 Study Group.	1-Year Outcomes of Patients Undergoing Primary Angioplasty for Myocardial Infarction Treated With Prasugrel Versus Ticagrelor.	<i>J Am Coll Cardiol.</i> 2018; 71: 371-381
Motovska Z, Hlinomaz O, Miklik R, Hromadka M, Varvarovsky I, Dusek J, Knot J, Jarkovsky J, Kala P, Rokyta R, Tousek F, Kramarikova P, Majtan B, Simek S, Branny M, Mrozek J, Cervinka P, Ostransky J, Widimsky P; PRAGUE-18 Study Group.	Prasugrel Versus Ticagrelor in Patients With Acute Myocardial Infarction Treated With Primary Percutaneous Coronary Intervention: Multicenter Randomized PRAGUE-18 Study.	<i>Circulation.</i> 2016; 134: 1603-1612.
Toušek P, Kočka V, Malý M, Kozel M, Petr R, Hajsl M, Jarkovský J, Lisa L, Buděšínský T, Widimský P.	Long-term follow-up after bioresorbable vascular scaffold implantation in STEMI patients: PRAGUE-19 study update.	<i>EuroIntervention.</i> 2016; 12: 23-9.
Kočka V, Malý M, Toušek P, Buděšínský T, Lisa L, Prodanov P, Jarkovský J, Widimský P.	Bioresorbable vascular scaffolds in acute ST-segment elevation myocardial infarction: a prospective multicentre study 'Prague 19'.	<i>Eur Heart J.</i> 2014; 35: 787-94.
Osmancik P, Budera P, Talavera D, Hlavicka J, Herman D, Holy J, Cervinka P, Smid J, Hanak P, Hatala R, Widimsky P.	Five-year outcomes in cardiac surgery patients with atrial fibrillation undergoing concomitant surgical ablation versus no ablation. The long-term follow-up of the PRAGUE-12 Study.	<i>Heart Rhythm.</i> 2019; 16: 1334-1340.
Osmancik P, Tousek P, Herman D, Neuzil P, Hala P, Stasek J, Haman L, Kala P, Poloczek M, Branny M, Chovancik J, Cervinka P, Holy J, Vancura V, Rokyta R, Taborsky M, Kovarnik T, Zemanek D, Peichl P, Haskova S, Jarkovsky J, Widimsky P; PRAGUE-17 Investigators.	Interventional left atrial appendage closure vs novel anticoagulation agents in patients with atrial fibrillation indicated for long-term anticoagulation (PRAGUE-17 study).	<i>Am Heart J.</i> 2017 Jan;183:108-114.
Curila K, Prochazkova R, Jurak P, Jastrzebski M, Halamek J, Moskal P, Stros P, Vesela J, Waldauf P, Viscor I, Plesinger F, Sussenbek O, Herman D, Osmancik P, Smisek R, Leinveber P, Czarnecka D, Widimsky P.	Both selective and nonselective His bundle, but not myocardial, pacing preserve ventricular electrical synchrony assessed by ultra-high-frequency ECG.	<i>Heart Rhythm.</i> 2019 Dec 2. pii: S1547-5271(19)31028-8.
Linhart A, Dostálová G, Bělohlávek J, Vítek L, Karetová D, Ingrischová M, Bojanovská K, Poláček P, Votavová R, Cífková R.	Carotid intima-media thickness in young survivors of acute myocardial infarction.	<i>Exp Clin Cardiol.</i> 2012; 17: 215-20.

(continued)

