



# „Evoluce srdečních katetrizací a intervenční kardiologie“

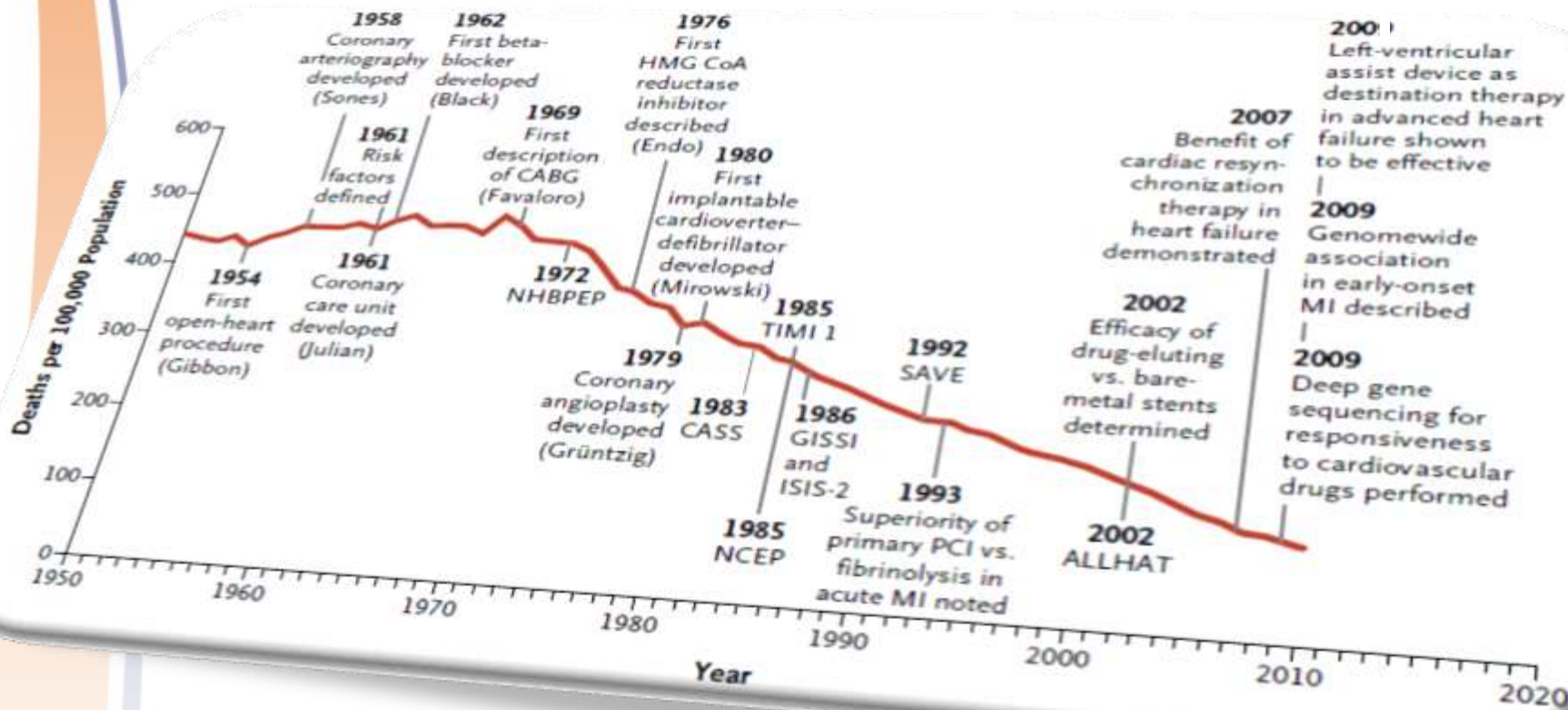
*P. Červinka*

*Krajská zdravotní a.s., Masarykova nemocnice  
v Ústí nad Labem, Klinika kardiologie a UJEP v Ústí nad Labem*

*(Ústí nad Labem 5.6. 2013)*

# Evolve srdečních katetrizací a intervenční kardiologie

## ➤ Snížení kardiovaskulární mortality v závislosti na vědeckém pokroku



ACC/AHA ANNIVERSARY ARTICLE

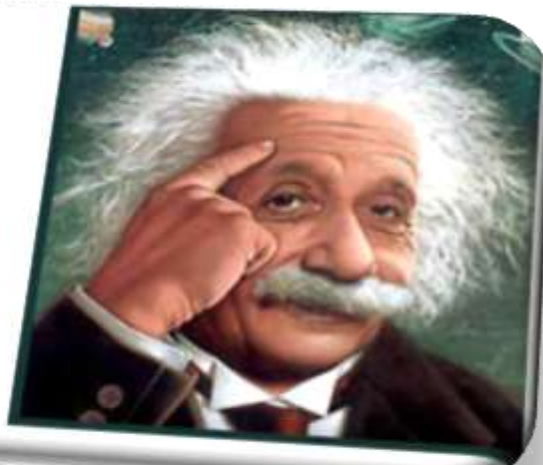
### A Tale of Coronary Artery Disease and Myocardial Infarction

Elizabeth C. Nabel, M.D., and Eugene Braunwald, M.D.  
*N Engl J Med* 2012;366:54-63

## ➤ **HISTORIE**

*Jak vzniká vynález? To všichni vědí, že je něco nemožné, a pak se objeví nějaký blázen, který neví, že je to nemožné, a udělá vynález.,,*

