SUBKUTÁNNÍ IMPLANTABILNÍ KARDIOVERTERY - DEFIBRILÁTORY

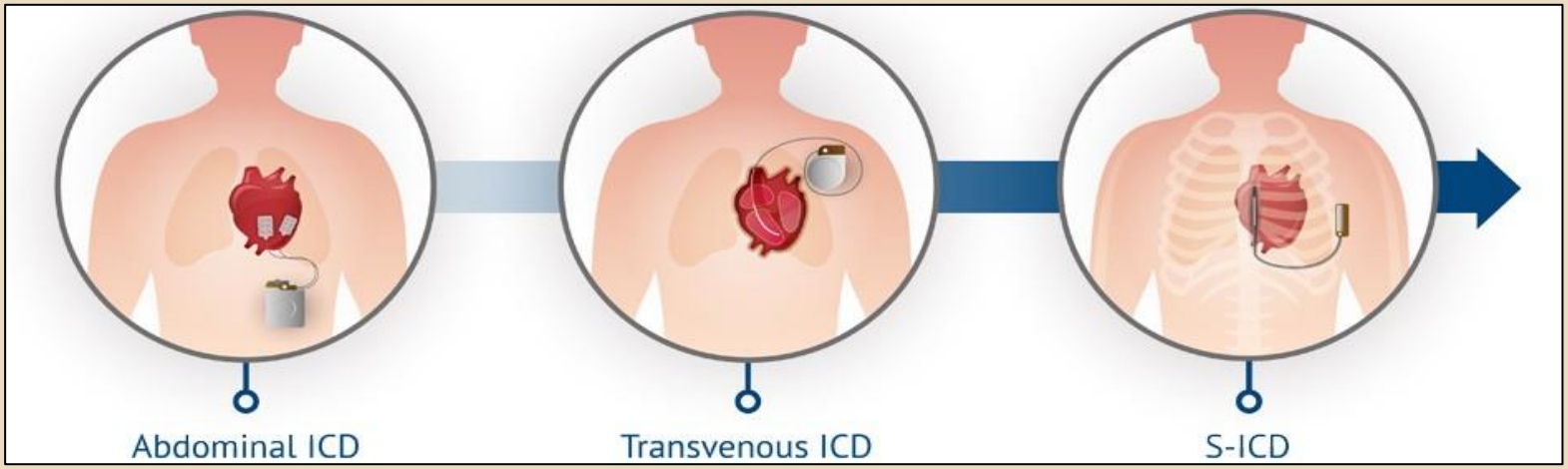
L.Křivan

IKK FN Brno

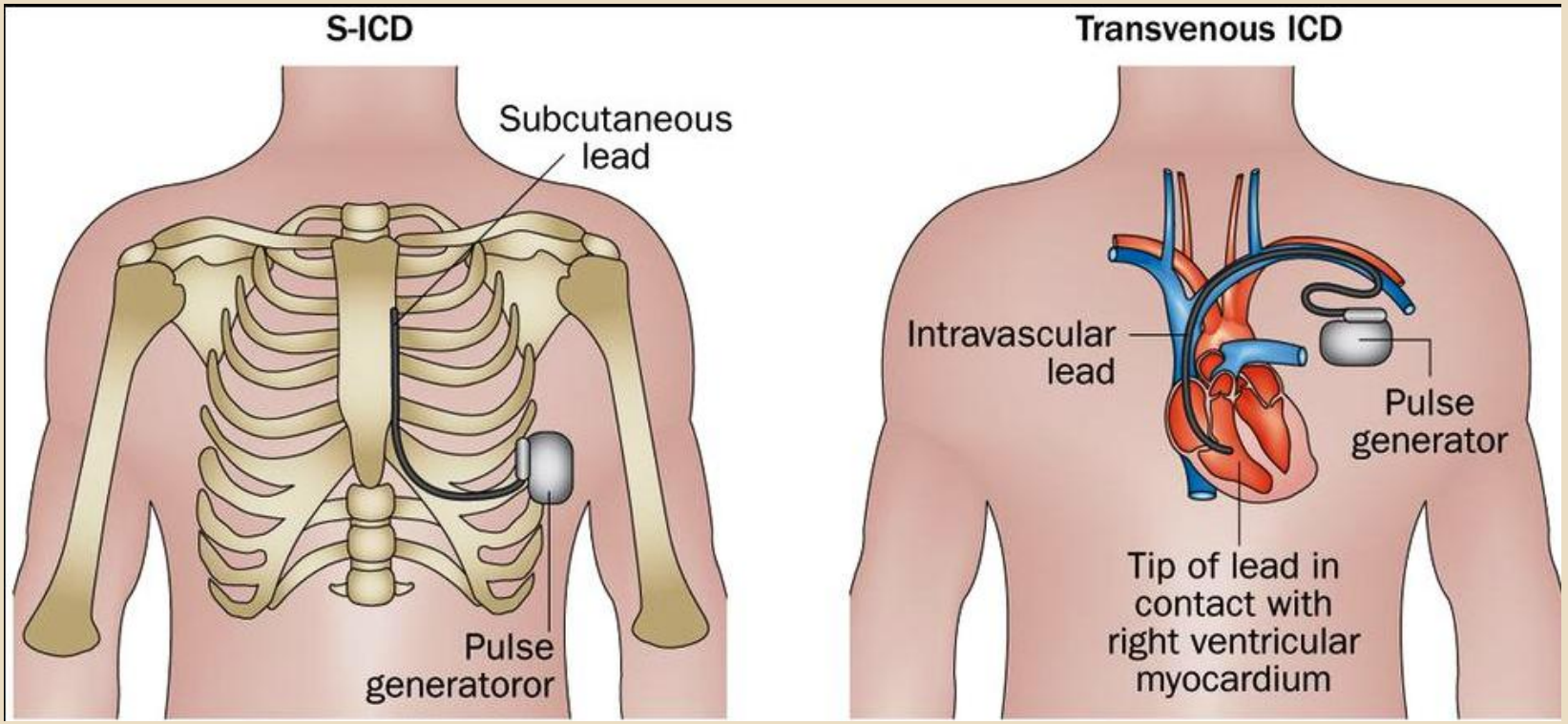
LF MU Brno

Historie

- 1970 - Mirowski automatický standby defibrilátor u zvířat
- 1970 – První subkutánní defibrilátor u psů
- 1980 – Mirowski ICD u prvních 3 pacientů
- 1984 – první implantace v ČR
- Současnost – USA > 100.000 implantací ročně
- Přelom tisíciletí – použití S – ICD u nemocných



USA registr 2012-2015



3.717

393.734

Komplikace TV ICD

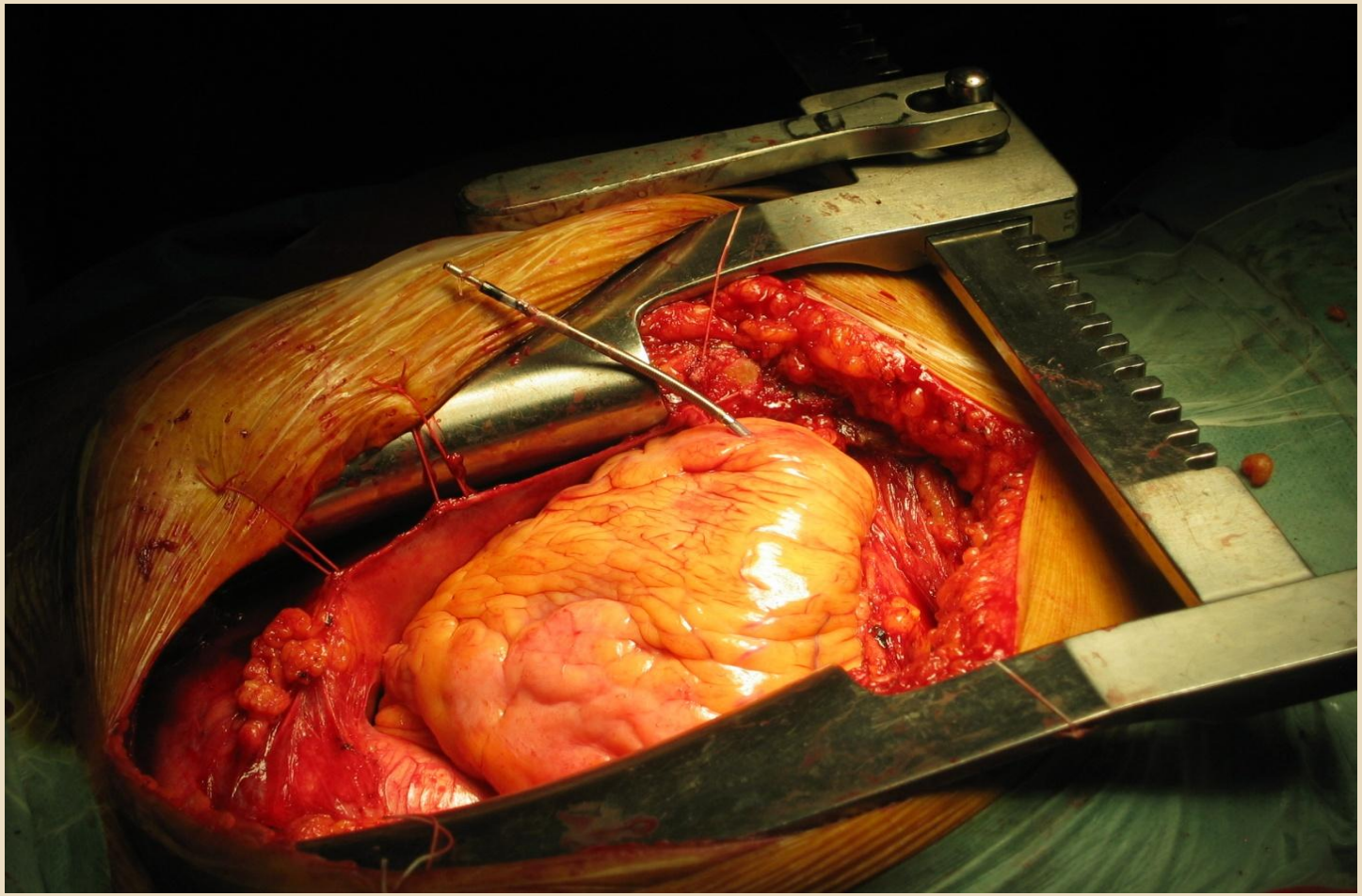
- Trombóza žilního systému 0,5 – 3%
- Stenóza žilního systému 7%
- Infekce, IE 2 - 8%
- Displacement elektrody 1,7%
- Perforace myokardu 0,4 - 2%
- Nutnost revize RV elektrody 6,5% / 2 roky 13% / 5 let

Křivan L., Kozák M., Vlašínová J.,Sepši M. PACE 2008;31(1), 3–6
Duray GZ., Europace (2009) 11, 297–302
Kozák M., Sepši M., Křivan L., Vlašínová J.Cardiol 2002;11(4):259-263