Table 2 Continued

Authors	Title	Journal
Belohlavek J, Kucera K, Jarkovsky J, Franek O, Pokorna M, Danda J, Skripsky R, Kandrnal V, Balik M, Kunstyr J, Horak J, Smid O, Valasek J, Mrazek V, Schwarz Z, Linhart A.	Hyperinvasive approach to out-of-hospital cardiac arrest using mechanical chest compression device, prehospital intraarrest cooling, extracorporeal life support and early invasive assessment compared to standard of care. A randomized parallel groups comparative study proposal. "Prague OHCA study".	<i>J Transl Med.</i> 2012 Aug 10;10:163.
Bělohlávek J, Mlček M, Huptych M, Svoboda T, Havránek S, Ošťádal P, Bouček T, Kovárník T, Mlejnský F, Mrázek V, Bělohlávek M, Aschermann M, Linhart A, Kittnar O.	Coronary versus carotid blood flow and coronary perfusion pressure in a pig model of prolonged cardiac arrest treated by different modes of venoarterial ECMO and intraaortic balloon counterpulsation.	<i>Crit Care.</i> 2012 Dec 12;16(2):R50.
Havranek S, Belohlavek J, Mlcek M, Huptych M, Boucek T, Svoboda T, Fichtl J, Hrachovina M, Linhart A, Kittnar O.	Median frequencies of prolonged ventricular fibrillation treated by V-A ECMO correspond to a return of spontaneous circulation rate.	<i>Int J Artif Organs.</i> 2014 Jan;37(1):48-57.
Rosa J, Widimský P, Waldauf P, Zelinka T, Petrák O, Táborský M, Branny M, Toušek P, Čurila K, Lambert L, Bednár F, Holaj R, Štrauch B, Václavík J, Kociánová E, Nykl I, Jiravský O, Rappová G, Indra T, Krátká Z, Widimský J Jr.	Renal denervation in comparison with intensified pharmacotherapy in true resistant hypertension: 2-year outcomes of randomized PRAGUE-15 study.	<i>J Hypertens.</i> 2017 May;35(5):1093-1099. doi: 10.1097
Cífková R, Bruthans J, Wohlfahrt P, Krajčoviechová A, Šulc P, Jozífová M, Eremiášová L, Pudil J, Linhart A, Widimský J Jr, Filipovský J, Mayer O Jr, Škodová Z, Poledne R, Stávek P, Lánská V.	30-year trends in major cardiovascular risk factors in the Czech population, Czech MONICA and Czech post-MONICA, 1985 - 2016/17.	<i>PLoS One.</i> 2020 May 11;15(5):e0232845.
Bernat I, Horak D, Stasek J, Mates M, Pesek J, Ostadal P, Hrabos V, Dusek J, Koza J, Sembera Z, Brtko M, Aschermann O, Smid M, Polansky P, Al Mawiri A, Vojacek J, Bis J, Costerousse O, Bertrand OF, Rokyta R.	ST Elevation Myocardial Infarction Treated by RADIAL or Femoral Approach in a Multicenter Randomized Clinical Trial : The STEMI-RADIAL Trial.	<i>J Am Coll Cardiol.</i> 2014; 63: 964-972.
Kohoutova M, Horak J, Jarkovska D, Martinkova V, Tegl V, Nalos L, Vistejnova L, Benes J, Svirglerova J, Kuncova J, Matejovic M, Stengl M.	Vagus Nerve Stimulation Attenuates Multiple Organ Dysfunction in Resuscitated Porcine Progressive Sepsis.	<i>Crit Care Med</i> 2019; 47:e461-e469.
Mayer O, Seidlerová J, Bruthans J, Filipovský J, Timoracká K, Vaněk J, Černá L, Wohlfahrt P, Cífková R, Theuwissen E, Vermeer C.	Desphospho-uncarboxylated matrix Gla-protein is associated with mortality risk in patients with chronic stable vascular disease.	<i>Atherosclerosis</i> 2014; 235: 162-168.
Solař M, Malířová E, Ballon M, Pelouch R, Ceral J.	Confirmatory testing in primary aldosteronism: extensive medication switching is not needed in all patients.	<i>European Journal of Endocrinology</i> , 2012, 166(4), 679-686.
Hazuková R, Řezáčová M, Kočí J, Čermáková E, Pleskot M.	Severe deoxyribonucleic acid damage after out-of-hospital cardiac arrest in successfully resuscitated humans	<i>International Journal of Cardiology</i> , 2016, 207, 33-35.
Pudil R, Vašatová M, Fučíková A, Řehulková H, Řehulka P, Palička V, Stulík J.	Vascular Endothelial Growth Factor Is Associated with the Morphologic and Functional Parameters in Patients with Hypertrophic Cardiomyopathy.	<i>BioMed Research International</i> , 2015, Art. No. 762950. ISSN 2314-6133.

technique was applicable in 85% of patients and was at least as clinically safe and effective as on-pump surgery. The patency of arterial coronary bypass grafts inserted on the beating heart was excellent and similar to grafts performed on pump. PRAGUE-6 was a continuation of PRAGUE-4 focused on patients with a Euroscore greater than 6

points. The PRAGUE-12 study was investigating the role of surgical treatment (cryoablation or surgical ablation) of atrial fibrillation added to elective CABG or valve surgery. In the control group, just the main disease (coronary arteries and/or valves) was treated without atrial ablation. Surgical ablation improved the likelihood of sinus rhythm



Figure 1 Four founders of the PRAGUE Study Group—heads of four original cath-labs participating in the first ‘PRAGUE’ study 1996–99. Petr Widimsky (Charles University Prague—Third Faculty of Medicine), Michael Zelizko (IKEM Prague), Michael Aschermann (Charles University Prague—First Faculty of Medicine), Ladislav Groch (Masaryk University Brno).

post-operatively without increasing peri-operative complications. However, this did not translate to improved clinical outcomes at 1 year.

