

ROBOTICKÁ KARDIOCHIRURGIE- Od experimentálního použití k rutinní klinické praxi

Štěpán ČERNÝ

Klinika kardiovaskulární chirurgie

FN Motol, Praha



Robotická KCH

Robotika obecně



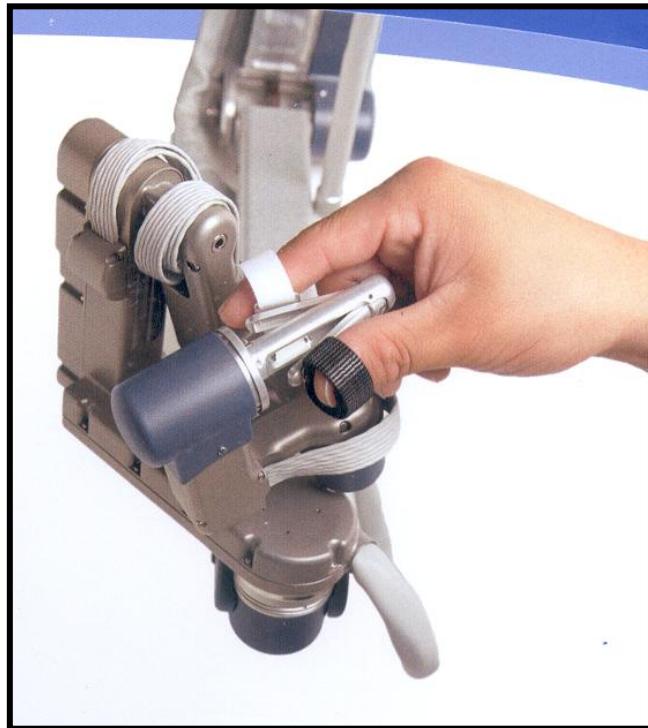
ROBOTIKA

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TELEMANIPULACE

Robotická KCH

Robotika obecně



ROBOTIKA

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TELEMANIPULACE

- Evropští kardiochirurgové v roce 1998 jako první použili robotickou technologii v kardiochirurgii
- Všechny velké kroky ve vývoji operačních technik u jednotlivých operací byli učiněny v Evropě
- A to jak u revaskularizací tak intrakardiálních operací

Chirurgie à cœur ouvert assistée par ordinateur. Premier cas opéré avec succès

First computer assisted open heart operation

Alain Carpentier*, Didier Loulmet, Bertrand Aupècle, Jean-Philippe Kieffer, Dominique Tournay, Pierre Guibourt, Annick Fiemeyer, Denis Méléard, Pierre Richomme, Cyril Cardon

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(Reçu le 21 mai 1998, accepté le 25 mai 1998)

Abstract – The recent development of less invasive intracardiac surgery using small incisions and videooscopic techniques allowed an evaluation of the advantages and limitations of this new approach. Among the limitations was the increased difficulty of the surgical technique when using long instruments through small incisions and ports. We investigated whether computer assisted surgical instruments might bring a solution to this problem. Among the existing systems, we selected the Intuitive System because of two original features. It provides a stable, magnified, three dimensional view of the operating field at a console where the surgeon is seated to operate, and it uses computer assisted instruments having the same dexterity and range of motion as the hand. After 10 months of active work to adapt this system to intracardiac surgery, the first open heart operation using computer assisted instruments was carried out on a 52-year-old woman presenting an aneurysm and a large defect of the atrial septum. The patient was extubated 8 h after the operation, returned to her room 16 h later and was discharged from the hospital 8 d post-operatively with normal heart function and no residual shunt. This preliminary experience showed that computer assisted cardiac surgery is feasible and may open new and promising directions in open heart surgery. (© Académie des sciences / Elsevier, Paris.)

C. R. Acad. Sci. Paris, Sciences de la vie / Life Sciences 1998, 321, 437–442



1998 jako první použili robotickou

chirurgických technik u jednotlivých

- A to jak u revaskularizací tak intrakardiálních operací

Carpentier A et al: C R Acad Sci III 1998;321:437-42

Chirurgie à cœur ouvert assistée par ordinateur. Premier cas opéré avec succès



First

ENDOSCOPIC CORONARY ARTERY BYPASS GRAFTING WITH THE AID OF ROBOTIC ASSISTED INSTRUMENTS

Alain
Pierre

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Nicola d'Attellis, MD
Alain Berrebi, MD
Cyril Cardon, MD
Olivier Ponzio, MD
Bertrand Aupécle, MD
John Y. M. Relland, MD

Département
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Objective: The development of endoscopic coronary artery bypass grafting has been limited because of poor visualization and increased technical difficulties in carrying out operations through ports. We investigated whether the use of robotic assisted instruments could minimize these difficulties. **Methods:** After a period of technical development and training on cadavers (n = 8) with the Intuitive Surgical system (Intuitive Surgical, Inc, Mountain View, Calif), the first clinical application in coronary artery surgery was performed in 4 male patients (mean age 59 ± 6 years) with the indication of grafting the left internal thoracic artery to the left anterior descending coronary artery. Robotic assisted 3-dimensional endoscopes and instruments were introduced into the left side of the chest through 3 intercostal ports. The Heartport system (Heartport, Inc, Redwood City, Calif) was used for arresting the heart during the anastomosis. **Results:** In 2 patients, the harvesting of the left internal thoracic artery was completed endoscopically with robotic assisted instruments and the anastomosis to the left anterior descending artery was performed through a minithoracotomy with conventional instruments. In 2 other patients, the entire operation was completed endoscopically with robotic assisted instruments. Early postoperative coronary angiography demonstrated the patency of the grafts in all cases. At 6-month follow-up, all patients were free of symptoms. **Conclusions:** Robotic assisted instruments make endoscopic coronary bypass possible and open a new era in minimally invasive surgery. (J Thorac Cardiovasc Surg 1999;118:4-10)

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COMPUTER-ENHANCED "ROBOTIC" CARDIAC SURGERY: EXPERIENCE IN 148 PATIENTS

Friedrich W. Mohr, MD, PhD
Volkmar Falk, MD, PhD
Anno Diegeler, MD, PhD
Thomas Walther, MD, PhD
Jan F. Gummert, MD, PhD
Jan Bucerius, MD
Stefan Jacobs, MD
Rüdiger Autschbach, MD, PhD

Objective: A computer-enhanced instrumentation system was used in 148 patients to minimize access in cardiac surgical procedures.

Methods: The dVinci telemanipulation system (Intuitive Surgical, Mountain View, Calif) provides a high-resolution 3-dimensional videoscopic image and allows remote, tremor-free, and scaled control of endoscopic surgical instruments with 6 degrees of freedom. By April 2000, the system had been used in 131 patients for coronary artery bypass grafting and 17 patients for mitral valve repair. In the coronary bypass group, the system was used in one of three ways: (1) to take down the internal thoracic artery followed by a minimally invasive direct coronary bypass procedure ($n = 81$); (2) to perform the anastomosis between the internal thoracic artery and the left anterior descending coronary artery in standard-sternotomy coronary bypass ($n = 15$); or (3) for total endoscopic coronary artery bypass grafting to anastomose the left internal thoracic artery to the left anterior descending on the arrested heart ($n = 27$) or the beating heart ($n = 8$). In 17 patients with non-ischemic mitral valve insufficiency the mitral valve was repaired. Closed-chest cardiopulmonary bypass with cardioplegic arrest (Port-Access technique; Heartport, Inc, Redwood City, Calif) was used for arrested-heart total endoscopic coronary bypass and mitral valve repair.

Results: The da Vinci system allows for precise tissue handling and enables the endoscopic performance of cardiac surgical tasks that require a high degree of dexterity (coronary anastomosis, mitral valve repair). No technical mishaps have occurred. The internal thoracic artery was successfully taken down in 79 of 81 patients in the group undergoing minimally invasive coronary bypass and, after a steep learning curve, is currently performed in less than 40 minutes. The postoperative patency rate is 96.3%. Total endoscopic coronary bypass was completed in 22 of 27 cases with 95.4% patency as demonstrated by angiography at 3 months' follow-up. Closed-chest endoscopic beating-heart bypass grafting was successfully performed in 2 out of 8 patients with the use of a new endoscopic stabilizer. In the group having mitral valve repair, primary endoscopic computer-enhanced repair was successfully completed in 14 of 17 patients; three others had to be changed to a standard endoscopic technique, including 1 who required valve replacement. At 3 months' follow-up, 1 additional patient underwent early reoperation for recurrent mitral insufficiency. Overall early and late mortality in this cohort of 148 patients was 2.0% and was not related to the use of the system.

Conclusion: In conclusion, computer-enhanced endoscopic cardiac surgery can be performed safely in selected patients. Internal thoracic artery take-down is now routinely performed with good results. Total endoscopic coronary bypass is feasible on the arrested heart but does not offer a major benefit over the minimally invasive direct approach because cardiopulmonary bypass is still required. The early clinical experience with closed-chest beating-heart bypass grafting outlines the limitations of this approach despite some procedural success. (*J Thorac Cardiovasc Surg* 2001;121:842-53).



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Bertrand Aupécle, MD
John Y. M. Relland, MD

Objective: The aim of this study was to evaluate the feasibility and safety of endoscopic coronary artery bypass grafting (CABG) with the aid of robotic assisted instruments. The study was performed in 22 patients with coronary artery disease (CAD) who had a previous CABG or a previous myocardial infarction (MI) and who had a left internal thoracic artery (LITA) available for anastomosis. The results showed that endoscopic CABG with the aid of robotic assisted instruments is a safe and effective procedure. The postoperative mortality was 0% and the long-term survival was 95.4% at 3 months follow-up. The study concluded that endoscopic CABG with the aid of robotic assisted instruments is a safe and effective procedure for the treatment of CAD.

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CLOSED-CHEST CORONARY ARTERY SURGERY ON THE BEATING HEART WITH THE USE OF A ROBOTIC SYSTEM

Utz Kappert, MD, Romuald Cichon, MD, Jens Schneider, MD, Vassilios Gulielmos, MD, Sems M. Tugtekin, MD, Klaus Matschke, MD, Ina Schramm, MD, and Stephan Schueler, MD, PhD, *Dresden, Germany*

From the Cardiovascular Institute, University of Dresden, Dresden, Germany.

Received for publication Feb 23, 2000; accepted for publication June 16, 2000.

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J Thorac Cardiovasc Surg 2000;120:809-11

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0022-5223/2000 \$12.00 + 0 12:54/109543

doi:10.1067/mtc.2000.109543

The introduction of robotic instrumentation has led to new minimally invasive surgical options in patients with coronary artery disease.¹⁻⁴ The application of an intrathoracic stabilizer enables closed-chest off-pump coronary artery bypass grafting (CABG) via a 4-point stab incision, avoiding sternotomy and minithoracotomy. We present a case of closed-chest off-pump CABG performed with wrist-enhanced robotic instrumentation in a patient with single-vessel coronary artery disease. The left internal thoracic artery (LITA) was used as the graft (operative day March 27, 2000).

than 40 minutes. The postoperative patency rate is 96.5%. Total endoscopic coronary bypass was completed in 22 of 27 cases with 95.4% patency as demonstrated by angiography at 3 months' follow-up. Closed-chest endoscopic beating-heart bypass grafting was successfully performed in 2 out of 8 patients with the use of a new endoscopic stabilizer. In the group having mitral valve repair, primary endoscopic computer-enhanced repair was successfully completed in 14 of 17 patients; three others had to be changed to a standard endoscopic technique, including 1 who required valve replacement. At 3 months' follow-up, 1 additional patient underwent early reoperation for recurrent mitral insufficiency. Overall early and late mortality in this cohort of 148 patients was 2.0% and was not related to the use of the system.

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Robotic Totally Endoscopic Coronary Artery Bypass and Catheter Based Coronary Intervention in One Operative Session

Johannes Bonatti, MD, Thomas Schachner, MD, Nikolaos Bonaros, MD, Günther Laufer, MD, Christian Kolbitsch, MD, Josef Margreiter, MD, Patrycja Jonetzko, MD, Otmar Pachinger, MD, and Guy Friedrich, MD

Departments of Cardiac Surgery, Cardiac Anesthesiology, and Cardiology, Innsbruck Medical University, Innsbruck, Austria

A 56-year-old male patient underwent robotically assisted totally endoscopic left internal mammary artery (LIMA) to left anterior descending artery (LAD) grafting. After protamine administration complete heart block developed in the patient. On intraoperative angiography the LIMA to LAD graft was perfectly patent but an acute occlusion of the right coronary artery (RCA) was noted. We performed an immediate on table percutaneous coronary angioplasty and stent placement to the RCA. The heart regained sinus rhythm and the wall motion abnormalities on the back wall of the heart resolved. No clinical symptoms indicating ongoing myocardial ischemia were noted postoperatively. This case demonstrates that a hybrid procedure of robotic totally endoscopic coronary artery bypass grafting and catheter based coronary intervention is feasible in one simultaneous session.

(Ann Thorac Surg 2005;79:2138-41)

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Carpentier A et al: C R Acad Sci III 1998;321:437-42
Loulmet D et al: J Thorac Cardiovasc Surg 1999;118:4-10
Mohr F et al: J Thorac Cardiovasc Surg 2001;121:842-53
Kappert U et al: J Thorac Cardiovasc Surg 2000;120:809-11
Bonatti J et al: Ann Thorac Surg 2005;79:2138-41

Robotická KCH

Historie 2006 - 2014



Robotic cardiac surgery: Time told!

Francis Robicsek, MD, PhD*

*I do not see a widespread use
because most cases are really
learn to do the simple video-assisted
the high cost of robotic technique.*
Friedrich Wilhelm M...

*Assimilation of this (robotic) technique
Evelio Rodriguez, MD*

The Journal of Thoracic and Cardiovascular Surgery

Vol 134, No. 3, September 2007

Robotics in cardiac surgery: The emperor's new clothes

Ralph J. Damiano Jr, MD

See related articles on pages
562 and 710.

*"But he has nothing on at all," said a little child at last. "Good heavens!
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Hans Christian*

Editorial Comment

CARDIOLOGY

Cardiology 2009;114:56-58
DOI: [10.1159/000212114](https://doi.org/10.1159/000212114)

Received: January 16, 2009
Accepted: January 16, 2009
Published online: April 10, 2009

Robot for Coronary Artery Bypass Grafting: A 'Million Dollar Coat Hanger'?

