CARDIAC & TRANSPLANT SURGERY

- mechanical circulatory support
- transplantation- heart, liver, kidney

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Mechanical circulatory support

Duration of support	Type of support needed	Localization	Flow
▪ **short-term** reversible damage ▪ **long-term** „brigde-to-transplantation“ ▪ **permanent** contraindications for heart transplantation	▪ **left-side** ▪ **right-side** ▪ **biventricular**	▪ **paracorporeal** ▪ **implantable**	▪ **Pulsatile** • **pneumatic** • **electromechanic** ▪ **Non-pulsatile** • **axial** • **centrifugal**

Mechanical circulatory support - indication

Postcardiotomy cardiogenic shock

unsuccessful weaning from extracorporeal circulation
malignant ventricular arrythmias
low cardiac output syndrom

Other etiology of cardiogenic shock

after acute myocardial infarction, after PCI, myocarditis…

Chronic heart failure

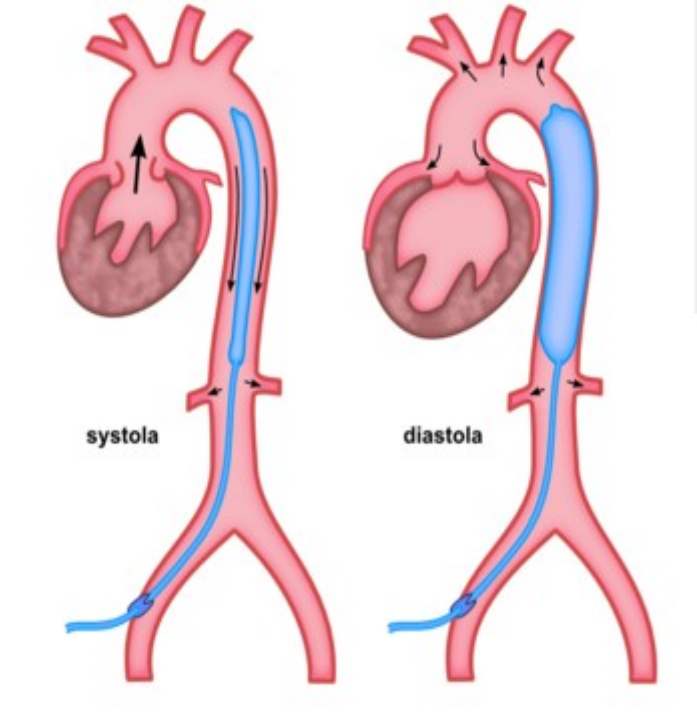
pts on waiting list for heart transplantation

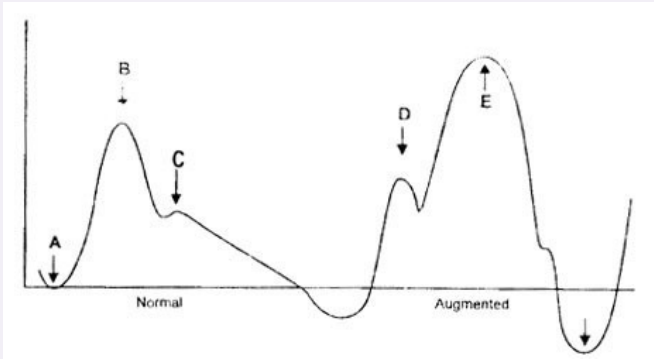
Acute rejection after HTx

Heart failure (primary graft non-function) after HTx

Patients with contraindications for heart transplantation

Intraaortic baloon counterpulsation





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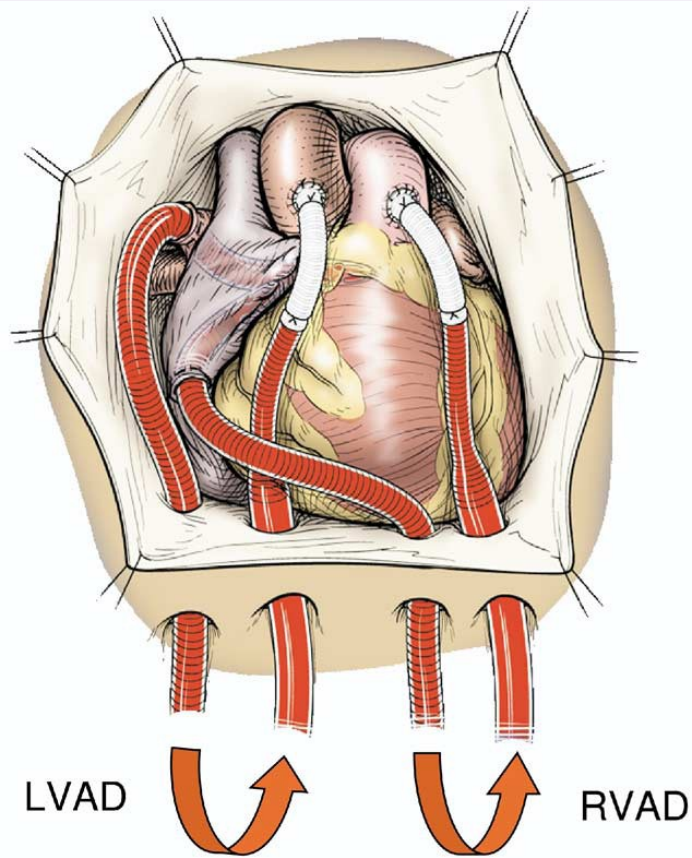
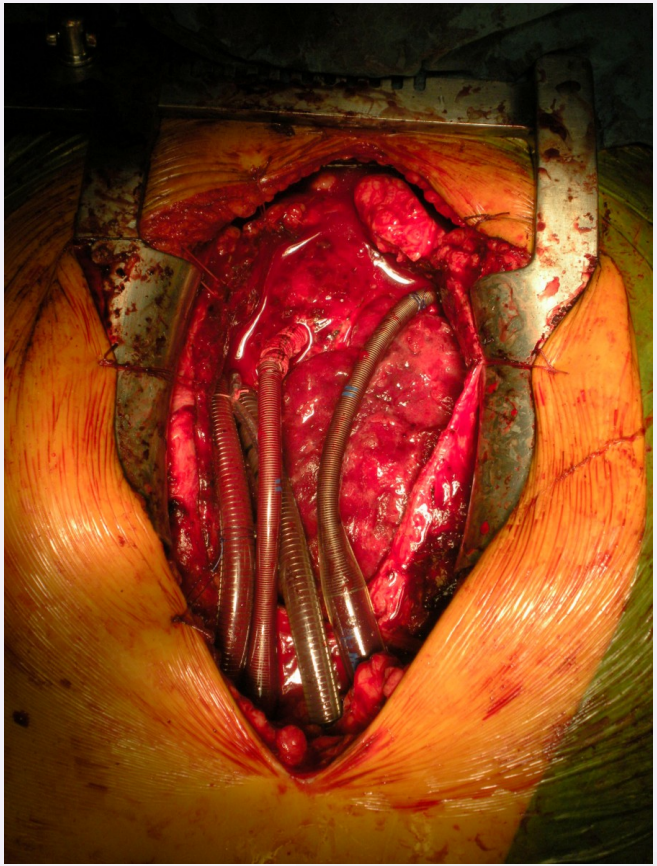
Short-term MCS - Centrimag



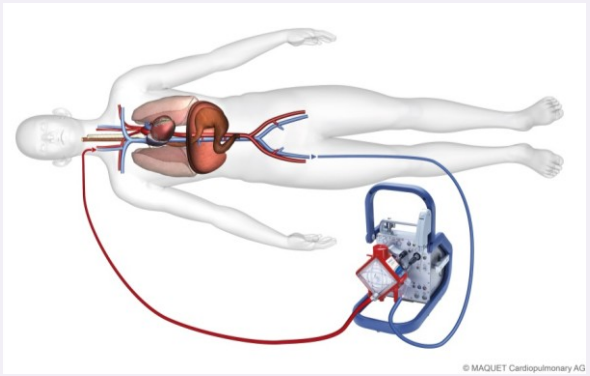


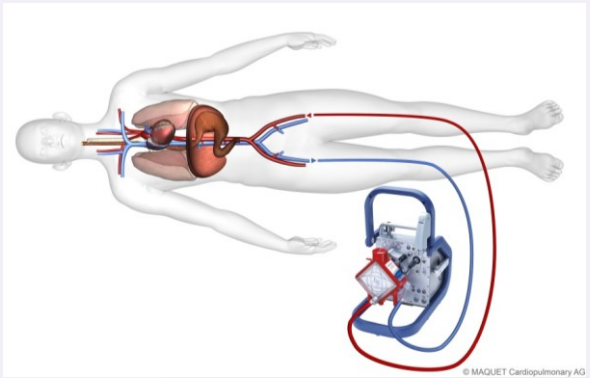
Short-term MCS - Centrimag

Short-term MCS - Centrimag

Short-term MCS - ECMO

extracorporeal membrane oxygenation





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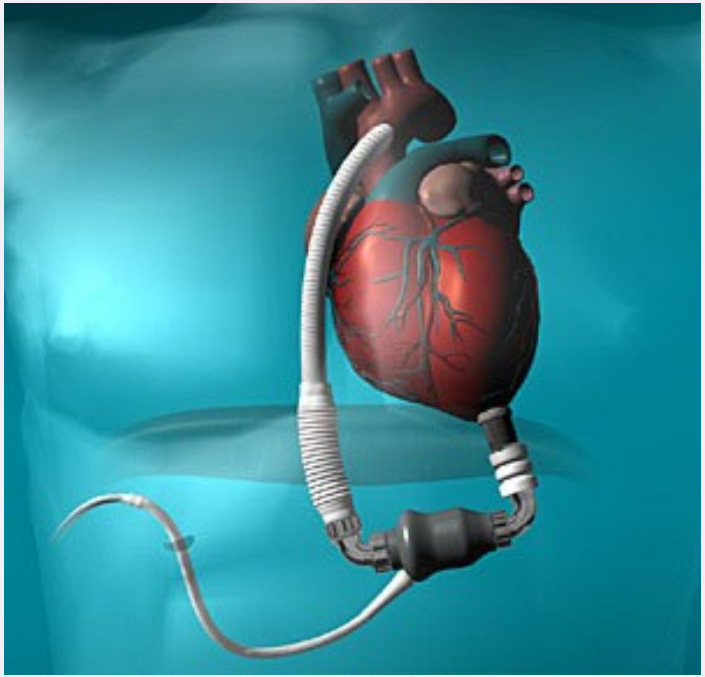
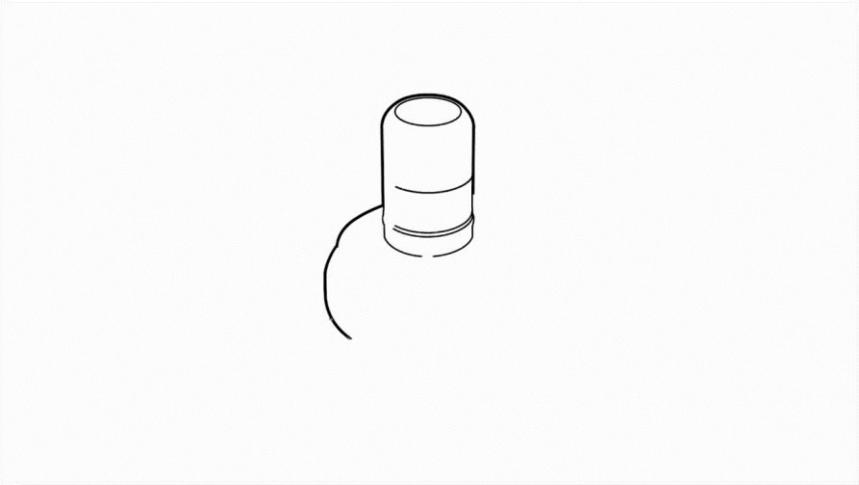
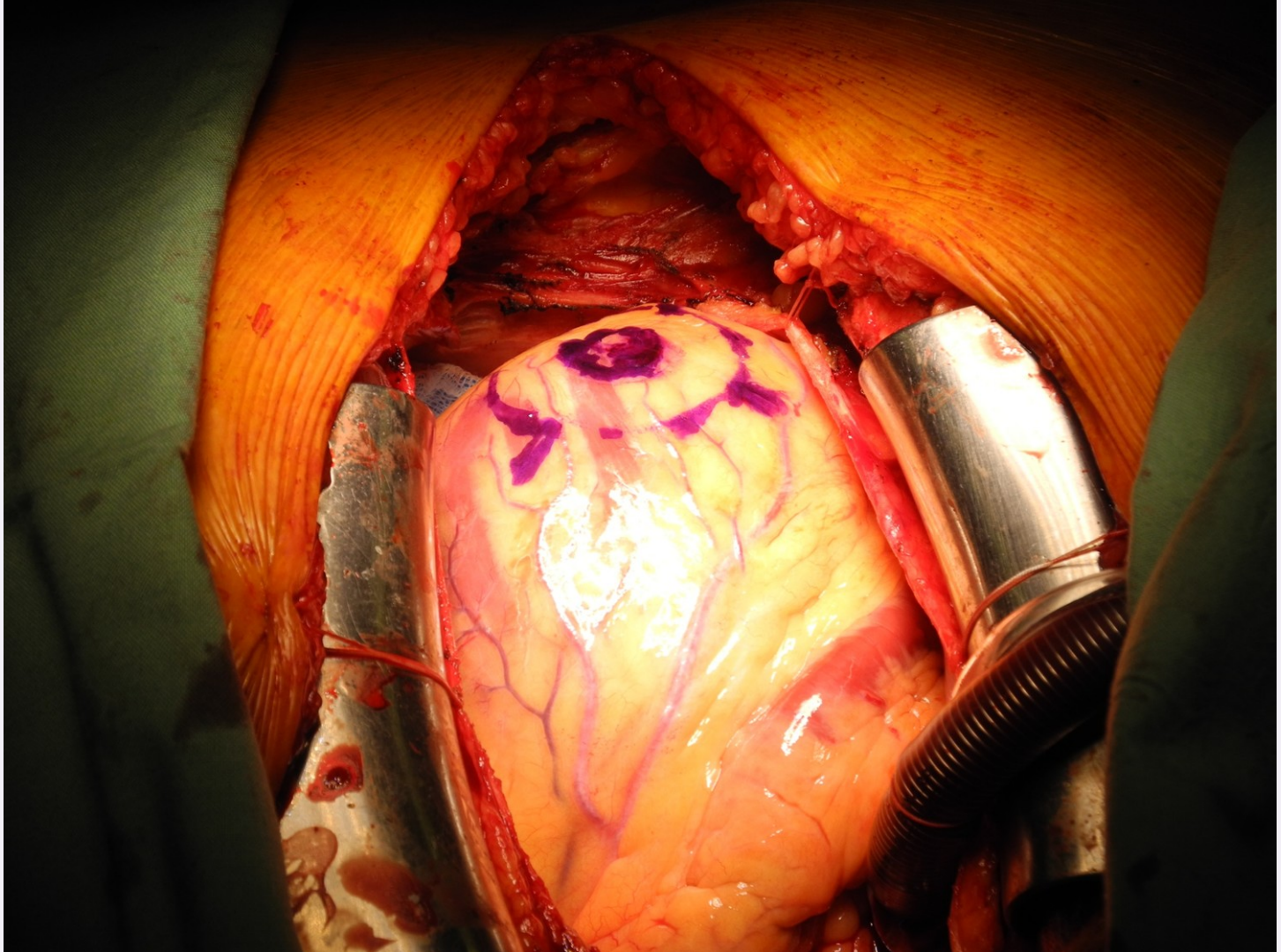
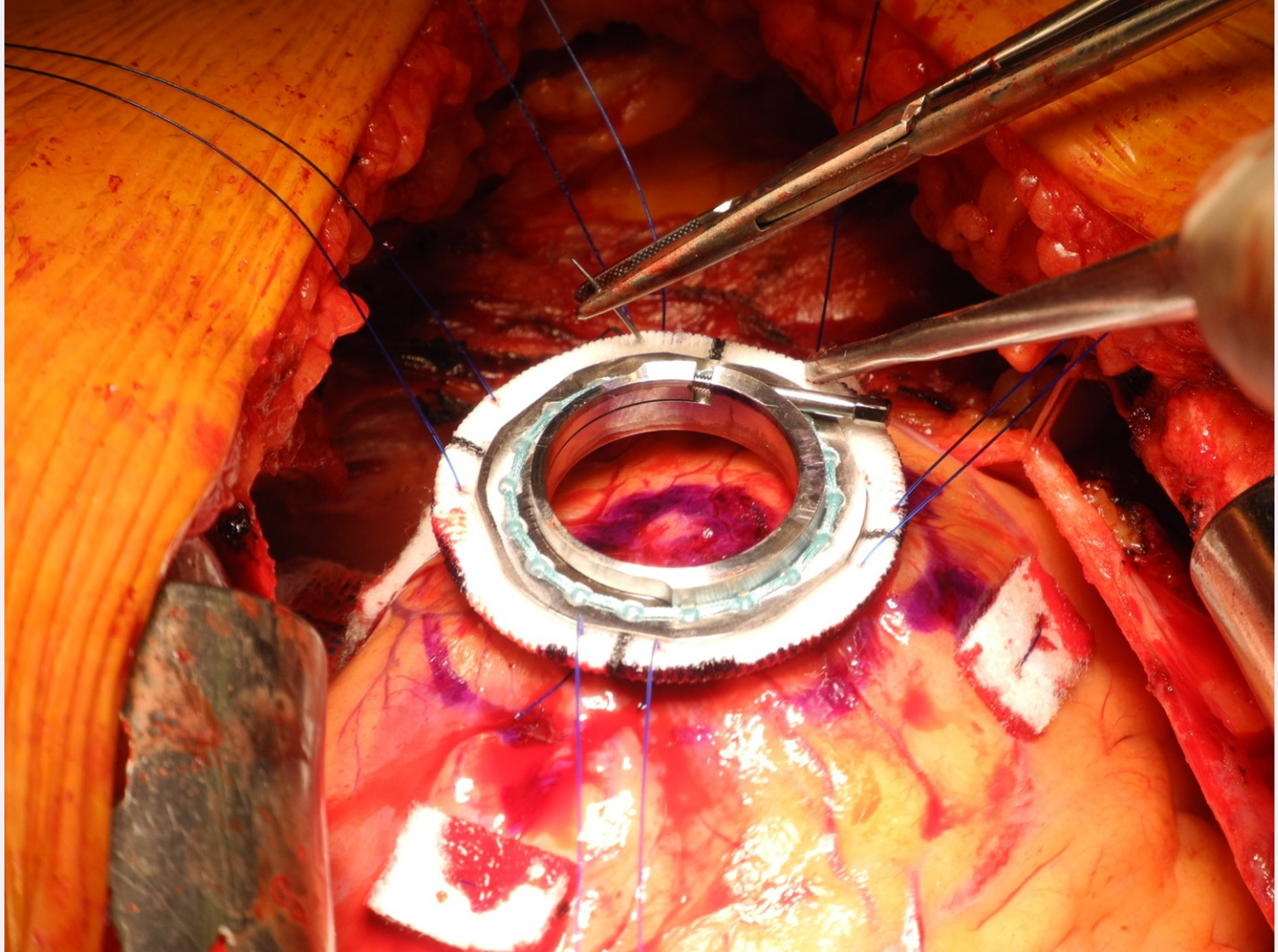
Long-term MCS – Heartmate II