*Albert Einstein*



# Evoluce srdečních katetrizací a intervenční kardiologie

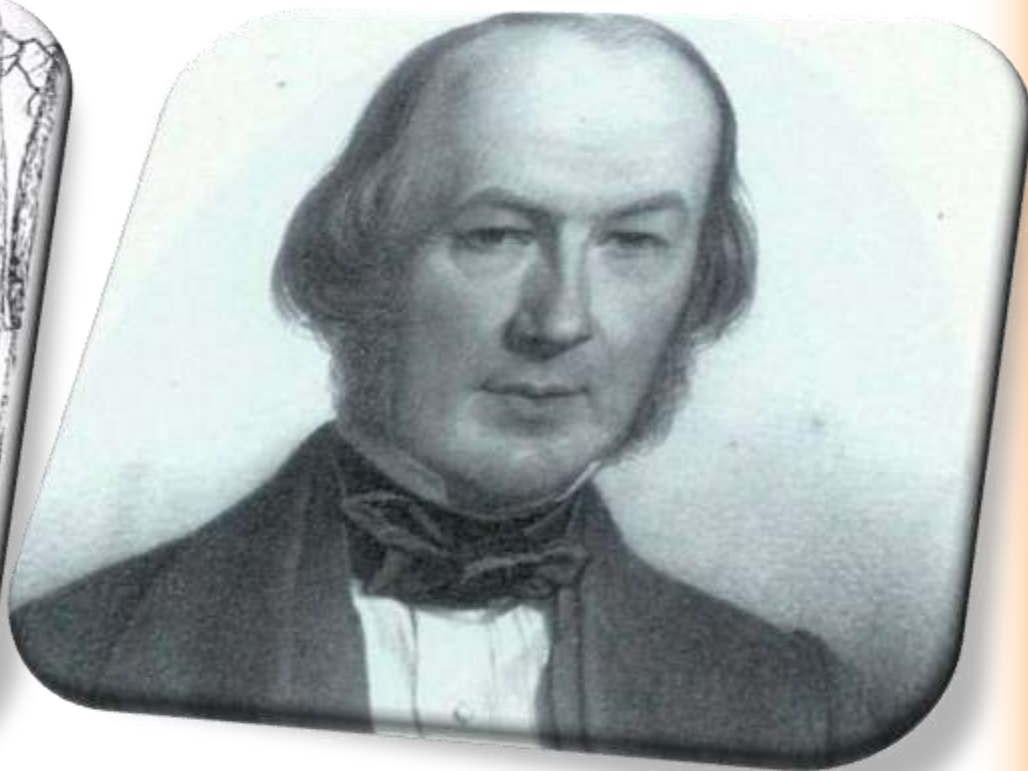
## ➤ 1733 S. Hales

- *kněz se zájmem o biologii*



## ➤ 1740 C. Bernarde

- *zakladatel moderní fyziologie*



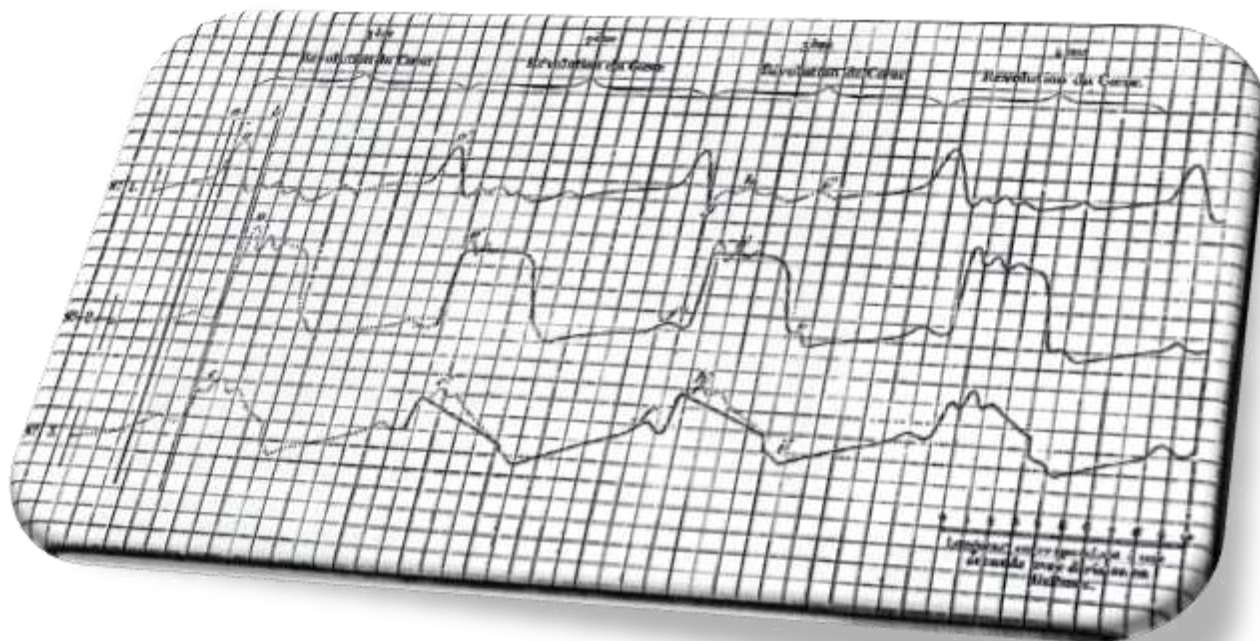
(*Hales S. Statistical assays containing haemostatics. In: Innis W, Manby R, Woodward T; 1733*)

# Evolutione srdečních katetrizací a intervenční kardiologie

*A. Chauveau, E. J. Marey*

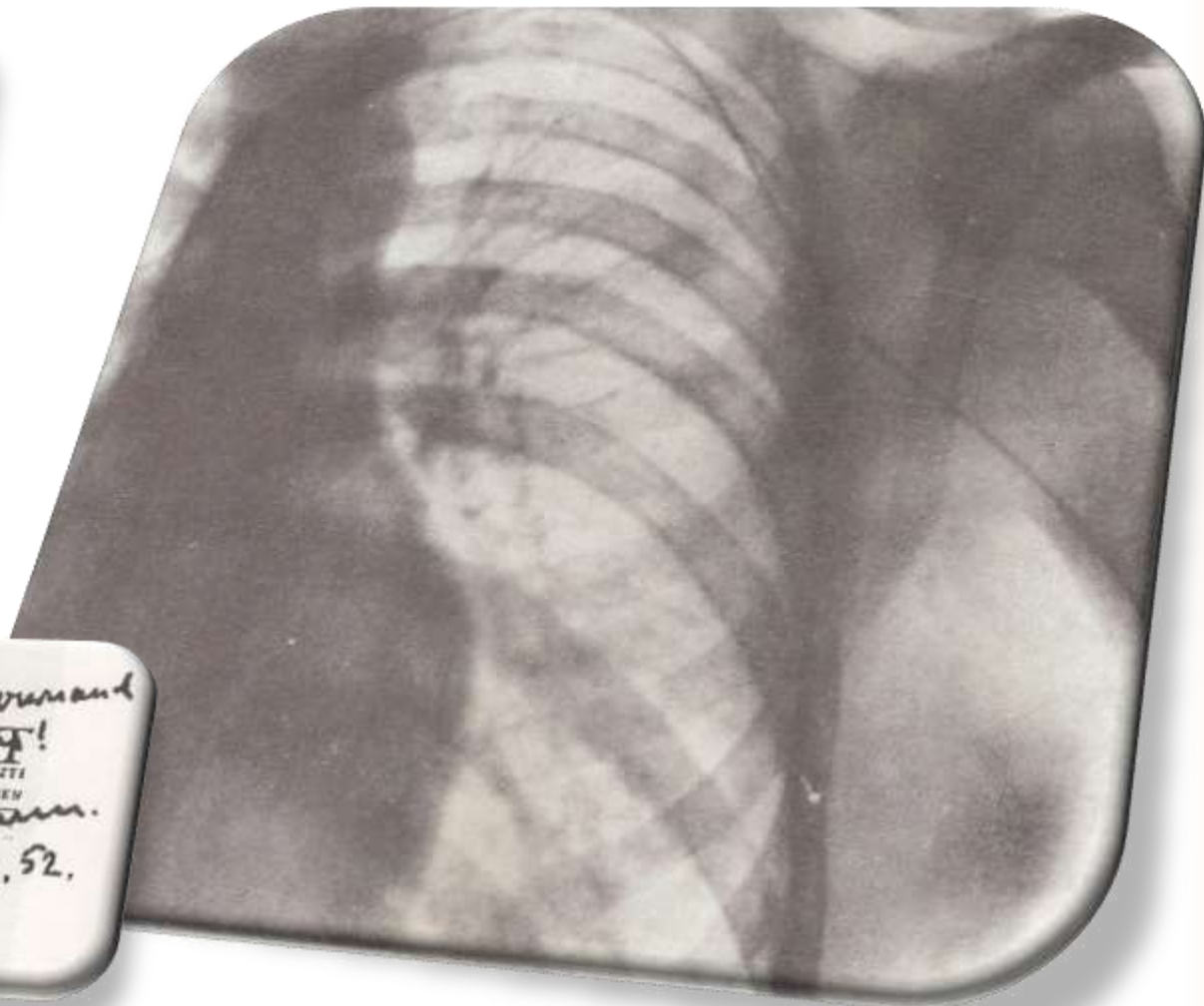


➤ *1861: záznam z pravé síně i komory*



# Evolutione srdečních katetrizací a intervenční kardiologie

- **1929: W. Forssmann si zavedl ureterální katétr cestou levé kubitální žíly do pravé síně a provedl RTG**



# Evoluce srdečních katetrizací a intervenční kardiologie

➤ 1942: A.F.

➤ 1942- /

➤ *Nobelova cena 1956:*



# Evolutione srdečních katetrizací a intervenční kardiologie

## ➤ *F. M. Sones:*

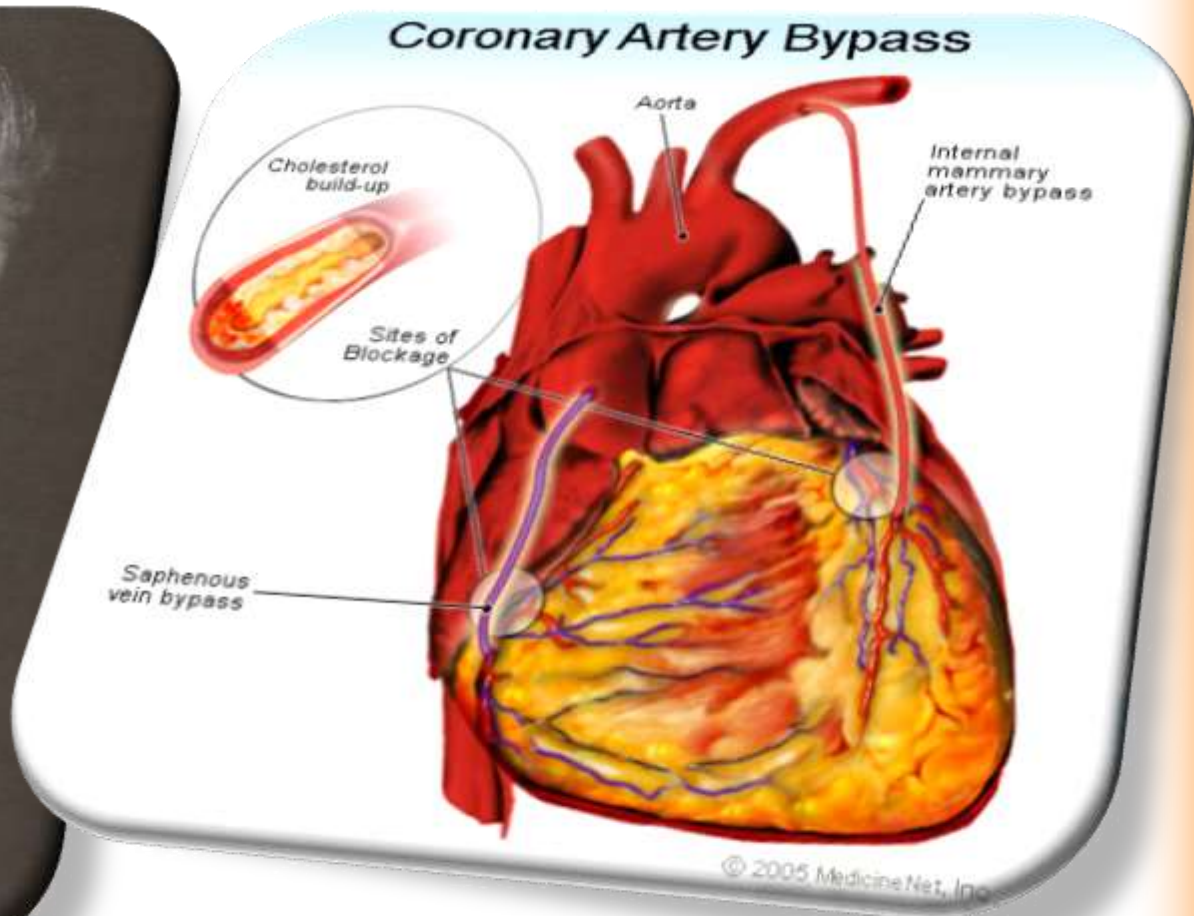
- *1959 selektivní koronarografie*
- *otevřena cesta k diagnostice a léčbě ICHS*