John A. Elefteriades

Yale University School of Medicine, New Haven, Conn., USA

Robicsek F: J Thorac Cardiovasc Surg 2008;135(2):243-6

Damiano RJ: J Thorac Cardiovasc Surg 2007;134(3):559-61

Elefteriades J: Cardiology 2009;114(1):56-8

Robotická KCH v Evropě 1998 - 2015

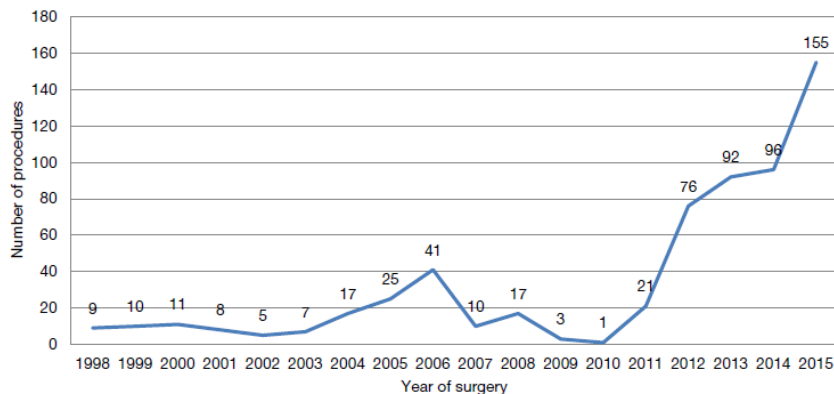
MVP

The state of robotic cardiac surgery in Europe

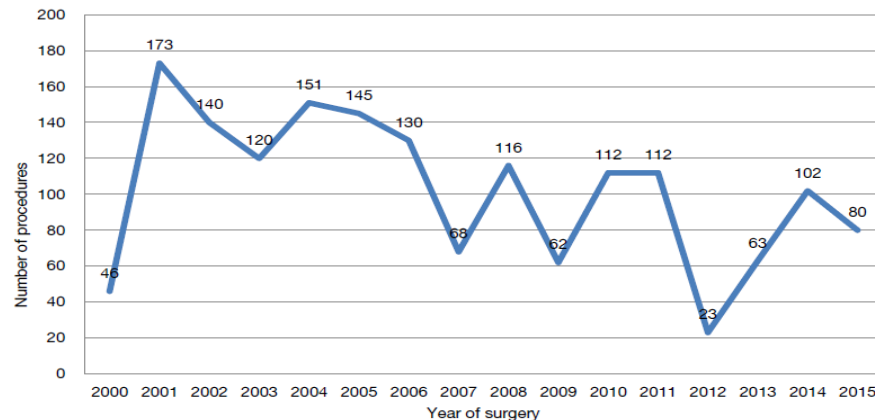
Matteo Pettinari¹, Emiliano Navarra², Philippe Noirhomme², Herbert Gutermann¹

ACB

Mitral valve procedures



Robot-assisted CABG



Keywords: Minimally invasive; mitral valve; coronary; robotic



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doi: 10.21037/acs.2017.01.02

View this article at: <http://dx.doi.org/10.21037/acs.2017.01.02>

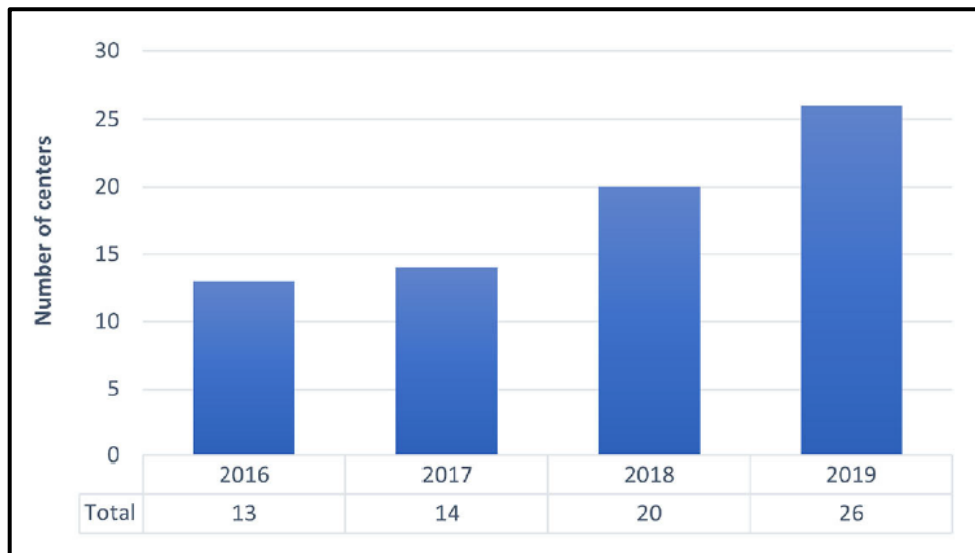
Robotic Cardiac Surgery in Europe: Status 2020

Stepan Cerny^{1†}, Wouter Oosterlinck^{2‡}, Burak Onan³, Sandeep Singh⁴, Patrique Segers⁵, Cengiz Bolcal⁶, Cem Alhan⁷, Emiliano Navarra⁸, Matteo Pettinari⁹, Frank Van Praet¹⁰, Herbert De Praetere¹¹, Jan Vojacek¹², Theodor Cebotaru¹³, Paul Modj¹⁴, Fabien Doguet¹⁵, Ulrich Franke¹⁶, Ahmed Ouda¹⁷, Ludovic Melly¹⁸, Ghislain Malapert¹⁹, Louis Labrousse²⁰, Monica Gianoli²¹, Alfonso Agnino²², Tine Philipsen²³, Jean-Luc Jansens²⁴, Thierry Folliquet²⁵, Meindert Palmen²⁶, Daniel Pereda²⁷, Francesco Musumeci²⁸, Piotr Suwalski²⁹, Koen Cathenis³⁰, Jef Van den Eynde^{2‡} and Johannes Bonatti^{31‡}
on behalf of the European Robotic CardioThoracic Surgeons (ERCTS)

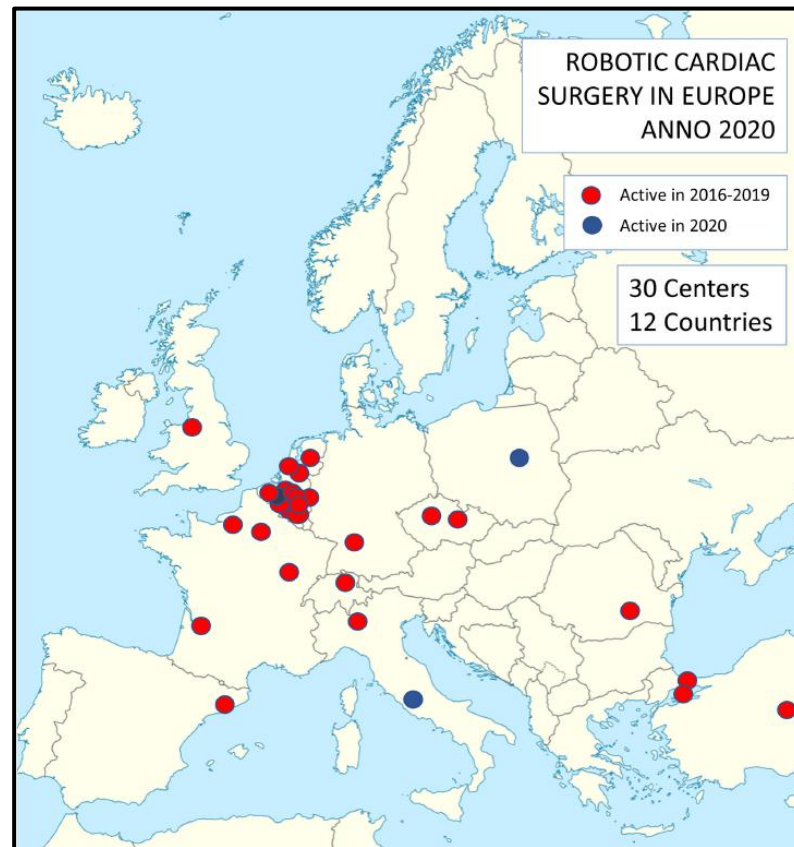
¹ Na Homolce Hospital, Prague, Czechia, ² Department of Cardiovascular Sciences, University Hospital Leuven, KU Leuven, Leuven, Belgium, ³ Istanbul Mehmet Akif Ersoy Cardiovascular Surgery Hospital, University of Health Sciences, Istanbul, Turkey, ⁴ ISALA Hospital, Zwolle, Netherlands, ⁵ Maastricht University Medical Center, Maastricht, Netherlands, ⁶ Gulhane Education ve Research Hospital, Ankara, Turkey, ⁷ Acibadem Maslak Hospital, Acibadem University, Istanbul, Turkey, ⁸ Cliniques Univesitaires Saint Luc, Brussels, Belgium, ⁹ Ziekenhuis Oost Limburg, Genk, Belgium, ¹⁰ OLV Ziekenhuis, Aalst, Belgium, ¹¹ Imelda Hospital Bonheiden, Bonheiden, Belgium, ¹² University Hospital Hradec Kralove, Hradec Kralove, Czechia, ¹³ MONZA Hospital, Bucharest, Romania, ¹⁴ Liverpool Heart and Chest, Liverpool, United Kingdom, ¹⁵ Rouen University Hospital, Rouen, France, ¹⁶ Robert Bosch Hospital, Stuttgart, Germany, ¹⁷ University Hospital Zurich, Zurich, Switzerland, ¹⁸ CHU UCL Namur – Site Godinne, Namur, Belgium, ¹⁹ CHU Dijon, Dijon, France, ²⁰ University Hospital Bordeaux, Bordeaux, France, ²¹ University Medical Centre Utrecht, Utrecht, Netherlands, ²² Humanita Gavazzeni, Bergamo, Italy, ²³ University Hospital Ghent, Ghent, Belgium, ²⁴ Erasme Hospital Brussels, Brussels, Belgium, ²⁵ Henri MONDOR Hospital, Assitance Publique/Hopitaux de Paris, Paris, France, ²⁶ Leiden University Medical Center, Leiden, Netherlands, ²⁷ Hospital Clinic de Barcelona, Barcelona, Spain, ²⁸ San Camillo Hospital, Rome, Italy, ²⁹ Central Teaching Hospital of the Ministry of the Interior and Administration, Centre of Postgraduate Medical Education, Warsaw, Poland, ³⁰ AZ Maria Middelaars, Ghent, Belgium, ³¹ University of Pittsburgh Medical Center (UPMC), Pittsburgh, PA, United States

Robotická KCH

Robotická KCH v Evropě 2016 - 2020



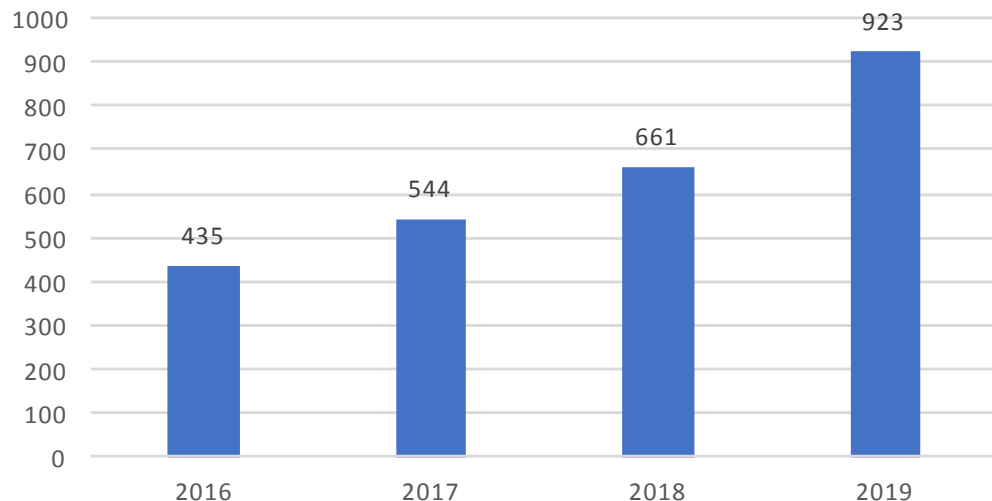
Cerny S et al: Front Cardiovasc Med 2022 Jan 20;8:827515