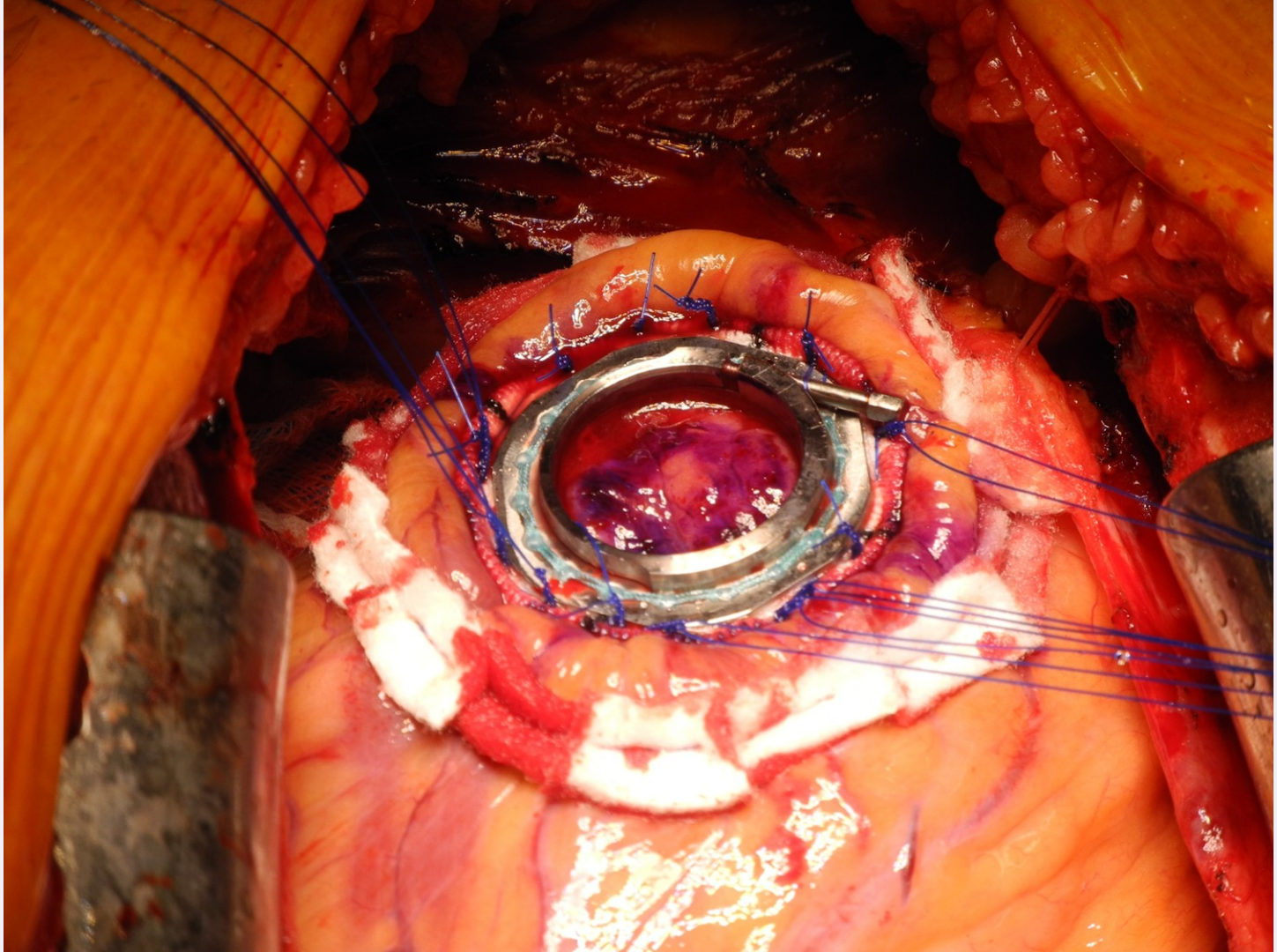


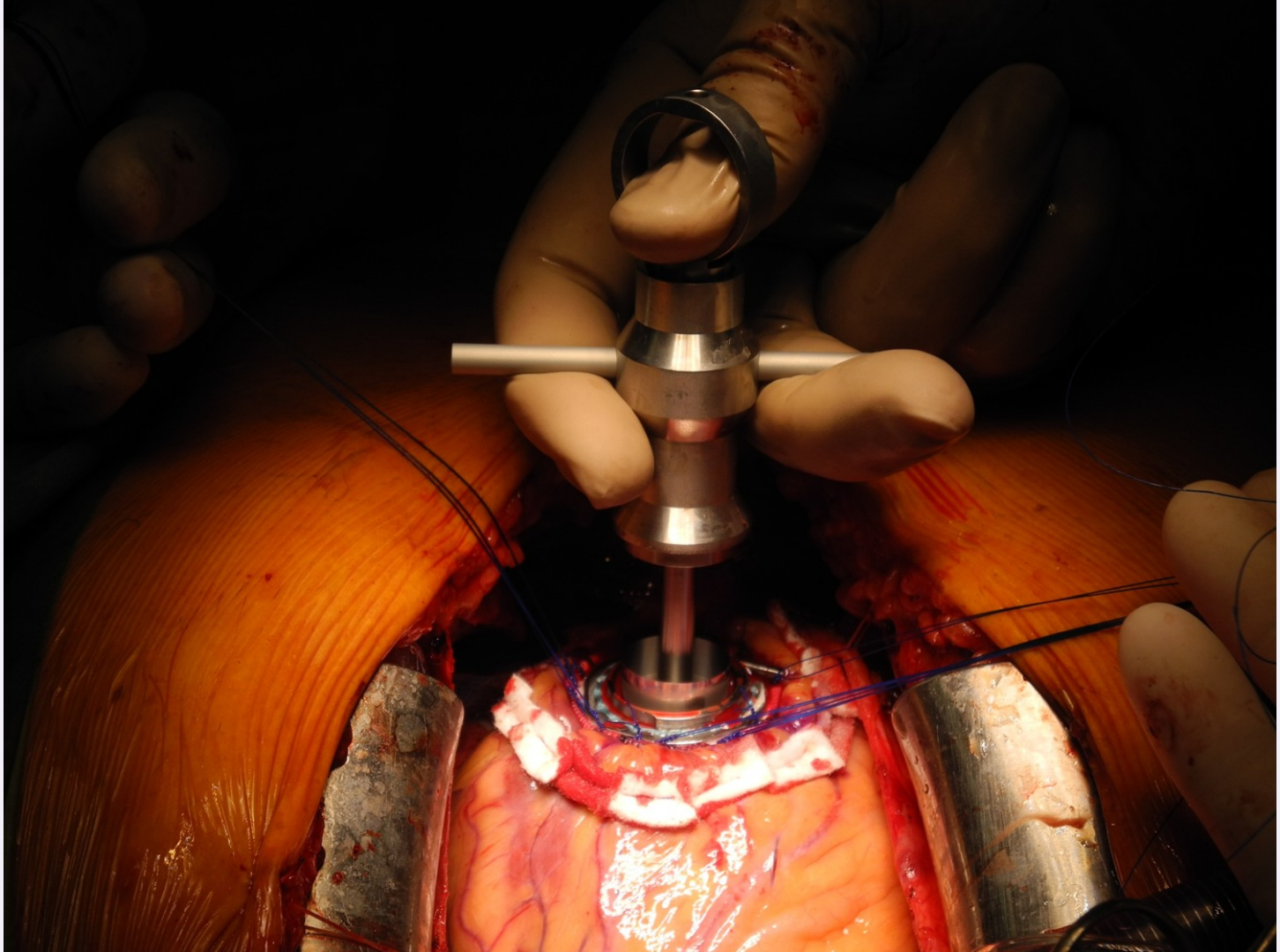
MCS – HeartWare HVAD

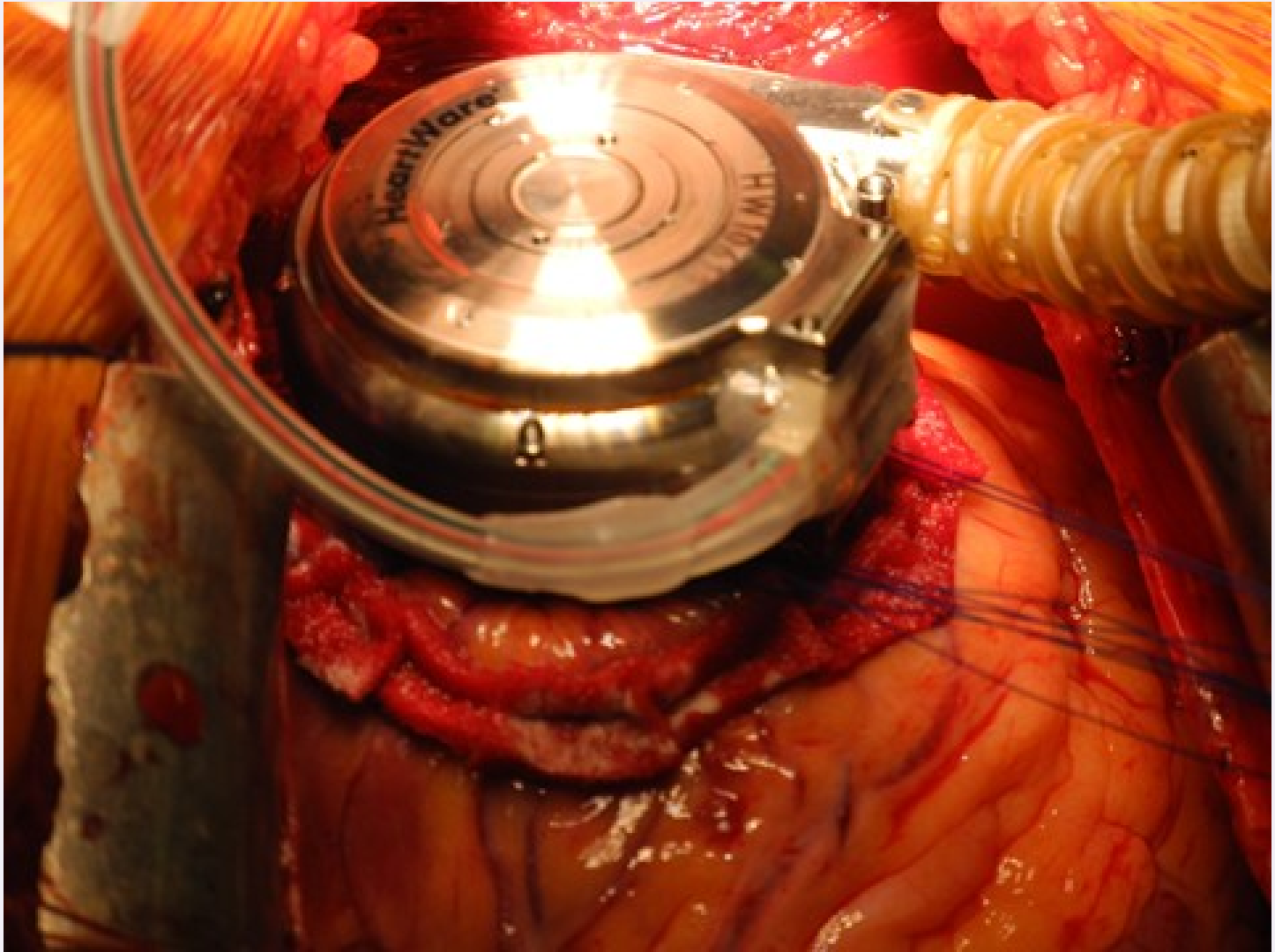


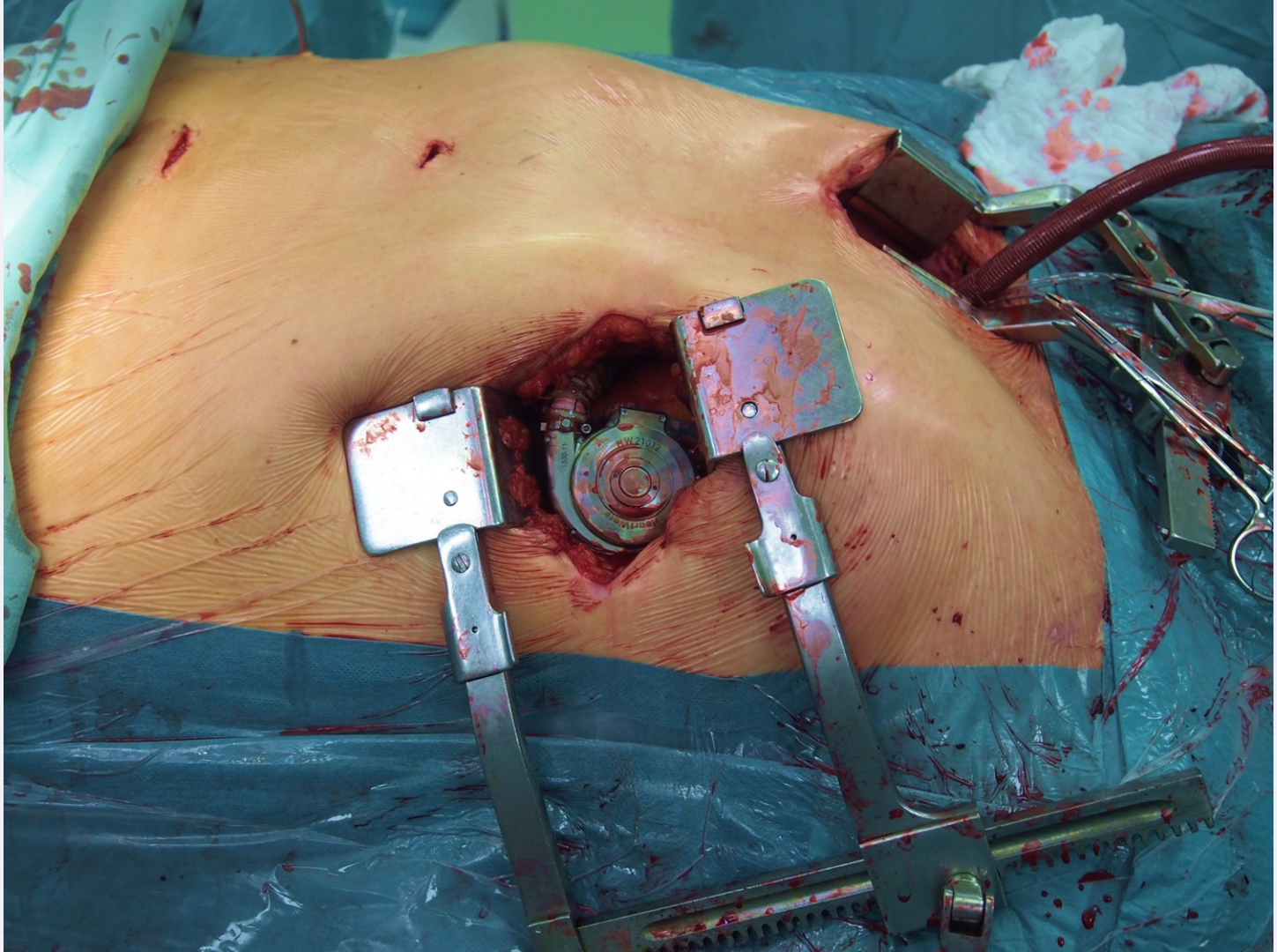


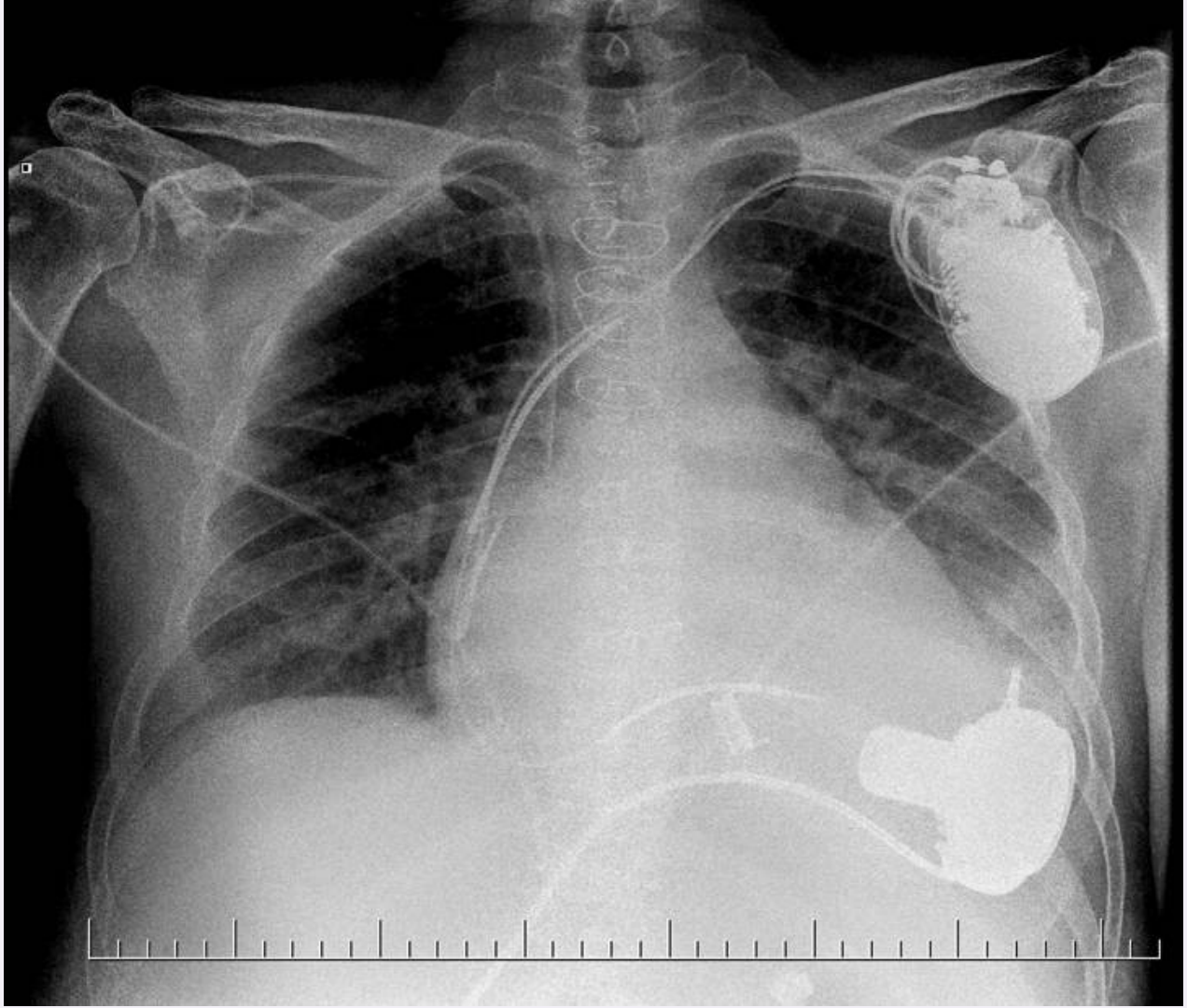




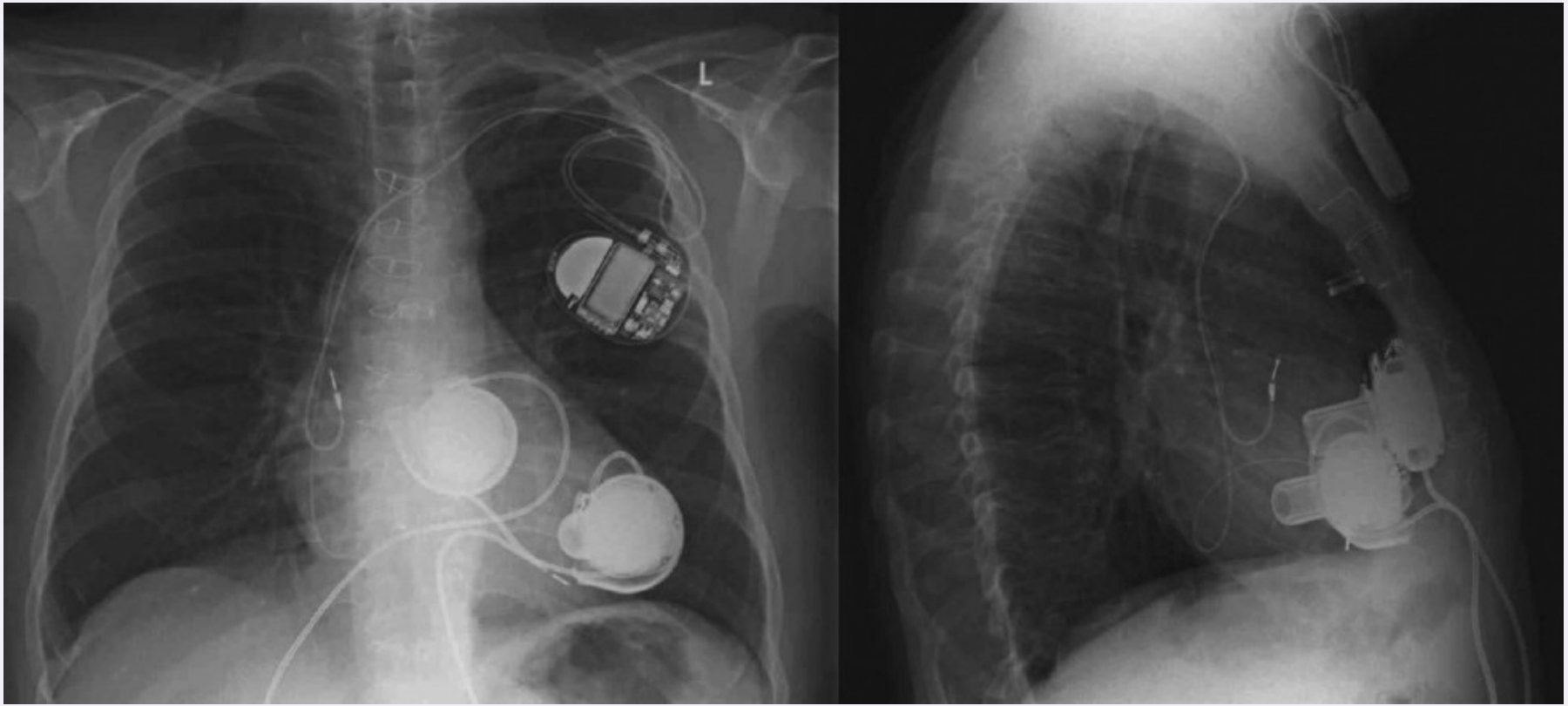



HeartWare

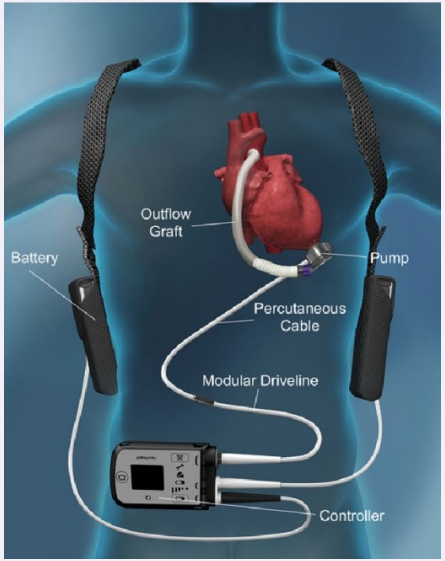


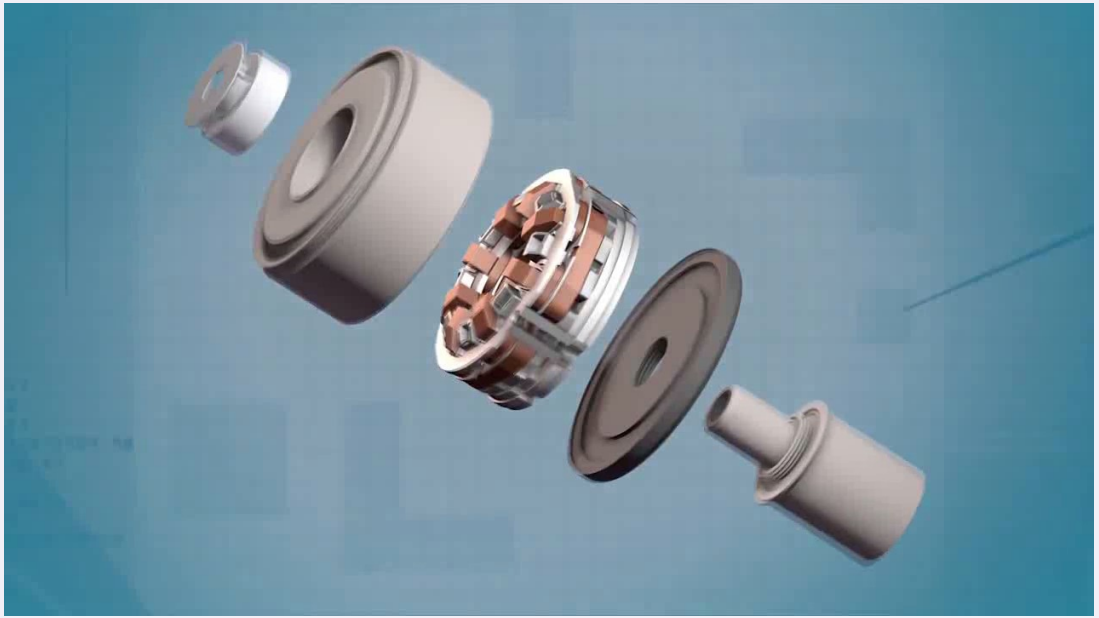