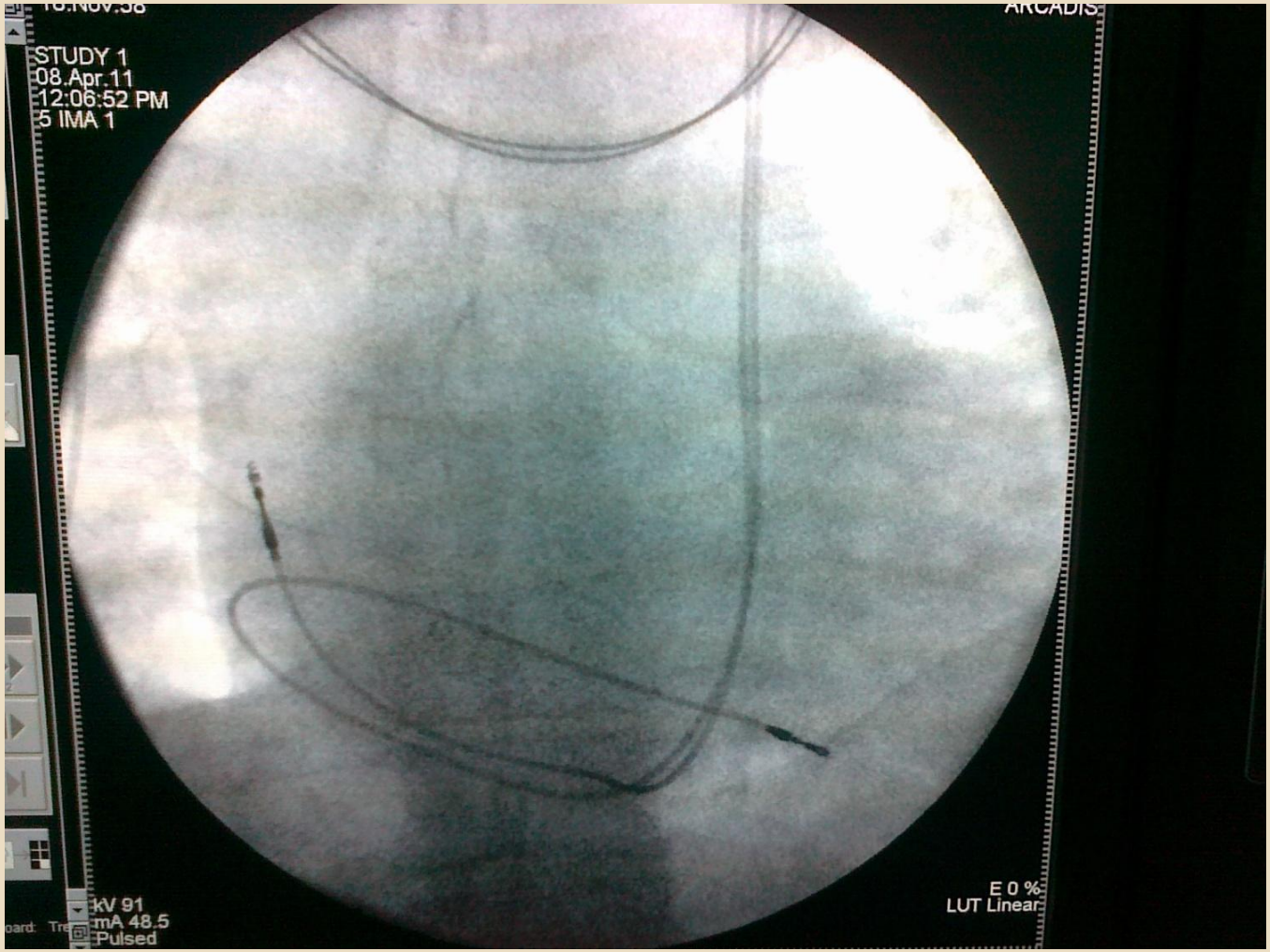
Komplikace TV přístupu

Komplikace TV přístupu

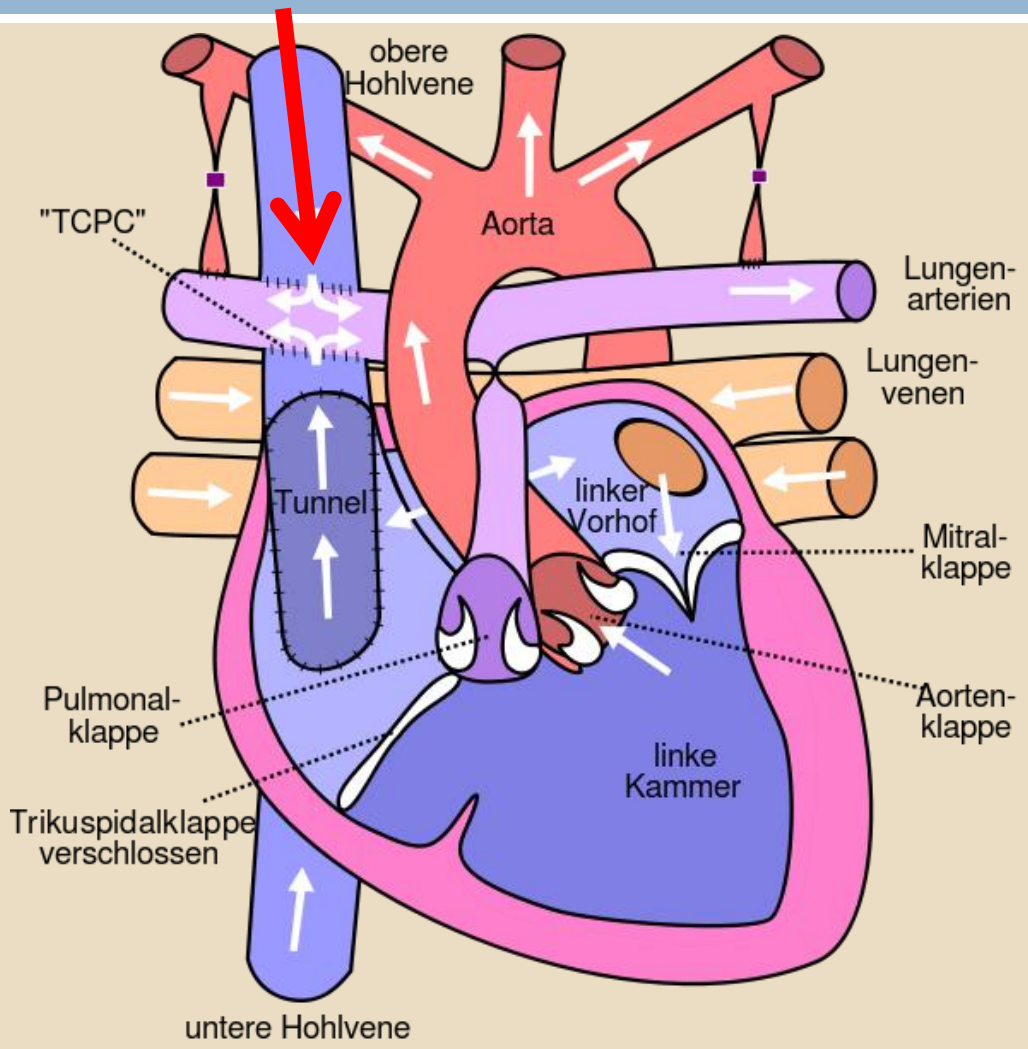
Komplikace TV přístupu



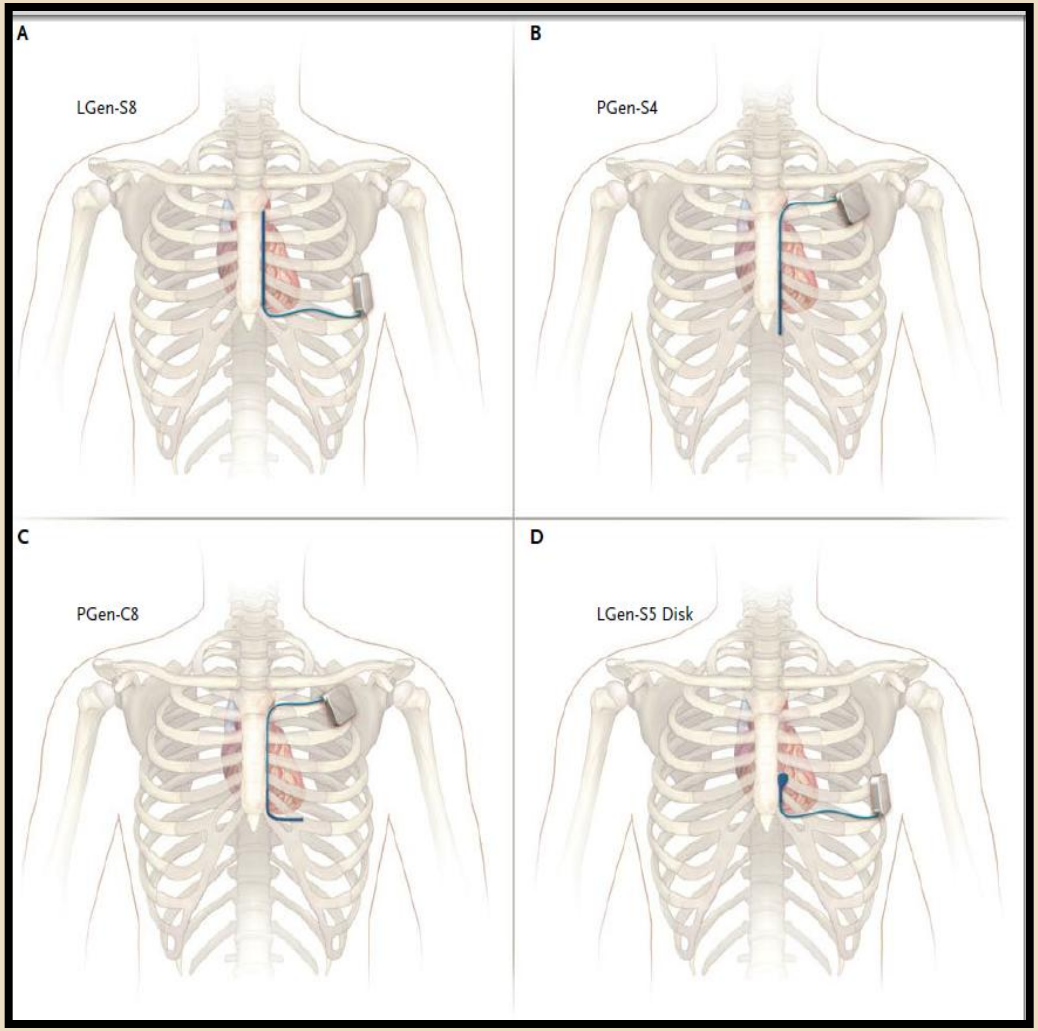
Anomálie žilního řečiště



VSV (TCPC)

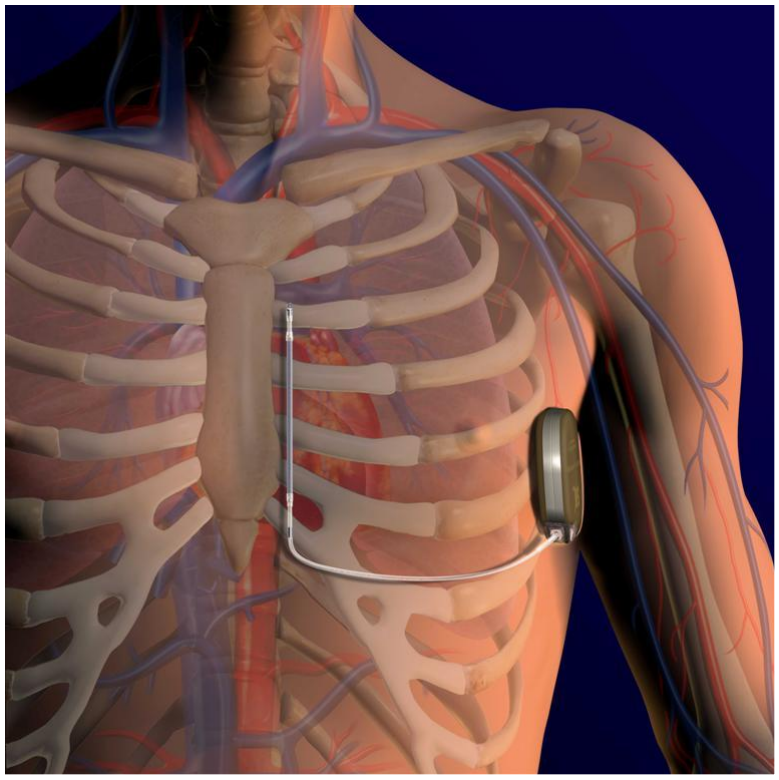

obere Hohlvene
"TCPC"
Aorta
Lungen-arterien
Lungen-venen
Tunnel
linker Vorhof
Mitral-klappe
Pulmonal-klappe
Aorten-klappe
linke Kammer
Trikuspidalklappe verschlossen
untere Hohlvene