As we did not believe in routine clopidogrel pre-treatment before any coronary angiography, we designed the study PRAGUE-8. The study population was the largest of the PRAGUE trials until that time ($n=1028$). Patients were randomized to either pre-treatment with non-selective use of clopidogrel 600 mg > 6 h before every CAG or selective use of clopidogrel 600 mg in the cath-lab after CAG, only in case of PCI. The high loading dose of clopidogrel before elective CAG increased the risk of minor bleeding complications, while the benefit on periprocedural infarction was not significant. The study confirmed our practice at that time, that—clopidogrel given in the catheterization laboratory between CAG and PCI was safe.

The PRAGUE-15 study was the second largest randomized study on the role of renal denervation in resistant hypertension. Catheter-based renal denervation (in addition to maximal pharmacologic therapy) was compared with adding spironolactone to previous maximal pharmacotherapy. The result was neutral (no benefit from renal denervation).

The PRAGUE-16 study is an ongoing prospective registry collecting data on acute stroke interventions aiming to investigate two questions: (i) feasibility/safety of catheter-

based interventions for acute ischaemic stroke performed in close cooperation of cardiologists, neurologists and radiologists, (ii) outcomes of patients treated by direct catheter-based thrombectomy (without bridging thrombolysis).

The PRAGUE-17 study was a national multicentre project comparing percutaneous closure of the left atrial appendage vs. best medical treatment (novel oral anticoagulants) in patients at high risk of stroke and increased risk of bleeding.

The PRAGUE-18 study compared prasugrel vs. ticagrelor in STEMI and found that both antiplatelet drugs are similarly effective and safe.

The PRAGUE-19 study was a prospective registry testing the feasibility and safety of bioresorbable vascular scaffolds in patients with acute STEMI.

The PRAGUE trials investigators met at the ancient Aula Magna of the Charles University (*Figure 3*) for a small ceremony in 2016 to celebrate 20 years from the design of the first study.

Prague-OHCA trial -hyperinvasive out-of hospital cardiac arrest management

Inspired by the PRAGUE trials, a multicenter trial named Prague-OHCA was initiated aiming to provide evidence,

Table 3 Overview of all PRAGUE trials (1999-2019)