MCS – 2x LVAD as BiVAD



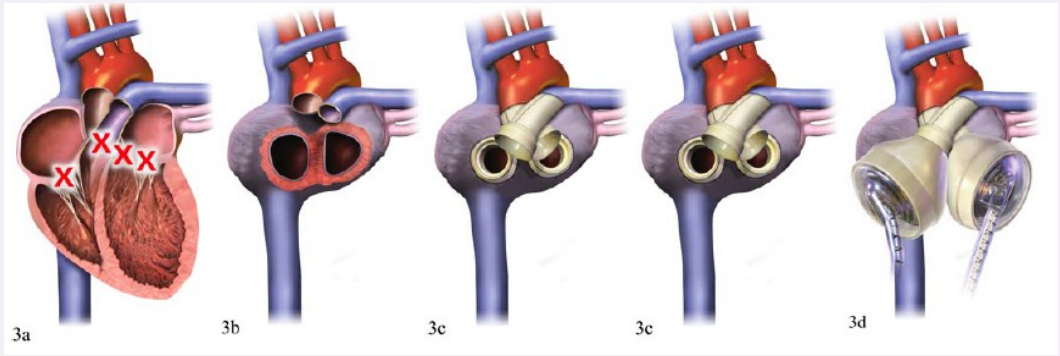
MCS – HEARTMATE 3

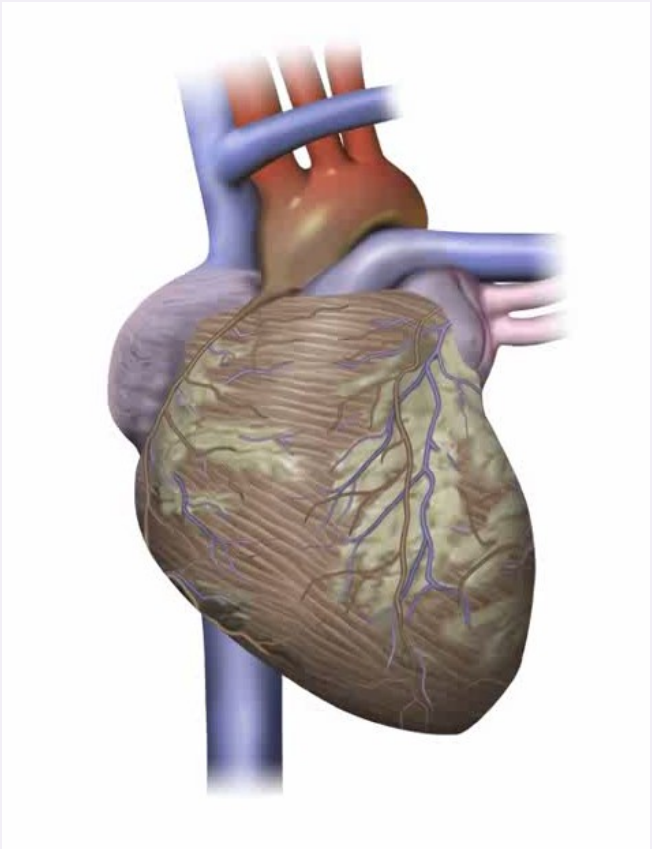




Total artificial heart - Syncardia

- pneumatic pump – pulsatile flow
- bridge-to-transplant
- noise





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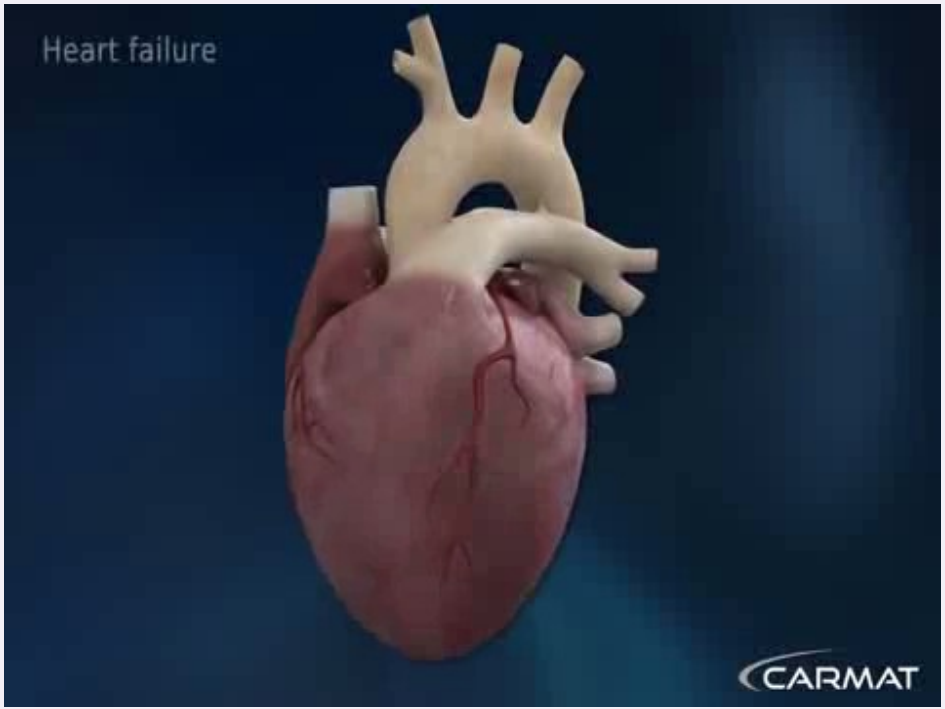
Total artificial heart - Carmat