# Evolutione srdečních katetrizací a intervenční kardiologie

- **1967: René Favaloro poprvé provedl aorto-koronární bypass**



# Evolution srdečních katetrizací a intervenční kardiologie

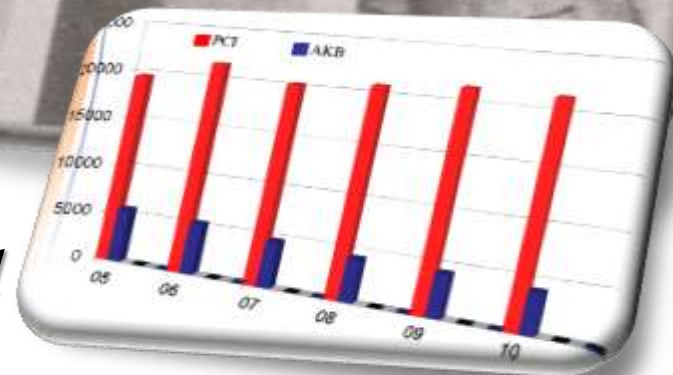
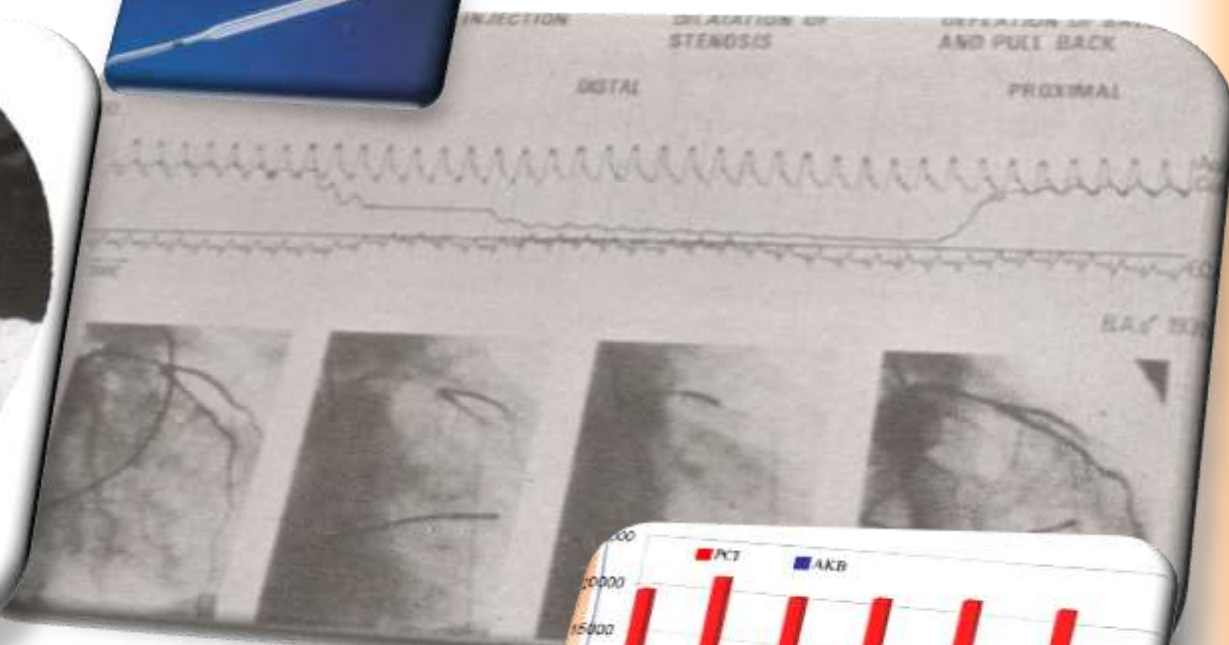
## Koronární intervence

### ➤ **Andreas Gruentzig:**

- 1977 perkutánní transluminální koronární angioplastika (PTCA/PCI)



*Andreas Gruentzig*  
Andreas R. Gruentzig, M.D.

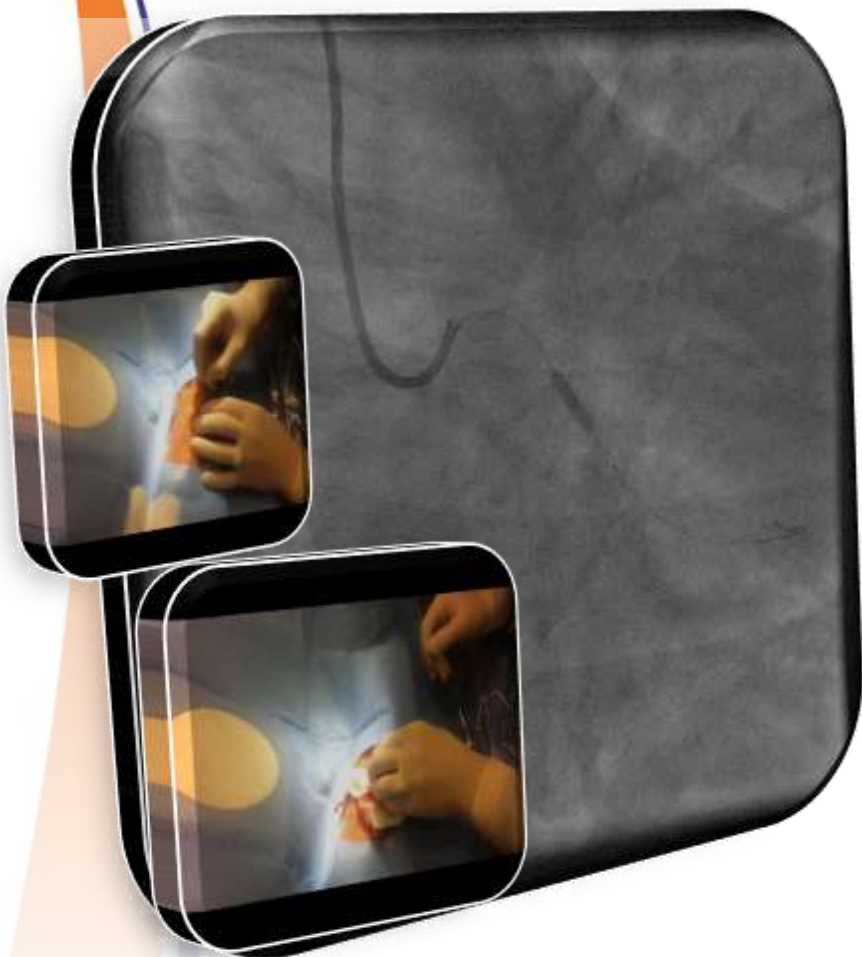


- zásadní přelom v léčbě ICHS
- > 2 miliony výkonů/rok; PCI:AKB 4:1
- >95% implantace stentu (PCI)



# Evolutione srdečních katetrizací a intervenční kardiologie

## ► PCI



- *mortalita <0,5%, IM <1%*



- *krátkodobá hospitalizace  
(ambulantní výkon)*

# Evoluce srdečních katetrizací a intervenční kardiologie

## ➤ 1986: Stenty: U. Sigwart

### Dedicated Bifurcation Stents

#### Balloon Expandable

• Tryton



• Pathfinder



• Twin Rail



• Dolphin



• Sidekick



• Croco/Pax



• Tonic Y



#### Self - Expandable

• Sideguard



• Stentys



• Axxess



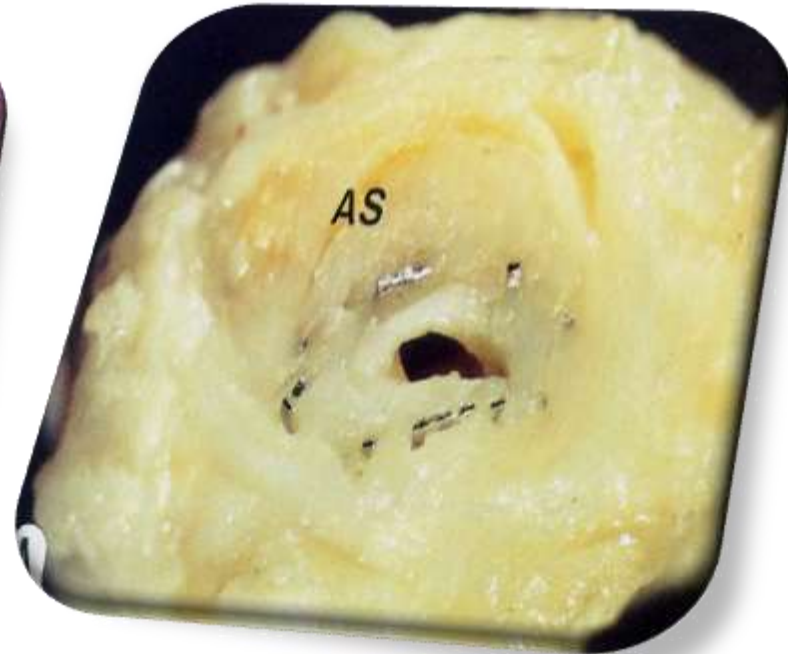
▪ ... (proplac) pře (kludující) disekci tepny /pokles urgentních AKB/

▪ Duální antiagregace (kyselina acetylsalicylová + ticlopidin) až 10% subakutních tromboz stentů během 2 týdnů