Acronym	Topic (question)	First presentation	Main publication
PRAGUE	STEMI: interhospital transport for prim. PCI vs. thrombolysis in the nearest hospital vs. facilitated PCI after interhospital transfer	ESC 1999 Barcelona: Hot Line Clinical Trials	<i>Eur Heart J</i> 2000
VINO*	Non-STEMI: prim. PCI vs. standard care	ESC 2000 Amsterdam Hot Line Clinical Trials	<i>Eur Heart J</i> 2002
PRAGUE-2	STEMI: interhospital transport for prim. PCI vs. thrombolysis in the nearest hospital	ESC 2002 Berlin Hot Line Clinical Trials TCT 2002 Washington Late Breaking Clinical Trials ESC/WCC 2006 Barcelona: sekce Clinical Trials Update	<i>Eur Heart J</i> 2003 <i>Eur Heart J</i> 2007
PRAGUE-3	Late presenters with STEMI: prim. PCI vs. conservative treatment	Study stopped after 44 patients due to slow recruitment	Not published
PRAGUE-4	Off-pump CABG vs. classical on-pump CABG	ESC 2002 Berlin Hot Line Clinical Trials ACC 2004 Late Breaking Clinical Trials	<i>Circulation</i> 2004 <i>Ann Thorac Surg</i> 2004
PRAGUE-5	Early (24 h) discharge after uncomplicated STEMI treated by prim. PCI	ESC 2007 Vienna: poster	<i>Int Heart J</i> 2008
PRAGUE-6	Off-pump CABG vs. classical on-pump CABG in high-risk patients	ACC 2013 San Francisco Late Breaking Clinical Trials	<i>Biomed Pap Med Fac Univ Palacky Olomouc</i> 2016
PRAGUE-7	Abciximab in cardiogenic shock	ESC 2009 Barcelona Hot Line Clinical Trials	<i>Acute Cardiac Care</i> 2011
PRAGUE-8	Clopidogrel pretreatment before elective CAG (\pm PCI)	ESC 2007 Vienna Hot Line Clinical Trials	<i>Eur Heart J</i> 2008
PRAGUE-9	Ischaemic mitral regurgitation: CABG + valvuloplasty vs. PCI alone (no valve intervention)	Prematurely stopped for slow recruitment	Not published
PRAGUE-10	Trimetazidin in heart failure	Study planned, but not realized	Not published
PRAGUE-11	Platelet activity during CABG	ESC 2007	<i>J Thorac Cardiovasc Surg</i> 2008
PRAGUE-12	CABG or valve surgery plus MAZE vs. surgery without MAZE in pts with atrial fibrillation and other indication for cardiac surgery	ESC 2012 Vienna Hot Line Clinical Trials	<i>Eur Heart J</i> 2012
PRAGUE-13	How to treat multivessel disease in STEMI	EuroPCR 2015 Paris Hot Line Clinical Trials	Not published (P.I. Dr. Hlinomaz from Brno).
PRAGUE-14	Perioperative bleeding vs. perioperative ischaemia during non-cardiac surgery in cardiac patients	ESC 2013 Amsterdam Hot Line Clinical Trials	<i>Nether Heart J</i> 2014
PRAGUE-15	Renal denervation vs. pharmacotherapy in resistant hypertension	ESH 2014 Athens Hot Line Clinical Trials	<i>Hypertension</i> 2015
PRAGUE-16	Direct catheter thrombectomy in acute ischemic stroke	EuroPCR 2014 Paris Hot Line Clinical Trials	<i>EuroIntervention</i> 2014 <i>J Am Coll Cardiol</i> 2015
PRAGUE-17	Percutaneous LAA closure vs. NOACs in atrial fibrillation	ESC 2016 Rome Registry Hot Line Study will be closed in 2019 and submitted for ESC or AHA	<i>J Am Coll Cardiol</i> 2020
PRAGUE-18	Prasugrel vs. ticagrelor before emergent PCI for AMI	ESC 2016 Rome Hot Line Clinical trials	<i>Circulation</i> 2016 <i>J Am Coll Cardiol</i> 2018
PRAGUE-19	Biodegradable stents (Absorb) during prim. PCI for STEMI	EuroPCR 2013 Paris Hot Line Clinical Trials	<i>Eur Heart J</i> 2014 <i>Circulation Interventions</i> 2015
PRAGUE-20	Role of potassium and alcohol in atrial fibrillation	Study started in 2015	
PRAGUE-21	Hybrid (cardiac surgery + electrophysiology) treatment of atrial fibrillation	Study started in 2014	
PRAGUE-22	Bioresorbable stents	Study started in 2017	
PRAGUE-23	Cangrelor in cardiogenic shock	Study started in 2018	



Figure 2 Zbyněk Straka—lead investigator of all cardiac surgery PRAGUE trials.

whether a hyperinvasive management of an out-of-hospital cardiac arrest by using mechanical chest compression device, prehospital intraarrest cooling, and extracorporeal life support would improve the outcomes as compared to the standard of care management. The trial (principal investigator is prof. Jan Belohlavek from the First Faculty of Medicine) is based on data acquired in experimental settings in the animal laboratory at the First Faculty of Medicine.

Research in inflammatory and metabolic myocardial diseases

Extensive multicenter research activities including several centers of the Charles University Medical faculties are focused on inflammatory myocardial diseases. This research has shown an unexpectedly high prevalence of borrelia burgdorferi infection among new onset heart failure cases in the Czech Republic. Multiple trials were conducted in the field of metabolic cardiomyopathies, namely Fabry disease (the principal investigator is prof. Ales Linhart from the First Faculty of Medicine).

Charles University cardiologists on the European scene

Several cardiologists from the Charles University were elected to important positions in the European Society of



Figure 3 Leading investigators from most centres participating in the PRAGUE trials.

Cardiology during last 20 years: Jaromir Hradec was ESC Board member, Michael Aschermann was ESC Nominating Committee member, Ales Linhart was chairman of the ESC Working Group on Myocardial and Pericardial Diseases, Josef Kautzner was ESC Board member, Zuzana Motovska is currently (2018-20) an ESC Board member and Petr Widimsky was ESC vice-president (2006-08) and ESC Council on Stroke founding chairman (2016-18).

Conclusion

The original clinical research conducted at the Charles University had tremendous impact on cardiology practice not only in the Czech Republic, but worldwide. The role of Czech interventional cardiologists was recognized also by

the World Health Organization by awarding them the annual prize for improving community health in 2014. The future of cardiovascular research at the Charles University seems to be bright as in 2019 the University introduced a new PhD program 'Cardiovascular Science' and first 12 young researchers have been enrolled in this program.

Funding

This paper was published as part of a supplement financially supported by the Cardiovascular Research Program of the Charles University 'Progres Q38'.

Conflict of interest: none declared.