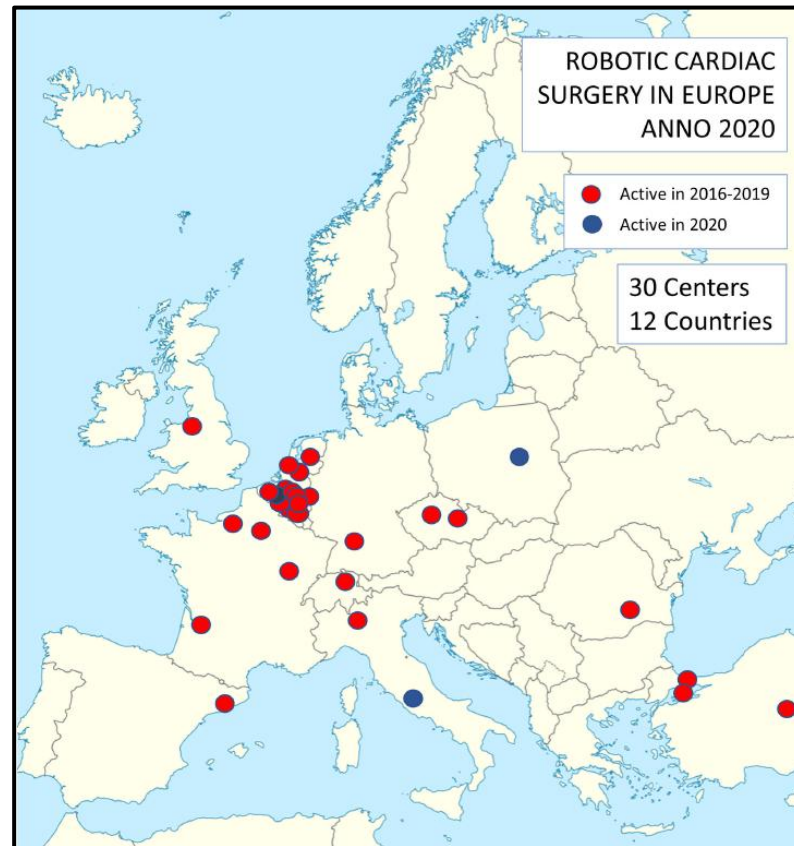
Robotická KCH

Robotická KCH v Evropě 2016 - 2020

Cases of Robotic Cardiac Surgery

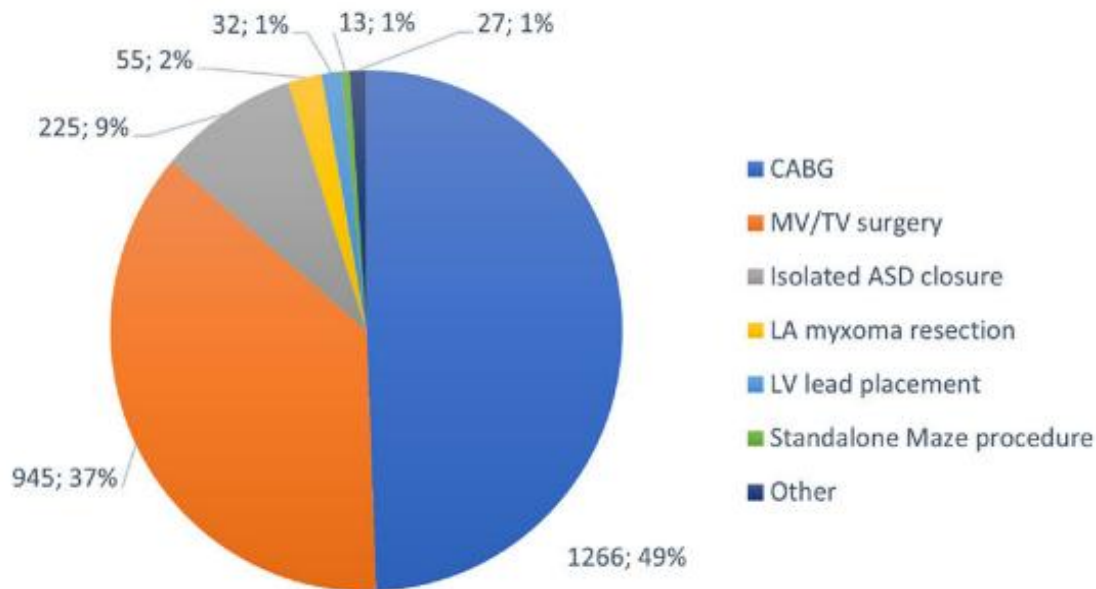


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Robotická KCH

Robotická KCH v Evropě 2016 - 2020



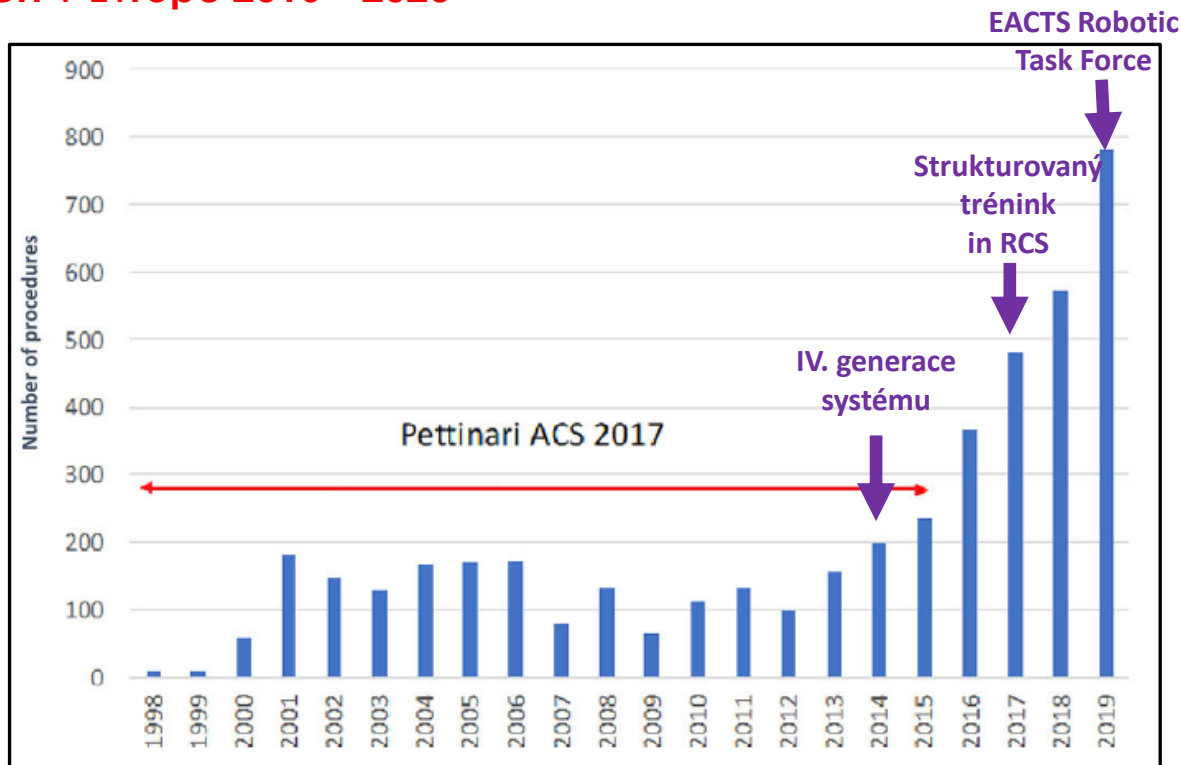
- **2653 pacientů**
 - CABG 1266 (49%)
 - Intrakardiální 1224 (46%)
 - DV MVP +/- TVP, MAZE
 - ASD, VSD etc
 - MAZE izolovaný
 - Myxom
 - EF + ostatní 73 (2,8%)
- Konverze 2,2%
- Revize 2,2%
- Mortalita 1,1 %
- CMP 0,2%

Cerny S et al: Front Cardiovasc Med 2022 Jan 20;8:827515

Robotická KCH



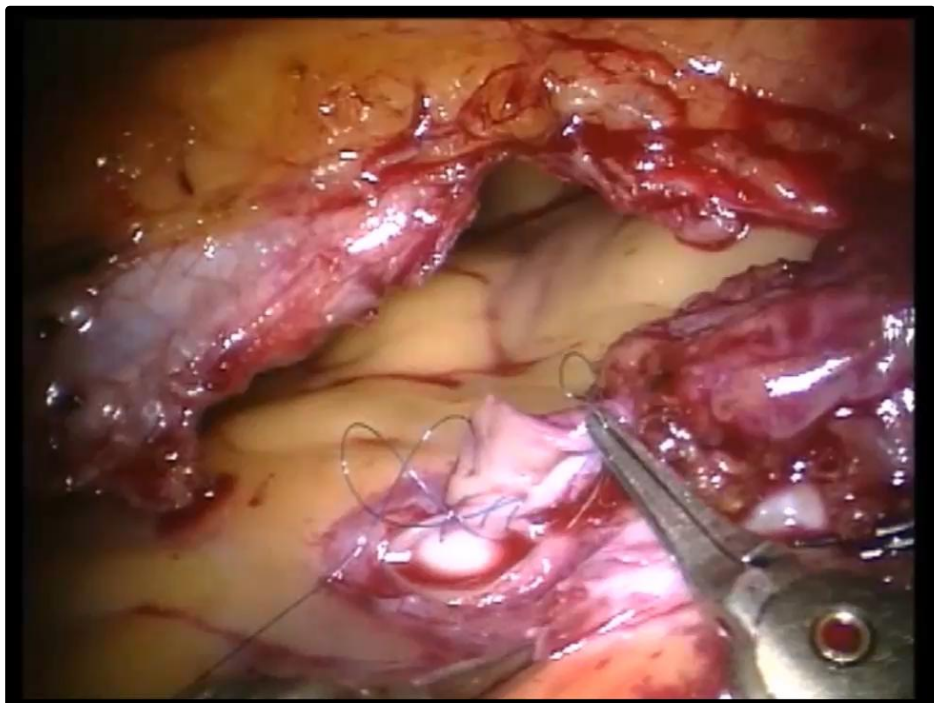
Robotická KCH v Evropě 2016 - 2020



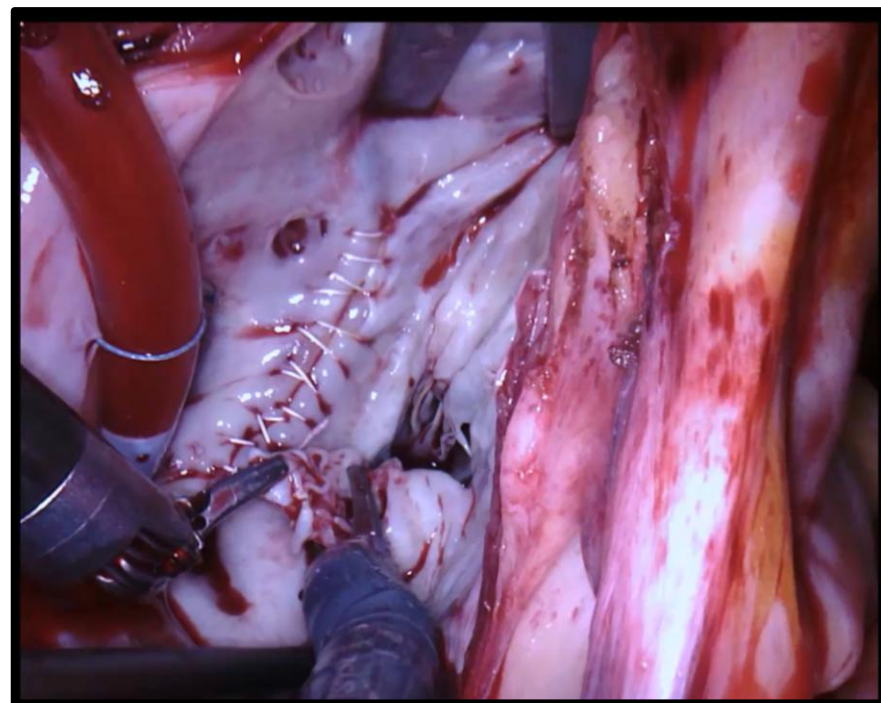
Cerny S et al: Front Cardiovasc Med 2022 Jan 20;8:827515

Robotická KCH

Robotická KCH – současné aplikace



Revaskularizace



Intrakardiální robotika

Roboticky asistovaná revaskularizace

Robotická KCH

Robotická revaskularizace – DVSST/RA-MIDCAB



ACB - Rozmístění portů

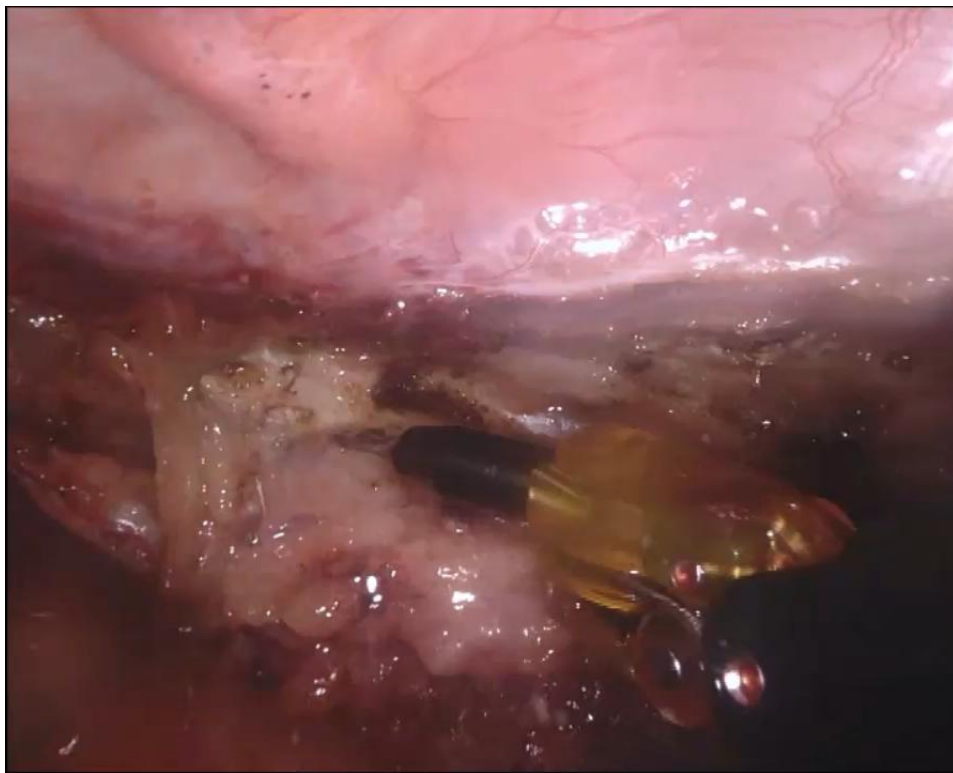
- Klíčový je odběr LIMA
- Tři až čtyři 8mm trokary
- 2, 4 a 6 mezižebří pro robotické nástroje a kameru
- Subkostální trokar pro stabilizátor
- RA - MIDCAB - 4 mezižebří pro minitorakotomii pro anastomózu 4-6 cm



ACB - odběr LIMA

- Větve přerušeny klipy či bipolární koagulací
- Možný odběr obou IMA
 - 1. Odběr RIMA
 - 2. Odběr LIMA
- Otevření perikardu a revize koronárních tepen
- Přerušení (obou) IMA