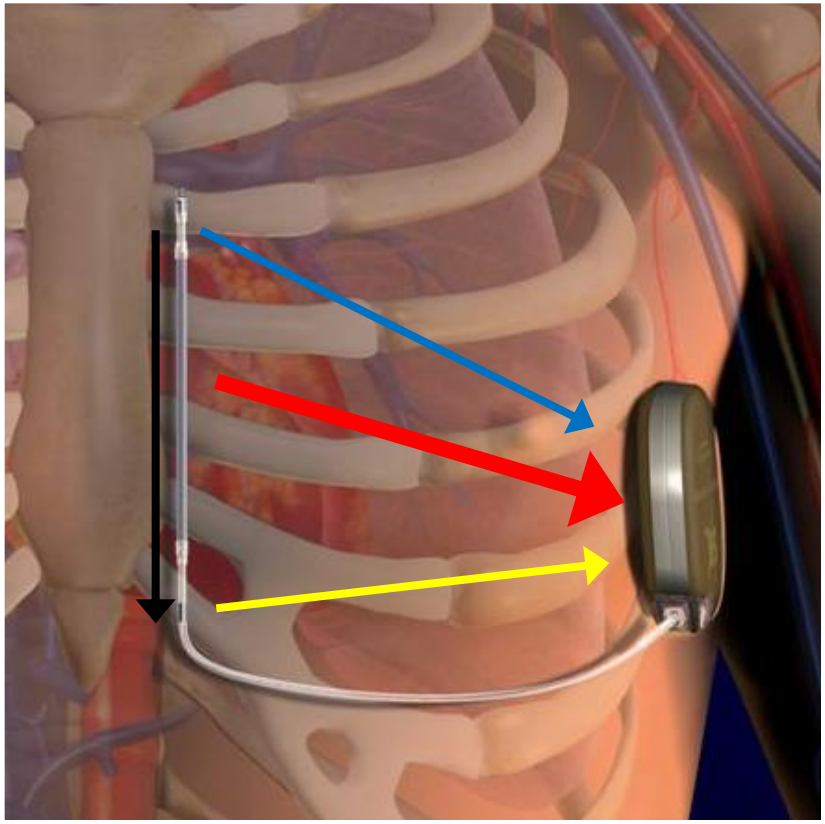
Testované konfigurace subkutánních ICD



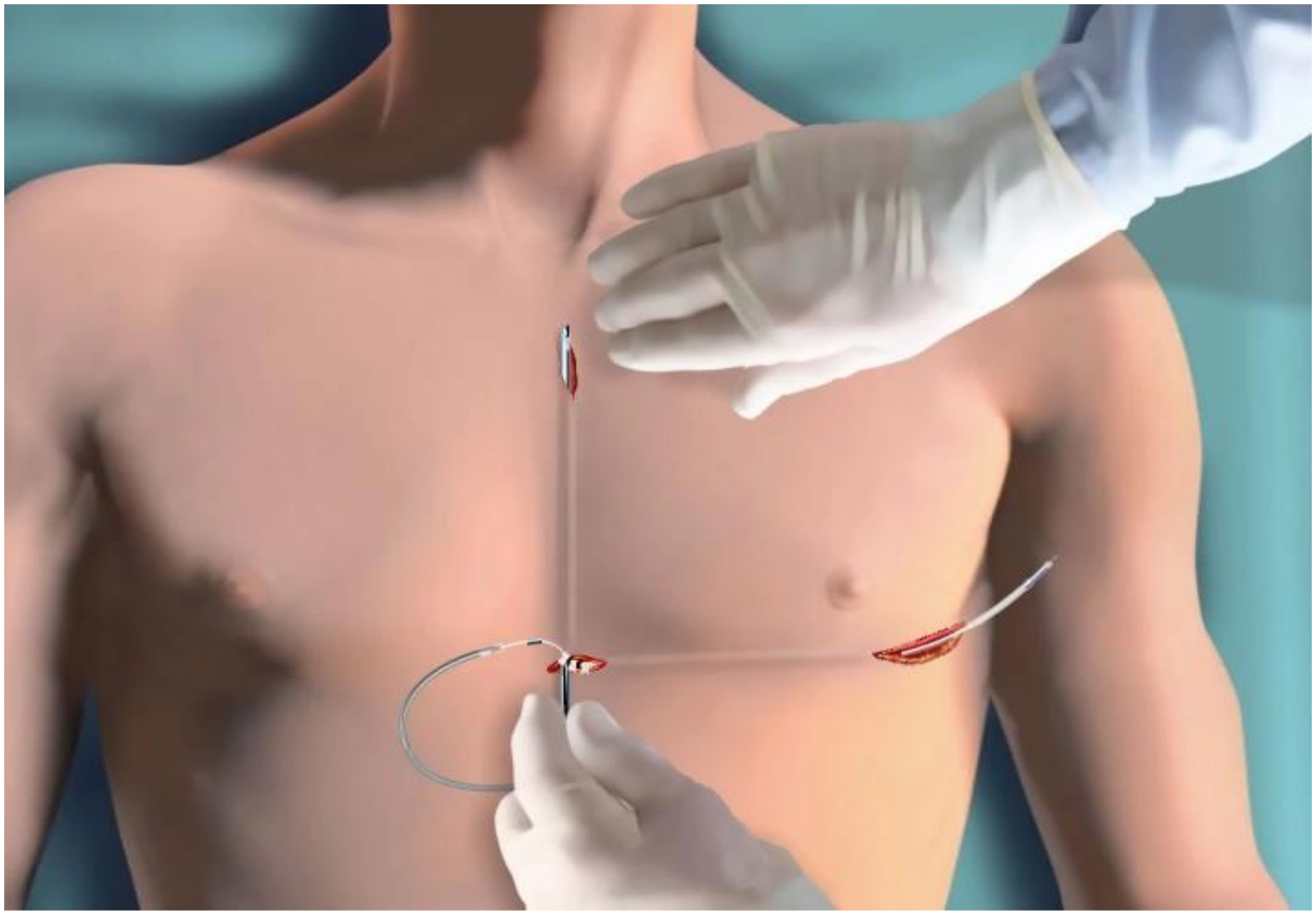
Bardy GH et al. NEJM 2010; DOI:10.1056

Snímací a DF vektory

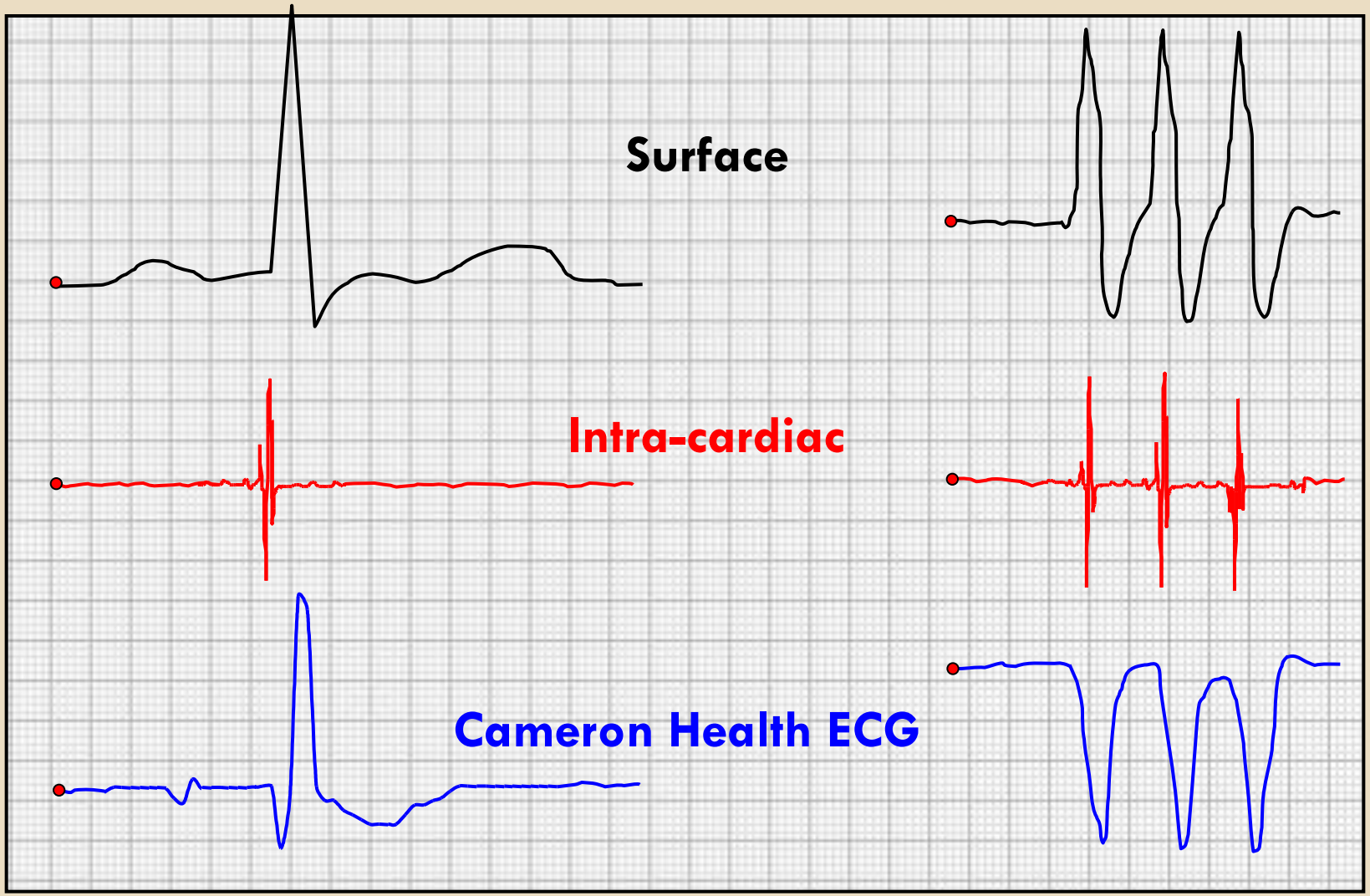




Implantace SC - ICD

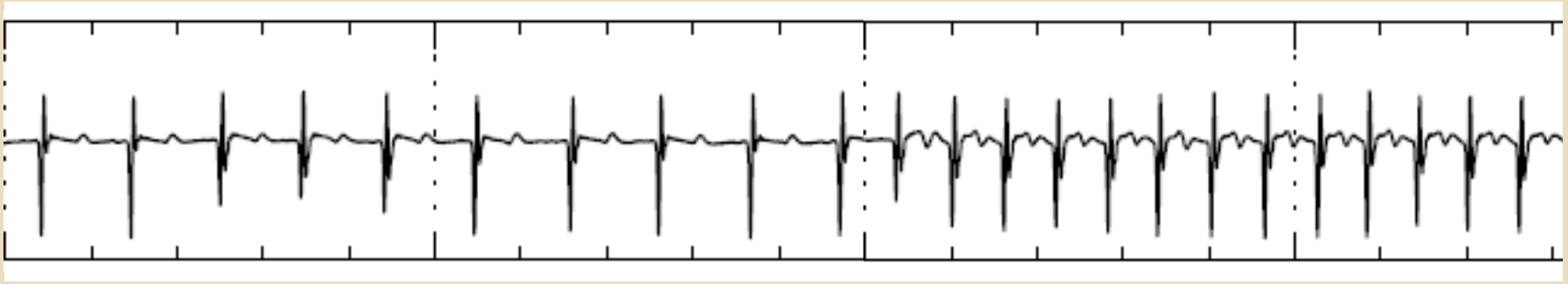


Senzing elektrické srdeční aktivity

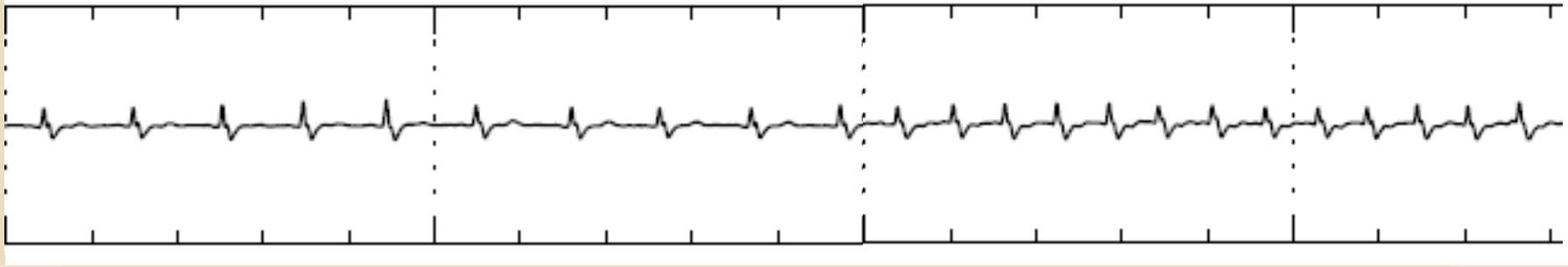


Výhoda SC senzingu?