# Evolutione srdečních katetrizací a intervenční kardiologie

## ➤ *Achillovou patou PTCA/PCI = restenóza*



- *Pozdní a narůstající zúžení lumen*
- *Po PTCA 40-45%, stenty 15-25%*
- *Celá řada přístupů ve snaze ovlivnit restenózu po PCI*



# Evolve srdečních katetrizací a intervenční kardiologie

## ➤ „Brachytherapie“/Radioaktivní stenty

### Brief Rapid Communication

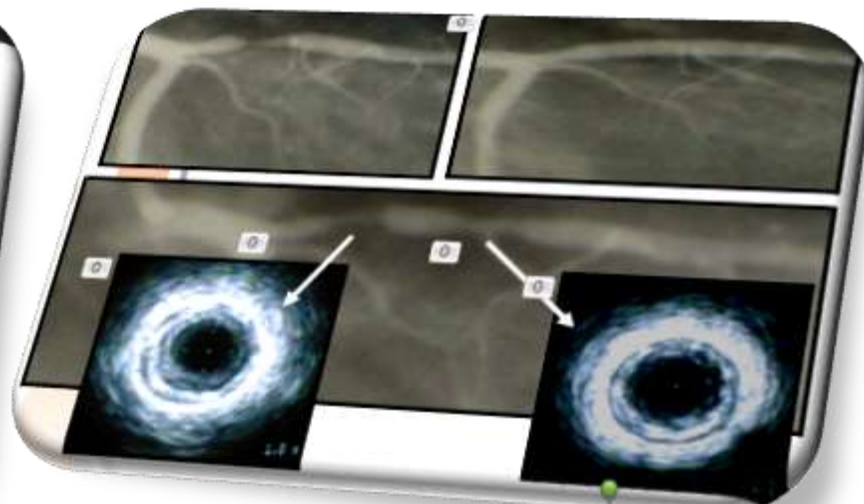
#### Late Coronary Occlusion After Intracoronary Brachytherapy

Marco A. Costa, MD, Mabel Sabaté, MD, Wim J. van der Giessen, MD, PhD, I. Patrick Kay, MBChB, Pavel Cervinka, MD, Jürgen M.R. Ligthart, BSc, Pedro Serrano, MD, Veronique L.M.A. Coen, MD, Peter C. Levendag, MD, PhD, Patrick W. Serruys, MD, PhD

**Background**—Intracoronary brachytherapy appears to be a promising technology to prevent restenosis. Presently, limited data are available regarding the late safety of this therapeutic modality. The aim of the study was to determine the incidence of late (>1 month) thrombosis after PTCA and radiotherapy.

**Methods and Results**—From April 1997 to March 1999, we successfully treated 108 patients with PTCA followed by intracoronary  $\beta$ -radiation. Ninety-one patients have completed at least 2 months of clinical follow-up. Of these patients, 6.6% (6 patients) presented with sudden thrombotic events confirmed by angiography 2 to 15 months after intervention (2 balloon angioplasty and 4 stent). Some factors (overlapping stents, unhealed dissection) may have triggered the thrombotic process, but the timing of the event is extremely unusual. Therefore, the effect of radiation on delaying the healing process and maintaining a thrombogenic coronary surface is proposed as the most plausible mechanism to explain such late events.

**Conclusions**—Late and sudden thrombosis after PTCA followed by intracoronary radiotherapy is a new phenomenon in interventional cardiology. (*Circulation*. 1999;100:789-792.)



#### Intravascular ultrasound study of the effect of beta-emitting ( $^{60}\text{Co}$ ) stents on vascular remodeling and intimal proliferation.

Genina P, Stávek J, Costa MA, Stursa J, Fiser M, Vodnansky P, Kodrová M, Veselka J, Pleskot M, Malý J.

#### Abstract

The aim of this study was to evaluate vessel remodeling after implantation of high-activity (mean,  $41.1 \pm 1.2$  microCi) beta-emitting ( $^{60}\text{Co}$ ) stents. Proton bombarding in cyclotron has brought the radioactivity. Intravascular ultrasound (IVUS) investigation has been completed in 10 patients. The angiographies performed at 6 months revealed restenosis > 50% in five cases (50%). IVUS analysis demonstrated an absence of remodeling behind the stent, with no changes in total vessel volume (TVV;  $353.6 \pm 126.3$  and  $343.9 \pm 90.6$  mm<sup>3</sup>) or plaque + media volume (PMV;  $171.7 \pm 57.4$  and  $166.8 \pm 42.6$  mm<sup>3</sup>). On the other hand, lumen volume (LV) within the stent decreased significantly from  $181.9 \pm 80.2$  to  $154.6 \pm 45.2$  mm<sup>3</sup> ( $P < 0.02$ ). This was due to presence of neointimal hyperplasia (NIH) at both extremities of implanted stents. No chronic recoil of the implanted stents was found. The analysis of edges (5 mm distally and proximally to the last stent struts) showed no significant changes in TVV ( $187.3 \pm 62.60$  and  $176.9 \pm 53.5$  mm<sup>3</sup>), but PMV increase significantly from  $61.9 \pm 31.2$  to  $82.2 \pm 43.4$  mm<sup>3</sup> ( $P < 0.04$ ) and LV decreased from  $125.2 \pm 40.7$  to  $84.7 \pm 22.0$  mm<sup>3</sup> ( $P < 0.02$ ). In conclusion, single  $^{60}\text{Co}$  radioactive beta-emitting stents with high initial activity are effective in reducing neointimal hyperplasia only within the stent body, as measured by IVUS, and they do not solve the problem of restenosis at the stent extremities as well as at the stent edges. Edge restenosis in this high radioactive stents was mainly (from 66%) due to neointimal proliferation.

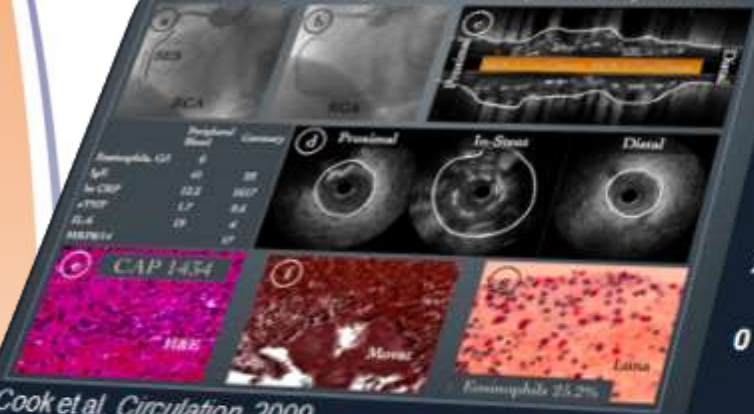


# Evoluce srdečních katetrizací a intervenční kardiologie

## ➤ Lékové stenty („drug eluting stents“)

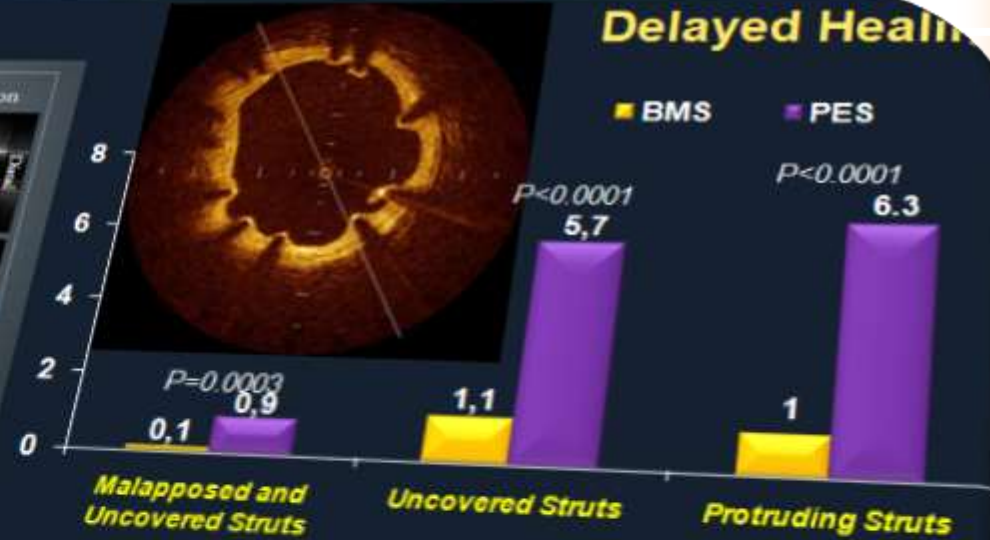
### Eosinophilic Infiltrates

#15, ♀, 75 y.o., Very Late ST 790 days after Implantation



Cook et al. Circulation 2009

### Delayed Healing



Guagliumi et al. Circulation 2011

### Vessel Remodeling



et al. Circulation 2007

### Neoatherosclerosis



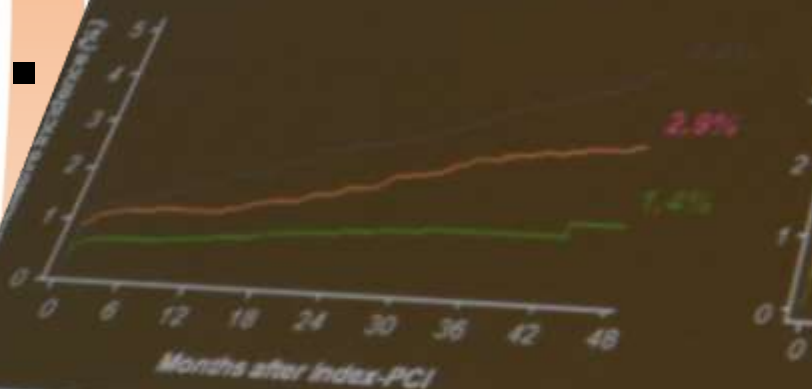
Nakazawa JACC

# Evoluce srdečních katetrizací a intervenční kardiologie

## ➤ Lékové stenty 2. generace

### Bern-Rotterdam Cohort Study EES vs. SES vs. PES: Stent Thrombosis (ST)

Definite Stent Thrombosis at 4 Years



Very Late Stent Thrombosis (Year 1-4)