Robotická revaskularizace – Otevření perikardu a identifikace RIA



ACB - odběr LIMA

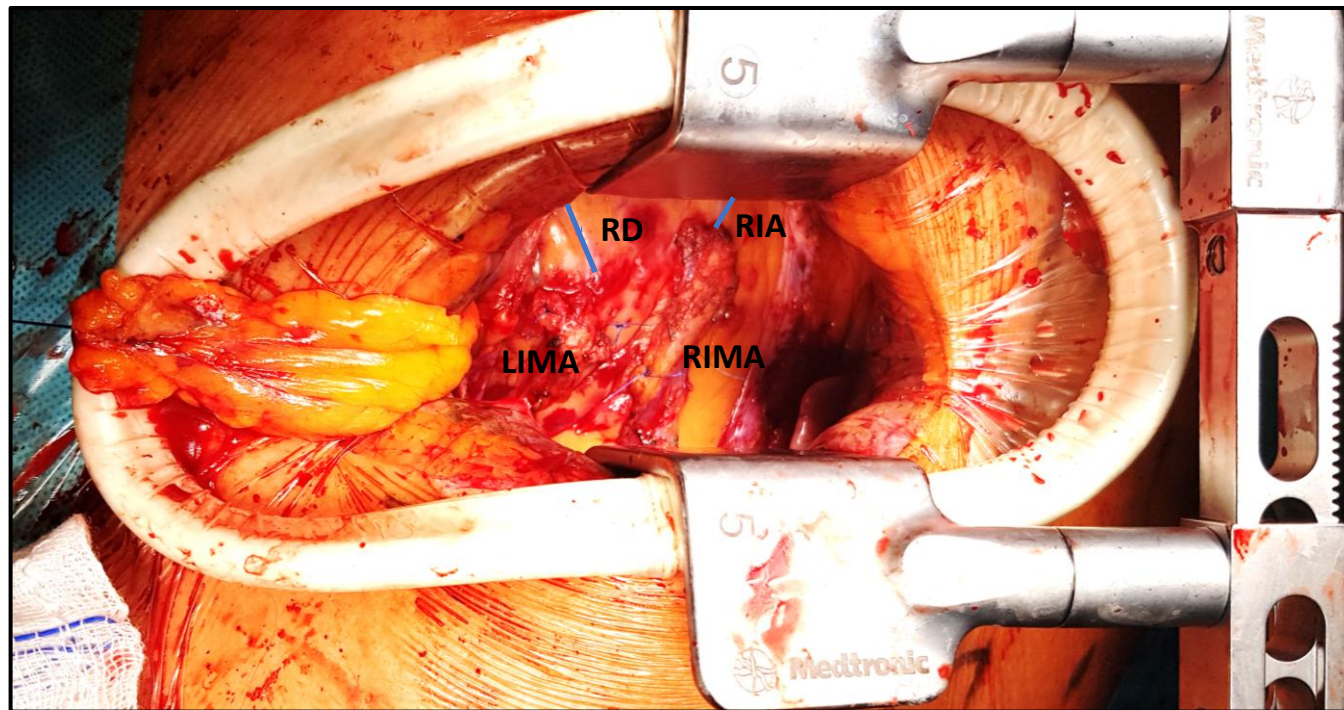
- Větve přerušeny klipy či bipolární koagulací
- Možný odběr obou IMA
 - 1. Odběr RIMA
 - 2. Odběr LIMA
- Otevření perikardu a revize koronárních tepen
- Přerušení (obou) IMA

Robotická KCH

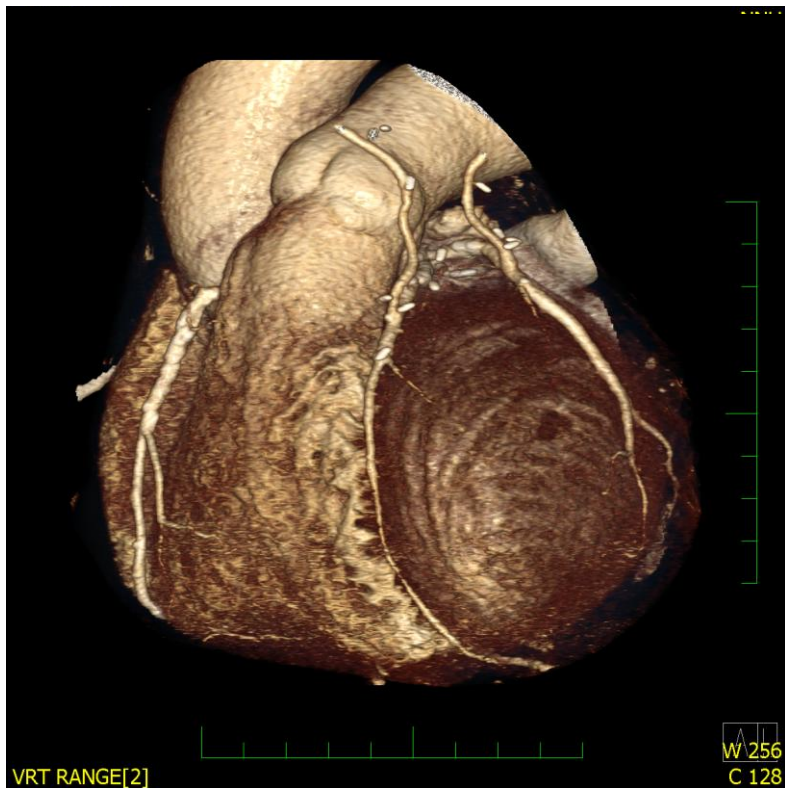
Robotická revaskularizace – DVSVST/RA-MIDCAB

RA MIDCAB/DVSVST

- Odběr LIMA roboticky
- Anastomóza manuálně ze 4-6 cm torakotomie obvykle ve 4 mezižebří
- Možné i použití obou IMA
- Provedení více než 2 anastomóz – BIMA, ev sekvenční LIMA



Robotická revaskularizace – DVSST/RA-MIDCAB



ACB s použitím BIMA

- RIA - RIMA
- RIM - LIMA
- CT SKG

Robotická KCH

Robotická revaskularizace – DVSVST/RA-MIDCAB

RA MIDCAB / DVSVST



Hybridní revskularizace



Hybrid Coronary Revascularization in Selected Patients With Multivessel Disease

5-Year Clinical Outcomes of the Prospective Randomized Pilot Study

Mateusz Tajstra, MD,^a Tomasz Hrapkowicz, MD, PhD,^b Michał Hawranek, MD, PhD,^a Krzysztof Filipiak, MD, PhD,^b Marek Gierlotka, MD,^a Marian Zembala, MD,^b Mariusz Gąsior, MD,^a Michael Oscar Zembala, MD,^b
on behalf of the POL-MIDES Study Investigators

ABSTRACT

OBJECTIVES This study aimed to investigate the 5-year clinical follow-up of the HYBRID (Hybrid Revascularization for Multivessel Coronary Artery Disease) trial.

BACKGROUND The HYBRID trial, the only randomized study involving thorough analysis of outcome after the 2 procedures, suggested that hybrid coronary revascularization (HCR) is feasible in selected patients with multivessel coronary disease referred for conventional coronary artery bypass grafting (CABG). There are currently no long-term outcome data from randomized trials in this setting.

METHODS A total of 200 patients with multivessel coronary disease referred for conventional surgical revascularization were randomly assigned to undergo HCR or CABG. The primary endpoint was the occurrence of all-cause mortality at 5 years.

RESULTS Nine patients (4 in HCR and 5 in CABG group) were lost to the 5-year follow-up. Finally, 191 patients (94 in HCR and 97 in CABG group) formed the basis of this study. The groups were well balanced in terms of pre-procedural characteristics. All-cause mortality at 5-year follow-up was similar in the 2 groups (6.4% for HCR vs. 9.2% for CABG; $p = 0.69$). The rates of myocardial infarction (4.3% vs. 7.2%; $p = 0.30$), repeat revascularization (37.2% vs. 45.4%; $p = 0.38$), stroke (2.1% vs. 4.1%; $p = 0.35$), and major adverse cardiac and cerebrovascular events (45.2% vs. 53.4%; $p = 0.39$) were also similar in the 2 groups.

CONCLUSIONS HCR has similar 5-year all-cause mortality when compared with conventional coronary bypass grafting (Safety and Efficacy Study of Hybrid Revascularization in Multivessel Coronary Artery Disease; NCT01035567) (J Am Coll Cardiol Interv 2018;11:847-52) © 2018 by the American College of Cardiology Foundation.

Gasior M et al: J Am Coll Cardiol Interv 2018;11:847-52

Robotická KCH

Hybridní revaskularizace

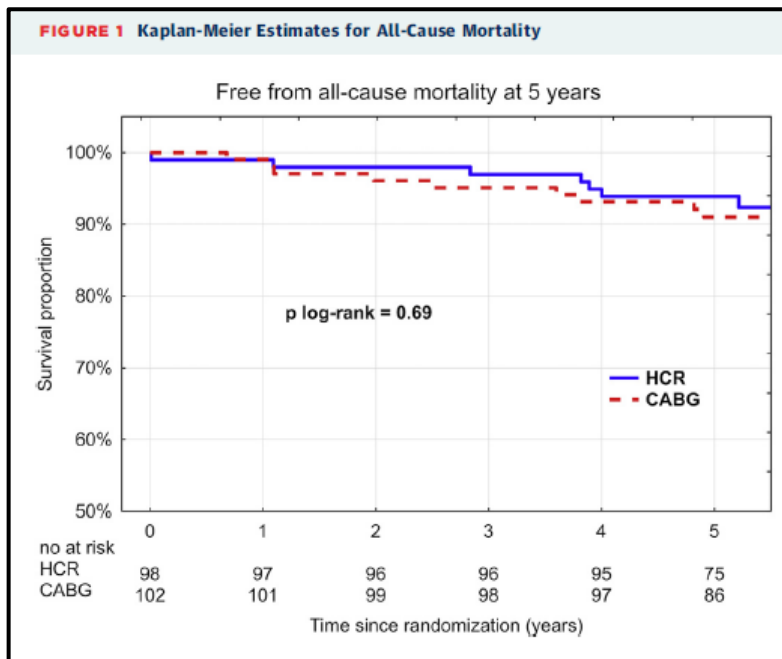


TABLE 2 5-Year Clinical Outcomes*†

	HCR (n = 94)	CABG (n = 97)	p Value
All-cause mortality‡	6.4	9.2	0.69
Myocardial infarction§	4.3	7.2	0.30
Coronary reintervention	37.2	45.4	0.38
Stroke	2.1	4.1	0.35
Any major adverse cardiac or cerebrovascular events¶	45.2	53.4	0.39

Gasior M et al: J Am Coll Cardiol Interv 2018;11:847-52

Long-term survival in triple-vessel disease: Hybrid coronary revascularization compared to contemporary revascularization methods

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Karthik Seetharam MD² | Derek R. Brinster MD² | Luigi Pirelli MD² | Chad A. Kliger MD² |
S. Jacob Scheinerman MD² | Varinder P. Singh MD¹ | Nirav C. Patel MD²

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Abstract

Background: Hybrid coronary revascularization (HCR) constitutes a left internal mammary artery graft to the left anterior descending (LAD) coronary artery, coupled with percutaneous coronary intervention (PCI) for non-LAD lesions. This management strategy is not commonly offered to patients with complex multivessel disease. Our objective was to evaluate 8-year survival in patients with triple-vessel disease (TVD) treated by HCR, compared with that of concurrent matched patients managed by traditional coronary artery bypass grafting (CABG) or multivessel PCI.

Abstract

Background: Hybrid coronary revascularization (HCR) constitutes a left internal mammary artery graft to the left anterior descending (LAD) coronary artery, coupled with percutaneous coronary intervention (PCI) for non-LAD lesions. This management strategy is not commonly offered to patients with complex multivessel disease. Our objective was to evaluate 8-year survival in patients with triple-vessel disease (TVD) treated by HCR, compared with that of concurrent matched patients managed by traditional coronary artery bypass grafting (CABG) or multivessel PCI.

Methods: A retrospective review was undertaken of 4805 patients with TVD who presented between January 2009 and December 2016. A cohort of 100 patients who underwent HCR were propensity-matched with patients treated by CABG or multivessel PCI. The primary endpoint was all-cause mortality at 8 years.

Results: Patients with TVD who underwent HCR had similar 8-year mortality (5.0%) as did those with CABG (4.0%) or multivessel PCI (9.0%). A composite endpoint of death, repeat revascularization, and new myocardial infarction, was not significantly different between patient groups (HCR 21.0% vs CABG 15.0%, $P = .36$; HCR 21.0% vs PCI 25.0%, $P = .60$). Despite a higher baseline synergy between percutaneous coronary intervention with taxus and cardiac surgery (SYNTAX) score, HCR was able to achieve a lower residual SYNTAX score than multivessel PCI ($P = .001$).

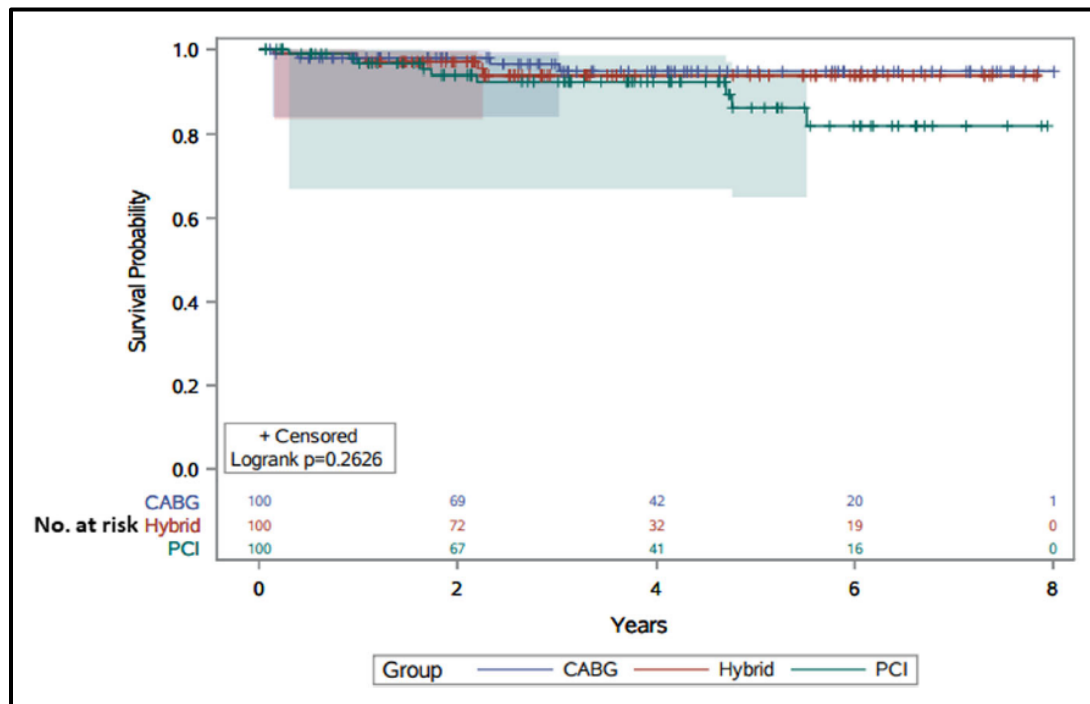
Conclusions: In select patients with TVD, long-term survival and FREEDOM from major adverse cardiovascular events after HCR are similar to that seen after traditional CABG or multivessel PCI. HCR should be considered for patients with multivessel disease, presuming a low residual SYNTAX score can be achieved.