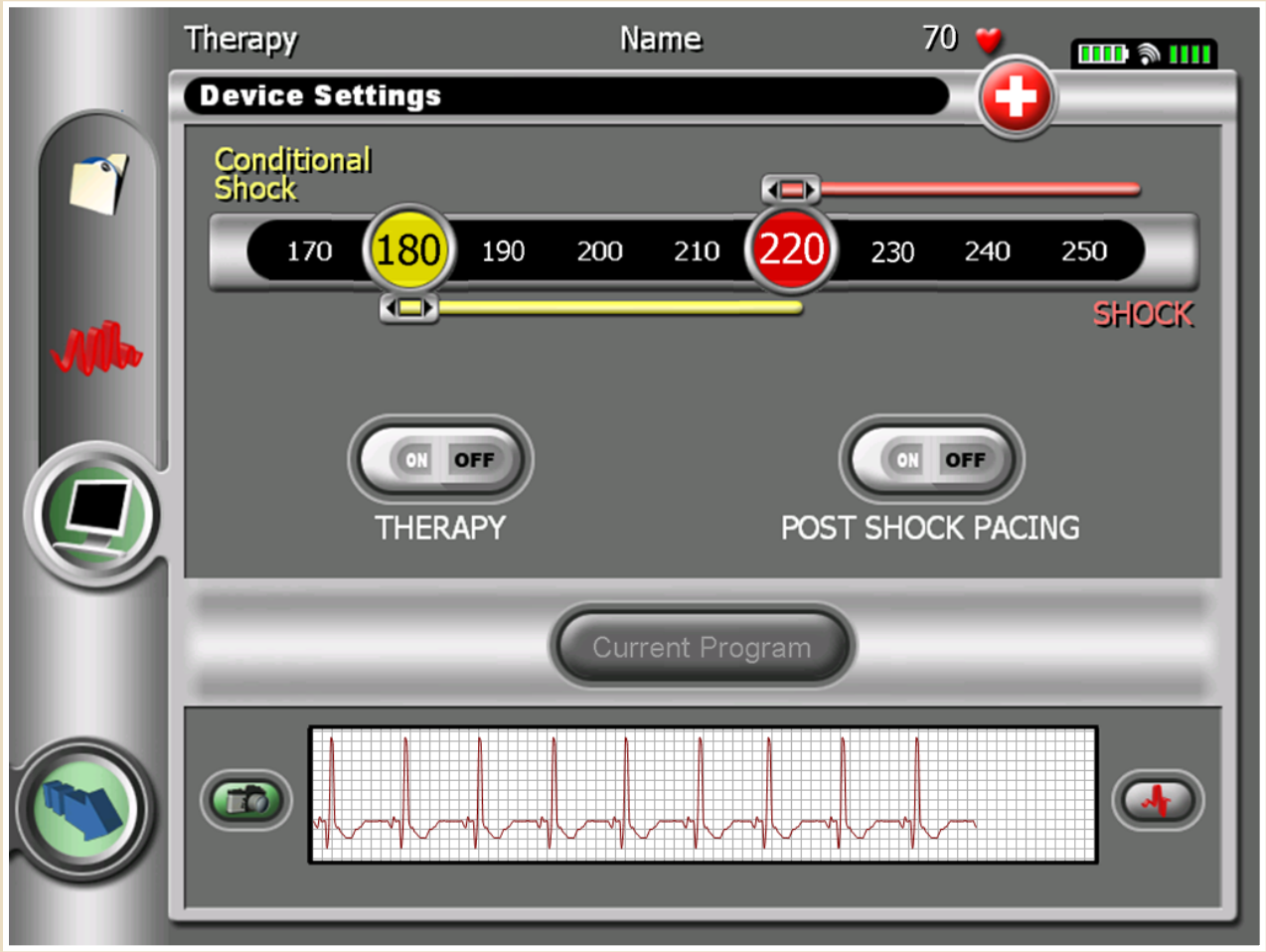
RV ONLY ANALYSIS



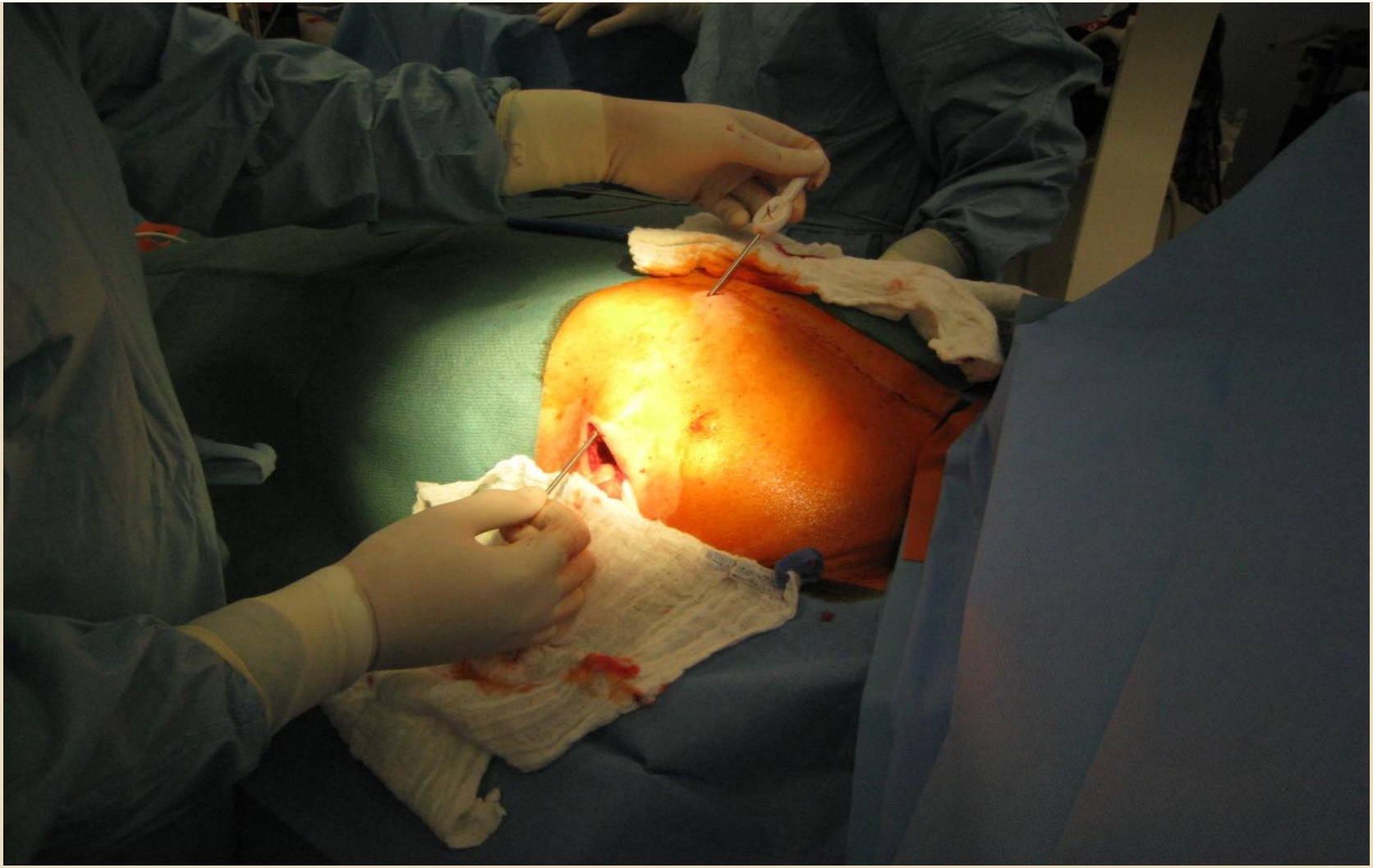
S-ICD ANALYSIS



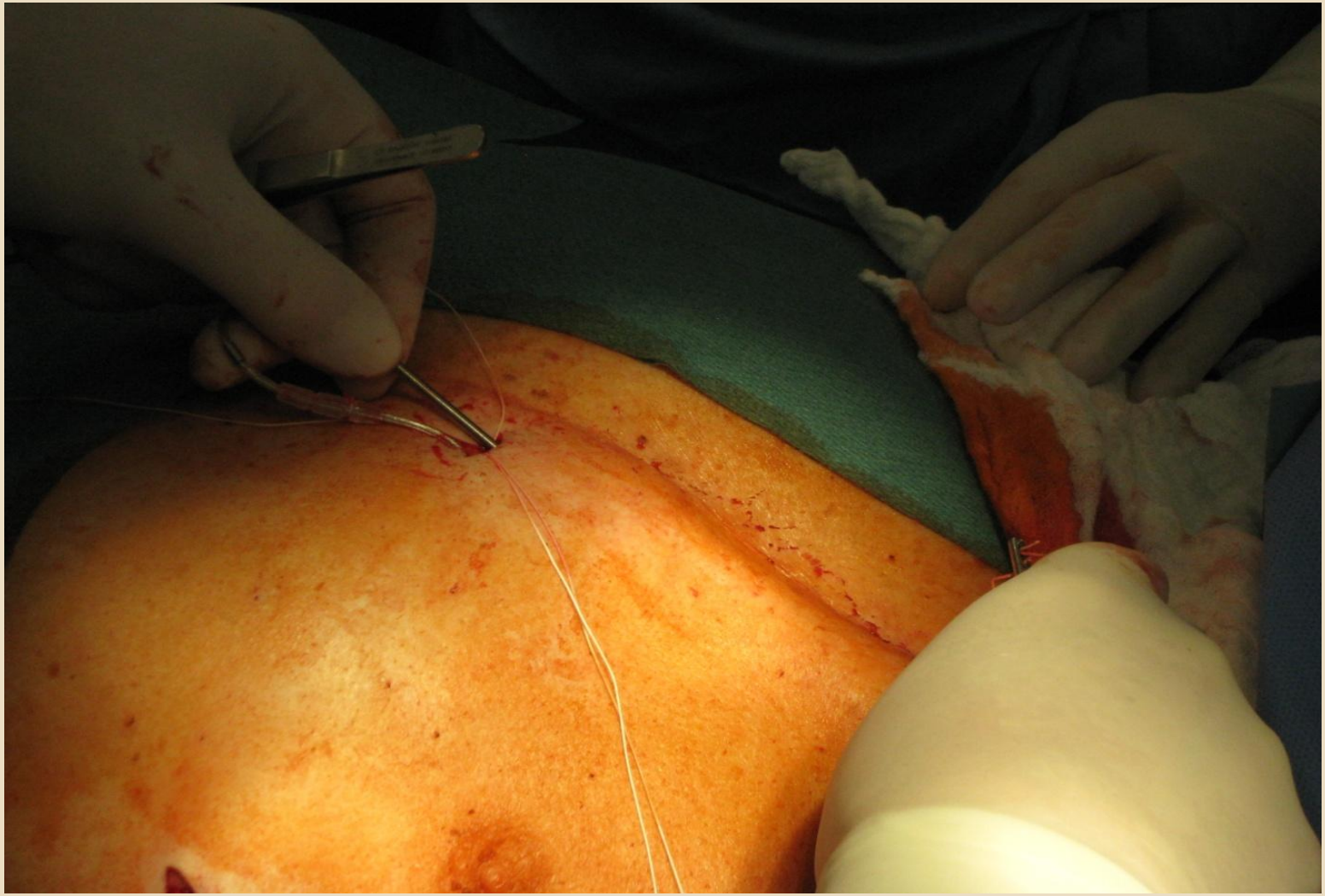
Jednoduchá programace



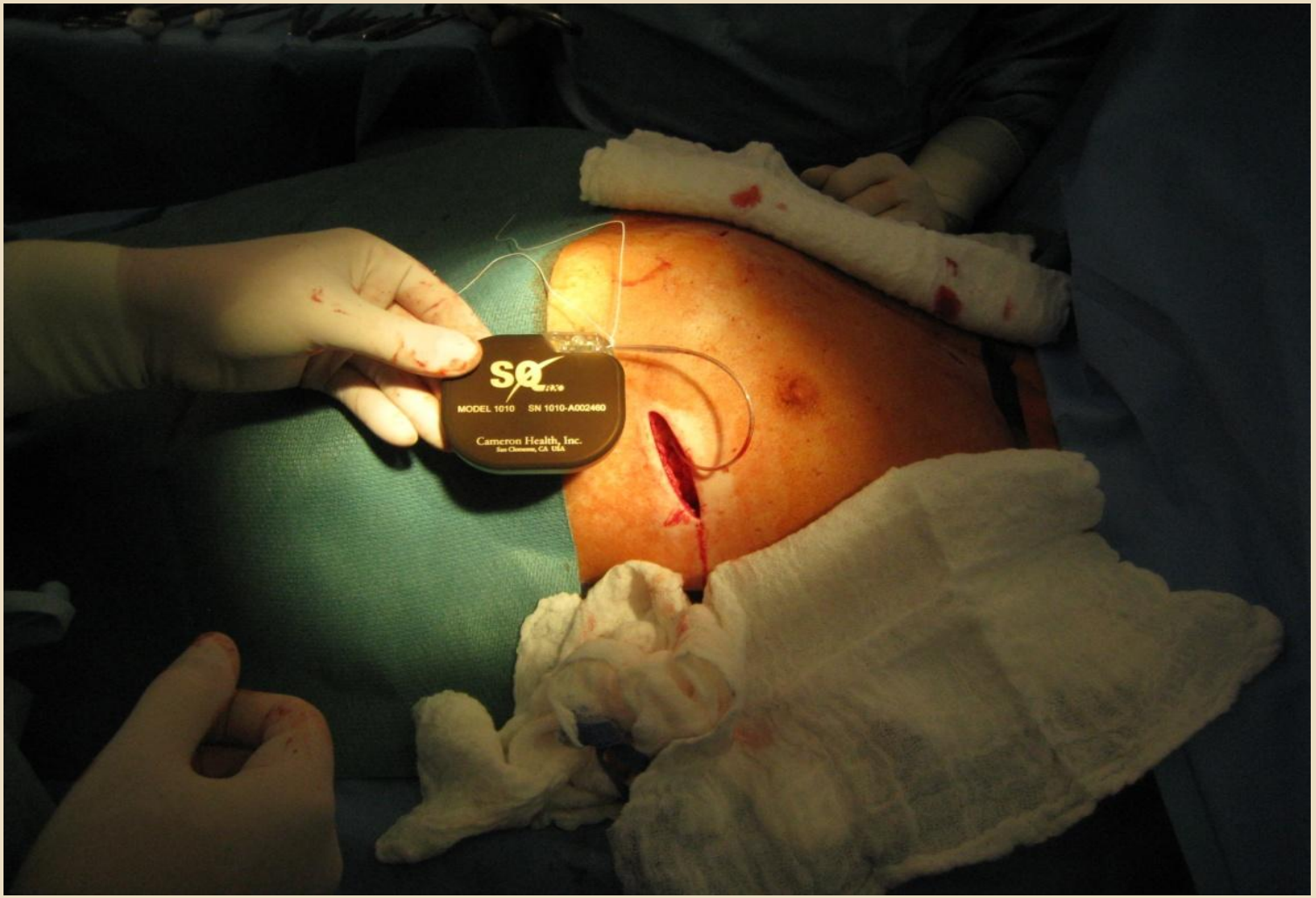
Implantace SC - ICD



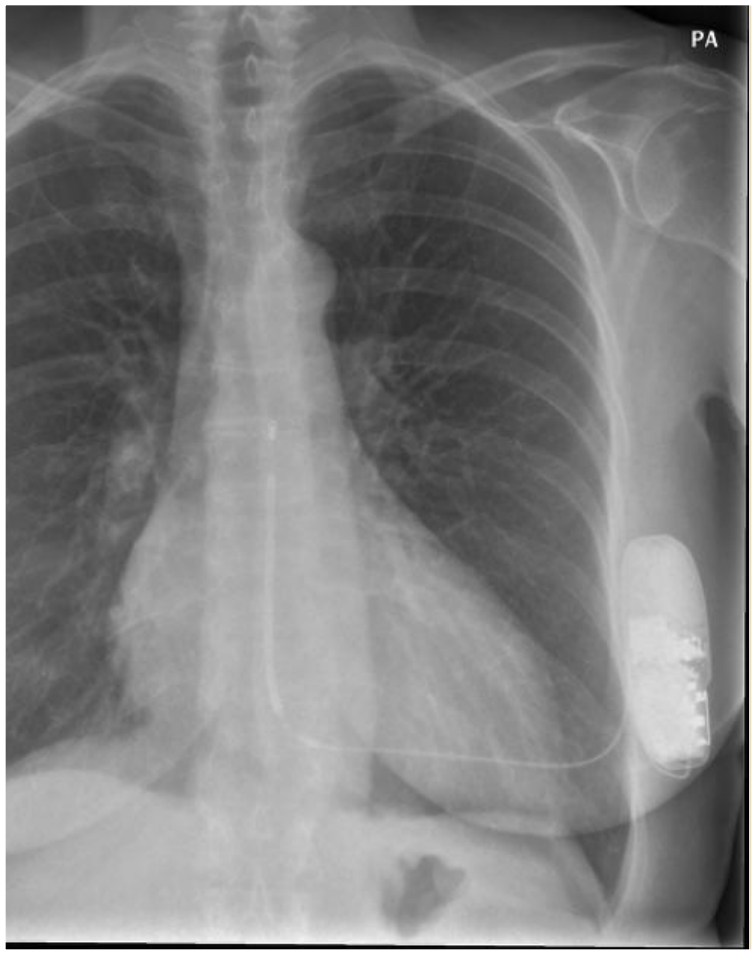
Implantace SC - ICD

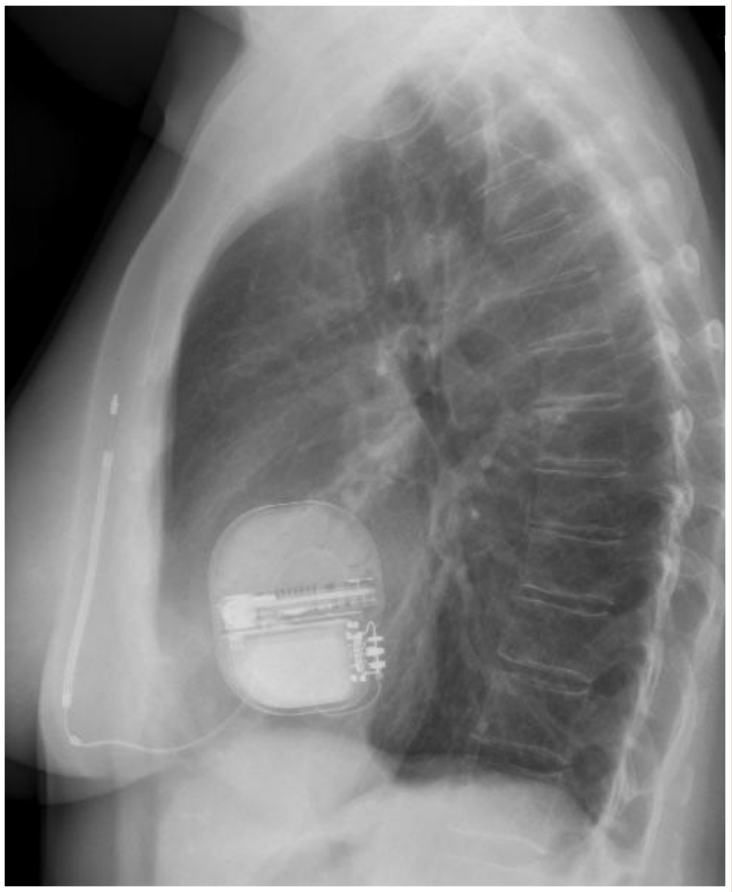


Implantace SC - ICD



RTG poloha ICD a elektrody





Pacient J.Š. měsíc po implantaci

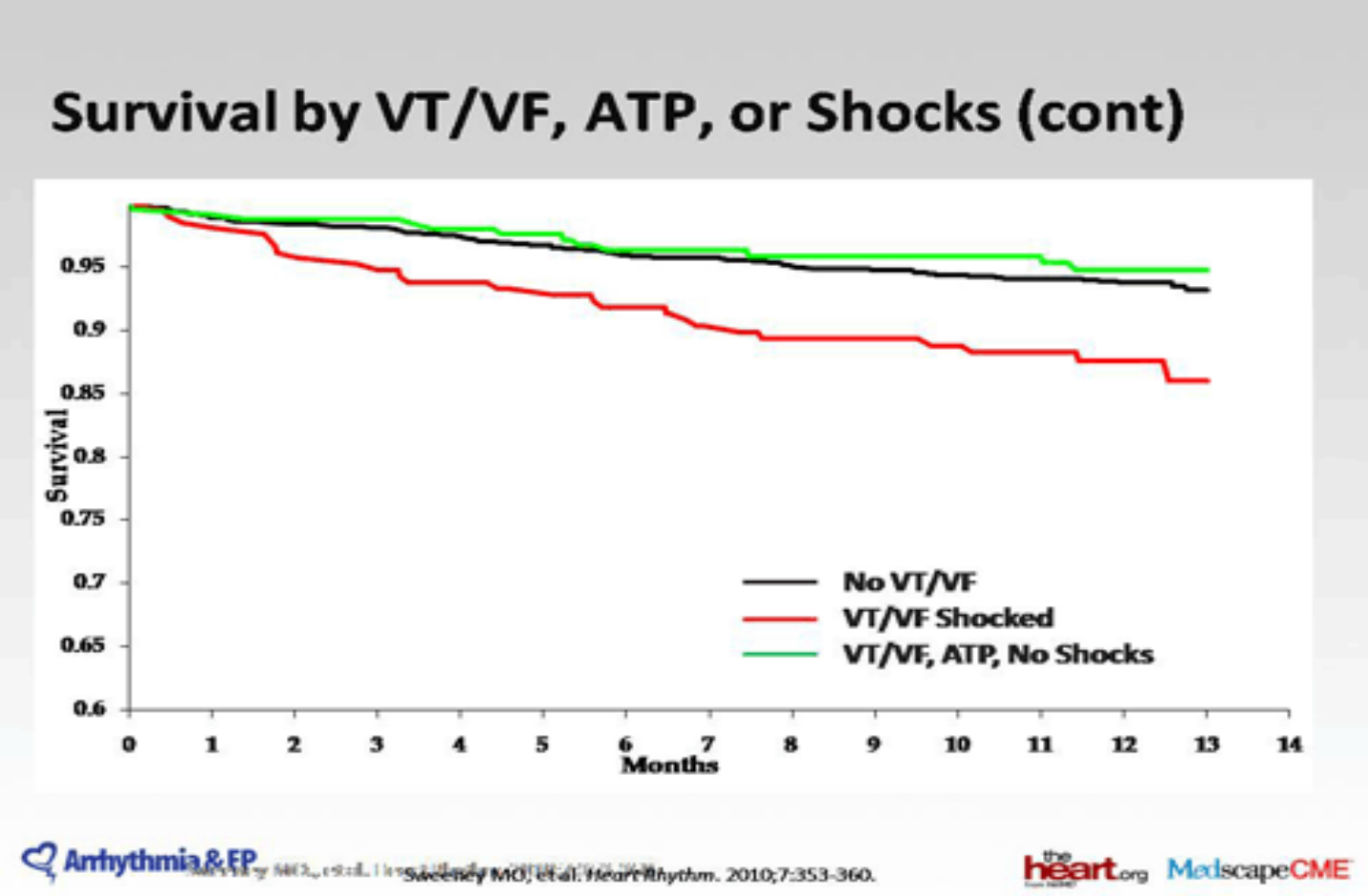
Úspěšnost v terminaci maligní arytmie

Summary of Available Data from Clinical Trials/Registries Regarding the Performance of the Subcutaneous ICD in Different Patient Cohorts