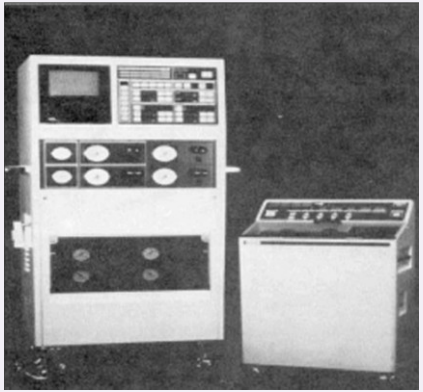
- electrohydraulic pump, biological valves, membranes - bovine pericardium
- pulsatile flow, autoregulation



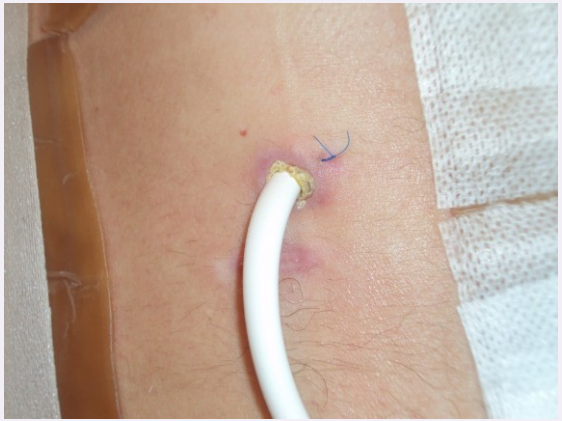
MCS - future

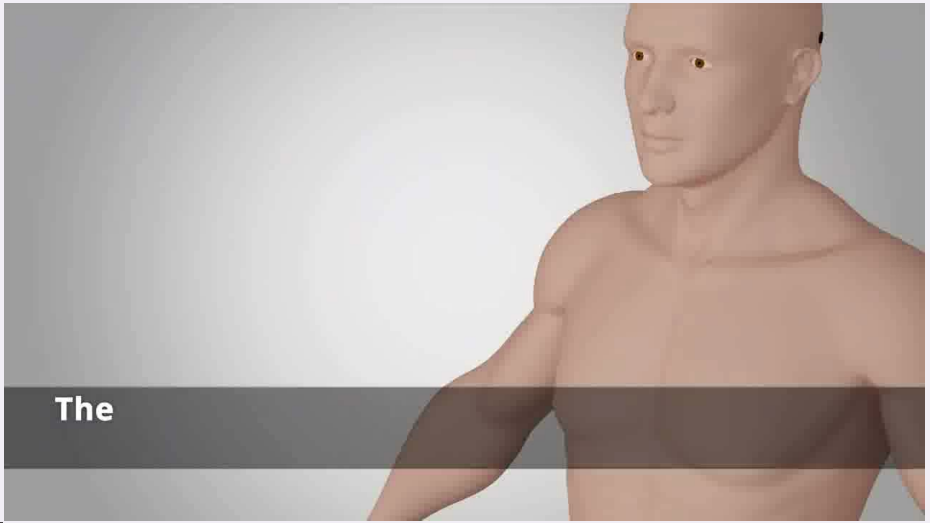
- miniaturization??? – external components
- wireless
- telemonitoring
- no anticoagulation

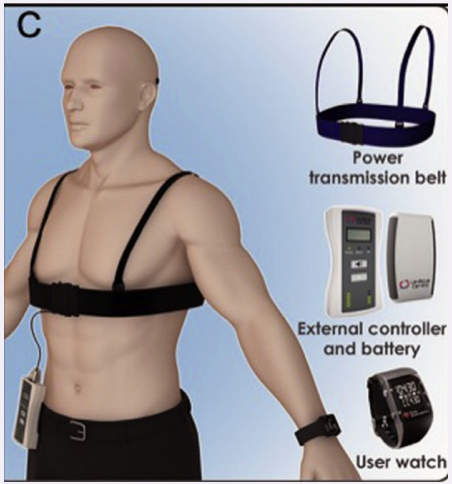
MCS - future - miniaturization

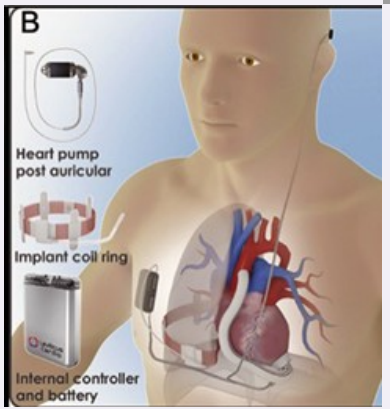


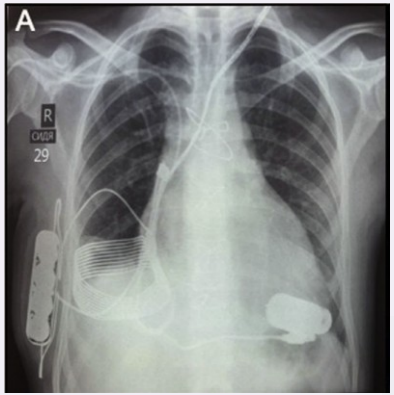
MCS - future - wireless











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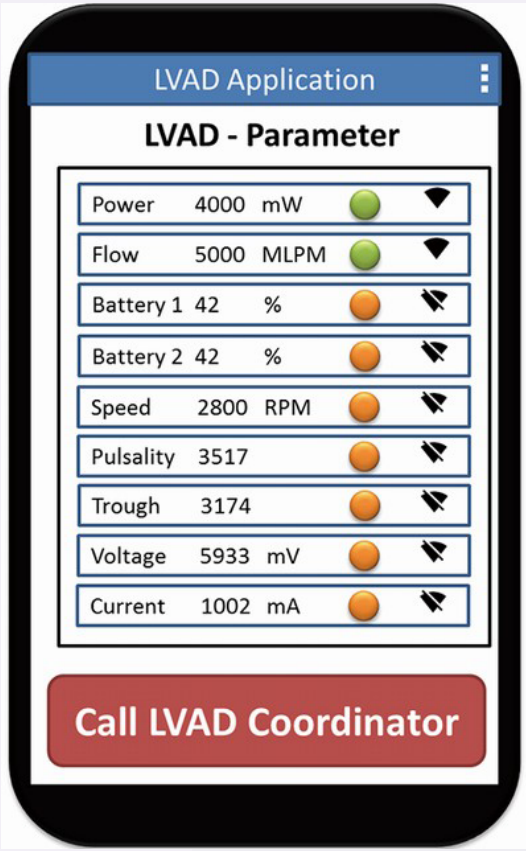
MCS - future - telemonitoring



MCS - future – no anticoagulation

Evaluation of low-intensity anti-coagulation with a fully magnetically levitated centrifugal-flow circulatory pump—the MAGENTUM 1 study

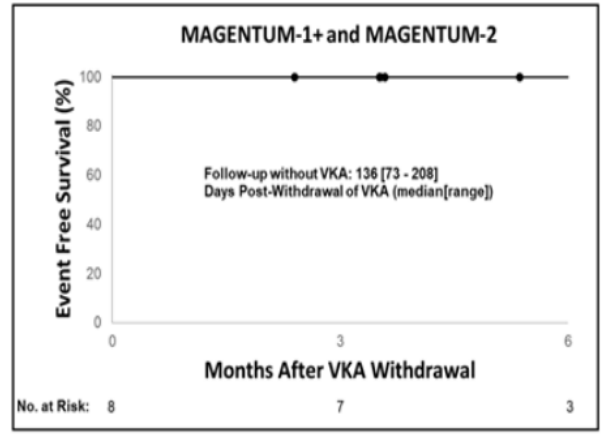
Ivan Netuka, MD, PhD[a,*], Peter Ivák, MD, PhD[a,b], Zuzana Tučanová, MD[a], Stanislav Gregor, PharmD[c], Ondrej Szárszoi, MD, PhD[a], Poornima Sood, MD[d], Daniel Crandall, PhD[d], Jessica Rimsans, PharmD, BCPS[e], Jean Marie Connors, MD[f], Mandeep R. Mehra, MD[g]

A Trial of Complete Withdrawal of Anticoagulation Therapy in the Heartmate 3 Pump

I. Netuka[1,*], P. Ivak[1], Z. Tucanova[1], S. Gregor[1], O. Szarszoi[1], J. Rimsans[2], J. Connors[2], D. Crandall[3], P. Sood[3], M. Mehra[2]

after 6 weeks - ↓ INR 1,5-1,9
n = 15
after 6 months
- no stroke, no pump thrombosis
- 1x GI bleeding

from MAGENTUM 1 study – n = 5
MAGENTUM 2 – after 6 months – complete withdrawal anticoagulation therapy



Netuka, I, et al. JHLT, 2018, 37.5: 579-586
Netuka I., et al. JHLT, 2019, 38.4: S113

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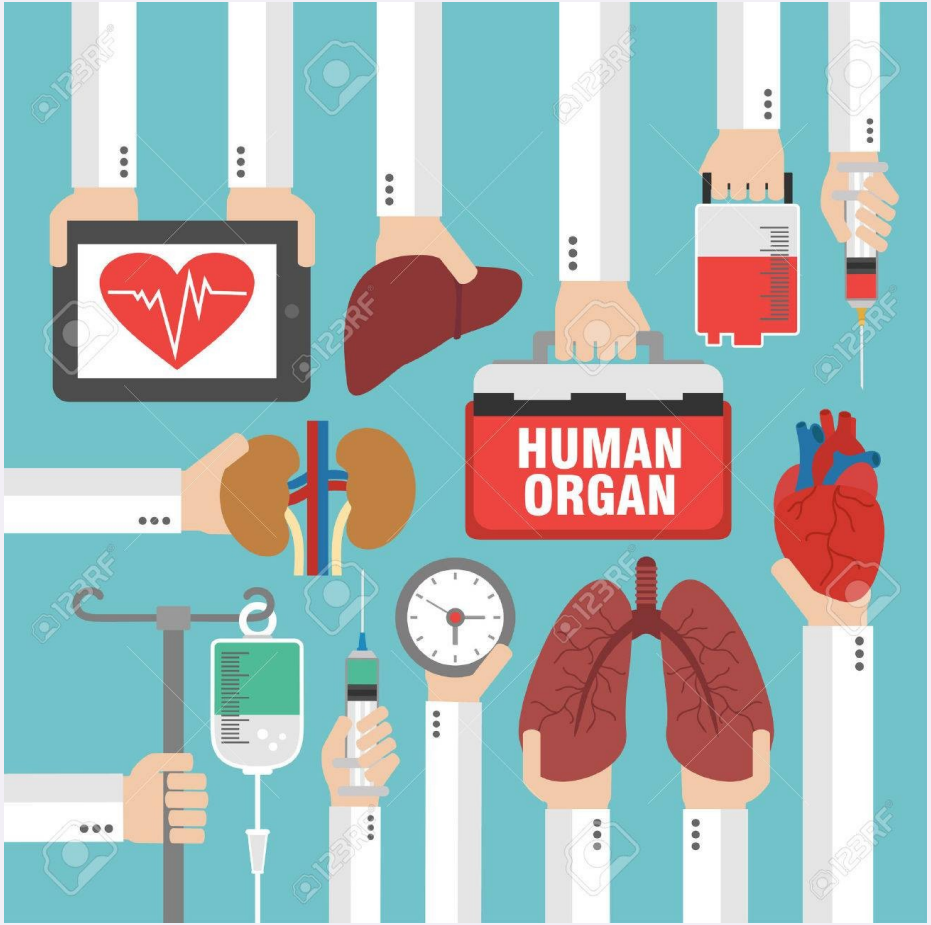
Transplant surgery



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Heart transplantation

Heart transplantation

1967 - Christian Barnard
1983 - cyclosporine
CKTCH Brno - 1992
- 1995 - children

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Heart transplantation

indications

terminal heart failure
(coronary artery disease, valve disease, cardiomyopathy)

contraindications

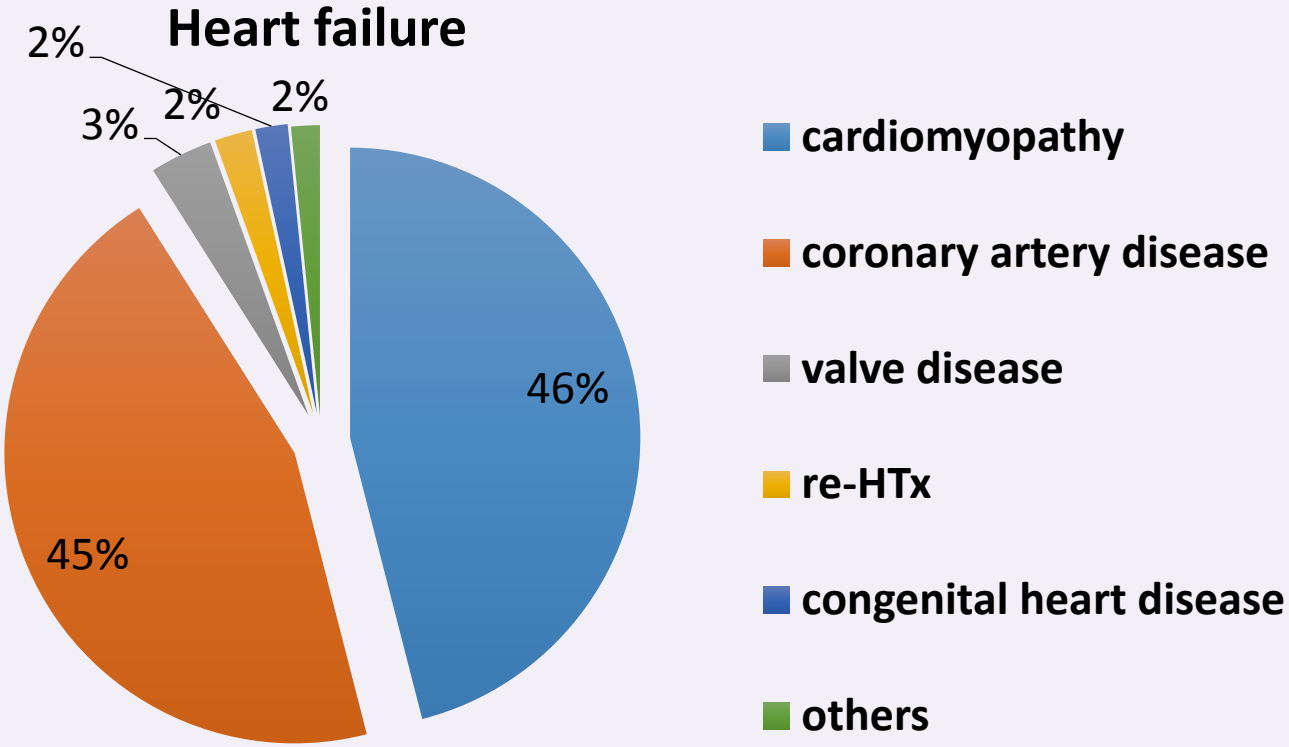
fixed pulmonary hypertension
neoplasms
active alcohol or drug abuse
age over 65 years (individual assessment)