EES vs. SES HR = 0.41, 95% CI 0.27-0.62, P < 0.0001  
SES vs. PES HR = 0.33, 95% CI 0.23-0.48, P < 0.0001

EES vs. SES HR = 0.33, 95% CI 0.15-0.72, P = 0.006  
SES vs. PES HR = 0.24, 95% CI 0.13-0.47, P < 0.0001

— Drug-eluting stent

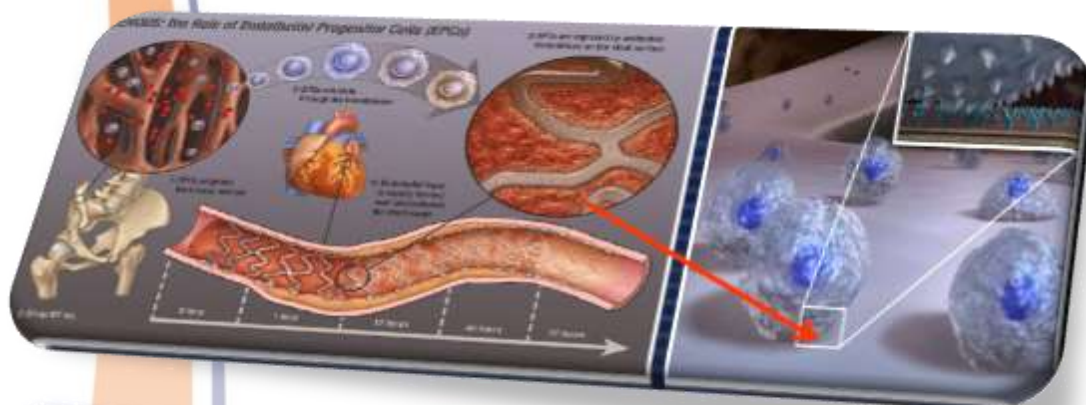
— Bare-metal stent



# Evoluce srdečních katetrizací a intervenční kardiologie

## Vychytávání endoteliálních progenitorových buněk (EPC)

- *imobilizované myši CD34 protilátky proti EPC*
- *mobilizací vlastních EPC v místě poranění cévy, stentu=akcelerace endotelizace*



**ACC.09 Summit**  
Saturday, March 28, 2009

TIME	Late Breaking Clinical Trials I
PLACE	Saturday, March 28, 2009, 8:30 a.m. – 10:00 a.m.
2402	Orange County Convention Center, Room W415

CME/CE Hours: 1.5

Co-Moderators: Martin B. Leon, New York, NY  
Spencer B. King, III, Atlanta, GA

Panelists: David P. Faxon, Boston, MA  
Richard J. Shemin, Boston, MA

9:10  
**A Randomized Comparison of Genous Stent Versus Chromium-Cobalt Stent for Treatment of ST-Elevation Myocardial Infarction. A 6-Month Clinical, Angiographic and IVUS Follow-Up. GENIUS-STEMI Trial — Pavel Cervinka, Marian Bystrov, Radim Spacek, Martin Kvanak, Josef Jakabcin, Department of Cardiology, Masaryk Hospital, Ústí nad Labem, Czech Republic.**

Commentator — Jeffrey J. Popma, Boston, MA

**The heart of the matter**  
FROM THE ACC.09 IN THE GENIUS-STEMI TRIAL FOR PROMISING



**Small Study Supports Use of Endothelial Progenitor Cell-Capturing Stents**

**Stent News**  
Small Trial for Innovative 'Healing' Stent Contradicts Findings from Larger Studies

**Stent News**  
Small Trial for Innovative 'Healing' Stent Contradicts Findings from Larger Studies

**Randomized comparison of endothelial progenitor cells capture stent versus cobalt-chromium stent for treatment of ST-elevation myocardial infarction. Six month clinical, angiographic, and IVUS follow-up.**

**Purpose:** The aim of this trial was to assess the feasibility and safety of endothelial progenitor cells capture (EPC) stent in the treatment of acute ST-elevation myocardial infarction (STEMI) when compared with cobalt-chromium stents (CoCr).

**Methods:** Between July 2008 and May 2009, 100 patients with single vessel disease undergoing primary PCI for STEMI were randomly assigned to receive either EPC stent (n = 50) or CoCr stent (n = 50). High-pressure stent implantation was carried out in both groups. Dual antiplatelet treatment was administered for 30 days in both groups. All patients underwent 6 month clinical, angiographic, and IVUS follow-up.

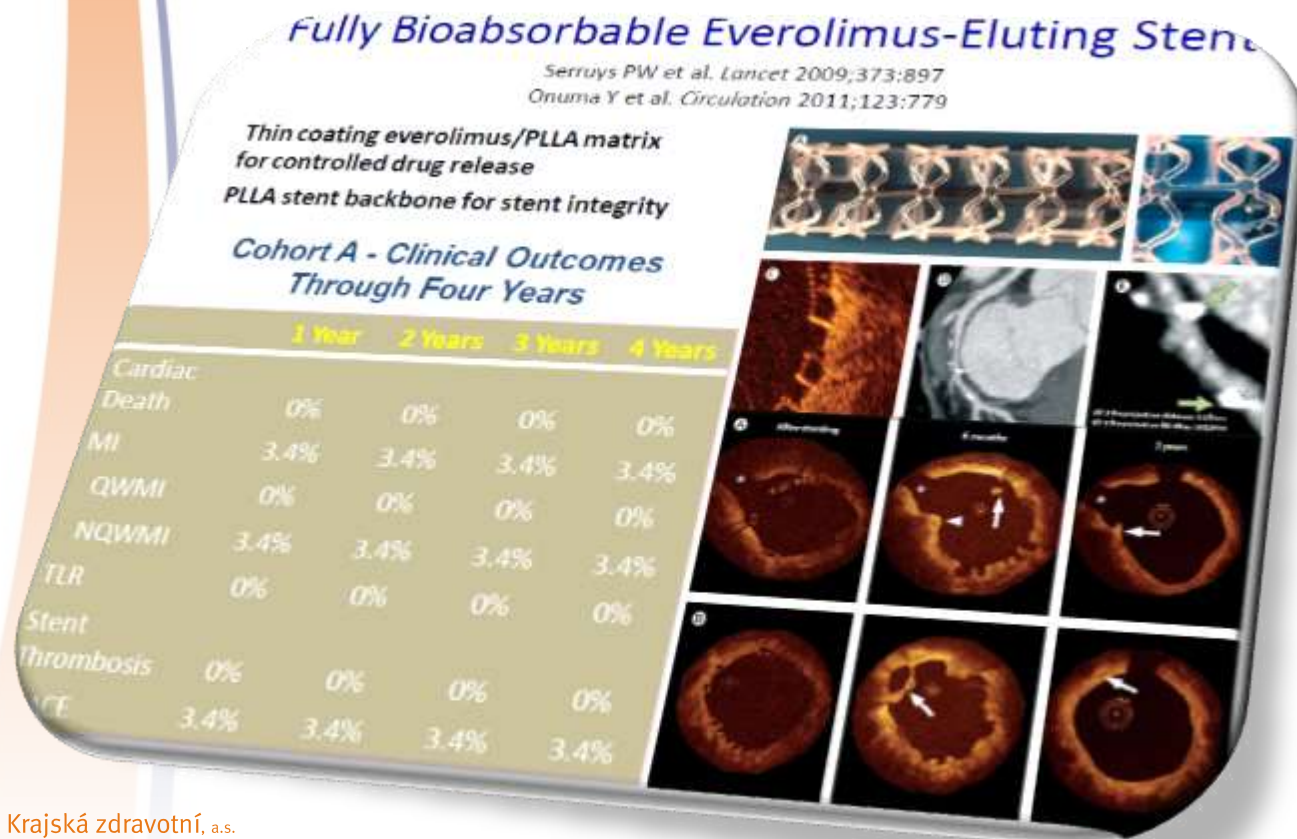
**Results:** The rate of major adverse cardiovascular events (MACE) at 30 days was comparable in both groups. At 6-month follow-up, the rates of MACE and TLR in the EPC stent group when compared with CoCr stent were 26% vs 10%, P = 0.06 and 14% vs 4%, P = 0.02, respectively. There were three cases (6%) of stent thrombosis (ST) in the EPC stent group versus none in CoCr group.

**Conclusion:** The use of EPC capture stents in the setting of STEMI is feasible and safe in terms of 30-days outcome. However, at the 6-month follow-up, we found a trend of higher rates of MACE and TLR in the EPC stent capture group compared to CoCr stents. The study does not support the use of EPC capture stents with short duration dual antiplatelet therapy in patients with STEMI. Future randomized studies with large sample size will be necessary to demonstrate the safety of such approach. © 2010 Wiley-Liss, Inc.