KEYWORDS

coronary artery bypass grafting, coronary artery disease, heart team, hybrid coronary revascularization, minimally invasive, percutaneous coronary intervention

Basman C et al: J Card Surg 2020;35:2710-8

8 YEARS SURVIVAL



Robot-assisted vs. conventional MIDCAB: A propensity-matched analysis

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Department of Cardiac Surgery, Faculty of Medicine and University Hospital in Hradec Králové, Charles University, Hradec Králové, Czechia

Background: Robotic assistance (RA) in the harvesting of internal thoracic artery during minimally invasive direct coronary artery bypass grafting (MIDCAB) provides several potential benefits for surgeon and patient in comparison with conventional MIDCAB. The two technical options have not been thoroughly compared in the literature yet. We aimed to perform this in our cohort with the use of propensity-score matching (PSM).

Methods: This was a retrospective comparison of all consecutive patients undergoing conventional MIDCAB (2005–2021) and RA-MIDCAB (2018–2021) at our institution with the use of PSM with 27 preoperative covariates.

Results: Throughout the study period 603 patients underwent conventional and 132 patients underwent RA-MIDCAB. One hundred and thirty matched pairs were selected for further comparison. PSM successfully eliminated all preoperative differences. Patients after RA-MIDCAB had lower 24 h blood loss post-operatively (300 vs. 450 ml, $p = 0.002$). They had shorter artificial ventilation time (6 vs. 7 h, $p = 0.018$) and hospital stay (6 vs. 8 days, $p < 0.001$). There was no difference in the risk of perioperative complications, short-term and mid-term mortality between the groups.

Conclusions: RA-MIDCAB is an attractive alternative to conventional MIDCAB. It is associated with lower post-operative blood loss and potentially faster rehabilitation after surgery. The mortality and the risk of perioperative complications are comparable among the groups.

Gofus J et al: Front. Cardiovasc. Med. 9:943076. doi: 10.3389/fcvm.2022.943076

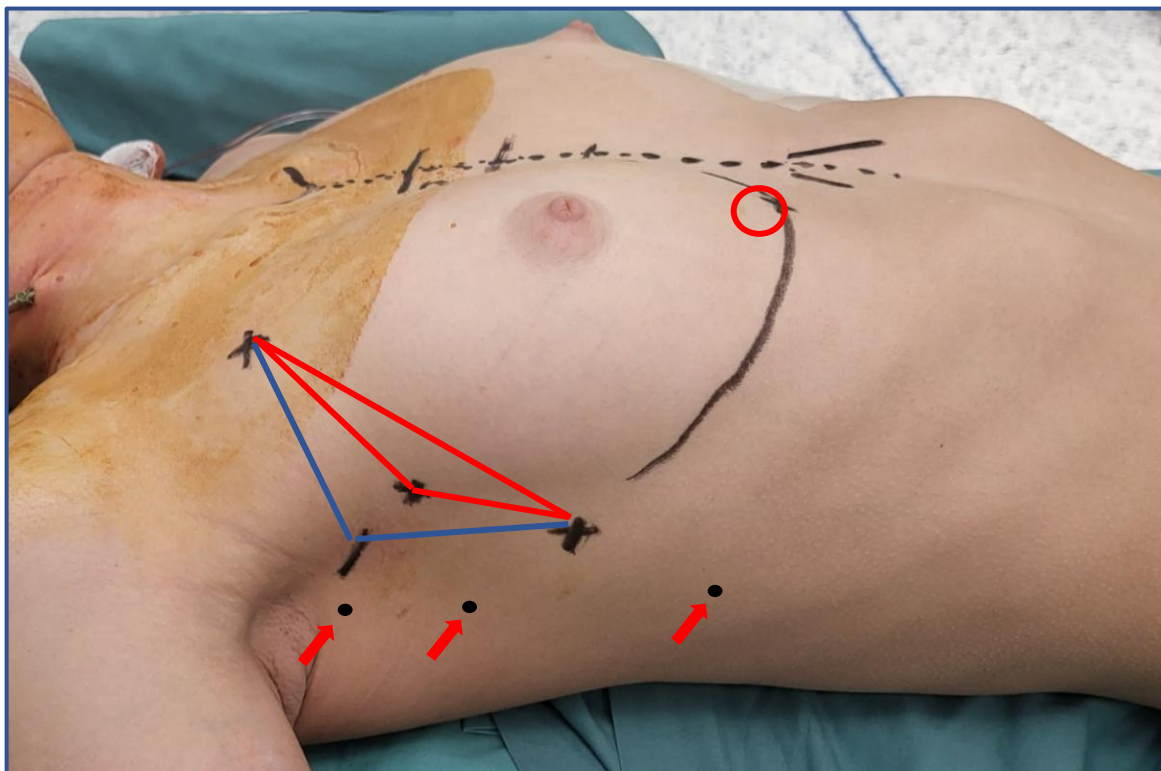
Intrakardiální robotické výkony

Robotická KCH

Robotická plastika mitrální chlopně

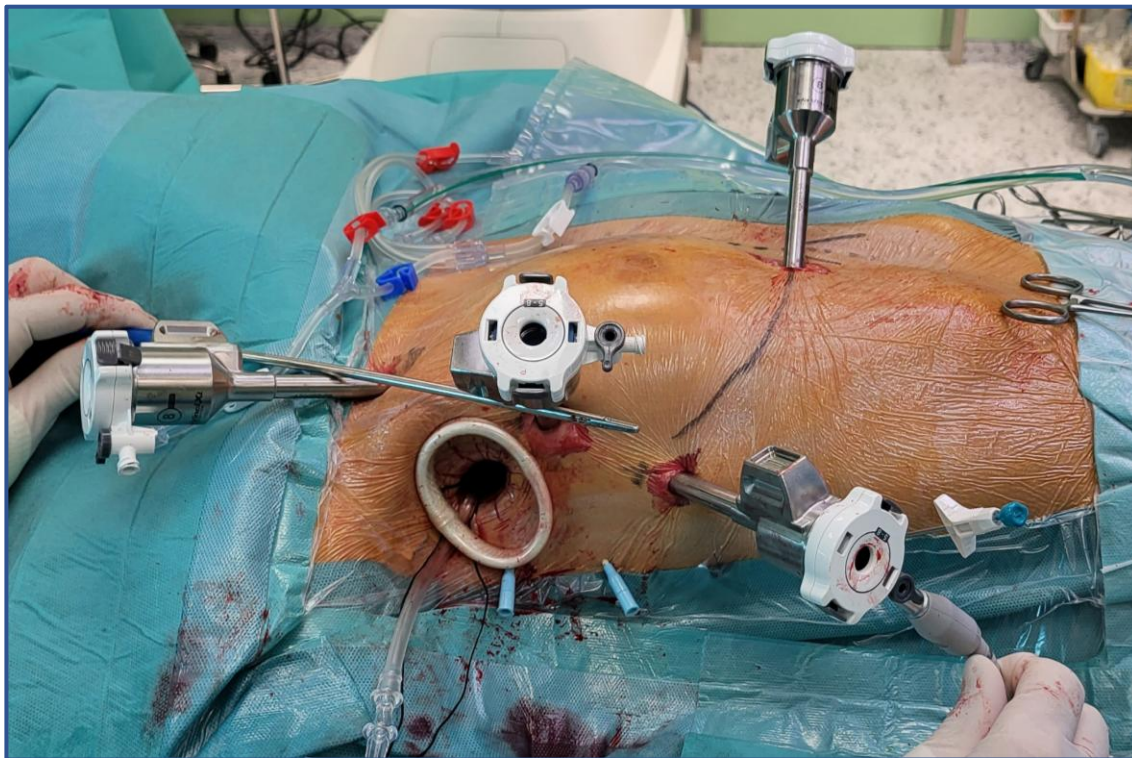
ROZMÍSTĚNÍ PORTŮ

- Čtyři 8mm trokary
- 2, 3 a 5 mezižebří pro robotické nástroje a kameru
- 4 (5-6) mezižebří pro dynamický LS rozvěrač
- 3 mezižebří pro asistentský port – 25 mm (1")
- Perikardiální a brániční trakční stehy



Robotická KCH

Robotická plastika mitrální chlopně

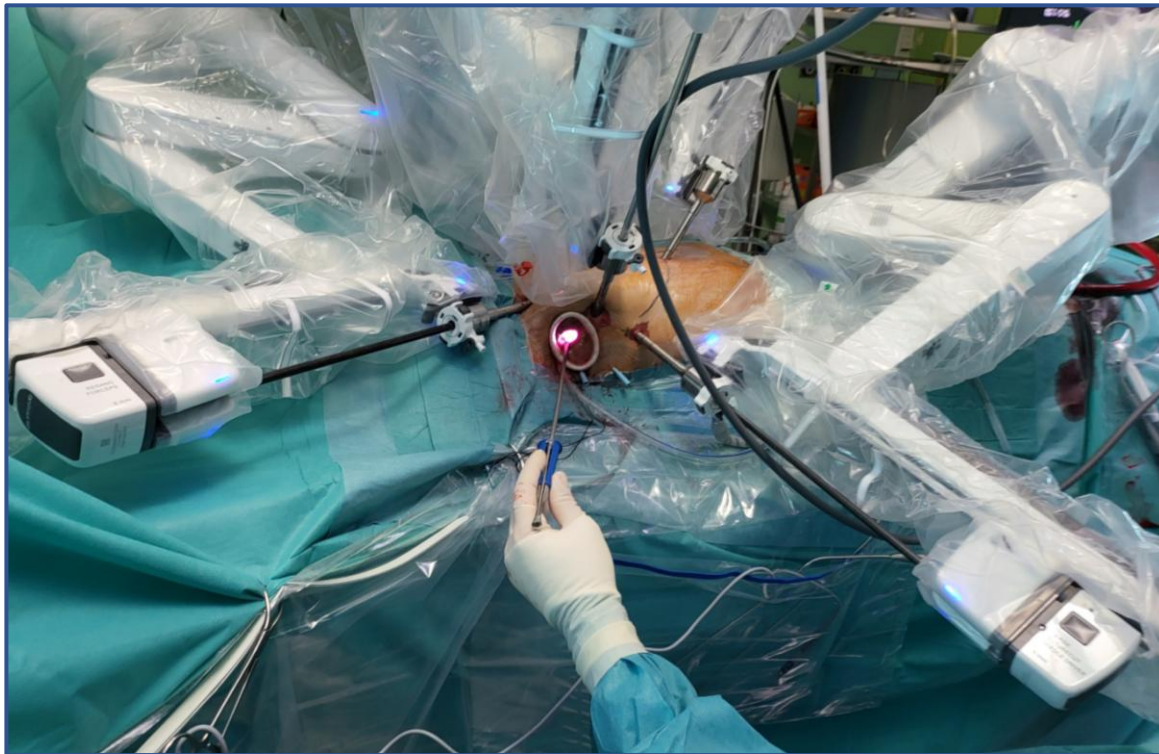


ROZMÍSTĚNÍ PORTŮ

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- Perikardiální a brániční trakční stehy

Robotická KCH

Robotická plastika mitrální chlopně



DOKOVÁNÍ ROBOTA

- Trokary jsou připojeny k robotickým ramenům
- Se systémem IV. generace nedochází k žádným konfliktům ramen
- Dynamický LS rozvěrač – nezávislé pohyby
- Asistentický port:
 - „soft tissue retractor“ – 25 mm (1“)
 - Žádné roztahování žebér – jedinou limitací je velikost ringu

Robotická KCH

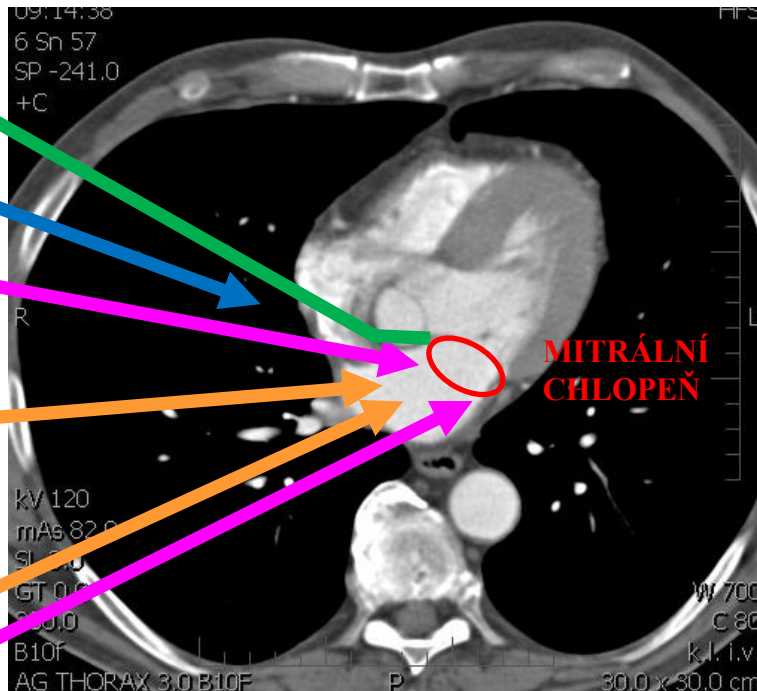
Robotická plastika mitrální chlopně

DYNAMICKÝ LS
ROZVĚRAČ

3D
CAMERA

ROBOTICKÉ
NÁSTROJE

ASISTUJÍCÍ
NÁSTROJ(E)