potential relative contraindications

active infection, pulmonary embolism, active peptic ulcer disease

liver, kidney failure – 2 or 3 organs transplantation

Heart failure - etiology



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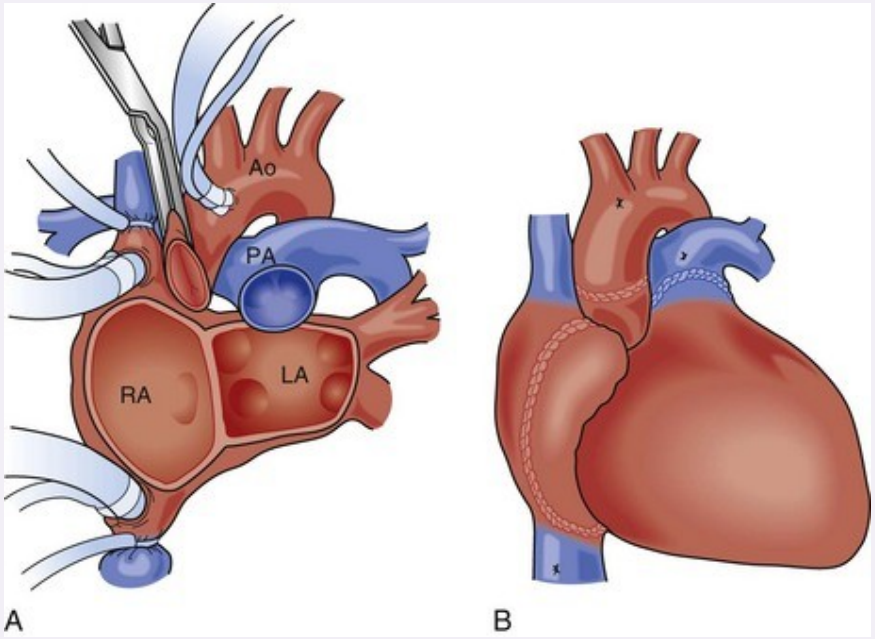
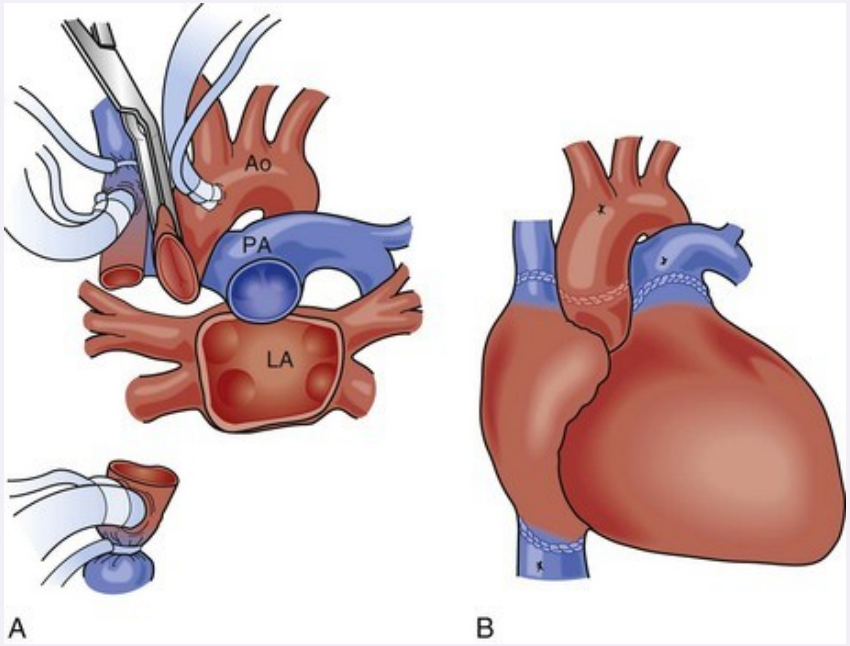
Heart transplantation - surgical technique

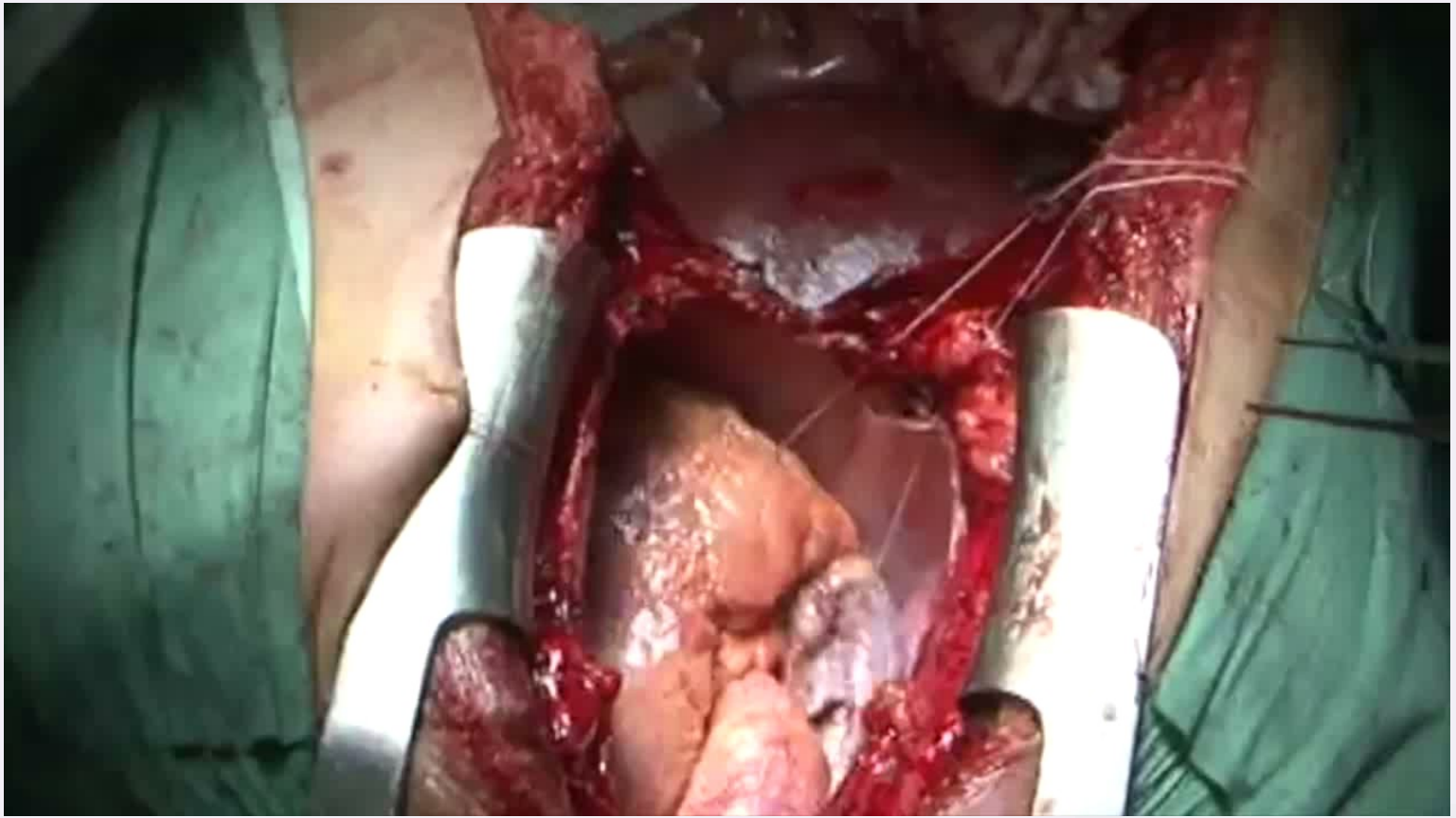
biatrial (Lower-Shumway)