# Evolve srdečních katetrizací a intervenční kardiologie

## ➤ Budoucnost: Biodegradabilní stenty

- uvolní aktivní látku a jsou degradovány (do 24 měsíců)
- není nebezpečí TS
- není nutnost dlouhodobé duální protidestičkové léčby
- není trvale rigidní kov=návrat vasomotorických vlastností ...

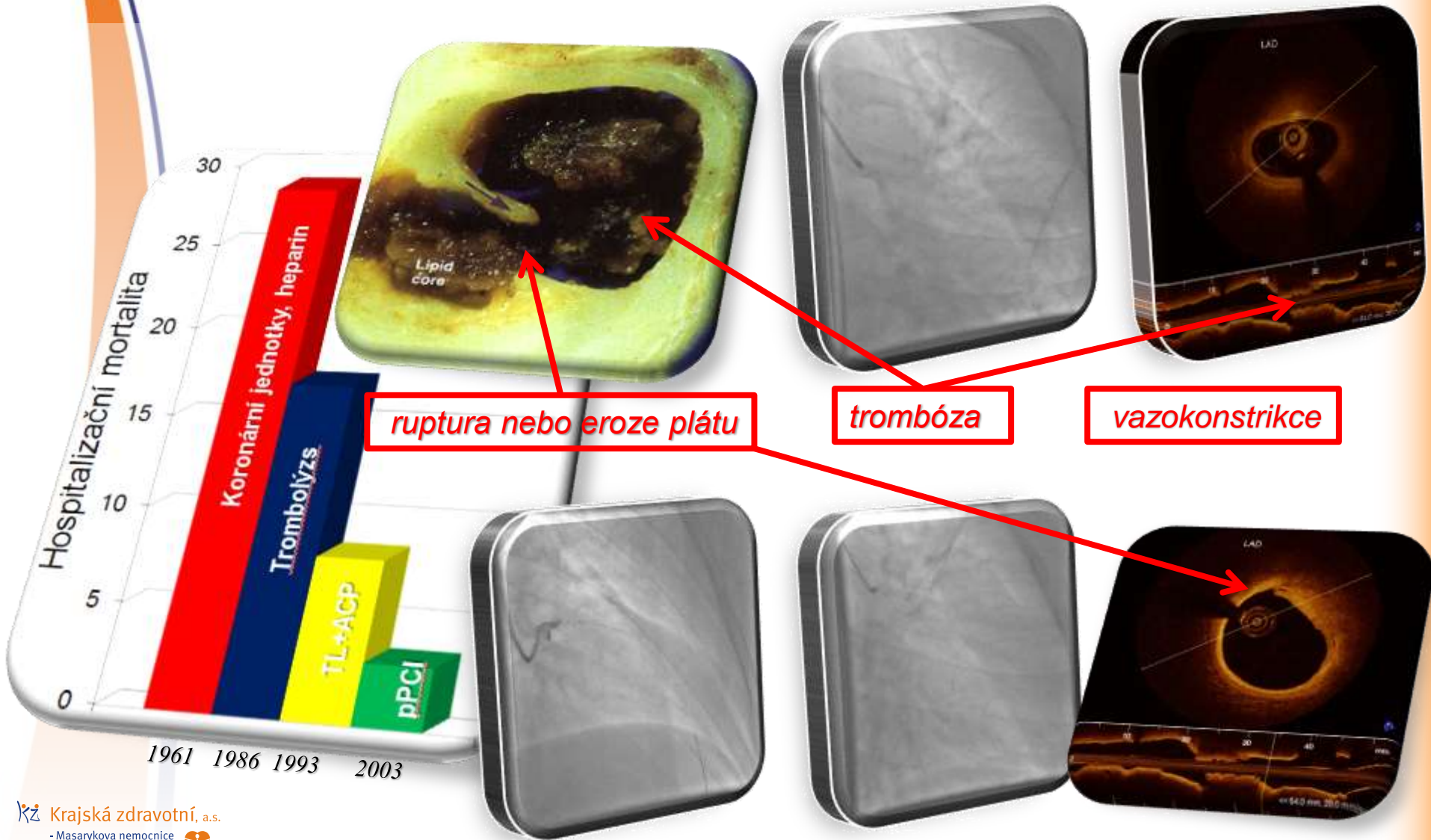


Igaki-Tamai	Hirota	Abbott Vascular
PLLA	Magnesium alloy	PLLA
NA	NA	Everolimus
•Zigzag design •Heated balloon deployment	•High collapse pressure •Low elastic recoil	•80% drug release @ 30days

Bioabsorbable Therapeutics, Inc.	REVA Medical
PAE salicylic acid / Sirolimus	Poly (DTE carbonate) Paclitaxel
•Anti-inflammatory effect	•Radio-opaque •Ratchet lock design

# Evoluce srdečních katetrizací a intervenční kardiologie

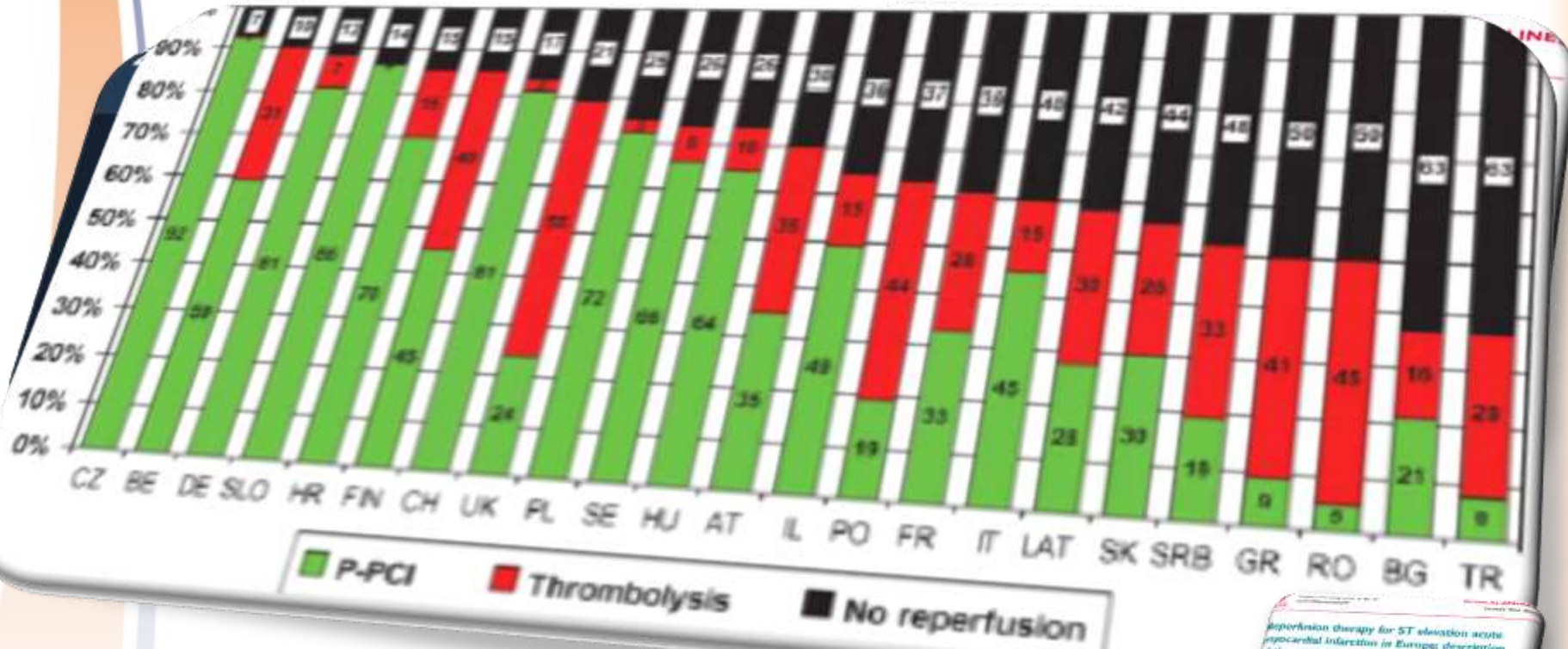
## ➤ Léčba infarktu myokardu: Primární (direktní PCI)



# Evoluce srdečních katetrizací a intervenční kardiologie

## ➤ Primární PCI

- Otevření tepny (TIMI 3 flow): - TL 50-70%; - dPCI >90%



Reperfusion therapy for ST elevation acute myocardial infarction in Europe: description of the current situation in 30 countries

See Website: [http://www.escap.org/ST-Elevation-Myocardial-Infarction](#)

# Evoluce srdečních katetrizací a intervenční kardiologie

## Nekoronární intervence

- ***Přístup do levého srdce transseptálním přístupem:***
  - *Ross J Jr, et al. Ann Surg 1959*
  - *Cope C, et al. J Thorac Surg 1959*