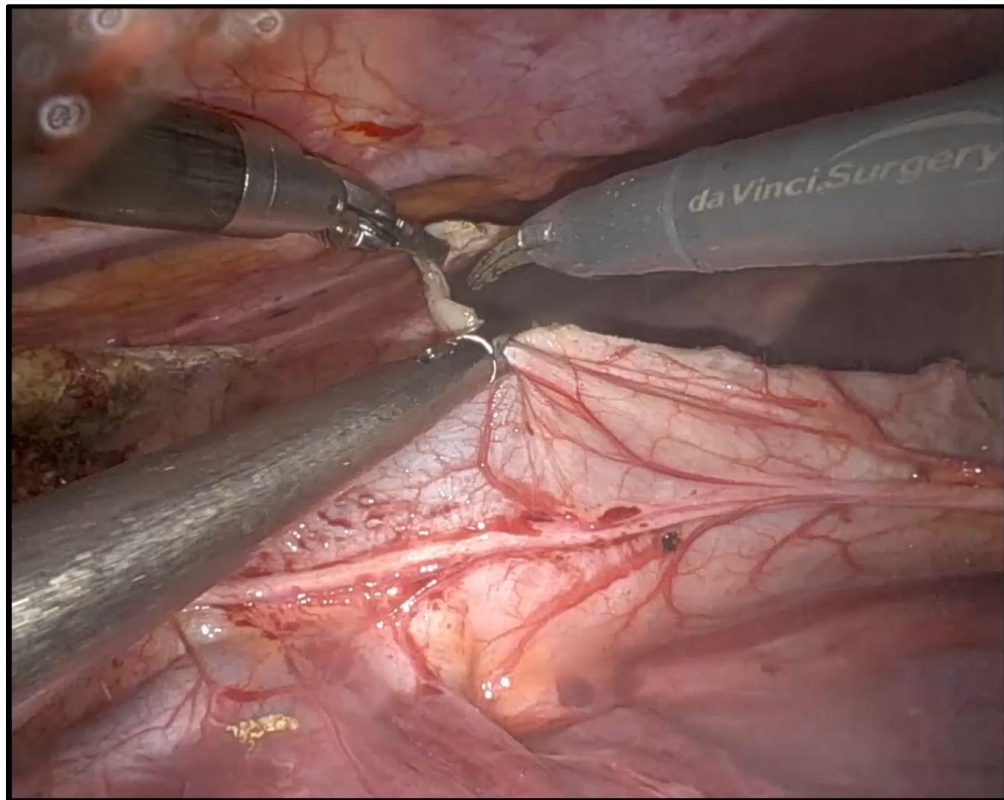


OPERAČNÍ POLE

- 3D Camera
- Dynamický LS rozvěrač
- Dvě robotická ramena – dva instrumenty
- 1 – 2 asistující nástroje

Robotická KCH

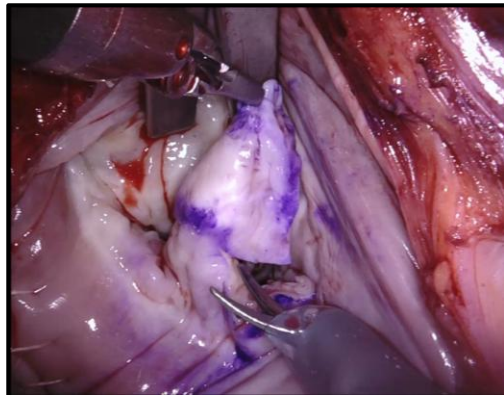
Robotická plastika mitrální chlopně



PLNĚ ENDOSKOPICKÝ VÝKON

- Excelentní 3D vizualizace a přístup ke všem segmentům hrudní dutiny
- Bez limitace pohybu instrumentů (žádný „fulcrum efect“) – 7 stupňů volnosti
- Možnost pracovat uvnitř hrudníku a přímo na chlopni více než dvěma nástroji
- Pokročilá kooperace mezi chirurgem a asistentem
- Dynamický LS rozvěrač – excelentí přístup k mitrální chlopni

Robotická KCH



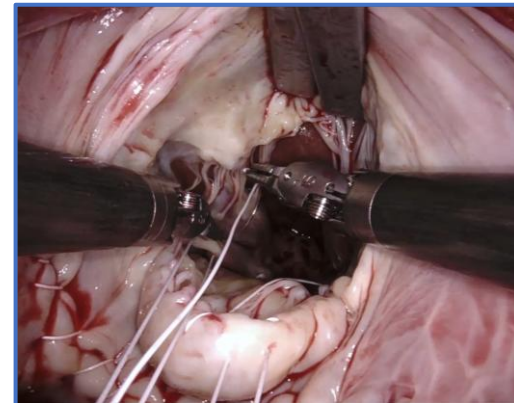
Techniky plastiky mitrální chlopně



Triangulární
resekce



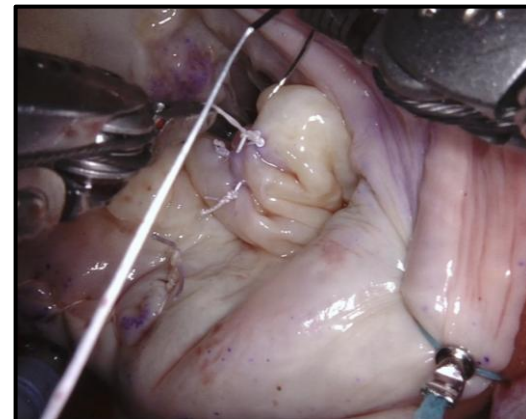
Arteficialní Gore-Tex
chordy "David"



Arteficialní Gore-Tex
chordy „Mohr“
(„loops“)

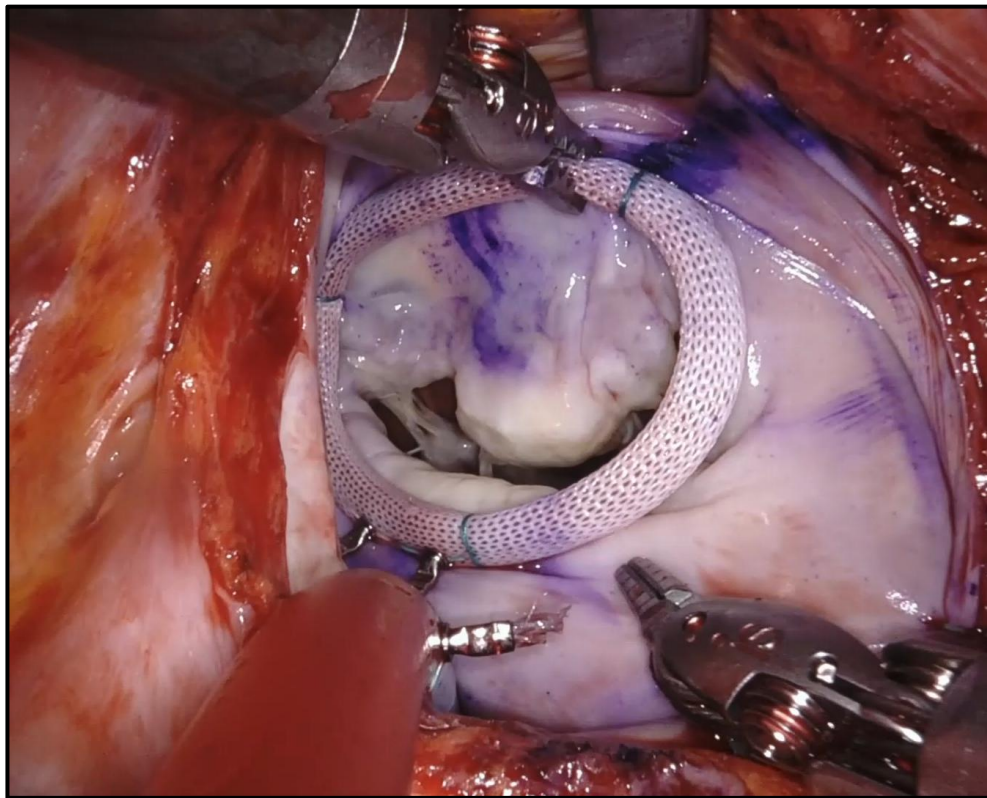


Komplexní
rekonstrukce



Robotická KCH

Robotická plastika mitrální chlopně



IMPLANTACE PRSTENCE

- Není potřeba kompromitovat techniku plastiky (bandy, pokračující stehy atd.)
- Implantace plného semirigidního prstence (principy remodelační anuloplastiky dle Carpentiera)
- „Knot fasteneres“ (CorKnot®) – jednotlivé stehy
- Další zjednodušení a vylepšení s novými ringy (Physio Flex®)

Robotická KCH

Robotická plastika mitrální chlopně



PLNĚ ENDOSKOPICKÝ VÝKON

- Bez mezižeburního rozvěrače = prakticky žádná pooperační bolest
- Plná stabilita hrudní stěny, bez porušení mezižeburních a hrudních svalů
- Návrat k plné fyzické aktivitě obvykle během 2 – 3 týdnů

Robotická plastika mitrální chlopně - osobní zkušenost

Robotic MVRep 2017-2024 – Single Surgeon (NHH, UHHK, UHM)

Patients demographic data	
Number of patients (n)	155
Female sex (n)	49 (31,6 %)
Age (years)	50,9 ± 13,8 (20 – 78)
Tricuspid regurgitation ≥ 3 gr (n)	7 (4,5 %)
Atrial fibrillation (n)	12 (7,7 %)
IHD (n)	0 (0 %)
NYHA (grade)	1,56 ± 0,56 (1-3)

Robotická plastika mitrální chlopně - osobní zkušenost

Robotic MVRep 2017-2024 – Single Surgeon (NHH, UHHK, UHM)

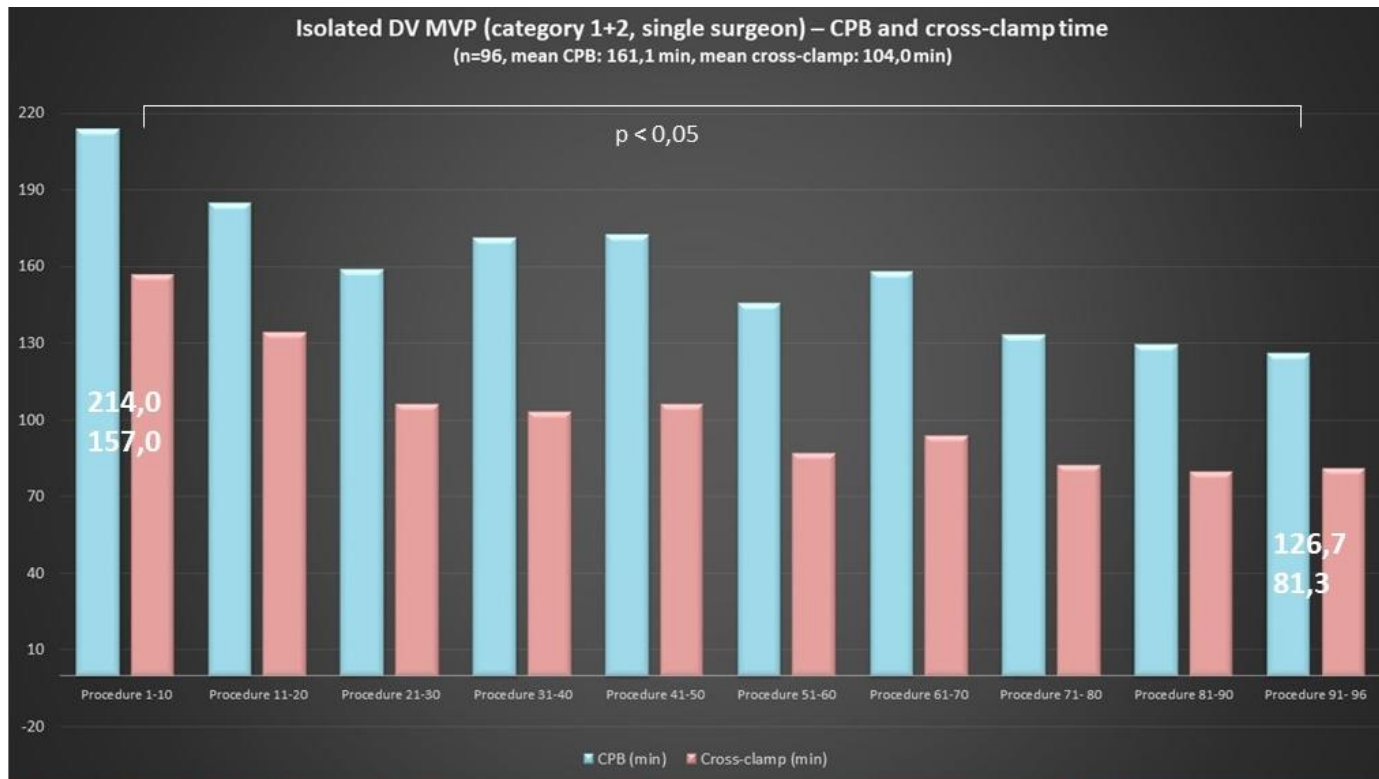
Surgical technique		
Valve repair (n)	155	(100 %)
Ring implantation (n)	155	(100 %)
Semirigid ring (Physio II®+PhysioFlex®) (n)	153	(98,7 %)
Ring size (size)	35,1 ± 3,6	(28-40)
• Isolated ring (n)	37	(20,4%)
• Triangular resection (n)	52	(33,6 %)
• Neochords (n)	58	(37,2 %)
• Chordal transfer (n)	7	(4,5 %)
• Other (n)	26	(16,8 %)
TV repair	7	(4,5 %)
MAZE - cryo (n)	12	(7,7 %)

Robotická plastika mitrální chlopně - osobní zkušenost

Robotic MVRep 2017-2024 – Single Surgeon (NHH, UHHK, UHM)

Early results		
Conversion – limited thoracotomy (n)	1	(0,6 %)
Conversion – sternotomy (n)	0	(0,0 %)
Early mitral valve reintervention (n)	0	(0,0 %)
Reexploration for bleeding (n)	3	(1,9 %)
Prolonged artificial ventilation (n)	2	(1,3 %)
Postoperative severe LCO (n)	1	(0,6 %)
Lymphocele (n)	8	(5,3 %)
Stroke (n)	0	(0 %)
Mortality (30d) (n)	0	(0 %)

Robotická plastika mitrální chlopně - osobní zkušenost



Robotická plastika mitrální chlopně - Evidence

The Expanding Role of Endoscopic Robotics in Mitral Valve Surgery: 1,257 Consecutive Procedures

Douglas A. Murphy, MD, Emmanuel Moss, MDCM, MS, Jose Binongo, PhD, Jeffrey S. Miller, MD, Steven K. M. ... Alexander M. Herzog, BS, V ... Michael E. Halkos, MD, MS

Division of Cardiothoracic Surgery, Emory ... Atlanta, Georgia

Background. The role of robotic in ... valve (MV) surgery continues to evolve ... this study was to assess the safety, eff ... MV surgery using a lateral endosc ... robotics (LEAR) technique.