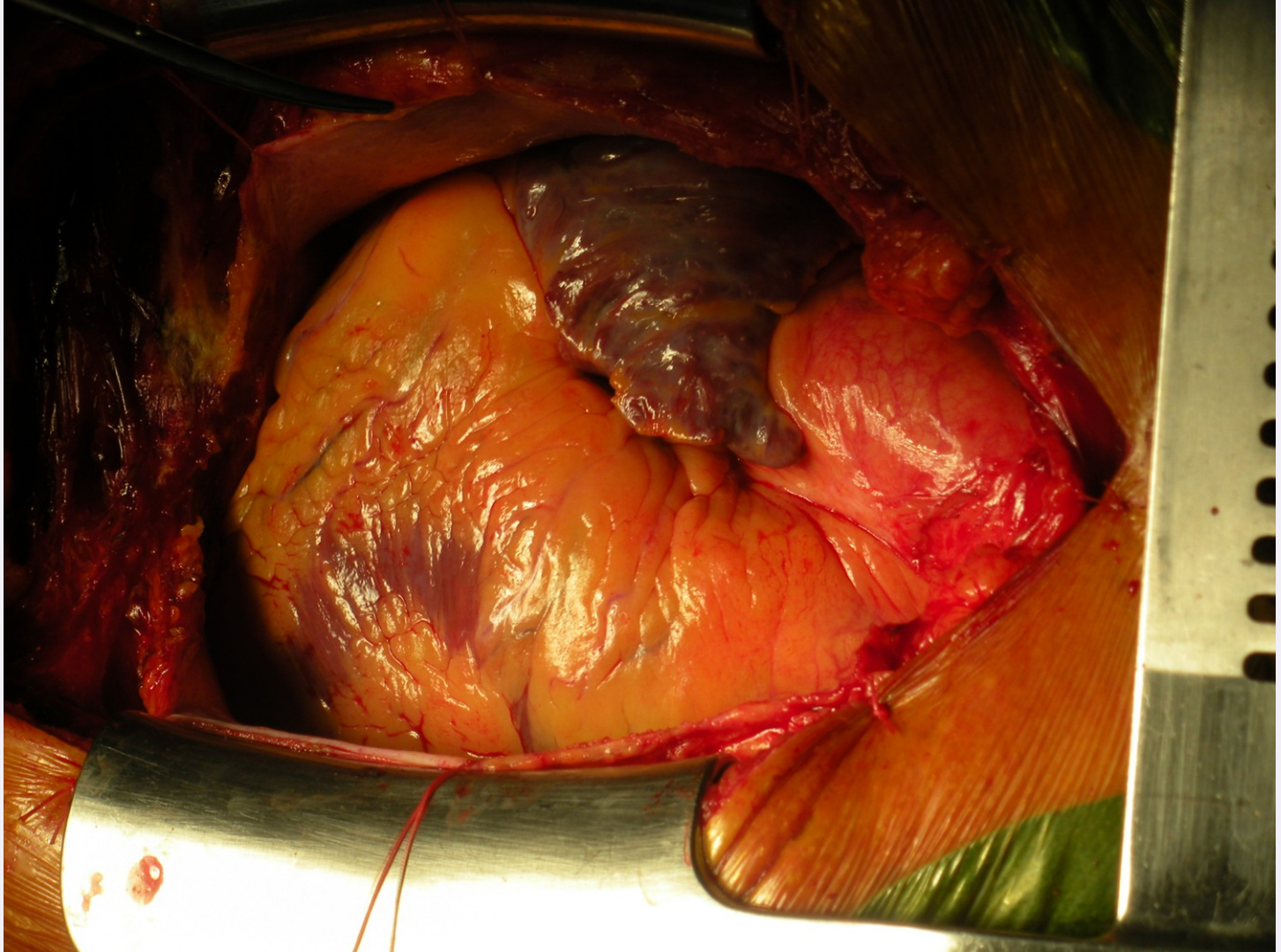


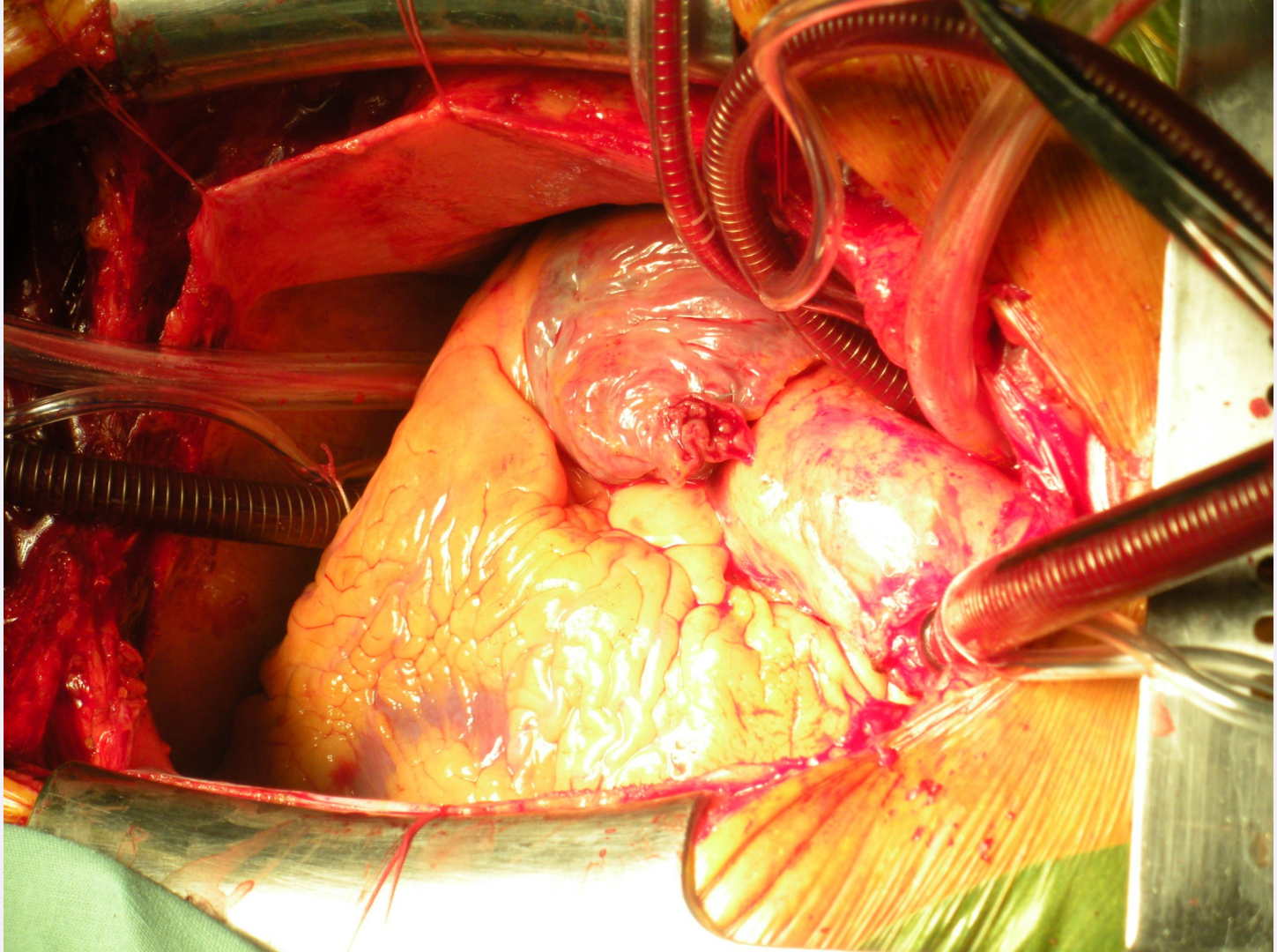
bicaval

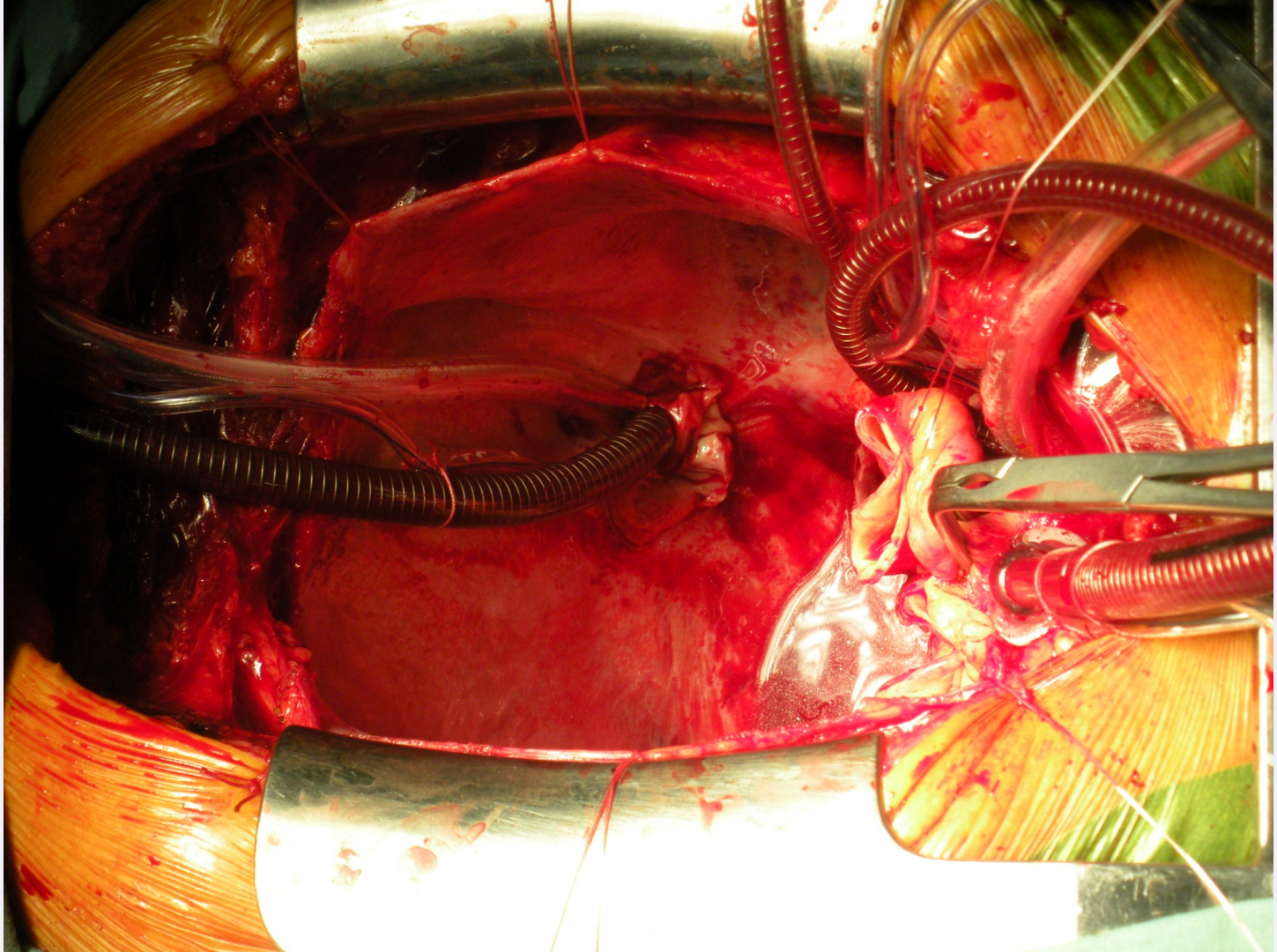


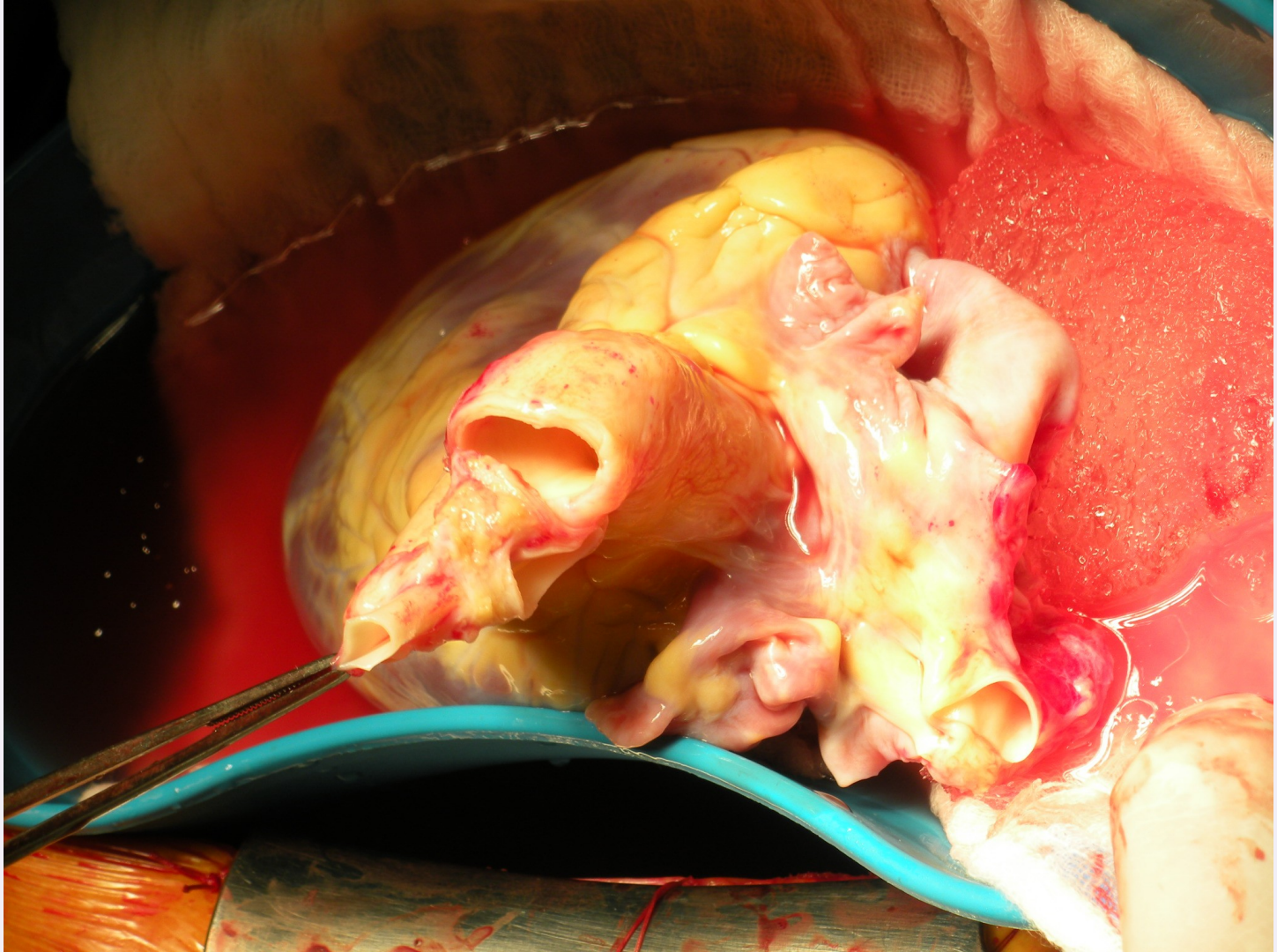
Heart transplantation - video

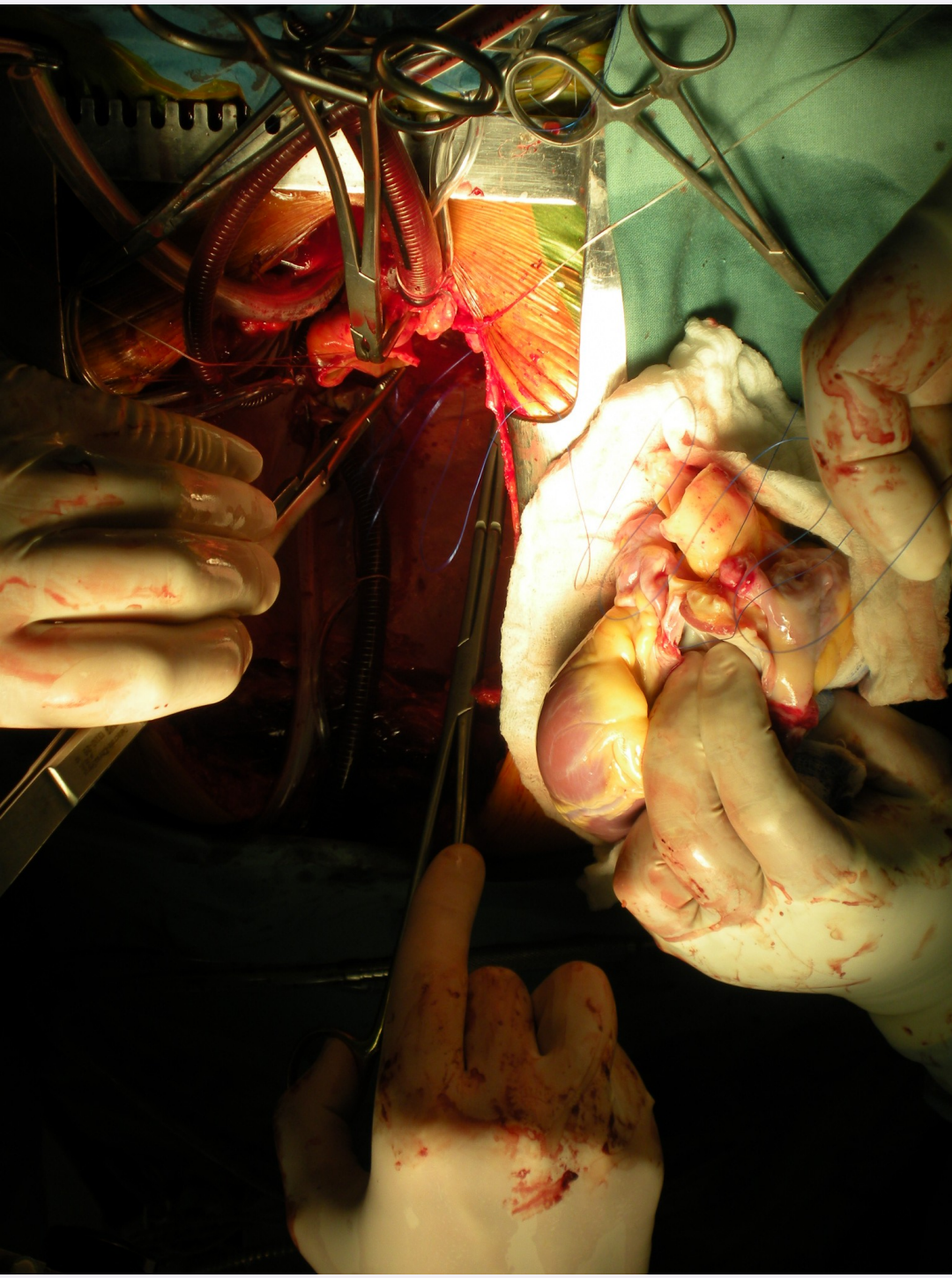


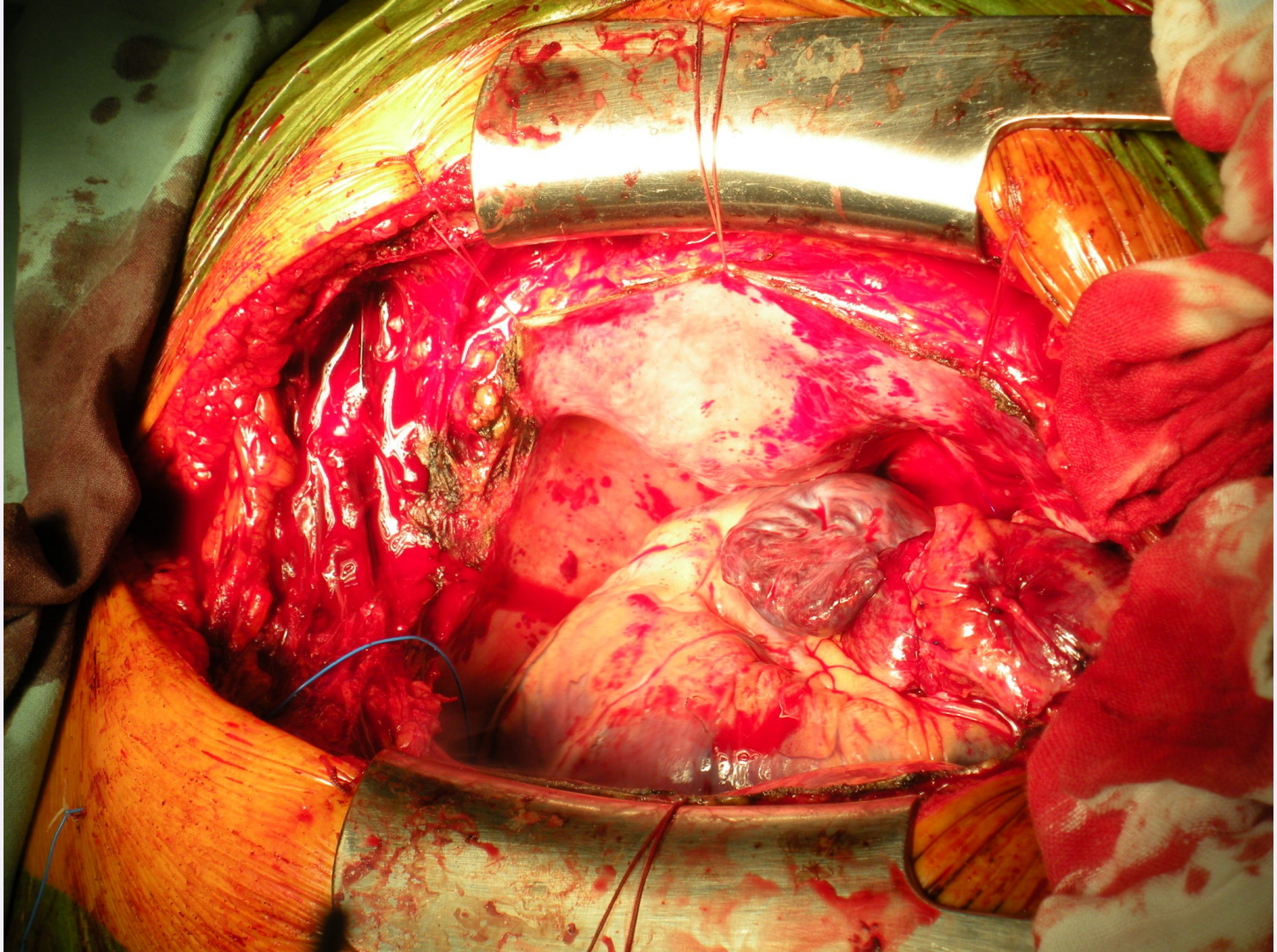


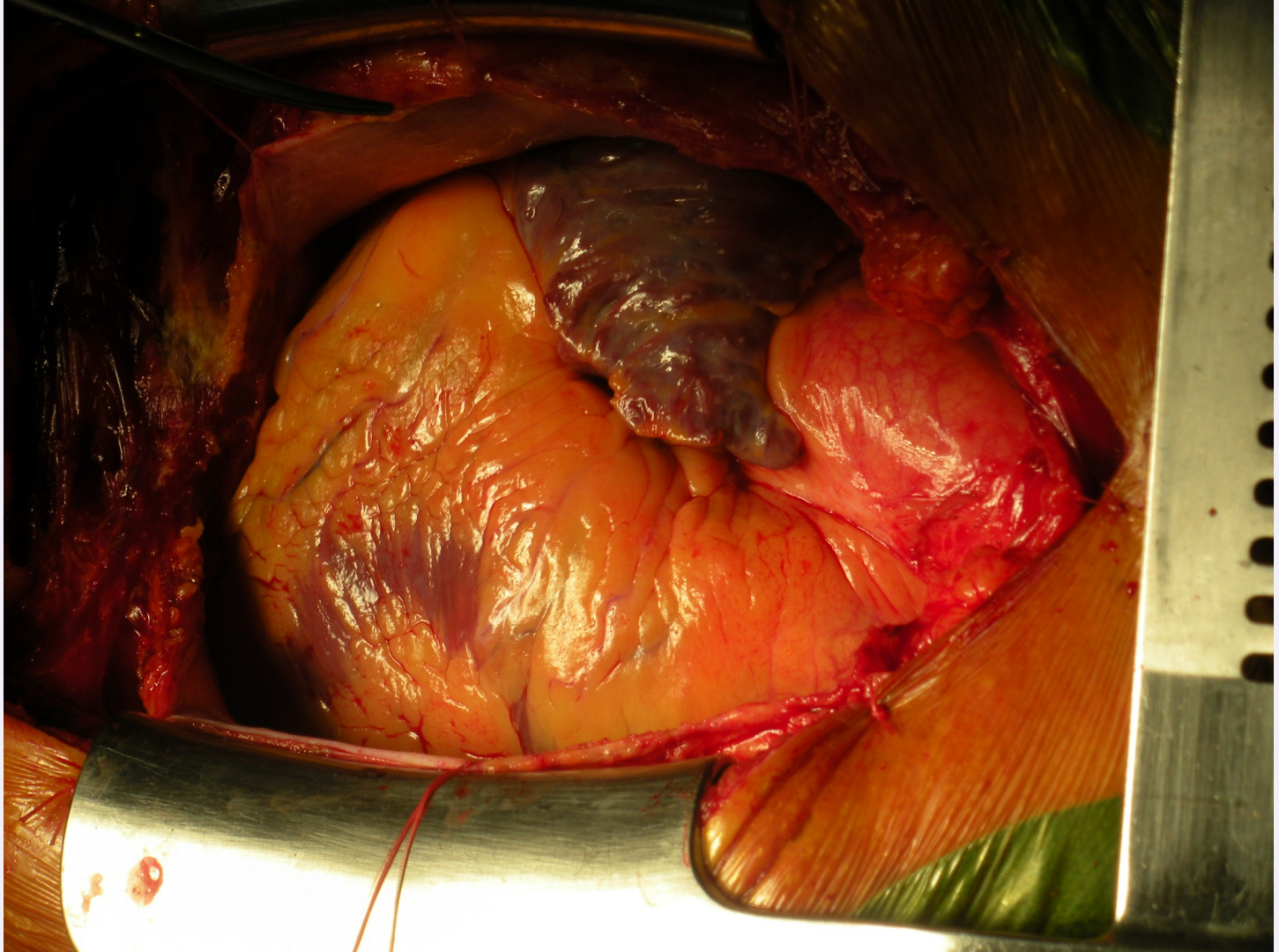












Heart transplantation - what happens next?