S-ICD Cohorts/ Trials	Patient Number	Mean Age (Years)	Primary Prevention %	EF %	Ischaemic %	Follow-up (Month)	Successful Termination of Induced VF %	Successful Termination of Clinical VT/VF %	Inappropriate Shocks %	Infection Rate %
CE Trial[21]	55	56	78	34	67	10±1	98	100	9	3.6
UK Cohort[22]	111	33	50	–	14	12	100	100	15	9.9
Dutch Cohort[23]	118	50	60	41	38	18	100	100	13	5.9
German I Cohort[24]	40	42	42.5	47	22.5	7.6	97.5	100	5	–
German II Cohort[25]	69	45	59.4	46	15.9	7.2	95.5	100	7.2	1.4
Pooled data (EFFORTLESS + IDE)[26]	882	50	~70	~40	37.8	21.7±11.5	98.6	98.2	13.1 at 3 years	11.1 at 3 years

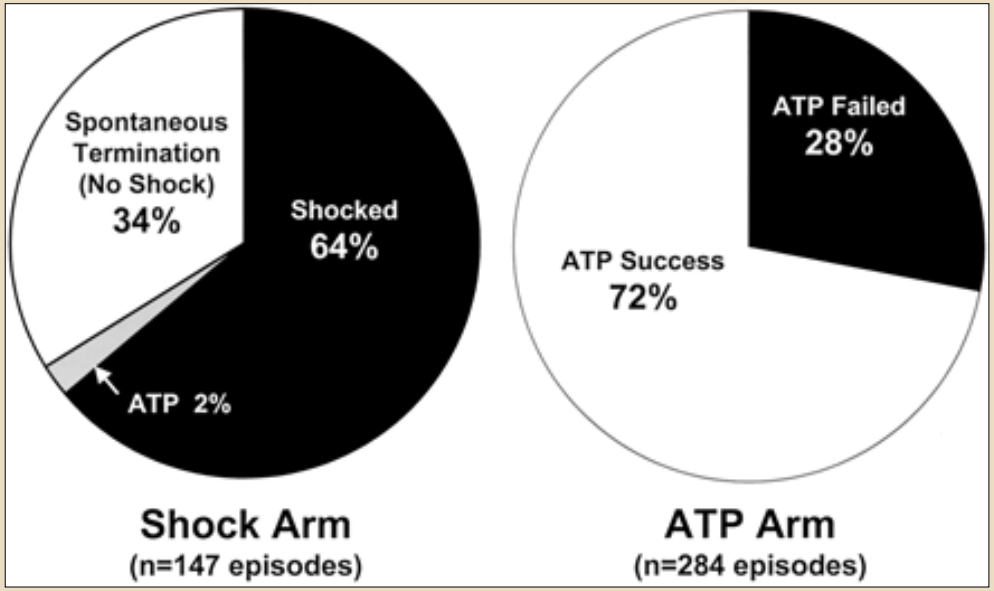
Hussam A., Arrhythm Elecrtophysiol. Rev 2015 Aug; 4(2): 116–121.