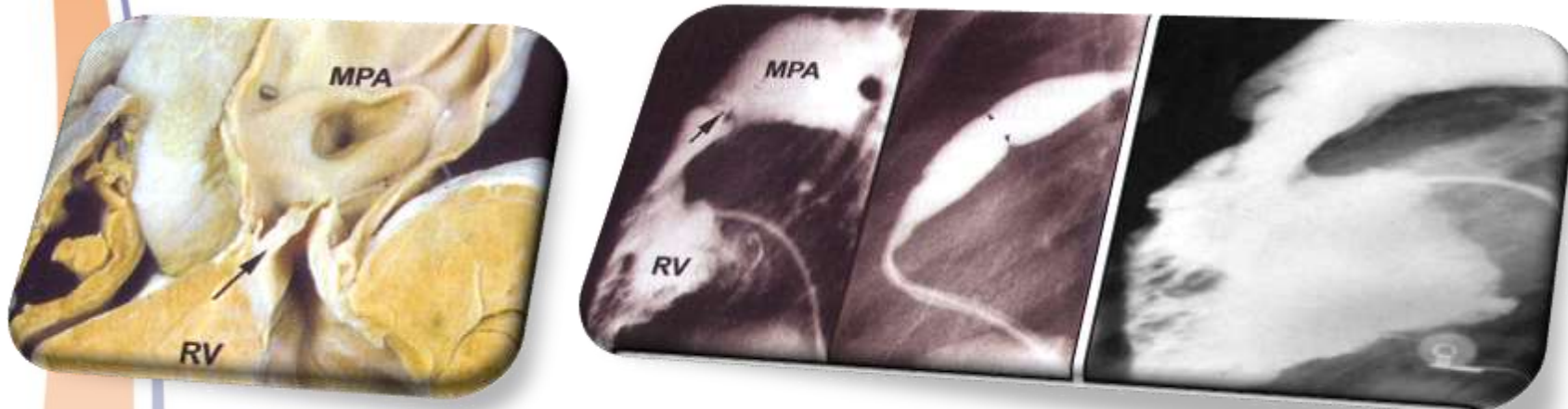
- *Steinhart L, Endrys J. Fortschr. Rontgenstr 1960*



# Evolutione srdečních katetrizací a intervenční kardiologie

## Chloňové vady - stenozující

- *Khan 1982: valvuloplastika chloňe plicnice*

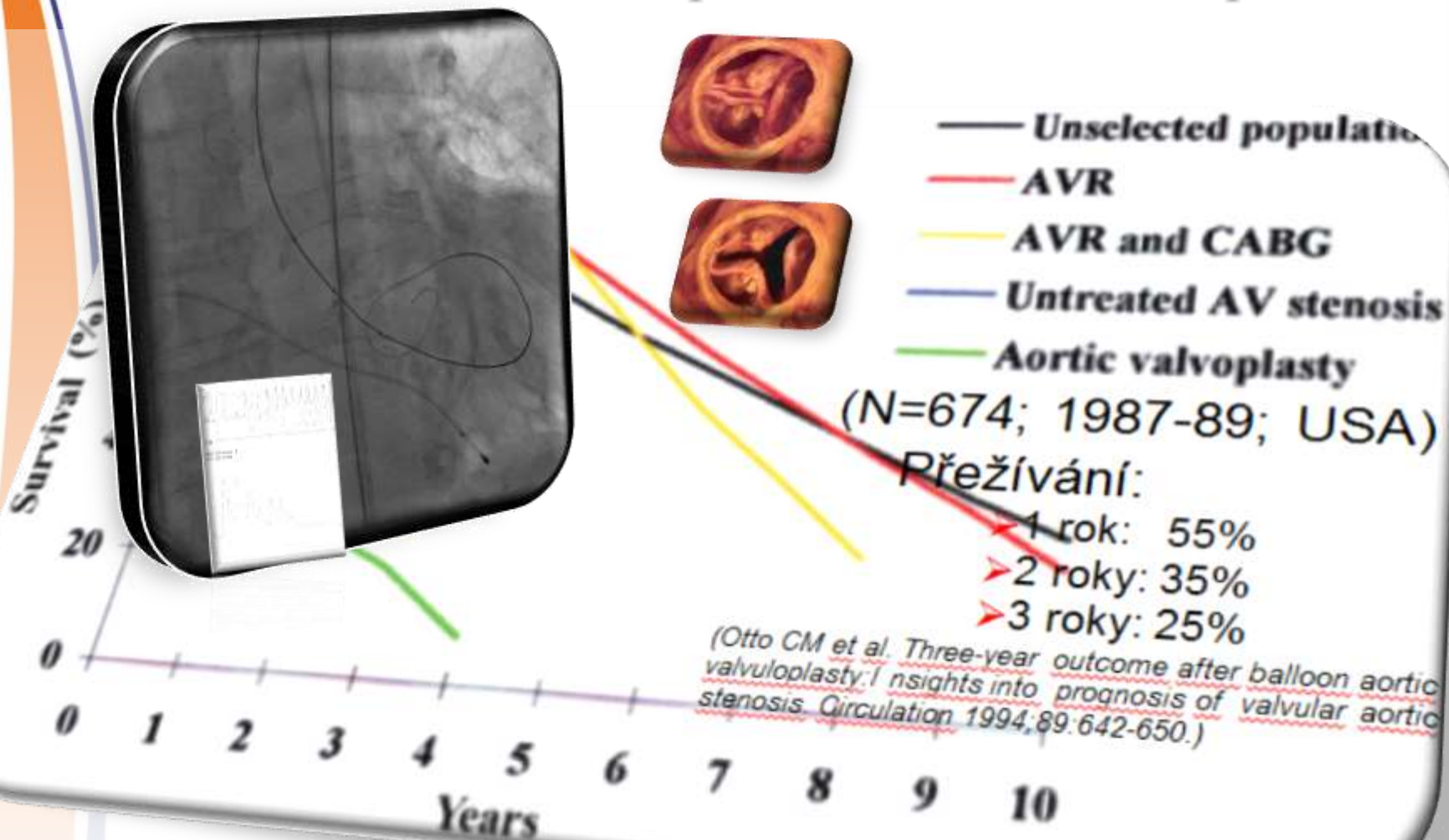


- *Inoue 1984: valvuloplastika mitrální chloňe*



# Evoluce srdečních katetrizací a intervenční kardiologie

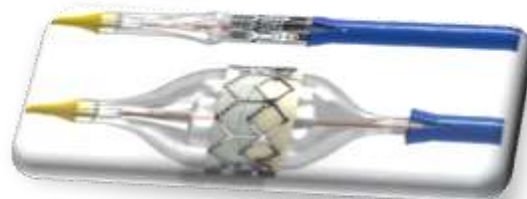
- *Labidi 1983: valvuloplastika aortální chlopně*



# Evolutione srdečních katetrizací a intervenční kardiologie

## ➤ A. Cribier 4/2002: *perkutánní náhrada aortální chlopně u inoperabilního nemocného (TAVI)*

### ▪ *The Edwards SAPIEN<sup>XT</sup>*





# Evolutione srdečních katetrizací a intervenční kardiologie

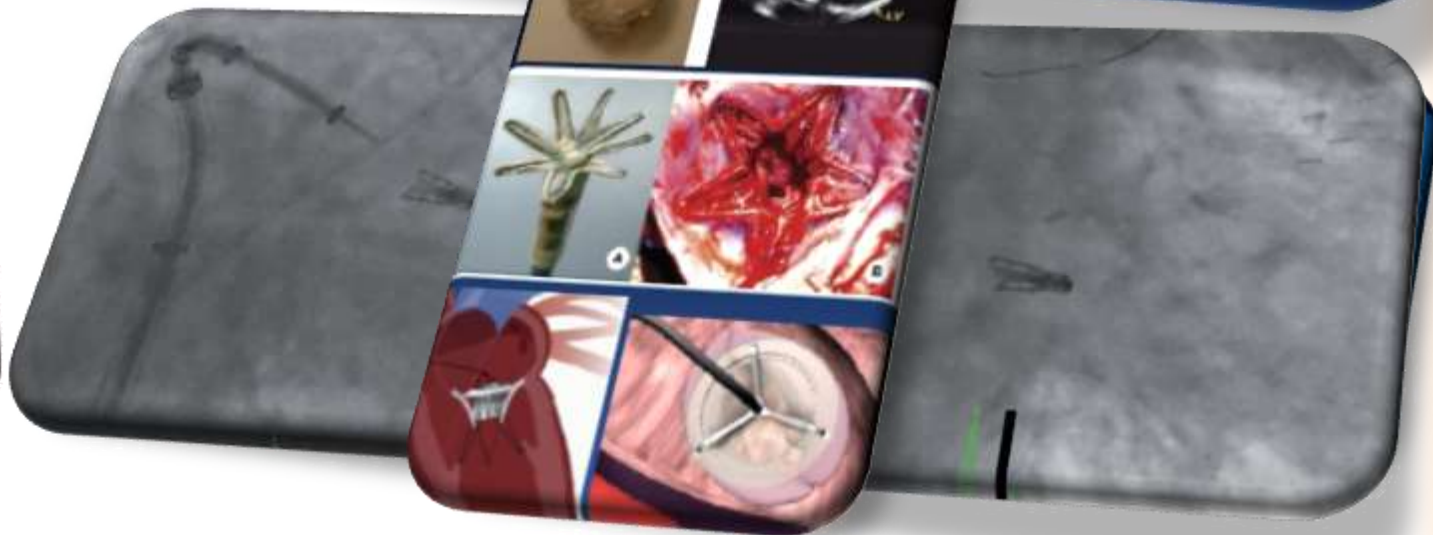
CAUTION!