Methods. From 2006 to 2013, a ded ... performed 1,257 consecutive isolates ... with or without tricuspid valve repair ... The procedures were performed robot ... right-side chest ports with femoral a ... aortic perfusion and balloon occlusion ... and data were recorded on all proced ... retrospectively.

Results. The mean age of all patien ... years, and 8.4% (n = 105) had previou ... The MV repair was performed in 1,1 ... The MV replacement was performed i ... and paravalvular leak repair in 2 pat ... atrial ablation was performed in 226 p

Early results of robotically assisted mitral valve surgery: Analysis of the first 1000 cases

A. Marc Gillinov, MD,^a Tomislav Mihaljevic, MD,^a Hoda Javadikargari, MD,^a Rakesh M. Suri, MD, DPhil,^a Stephanie L. Mick, MD,^a José L. Navia, MD,^a Milind Y. Desai, MD,^b Johannes Bonatti, MD,^a Mitra Khosravi, BS,^a Jay J. Idrees, MD,^a Ashley M. Lowry, MS,^a Eugene H. Blackstone, MD,^{a,b} and Lee G. Swanson, MD, PhD^a

ABSTRACT

Objective: The study objective was ment and clinical outcomes of robot 1000 cases performed in a tertiary c

Methods: We reviewed the first 100 going robotic primary mitral valve (n = 185), from January 2006 to n was degenerative (n = 960, 96%, (n = 10, 1.0%), ischemic (n = 3, 0 procedures were performed via right diaphragmatic bypass.

Results: Mitral valve repair was at tempts and 1 resection of fibroelasto repair, and 5 (0.5%) of whom under repair echocardiography showed th 992) left the operating room with no echocardiography showed that mit 97.9% of patients (915/935). There (1.4%) experienced a stroke; stroke i to 0.8% in the second 500 patients. C ischemic and cardiopulmonary bypa and intensive care unit and postoper

Conclusions: Robotic mitral valve s valve repair and low operative m algorithm-driven patient selection outcomes and procedural efficiency.

Can complex mitral valve repair be performed with robotics? An institution's experience utilizing a dedicated team approach in 500 patients^a

Didier F. Loulmet^a, Neel K. Ranganath^a, Peter J. Neuburger^b, Robert G. Nampiaparampil^b, Aubrey C. Galloway^a and Eugene A. Grossi^{a*}

^a Department of Cardiothoracic Surgery, Division of Cardiac Surgery, NYU Langone Health, New York, NY, USA

^b Department of Anesthesiology, Perioperative Care & Pain Medicine, Division of Cardiothoracic Anesthesia, NYU Langone Health, New York, NY, USA

OBJECTIVES: The full potential of robotics has not been achieved in terms of addressing the most challenging mitral valve (MV) cases. We outline our technique and report our early results with totally endoscopic robotic MV repair in a wide range of pathologies.

METHODS: From May 2011 to August 2017, a dedicated team attempted totally endoscopic robotic MV repair in 500 MV regurgitation patients. Repair complexity was scored in 3 categories. We analysed our sequential case experience by quartiles.

RESULTS: Patient mean age was 60.8 years (range 18–88). Aetiologies included: degenerative 382 (76.4%), functional 37 (7.4%), inflammatory 22 (4.4%) and others 59 (11.8%). Mitral annular calcification was present in 64 (12.8%) cases. Simple MV repair (annuloplasty alone or with 1 leaflet segment repair) was performed in 240 (48%) patients, complex (repair involving more than 1 segment on the same leaflet) in

140 (28%) patients and most complex (bileaflet repair or mitral annular calcification excision with atrioventricular groove repair) in 120 (24%) patients. Concomitant procedures included: left appendage closure (94.8%), patent foramen ovale/atrial septal defect (PFO/ASD) closure (19.6%), cryoablation (19.4%), tricuspid repair (6.2%) or hybrid percutaneous coronary revascularization (7.8%). The overall repair rate was 99.4%, with 0.6% early mortality and 1.2% stroke rate (0.2% permanent neurological deficit). Case complexity increased with our experience. Despite an increase in aortic occlusion and perfusion times (median 86.5 and 125 min) and a slight decrease in operating room extubation rate (overall 64%), length of hospital stay (median 4 days) and 30-day readmission rate (overall 3.6%) were not affected by the progressive inclusion of more complex cases.

CONCLUSIONS: Totally endoscopic robotic MV repair performed by a dedicated team allows one to address the entire spectrum of pathological complexity and provides consistent results.

Keywords: Mitral valve • Robotics • Mitral repair • Mitral valve repair

• 2757 pacientů

- 2656 plastik MCH
- 96 náhrad MCH
- 395 LS MAZE
- 171 plastik TCH
- 105 Reoperací

- Konverze 2,1%
- Revize 2,1%
- Mortalita 0,5%
- CMP 1,0%

Murphy DA et al: Ann Thorac Surg 2015;100:1675-82

Gillinov M et al: J Thorac Cardiovasc Surg 2018;155:82-91

Loulmet D et al: Eur J Cardiothor Surg 2019;56:470-8

Robotická plastika mitrální chlopně - Evidence

Robotic Mitral Valve Repair for Degenerative Mitral Regurgitation

Makoto Mori, MD, PhD,¹ Niharika Parsons, MD, MHSI,² Markus Krane, MD,¹ T. Sloane Guy, MD, MBA,³ Eugene A. Grossi, MD,⁴ Joseph A. Dearani, MD,⁵ Robert H. Habib, PhD,² Vinay Badhwar, MD,⁶ and Amar Geirsson, MD¹

ABSTRACT

BACKGROUND Contemporary national utilization and comparative safety data of robotic mitral valve repair for degenerative mitral regurgitation compared with nonrobotic approaches are lacking. The study aimed to characterize national trends of utilization and outcomes of robotic mitral repair of degenerative mitral regurgitation compared with sternotomy and thoracotomy approaches.

METHODS Patients undergoing intended mitral repair of degenerative mitral regurgitation in The Society of Thoracic Surgeons Adult Cardiac Surgery Database between 2015 and 2021 were examined. Mitral repair was performed in 61,322 patients. Descriptive analyses characterized center-level volumes and outcomes. Propensity score matching separately identified 5540 pairs of robotic vs thoracotomy approaches and 6962 pairs of robotic vs sternotomy approaches. Outcomes were operative mortality, composite mortality and major morbidity, postoperative length of stay, and conversion to mitral replacement.

RESULTS Through the 7-year study period, 116 surgeons across 103 hospitals performed mitral repair robotically. The proportion of robotic cases increased from 10.9% (949 of 8712) in 2015 to 14.6% (1274 of 8730) in 2021. In both robotic-thoracotomy and robotic-sternotomy matched pairs, mortality and morbidity were not significantly different, whereas the robotic approach had lower conversion (1.2% vs 3.1% for robotic-thoracotomy and 1.0% vs 3.7% for robotic-sternotomy), shorter length of stay, and fewer 30-day readmissions. Mortality and morbidity were lower at higher-volume centers, crossing the national mean mortality and morbidity at a cumulative robotic mitral repair case of 40.

CONCLUSIONS Robotic mitral repair is a safe and effective approach and is associated with comparable mortality and morbidity, a lower conversion rate, a shorter length of stay, and fewer 30-day readmissions than thoracotomy or sternotomy approaches.

(Ann Thorac Surg 2023;■:■-■)

Published by Elsevier Inc. on behalf of The Society of Thoracic Surgeons

- STS Adult Cardiac Surgical Database 2015 - 2021
- 63,122 pacientů s plastikou MCH pro primární MR
 - 7692 Robotických plastik MCH
 - 15,725 Plastik MCH z torakotomie
 - 39,705 Plastik MCH ze sternotomie
- „Propensity score matching“
 - Robotika vs. torakotomie - 5540 patients
 - Robotika vs. sternotomie – 6962 patients
- Mortalita 1,1%
- Revize 3,1%
- CMP 1,2%

Robotická plastika mitrální chlopně - Evidence



PO „PROPENSITY MATCHING“ PÁROVÁNÍ

- **ROBOTIKA vs. STERNOTOMIE:**
 - Méně konverzi na náhradu MCH ($p < 0.001$)
 - Méně transfuzí ($p < 0.001$)

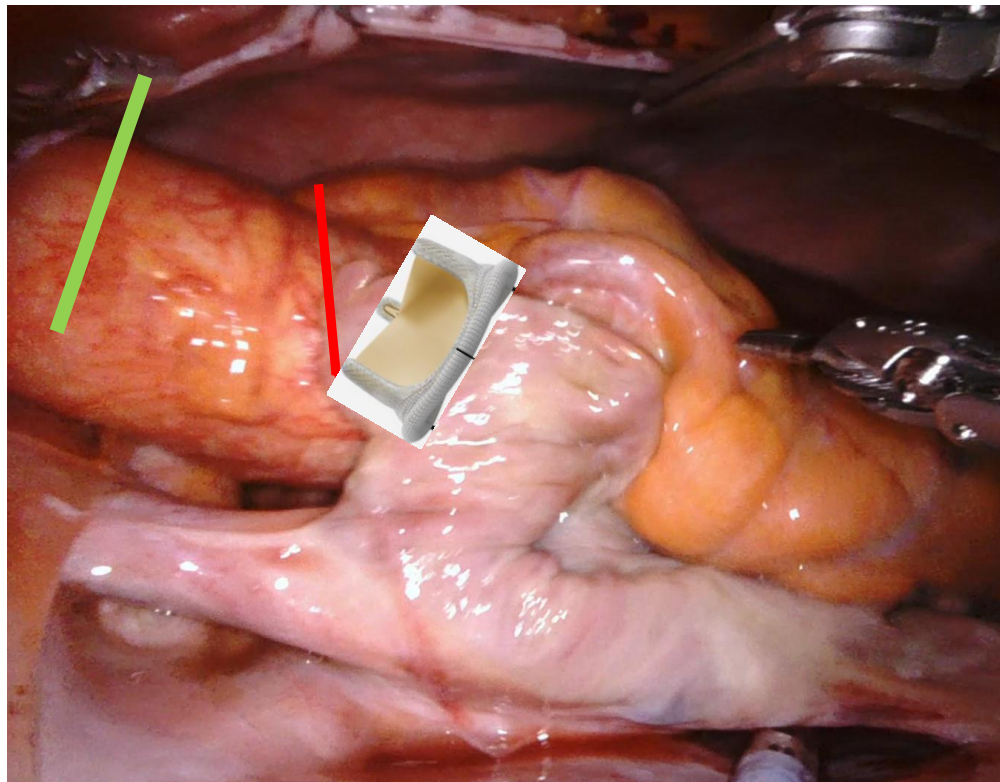
CONCLUSIONS Robotic mitral repair is a safe and effective approach and is associated with comparable mortality and morbidity, a lower conversion rate, a shorter length of stay, and fewer 30-day readmissions than thoracotomy or sternotomy approaches.

- Méně konverzi na náhradu MCH ($p < 0.001$)
- Méně transfuzí ($p < 0.001$)
- Menší výskyt pooperační FS ($p = 0.002$)
- Kratší pobyt v nemocnici ($p < 0.001$)
- Menší počet readmisí ($p < 0.001$)

— Sternotomy — Thoracotomy — Robotic

Robotická KCH

Robotická náhrada aortální chlopně - Koncept



- **ROBOTICKÉ ZÁKROKY NA MITRÁLNÍ CHLOPNI - LATERÁLNÍ PŘÍSTUP KE KOŘENI AORTY**
 - Kardioplegická jehla
 - Kořenový vent
 - Transtorakální svorka
- Tento přístup je vhodný také pro **NÁHRADU AORTÁLNÍ CHLOPNĚ**

Robotická náhrada aortální chlopně

Robotic Aortic Valve Replacement: First 50 Cases



Lawrence M. Wei, MD, Chris C. Cook, MD, J. W. Awori Hayanga, MD, MPH, J. Scott Rankin, MD, Christopher E. Mascio, MD, and Vinay Badhwar, MD

Department of Cardiovascular and Thoracic Surgery, West Virginia University, Morgantown, West Virginia

Prof. Vinay BADHWAR

- West Virginia University
- Complex robotic program
- Largest experience in rAVR

Badhwar V et al: J Thorac Cardiovasc Surg 2021;161(5):1753-9

Robotická náhrada aortální chlopně

Robotic aortic valve replacement

Vinay Badhwar, MD,^a Lawrence M. Wei, MD,^b Ramesh Daggubati, MD,^b Partho P. Sengupta

▶ Video clip is available online.

The management of aortic valve disease has benefited substantially from the introduction and internationalization of transcatheter aortic valve replacement, particularly for patients deemed at prohibitive, high-intermediate risk.¹⁻³ Although the rate of TAVR recently eclipsed that of surgical aortic valve replacement (SAVR), the volume of SAVR continues to increase incrementally over time, without any increase in 2% risk-adjusted operative mortality.⁴ Despite the low-risk TAVR trials leading to US regulatory approval, controversy remains as to the best longitudinal outcomes for patients at low surgical risk. This is particularly true for populations specifically excluded from published low-risk trials and for whom SAVR may be deemed more appropriate.

management.