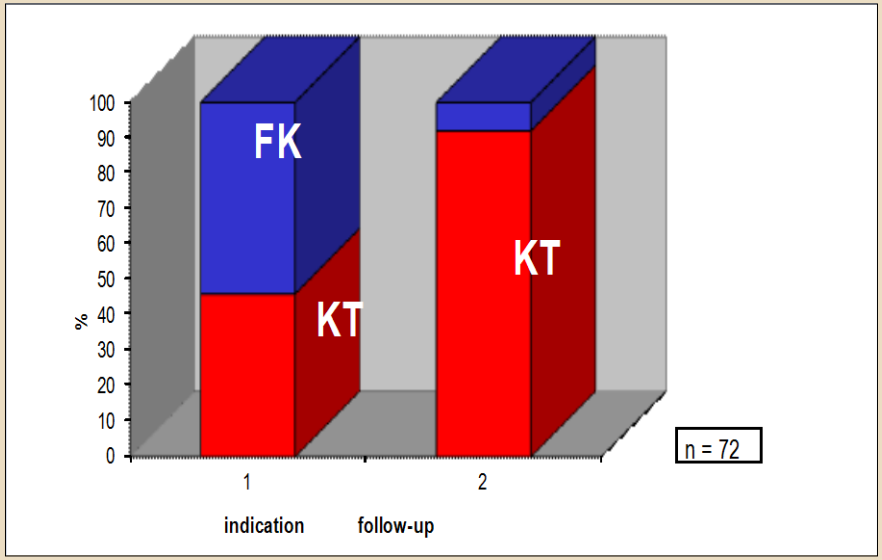
Rozdílný efekt ICD terapie komorových arytmií



Sweeney M. Heart Rhythm 2010;7:353-360

PainFREE Rx II trial



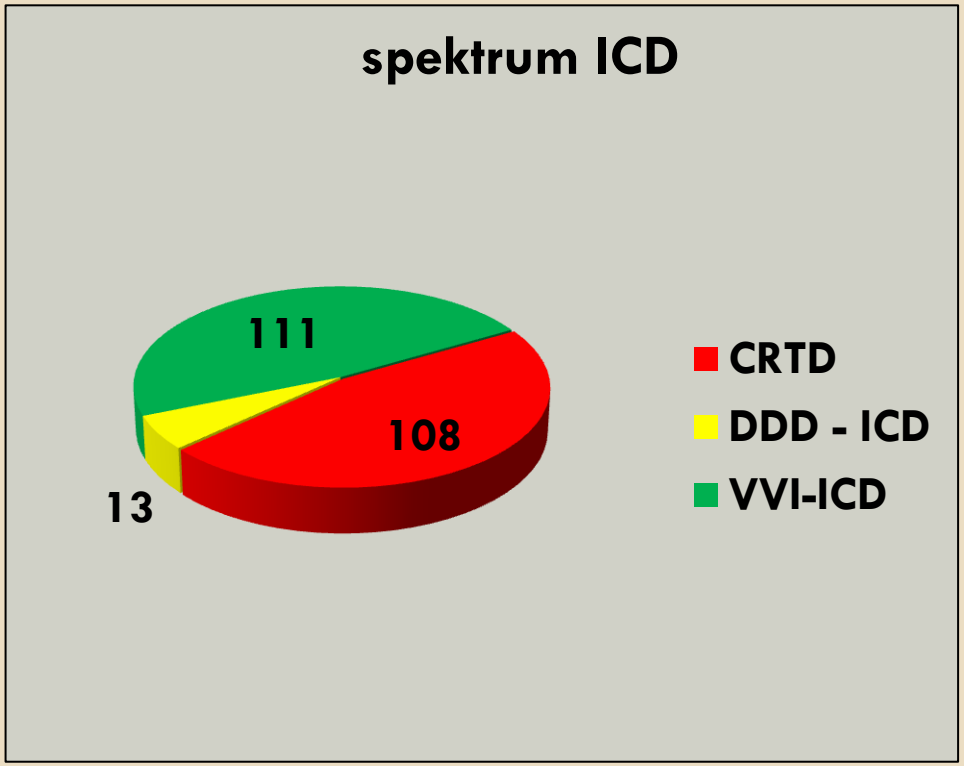


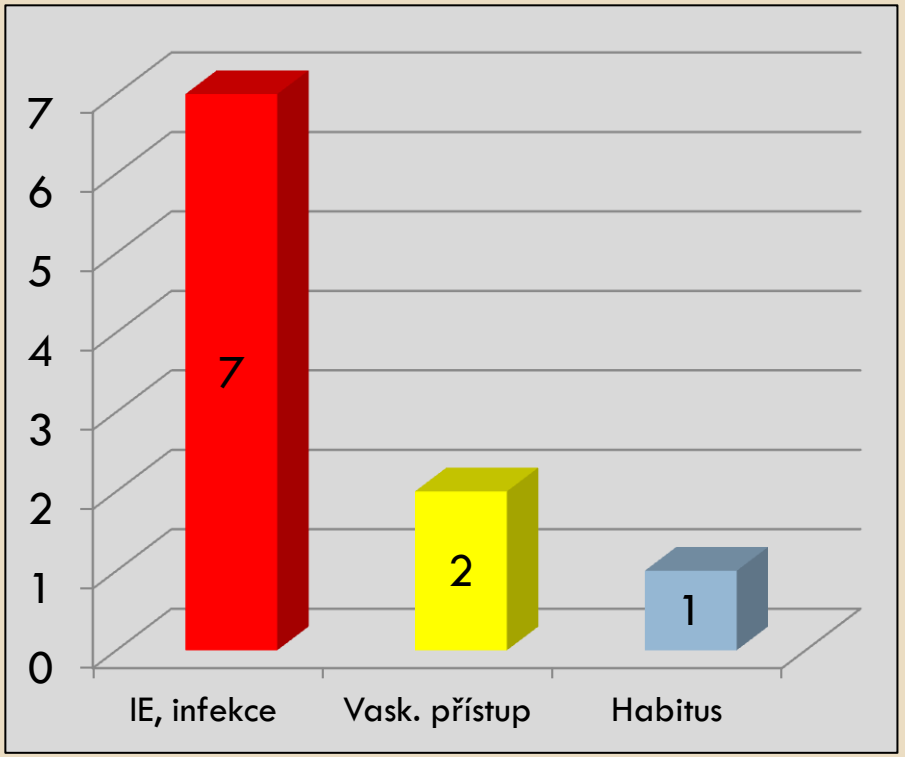
Wathen S. Circulation. 2004; 110: 2591-2596

IKK 2017

- 2017 n = 232

2011 – 2018 n = 10





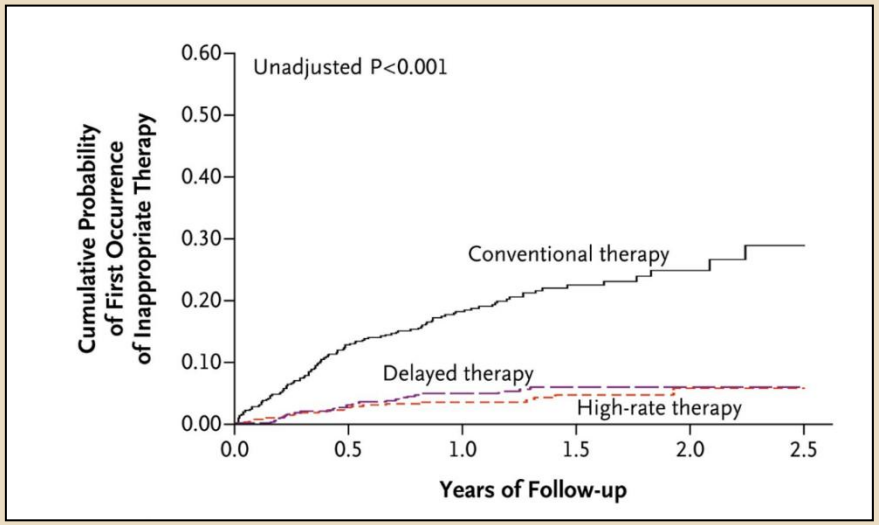
Metaanalýza RCT s ICD + dánský registr PM a ICD

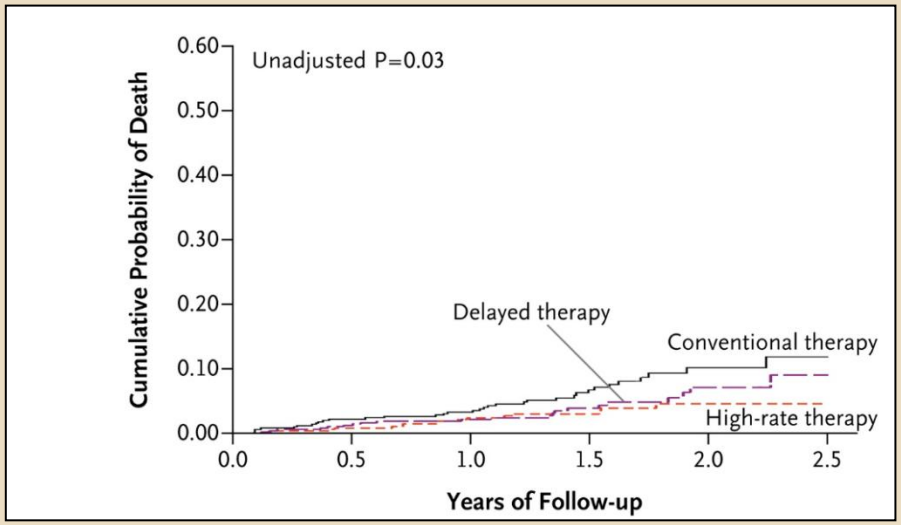
n = 6433 **1999 – 2013**
n = 43000 **2000 – 2012**

Věk Ø	64 let
EF LK Ø	30,5%
Celk. komplikace / 16 mos	9,1%
PNO	1,1%
Extrakce pro infekci	1,5%
Poškození elektrody	3,1%
Inf. Endokarditida / 1000 PY	3,1 – 6,3%

Ezzat AV., Open Heart 2015;2:e000198
Ozcan C., Europace 2017 Jun 1;19(6):1007-1014

Nevhodná terapie MADIT - RIT





Variable	Conventional Therapy (N=514)	High-Rate Therapy (N=500)	Delayed Therapy (N=486)	P Value for High-Rate Therapy vs. Conventional Therapy	P Value for Delayed Therapy vs. Conventional Therapy
First occurrence of therapy — no. of patients (%)					
Appropriate therapy	114 (22)	45 (9)	27 (6)	<0.001	<0.001
Shock	20 (4)	22 (4)	17 (3)	0.68	0.74
Antitachycardia pacing	94 (18)	23 (5)	10 (2)	<0.001	<0.001
Inappropriate therapy	105 (20)	21 (4)	26 (5)	<0.001	<0.001
Shock	20 (4)	11 (2)	13 (3)	0.12	0.28
Antitachycardia pacing	85 (17)	10 (2)	13 (3)	<0.001	<0.001

Moss AJ., et al. N Engl J Med 2012; 367:2275-2283

Registr nemocných s SC ICD

n = 994 2009 - 2014

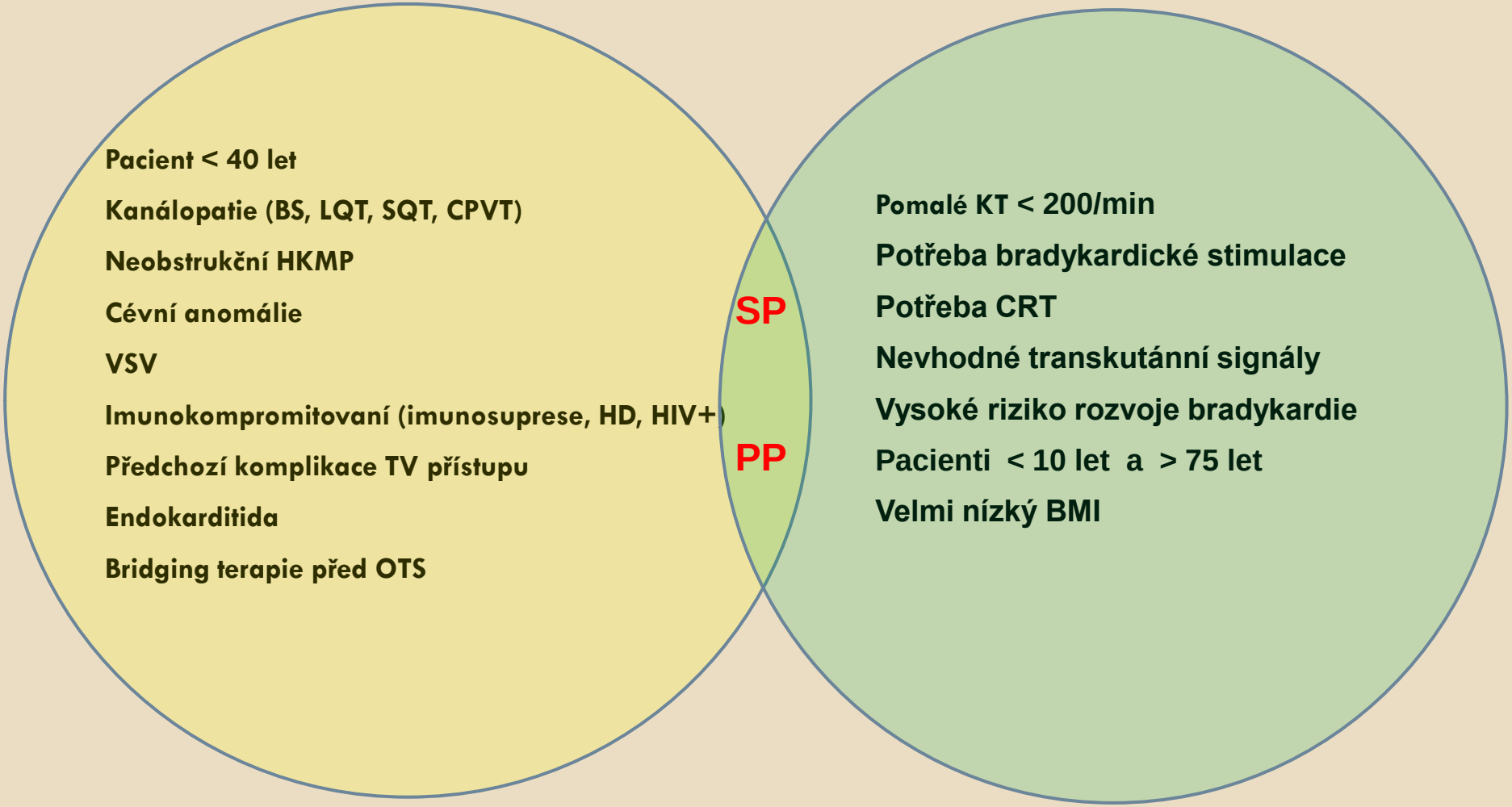
Věk Ø	48 let
EF LK Ø	43%
PP indikace	65%
Celkové komplikace / rok	2%
Nevhodná terapie / rok	8,1%
Extrakce pro infekci	2,4%
Poškození elektrody	0%
Infekční endokarditida	0%