CARDIOLOGISTS MAY BE CLOSER  
THAN THEY APPEAR



# Evoluce srdečních katetrizací a intervenční kardiologie

## ➤ *Chlopňové vady – mitrální regurgitace*



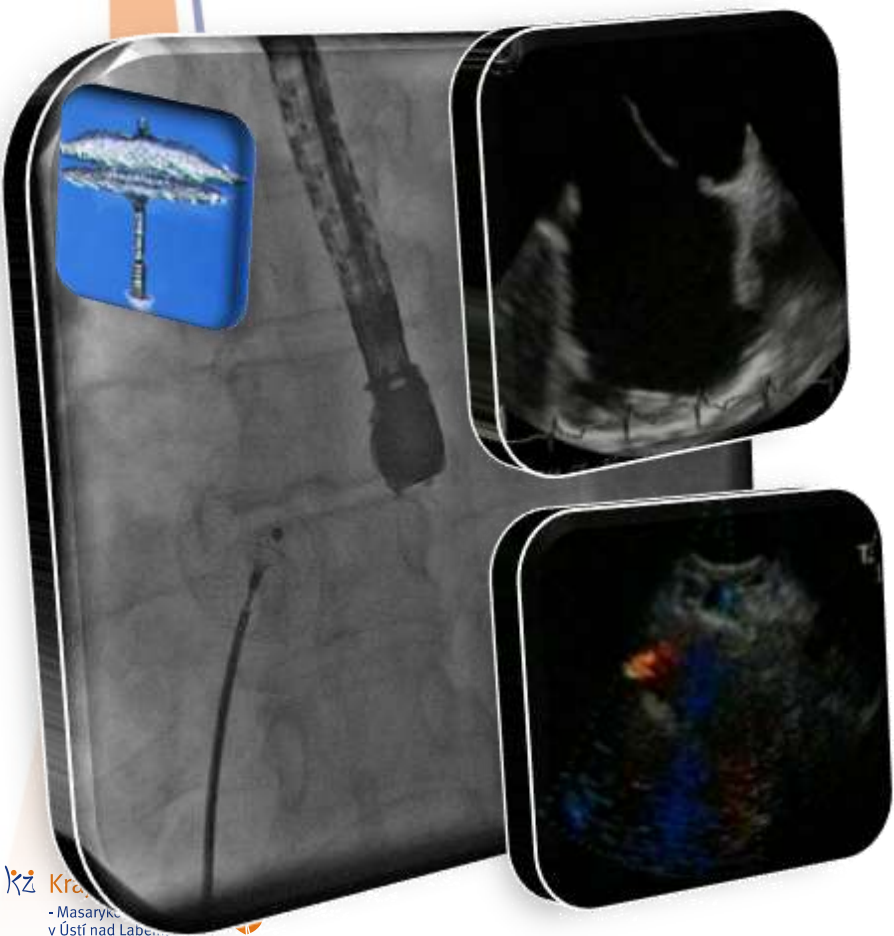
# Evoluce srdečních katetrizací a intervenční kardiologie

## ➤ *Vrozené srdeční vady*

- *Amplatzerův okluder 1996*

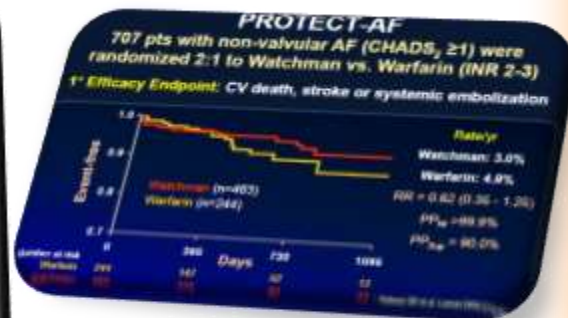
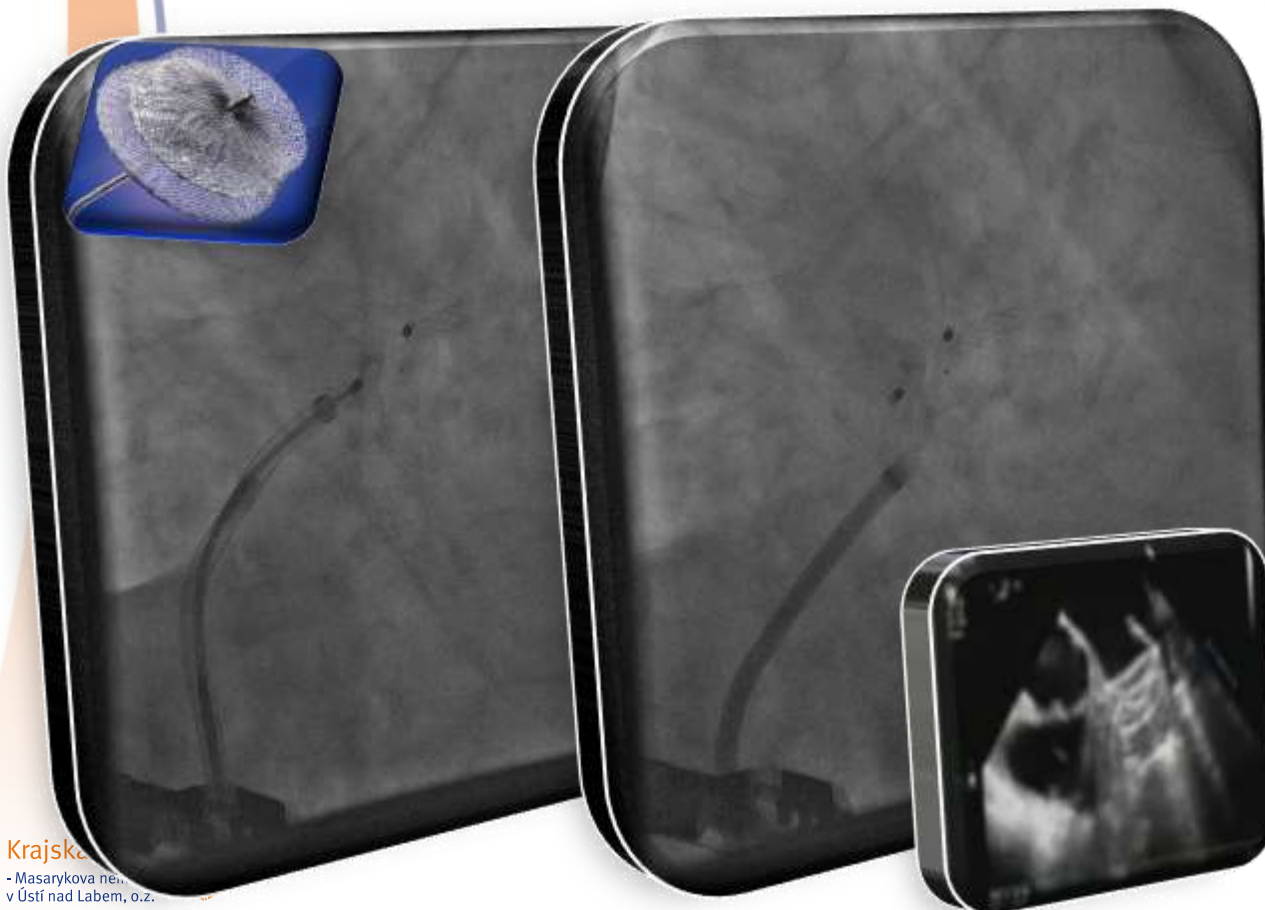
*Uzávěr DSS*

*Uzávěr Botallovy dučeje*



## Uzávěr ouška levé síně

- FS je nejčastější arytmií
- 5x vyšší riziko CMP; 15-20% CMP ve vztahu k FS
- 90% trombů v oušku LS
- KI antikoagulační léčby



**RE-LY: Dabigatran versus Warfarin in Patients with Atrial Fibrillation**  
18,113 pts with AF + ≥1 other risk factor were randomized 1:1 to dabigatran 110 mg bid vs. warfarin (INR 2-3)

Major Bleeding

	D 110mg Annual rate	D 150mg Annual rate	Warfarin Annual rate	D 110mg vs. Warfarin RR (95% CI)	P	D 150mg vs. Warfarin RR (95% CI)	P
Major or minor	11.0%	10.4%	10.2%	0.79-0.83	<0.001	0.85-0.91	0.002
Major	2.7%	2.1%	1.4%	0.60	<0.001	0.67-0.93	0.04
Life-threatening	1.7%	1.1%	1.0%	0.55-0.63	<0.001	0.66-0.99	0.04
Haemorrhagic	0.1%	0.1%	0.4%	0.17-0.30	<0.001	0.18-0.49	<0.001
Major GI	1.1%	1.1%	1.0%	1.0	0.43	1.19-1.08	<0.001

Conolly SJ et al. N Engl J Med. 2009; 361:1139-1151

# Evolve srdečních katetrizací a intervenční kardiologie

## ➤ Závěr:

- Intervenční kardiologie je důležitou součástí moderního kardiologického ošetření.  
Primary PCI is the Reason to be an Interventional Cardiologist!



Diagnostika  
Genetik

# Evolutione srdečních katetrizací a intervenční kardiologie

## Poděkování:

- profesor MUDr. Vladimír Pidrman, DrSc.



- profesor MUDr. Jaroslav Malý, CSc.



- profesor MUDr. Zbyněk Hrnčíř, DrSc

- svým nejbližším: manželce Miše, dětem Štěpánce, Tadeáškoví a Terezce



- kolegům FN HK a MN UL