- 50 pacientů
- Laterální přístup (3cm LEAR)
- Vše chirurgicky implantované chlopně (66% biologických, 34% mechanických)
- Jednotlivé stehy + CorKnot[®]
- MO 161 minut
- Svorka 112 minut

Robotic Aortic Valve Replacement: First 50 Cases

Check for updates

Lawrence M. Wei, MD, Chris C. Cook, MD, J. W. Awori Hayanga, MD, MPH, J. Scott Rankin, MD, Christopher E. Mascio, MD, and Vinay Badhwar, MD

Morgantown, West Virginia

surgical aortic valve replacement (SAVR) aortic regurgitation (AR), and need for concomitant procedures. Experience with fully robotic-assisted

tions were performed using a 3- to 4-cm incision, similar to our robotic mitral platform. In all cases,

29 kg/m², calcified bicuspid disease (mean ± SD), and The Society of Thoracic Surgeons (STS) score were used in 16 of 50 (32%), 16 in 2, and left atrial appendage ligation (minutes) were 166 for cardiopulmonary bypass, prototomy closure. All times plateaued in the operating room, and within 4 hours in the postoperative echocardiography demonstrating

no valvular or perivalvular abnormalities.

CONCLUSIONS RAVR appears to have procedural safety and short-term outcomes to rival alternatives. Incremental experience may facilitate the safe performance of concomitant procedures as deemed necessary.

Badhwar V et al: J Thorac Cardiovasc Surg 2021;161(5):1753-9

Wei LM et al: Ann Thorac Surg 2022;114(3):720-6

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Robotic Aortic Valve Replacement: First 50 Cases

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Robotic aortic valve replacement

Vinay Badhwar, MD,^a Lawrence J. ...
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Video clip is available online.

The management of aortic valve disease has changed substantially from the introduction and widespread adoption of transcatheter aortic valve replacement, particularly for patients deemed at high surgical risk. Although the recently eclipsed that of surgical aortic valve replacement (SAVR), the volume of SAVR has increased incrementally over time, without an increase in 2% risk-adjusted operative mortality. Low-risk TAVR trials leading to the current controversy remains as to the best treatment for patients at low surgical risk. This is particularly true for populations specifically excluded from TAVR trials and for whom SAVR may be the preferred option.

Robotic AVR Early Results

- 225 cases January 2020 – May 2022
- 97% OR extubation
- Incremental increase in co-morbid risk
- Additional concomitant procedures – Aortic root enlargement with patch, MV repair, MV replacement for MS, full Cox Maze. TV repair
- Institutional Multidisciplinary Heart Team now views RAVR as preferred option for low to intermediate risk

PH,
D,
West Virginia

valve replacement (SAVR) and need for concomitant procedures with fully robotic-assisted

performed using a 3- to 4-robotic mitral platform.

classified bicuspid disease (SD), and The Society of Thoracic Surgeons (STS) used in 16 of 50 (32%), and left atrial appendage (LAA) for cardiopulmonary support. All times plateaued and within 4 hours in the angiography demonstrating

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Robotická KCH

Robotická náhrada aortální chlopně



VIDEO: Prof. Vojáček, FN Hradec Králové

Robotická KCH

Robotická náhrada aortální chlopně



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Robotická KCH

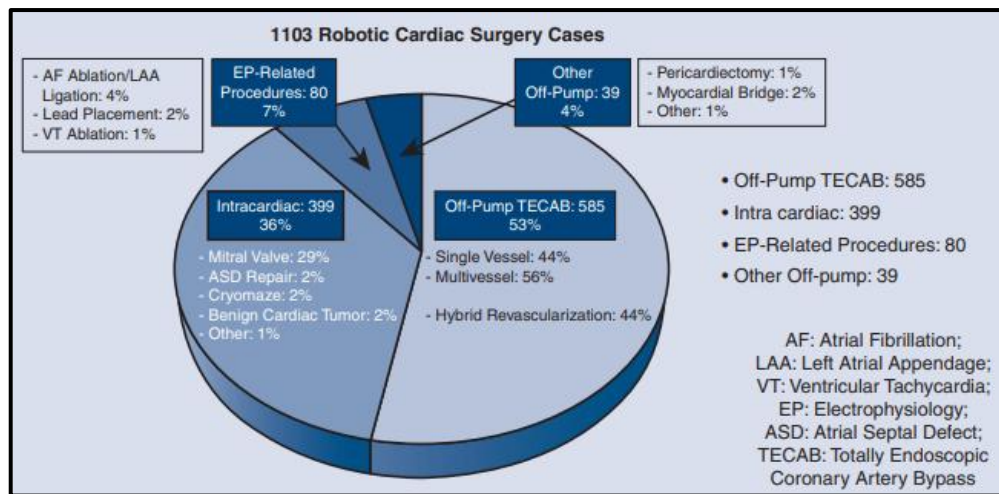


Kde tedy jsme?

Multi-spectrum robotic cardiac surgery: Early outcomes



Husam H. Balkhy, MD, Sarah Nisivaco, BS, Gianluca Torregrossa, MD, Hiroto Kitahara, MD, Brooke Patel, APN, Kaitlin Grady, PA-C, and Charocka Coleman, APN



- **1103 pacientů**
 - **TECAB 585 (53%)**
 - **Intrakardiální 399 (36%)**
 - DV MVP +/- TVP, MAZE
 - ASD, VSD atd
 - HOCM
 - AVR
 - **Elektrofyzologie 80 (7%)**
 - **Ostatní 39 (4%)**
- **Konverze 0,7%**
- **Revize 2,2%**
- **Mortalita 1,2%**
- **CMP 0,6%**

Balkhy H et al: JTCVS Techniques 2022;13:74-82

A Shifting Paradigm in Robotic Heart Surgery: From Single-Procedure Approach to Establishing a Robotic Heart Center of Excellence

Husam H. Balkhy¹, MD, Andrea Amabile¹, MD , and Gianluca Torregrossa¹, MD

Innovations
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Robotická KCH

Kam (snad) směřujeme?

„ROBOTIC HEART CENTER OF EXCELLENCE“



- **CHIRURGICKÁ REVASKULARIZACE**
 - RA-MIDCAB (LIMA, BIMA)
 - TECAB (LIMA, BIMIA)
 - ON PUMP
 - OFF PUMP
- **CHLOPENNÍ CHIRURGIE**
 - MVP/MVR
 - TVP
 - AVR
 - HOCM
- **VROZENÉ SRDEČNÍ VADY:**
 - ASD
- **CHIRURGIE ARYTMÍÍ:**
 - RA Cox MAZE IV
 - RA epikardiální RF ablace
 - RA implantace LV elektrod pro CRT

Balkhy H et al: Innovations 2020;15:187-194

Závěry



- **Robotická kardiokirurgie má v současné době jasně určené indikace a vypracované standardizované operační postupy**
- **Robotika v kardiokirurgii zaznamenala mezi lety 2016 – 2020 v Evropě dramatický rozvoj s dvojnásobným nárůstem center i operačních výkonů**
- **„Real life“ data z evropských center demonstrují že se jedná o reprodukovatelné a bezpečné výkony (konverze, revize, mortalita, EuroScore II)**
- **K rozvoji robotické kardiokirurgie v Evropě přispělo zformování robotické pracovní skupiny (Task Force) pod křídly EACTS a vytvoření strukturovaného výcviku v robotických operačních postupech**

- Robotická kardiochirurgie má v současné době jasně určené indikace a vypracované standardizované operační postupy
- Robotika v kardiochirurgii zaznamenala mezi lety 2016 – 2020 v Evropě dramatický rozvoj s dvojnásobným nárůstem center i operačních výkonů
- „Real life“ data z evropských center demonstrují že se jedná o reprodukovatelné a bezpečné výkony (konverze, revize, mortalita, EuroScore II)
- K rozvoji robotické kardiochirurgie v Evropě přispělo zformování robotické pracovní skupiny (Task Force) pod křídly EACTS a vytvoření strukturovaného výcviku v robotických operačních postupech
- Lze předpokládat další nárůst aktivních center, počtu výkonů i indikací (AVR), limitujícím faktorem může být evropská legislativa (MDR) a technická podpora výrobce systému (Endostabilizátor)

Robotická KCH

Kde to celé začalo?



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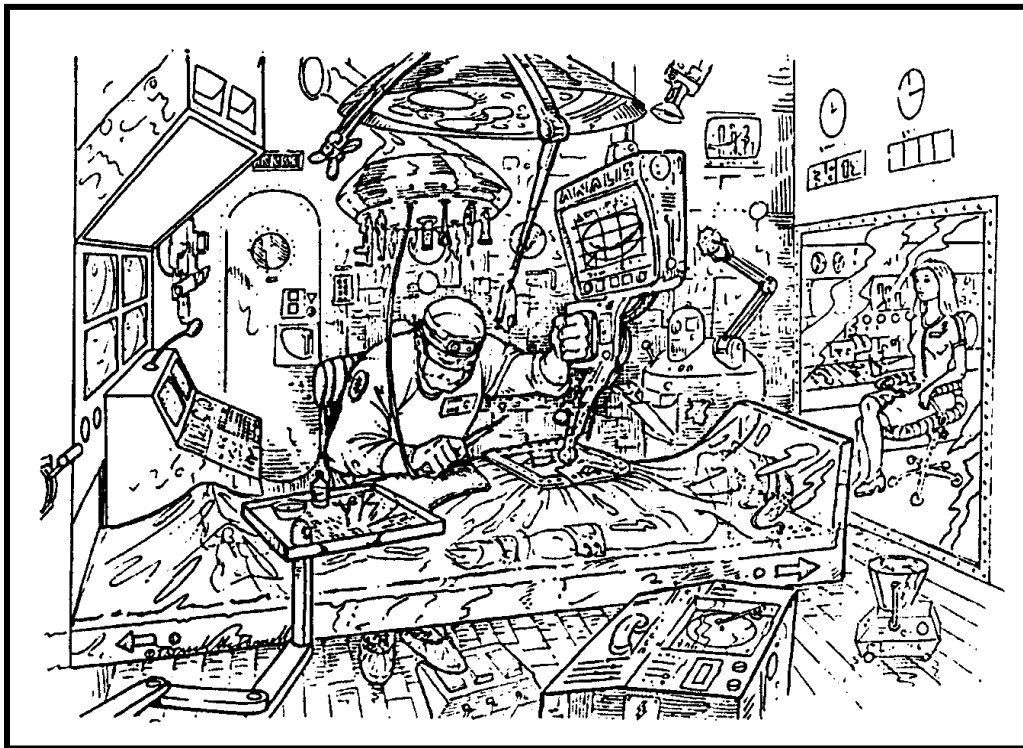
The Journal of THORACIC AND CARDIOVASCULAR SURGERY

J THORAC CARDIOVASC SURG 86:323-337, 1983

Honored Guest's Address

Cardiac valve surgery—the “French correction”

Alain Carpentier, M.D., Paris, France



Carpentier A, J Thorac Cardiovasc Surg 1983;86:323-37

Robotická KCH



Kde to celé začalo?

Chirurgie à cœur ouvert assistée par ordinateur. Premier cas opéré avec succès

First computer assisted open heart operation

Alain Carpentier*, Didier Loulmet, Bertrand Aupècle, Jean-Philippe Kieffer, Dominique Tournay, Pierre Guibourt, Annick Fiemeyer, Denis Méléard, Pierre Richomme, Cyril Cardon

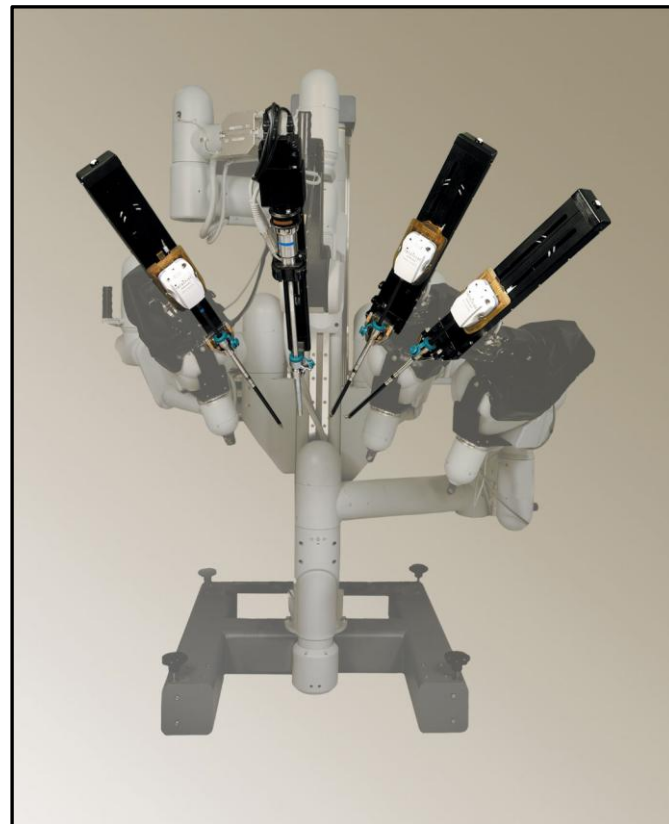
Département de chirurgie cardio-vasculaire et de transplantation d'organes, hôpital Broussais, 96, rue Didot, 75674 Paris cedex 14, France

(Reçu le 21 mai 1998, accepté le 25 mai 1998)

Abstract – The recent development of less invasive intracardiac surgery using small incisions and videoscopic techniques allowed an evaluation of the advantages and limitations of this new approach. Among the limitations was the increased difficulty of the surgical technique when using long instruments through small incisions and ports. We investigated whether computer assisted surgical instruments might bring a solution to this problem. Among the existing systems, we selected the Intuitive System because of two original features. It provides a stable, magnified, three dimensional view of the operating field at a console where the surgeon is seated to operate, and it uses computer assisted instruments having the same dexterity and range of motion as the hand. After 10 months of active work to adapt this system to intracardiac surgery, the first open heart operation using computer assisted instruments was carried out on a 52-year-old woman presenting an aneurysm and a large defect of the atrial septum. The patient was extubated 8 h after the operation, returned to her room 16 h later and was discharged from the hospital 8 d post-operatively with normal heart function and no residual shunt. This preliminary experience showed that computer assisted cardiac surgery is feasible and may open new and promising directions in open heart surgery. (© Académie des sciences / Elsevier, Paris.)

C. R. Acad. Sci. Paris. Sciences de la vie / Life Sciences 1998. 321. 437-442

Carpentier et al: C R Acad Sci III 1998;321:437-42



Děkuji za pozornost !!!!