Cameron Health – Boston Scientific

15.7 mm	Thickness	12.7 mm
69.9 cc	Volume	59.5 cc
145 gram	Weight	130 gram
5.1 years	Longevity	7.3 years
Not avaliable	Remote-Monitoring	LATTITUDE

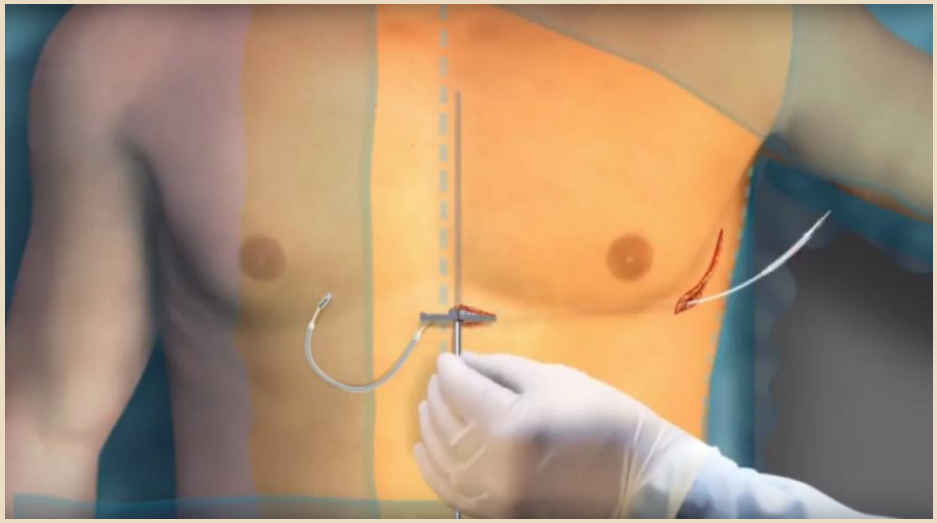
Pro S - ICD

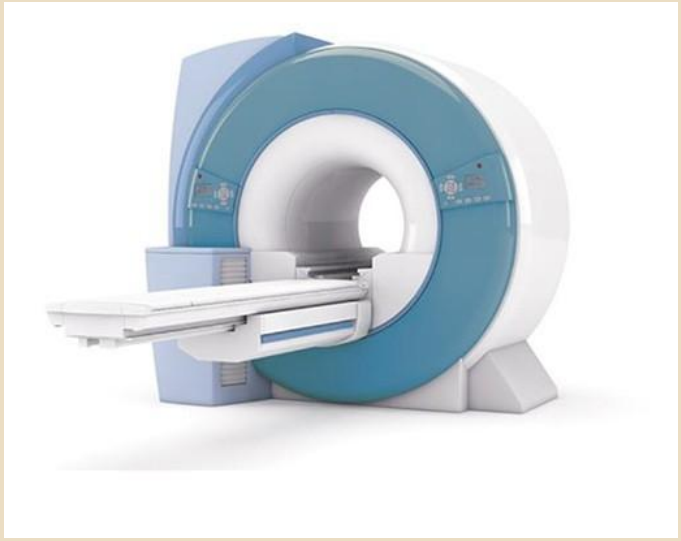
Pro TV - ICD



Hussam A., Arrhythm Elecrtophysiol. Rev 2015 Aug; 4(2): 116–121.

Nová generace S ICD





Duální zóna pro detekci arytmie


OSTRAVA!!!

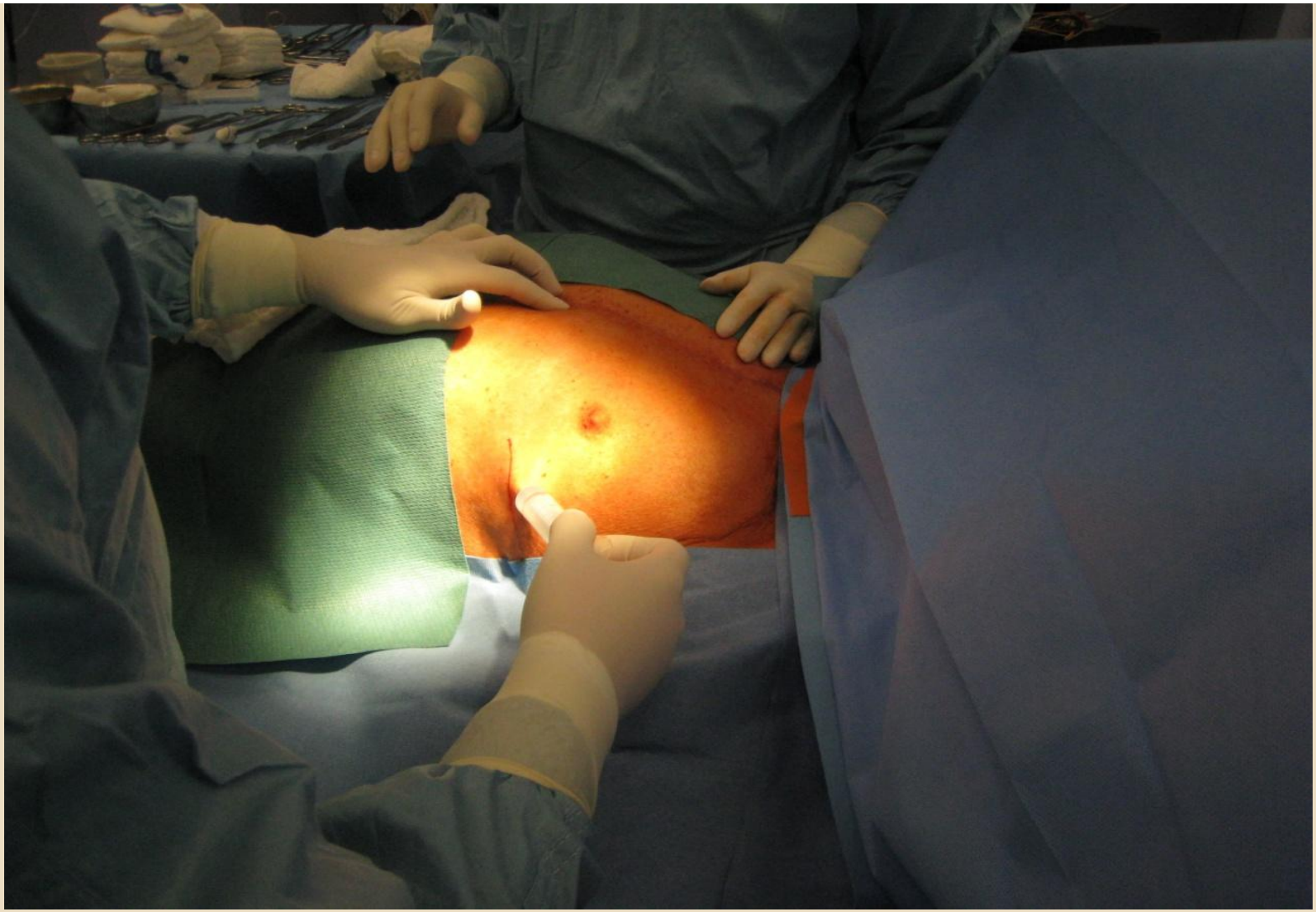
Výhody SC ICD

- Implantace bez užití skiaskopie ?
- Jednoduchost programace a užití
- Nejsou komplikace TV přístupu
- Větší životnost SC elektrody?
- Nižší výskyt nevhodné terapie ???

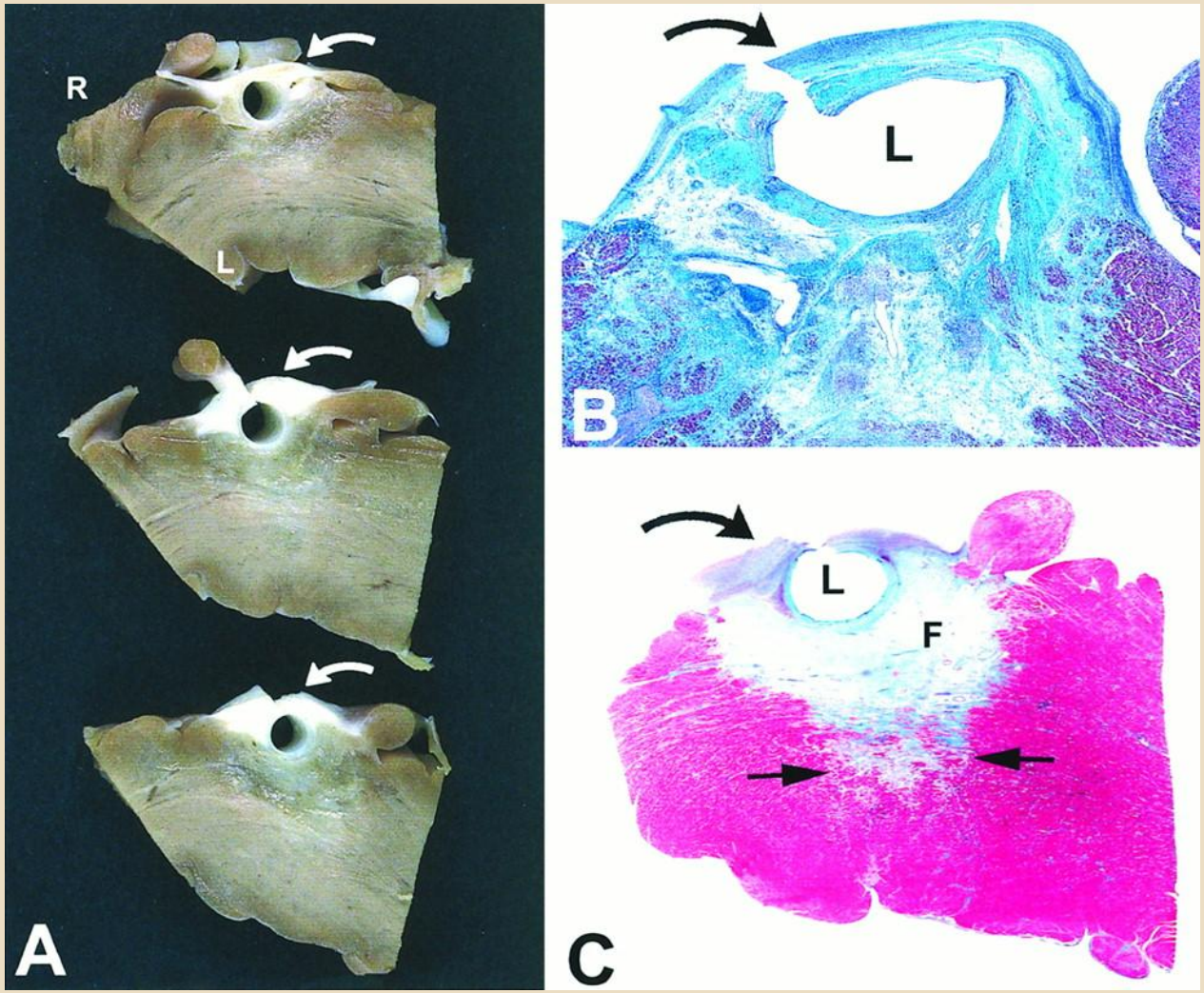
Nevýhody SC ICD

- Není stimulace při bradykardii
- Nelze užít stimulace v rámci CRT
- Nelze užít stimulace v rámci ATP
- Velikost přístroje
- Chybí dostatek dat z dlouhodobého sledování

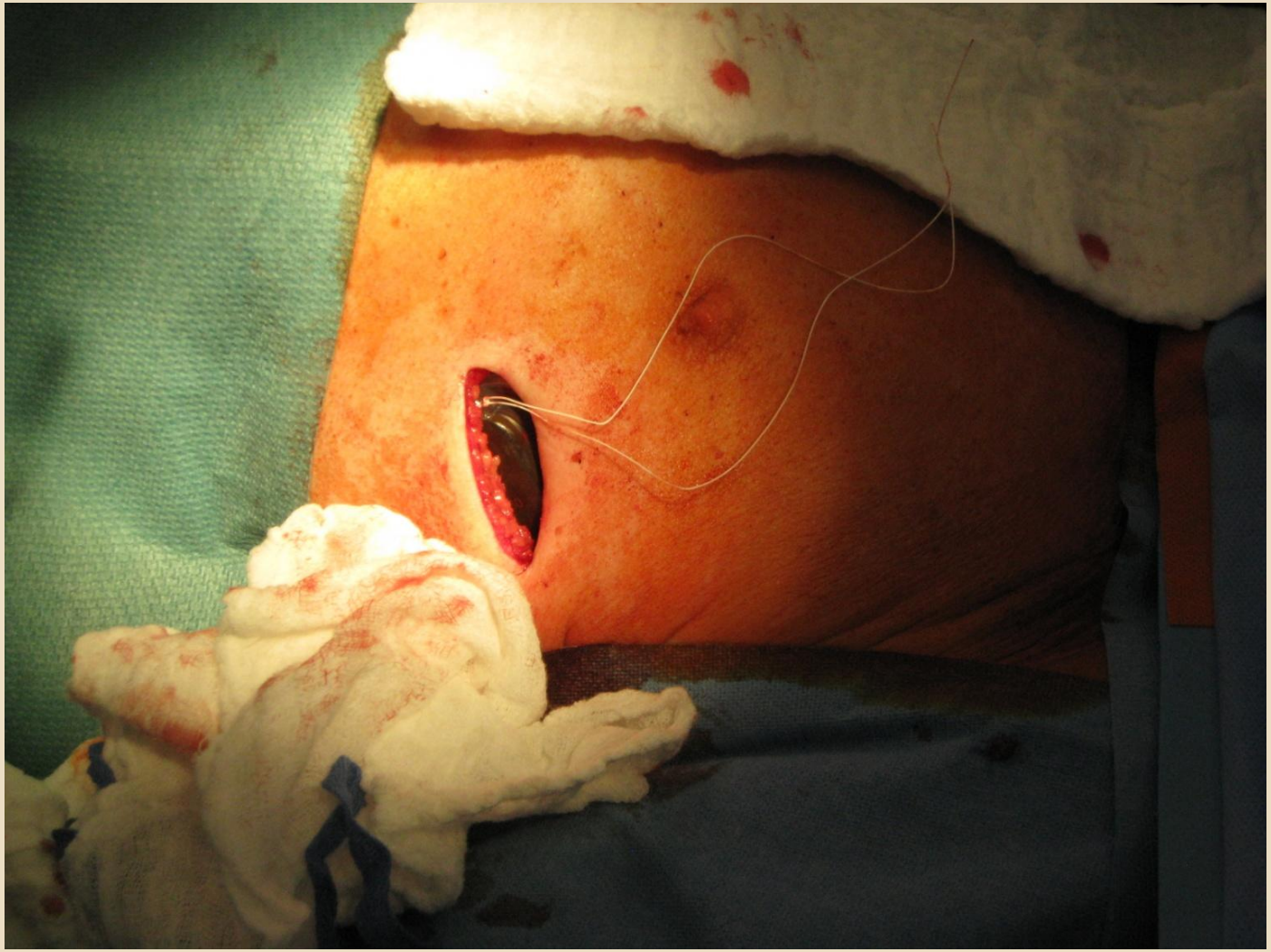
Implantace SC - ICD



Mikrotraumata myokardu způsobená ICD výbojem



Implantace SC - ICD

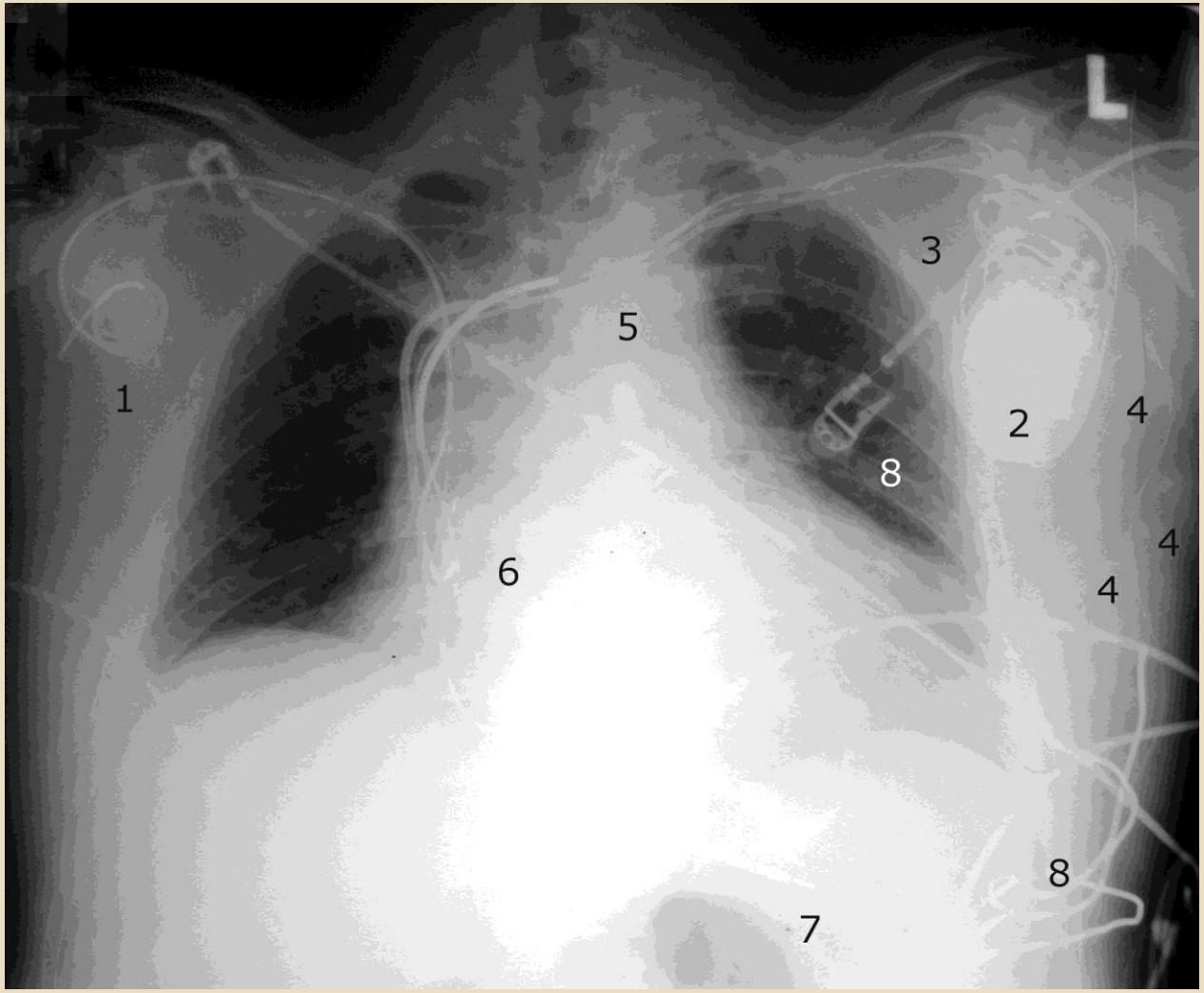


Kasuistika – J.Š. 1941

ICHS st.p. IM DS, uzávěr ACD - PCI, EF LK 40%, st.p. CMP, DM II na PAD,

- 2003 – primo ICD pro KT 180/min
- 2007 – výměna pro ERI
- 2007 – měsíc po výměně evakuace serózního výpotku
- 03/10 – bolest v kapse ICD, zduření, CRP 15, FW 60/80 – ústup potíží po Augmentinu
- 06/10 – recidiva obtíží, po Augmentinu (3 týdny) ústup
- 09/10 – recidiva obtíží, explantace infikovaného ICD, elektrody zaslepeny
- 12/10 – verifikována IE, extrakce elektrod na CKTCH
- 02/11 – implantace SC ICD Cameron Health

Komplikace TV přístupu



Porovnání TV a SC ICD

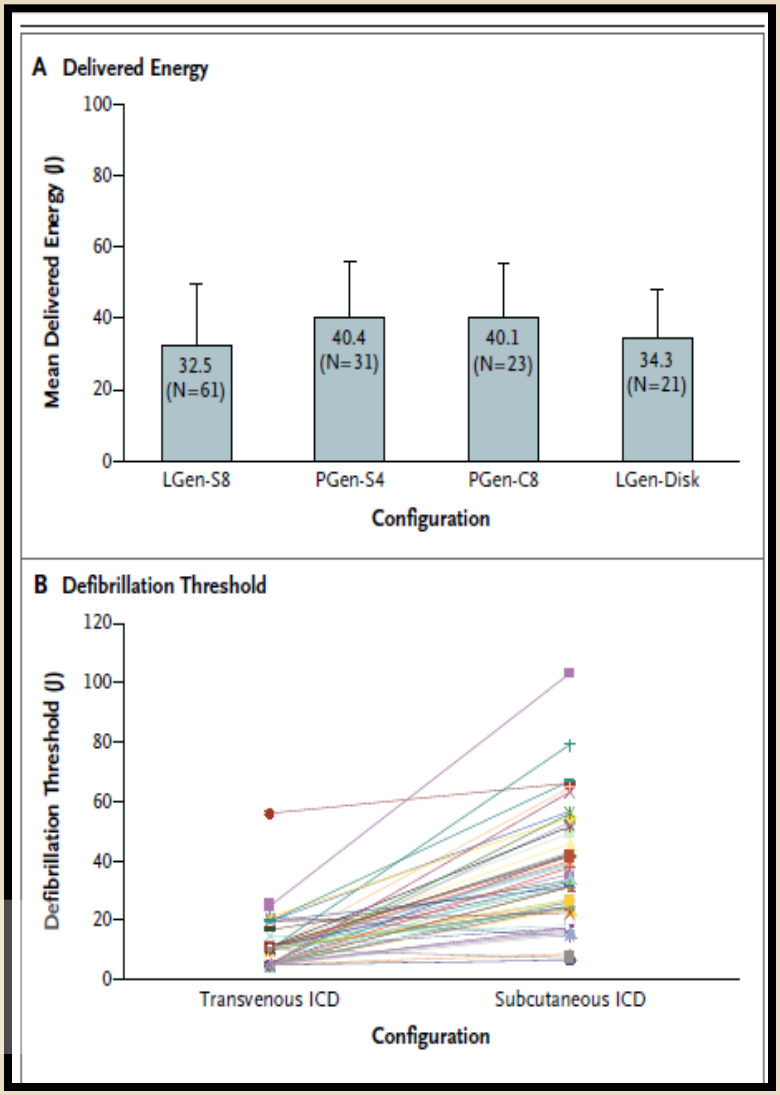


Figure 3. Energy Delivered with the Subcutaneous Implantable Cardioverter–Defibrillator (ICD), According to Lead Configuration, and a Comparison of Defibrillation Thresholds in Transvenous and Subcutaneous ICDs.

Panel A shows delivered defibrillation-threshold energies (measured in joules) in the four practical lead configurations that are described in Figure 1, as tested during trials of acute defibrillation ranges involving 78 patients. The T bars indicate standard deviations. Panel B shows a comparison of paired defibrillation-threshold data for transvenous ICDs and subcutaneous ICDs in 49 consecutive patients during randomized testing. The subcutaneous ICD was as effective as a transvenous ICD for terminating induced ventricular fibrillation, although with a significantly higher mean (±SD) energy requirement (36.6±19.8 J vs. 11.1±8.5 J, $P<0.001$). In these tests, the transvenous ICD in one patient and the subcutaneous ICD in another patient failed to defibrillate induced ventricular fibrillation at maximum device output. In each of these two cases, 20 J was arbitrarily added to the highest energy tested to assign a defibrillation-threshold value. In the patient whose subcutaneous device failed defibrillation testing, the parasternal electrode had been incorrectly placed 6 cm lateral to the sternum.

Bardy GH et al. NEJM 2010; DOI:10.1056