therapy:

- immunosupression: CNI (cyclosporine, tacrolimus) + mycopfenolate + steroids
- side effects: nephrotoxicity, diabetes, hypertension, infection, dyslipidemia, bone marrow suppression,neoplasms, osteoporosis

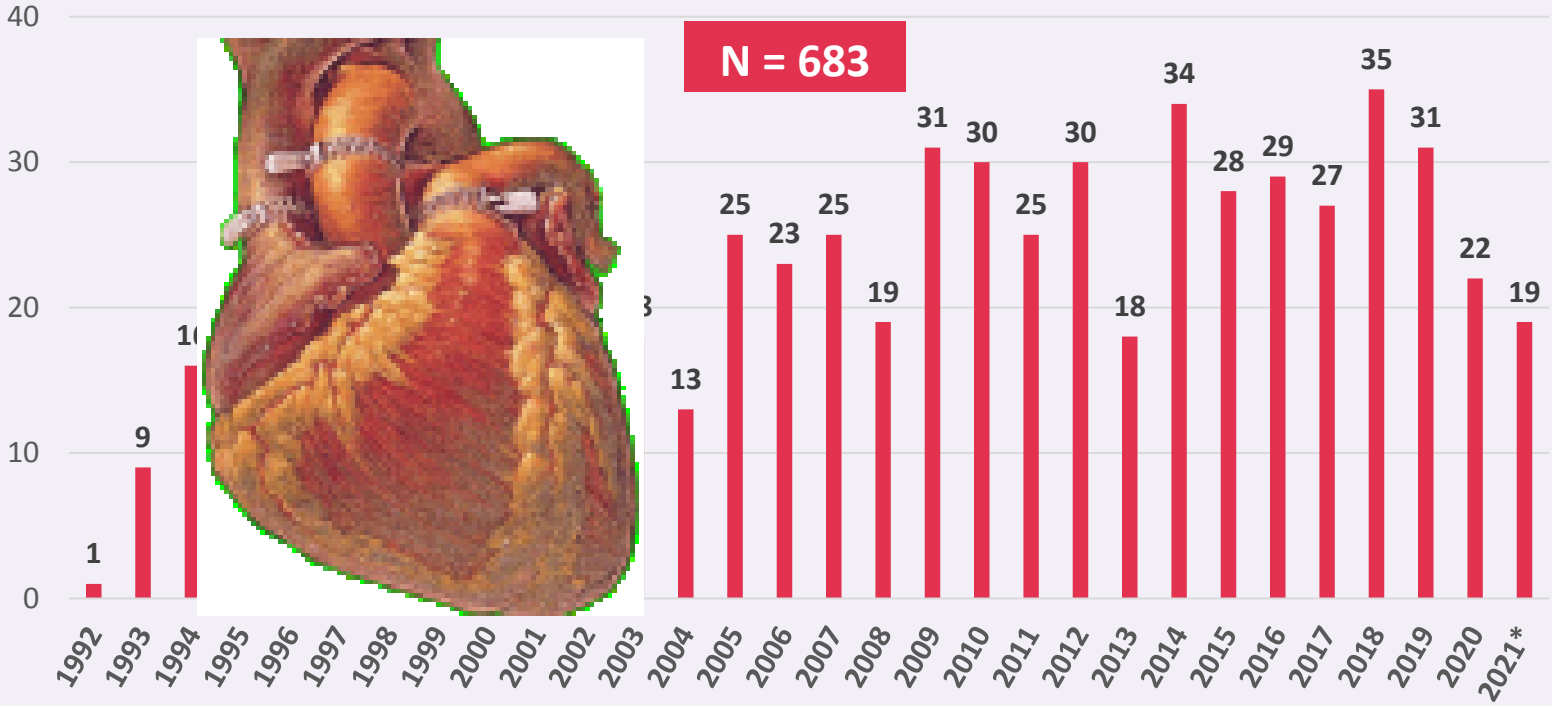
complications after Htx:

- RV failure, rejection, infection, cardiac allograft vasculopathy, complications of immunosuppressive therapy

follow-up after Htx:

- transplant center (biopsy, level of immunosupression, coronarography – OCT)

Heart transplantation - CKTCH Brno



1 year survival; 5 year survival - 82 % a 68 %

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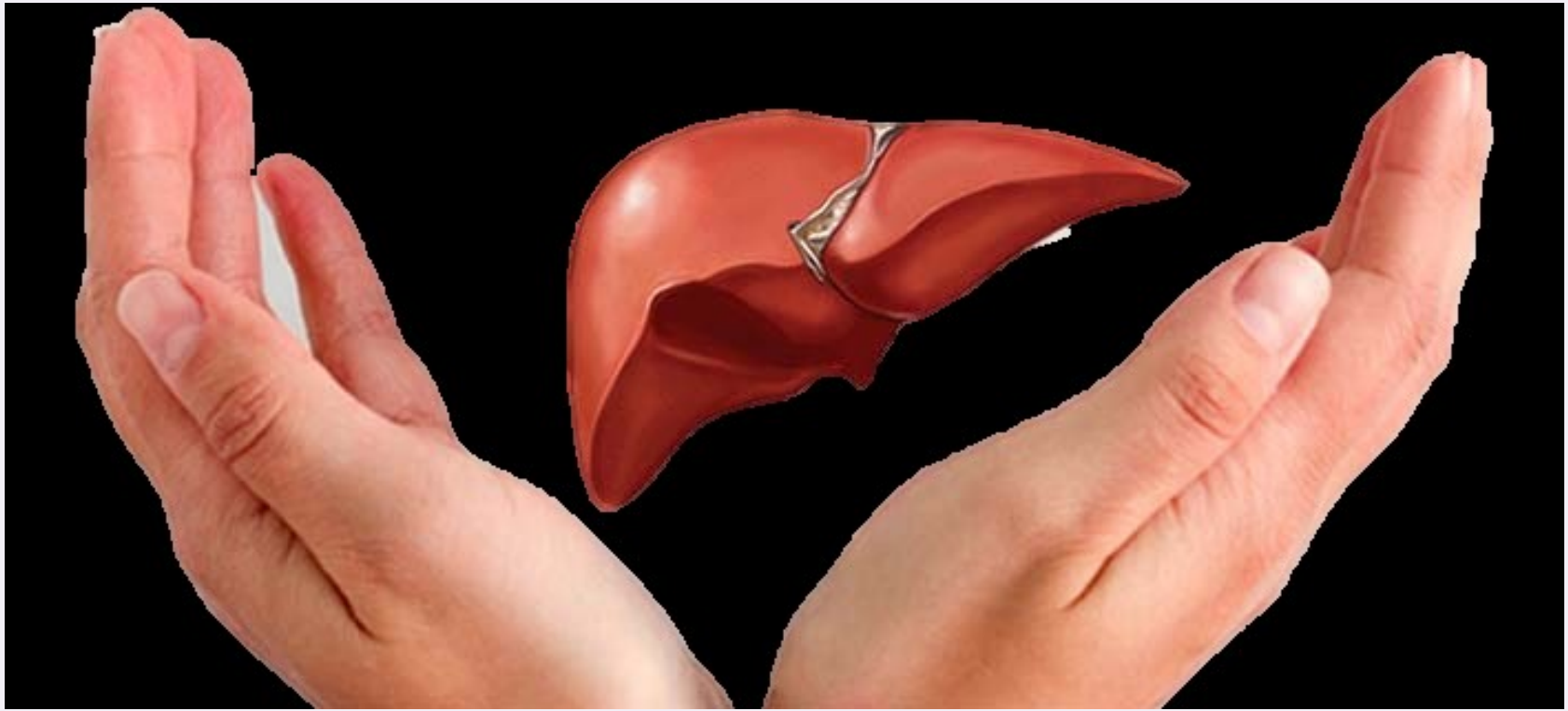
Liver transplantation



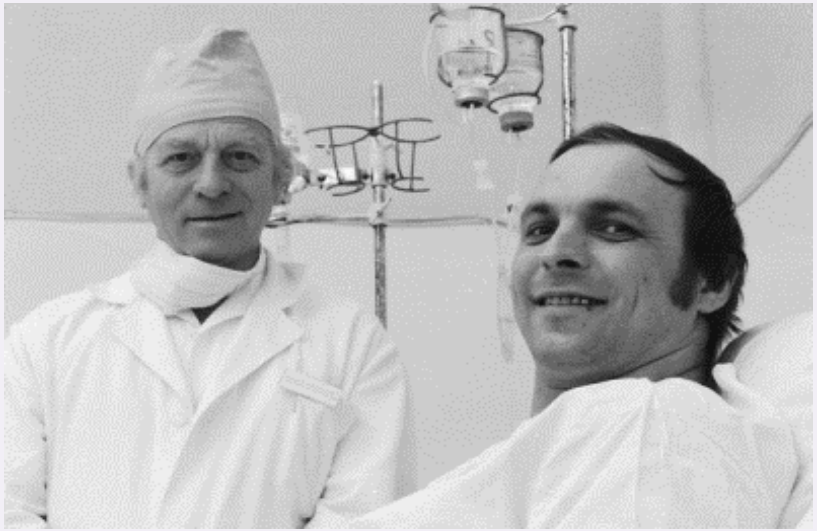
Liver transplantation

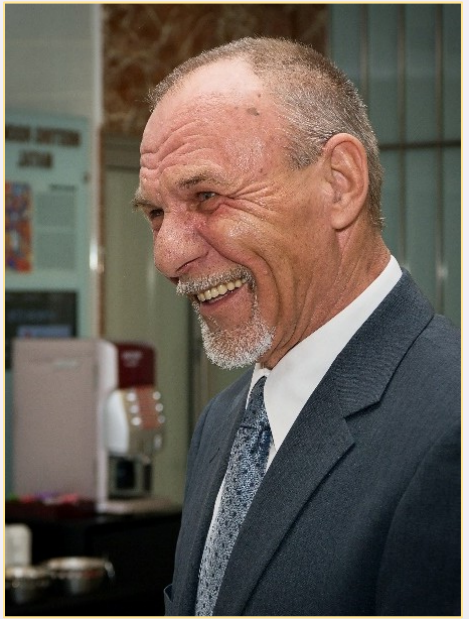
1967 – 1st succesfull liver transplantation - Starzl, Colorado, US

(pt with liver tumor, died one year after)

1983 – 1st liver transplantation in former ČSSR - Kořístek, Brno

(pt with liver tumor, still alive)





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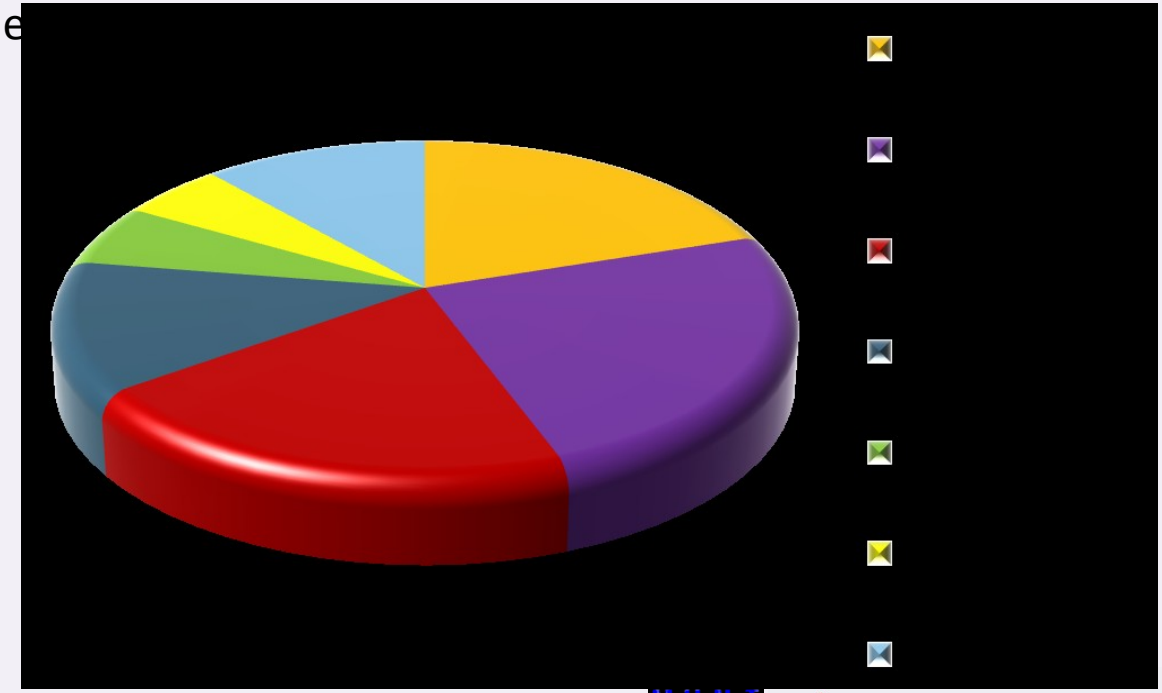
Liver transplantation

Indications irreversible liver dysfunction due to:

- liver cirrhosis (toxonutritive, cryptogenic, after viral hepatitis C, B)
- cholestatic or me
- tumours



Liver transplantation - surgery

laparotomy

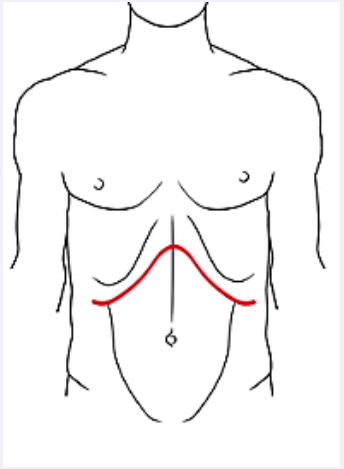
hepatectomy

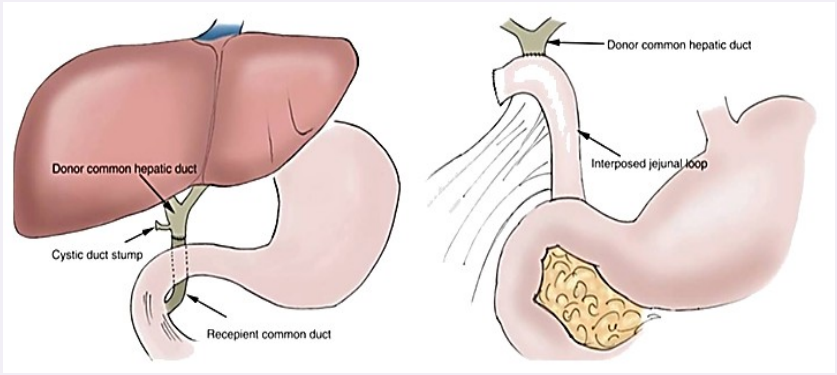
inferior vena cava anastomosis (classic or piggyback)

portal vein and hepatic artery anastomosis

bile duct anastomosis:

- choledocho-choledocho anastomosis
- choledocho-jejuno anastomosis sec. Roux





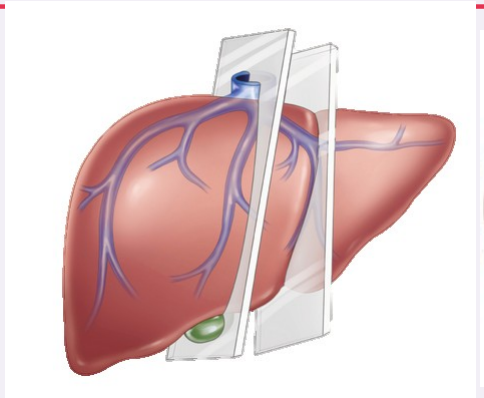
Liver transplantation - surgical techniques

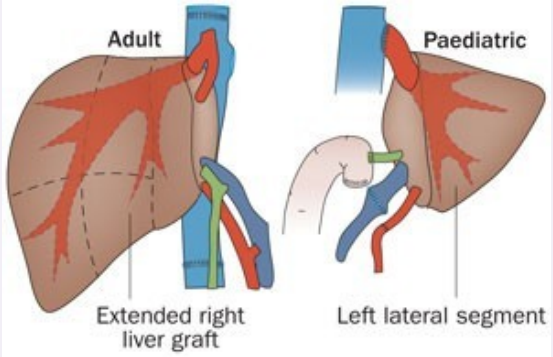
Tx whole liver graft

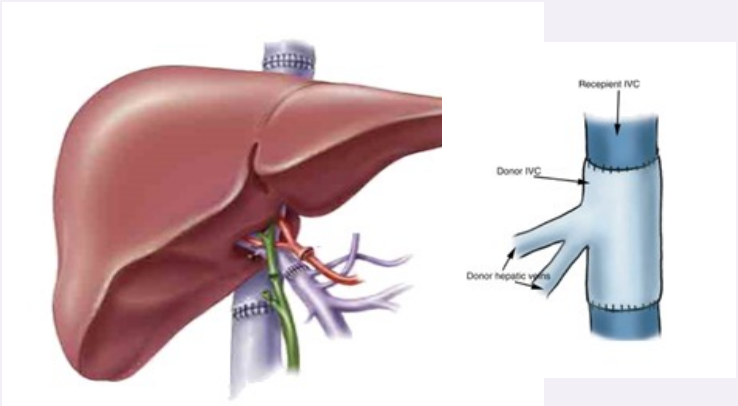
Tx graft reduction

Tx split graft
(1 child + 1 adult or 2 adults)

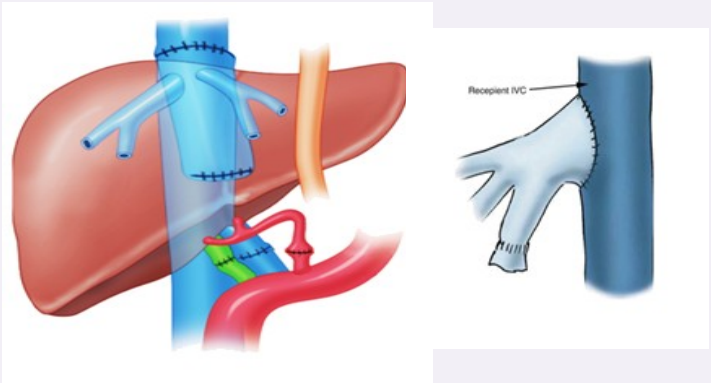
Tx from living donor





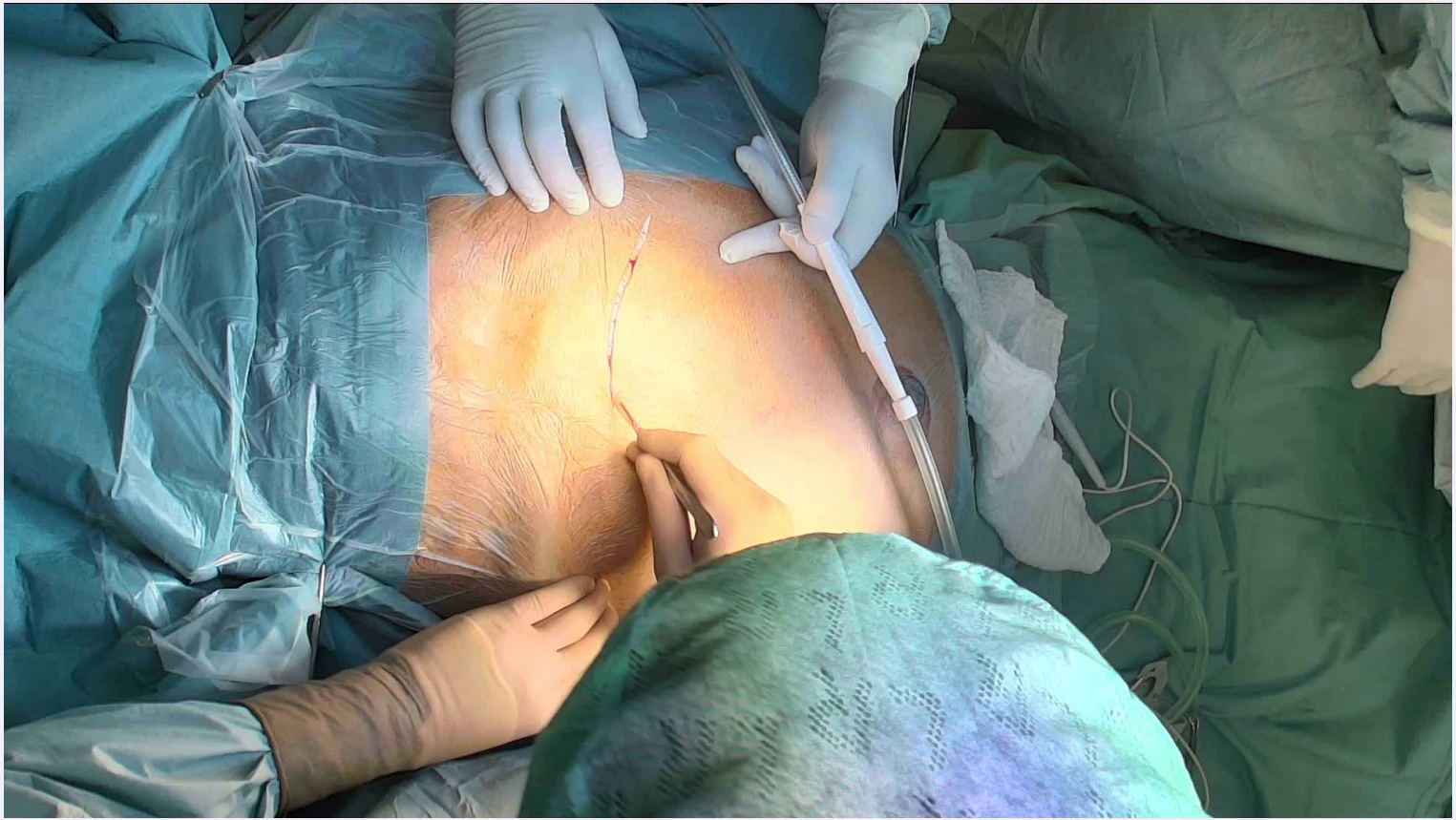


classic technique



piggyback

Liver transplantation - video



Liver transplantation - complications

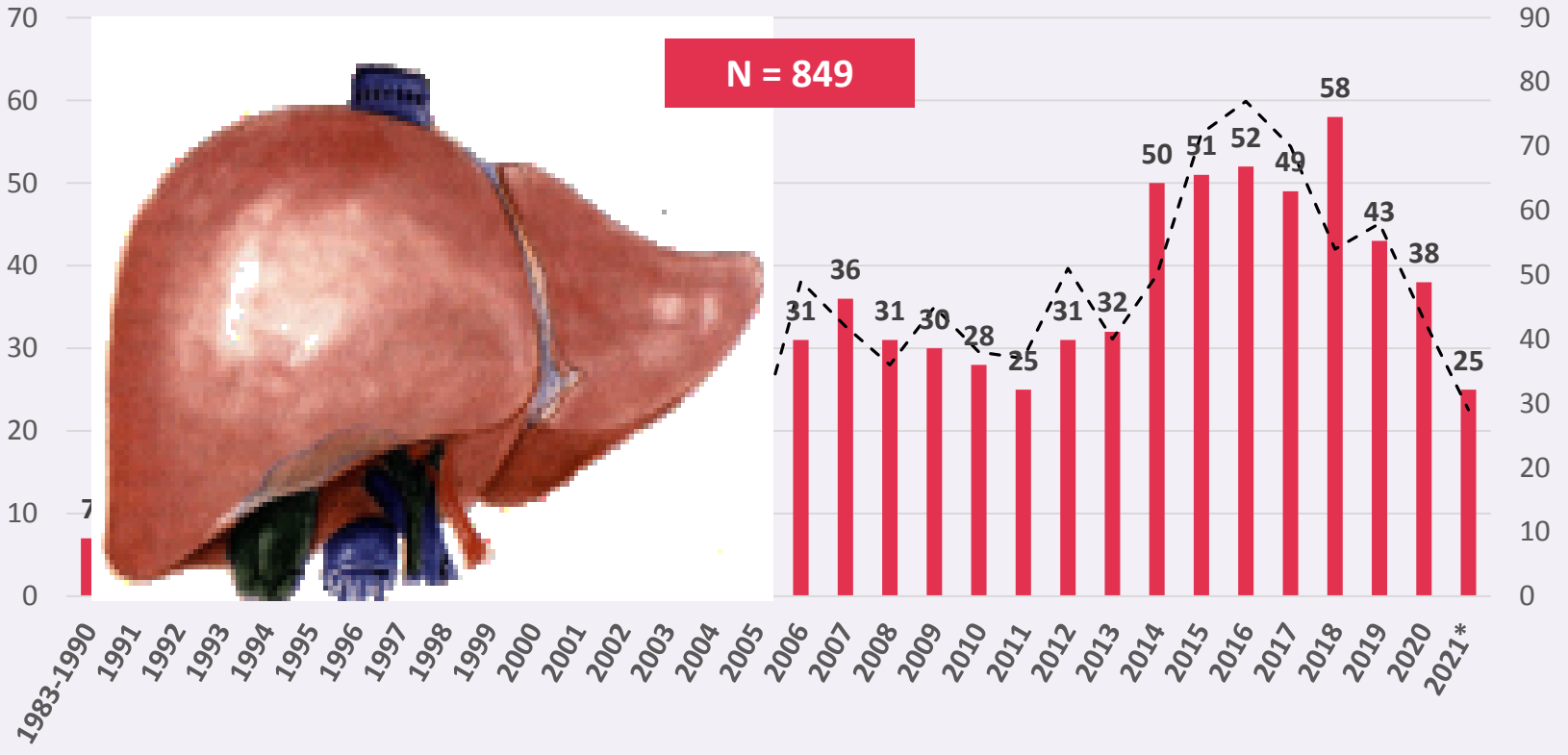
early:

- bleeding
- wound infection
- bile leak
- early rejection

late:

- bile duct stenosis
- hepatic artery stenosis/thrombosis
- hepatic veins stenosis
- chronic rejection
- recurrence of primary diseases

Liver transplantation - CKTCH Brno



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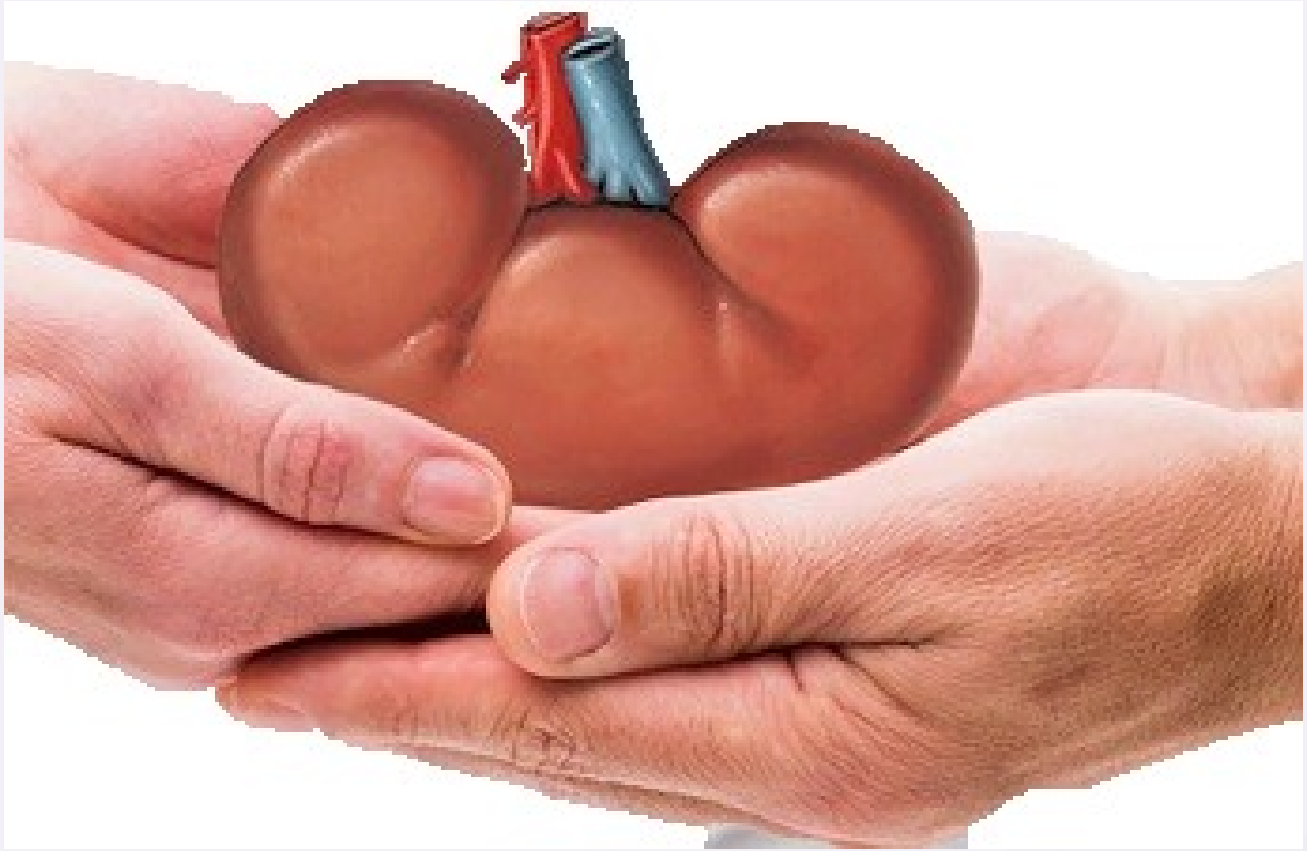
Kidney transplantation



Kidney transplantation

- treatment of choice for kidney failure (compared with a lifetime on dialysis)
- only 10% pts on dialysis listed on WL. Reason? - polymorbidity

1954 - 1st successful kidney transplantation - Murray, Boston, US
1961 - prof. Navrátil - Hradec Králové – 1st in former ČSSR
1972 - 1st in Brno

Indications - end-stage renal disease
- diabetic nephropathy
- glomerulonephritis
- interstitial nephropathy
- genetic disorders
- metabolic or systemic diseases

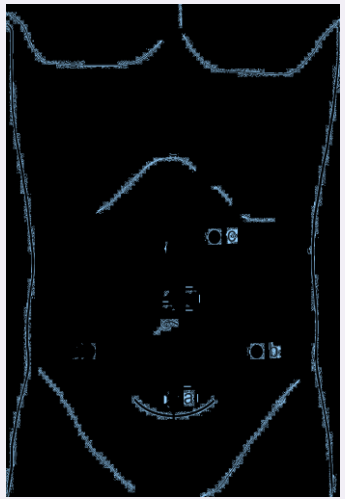
Kidney transplantation

deceased donor

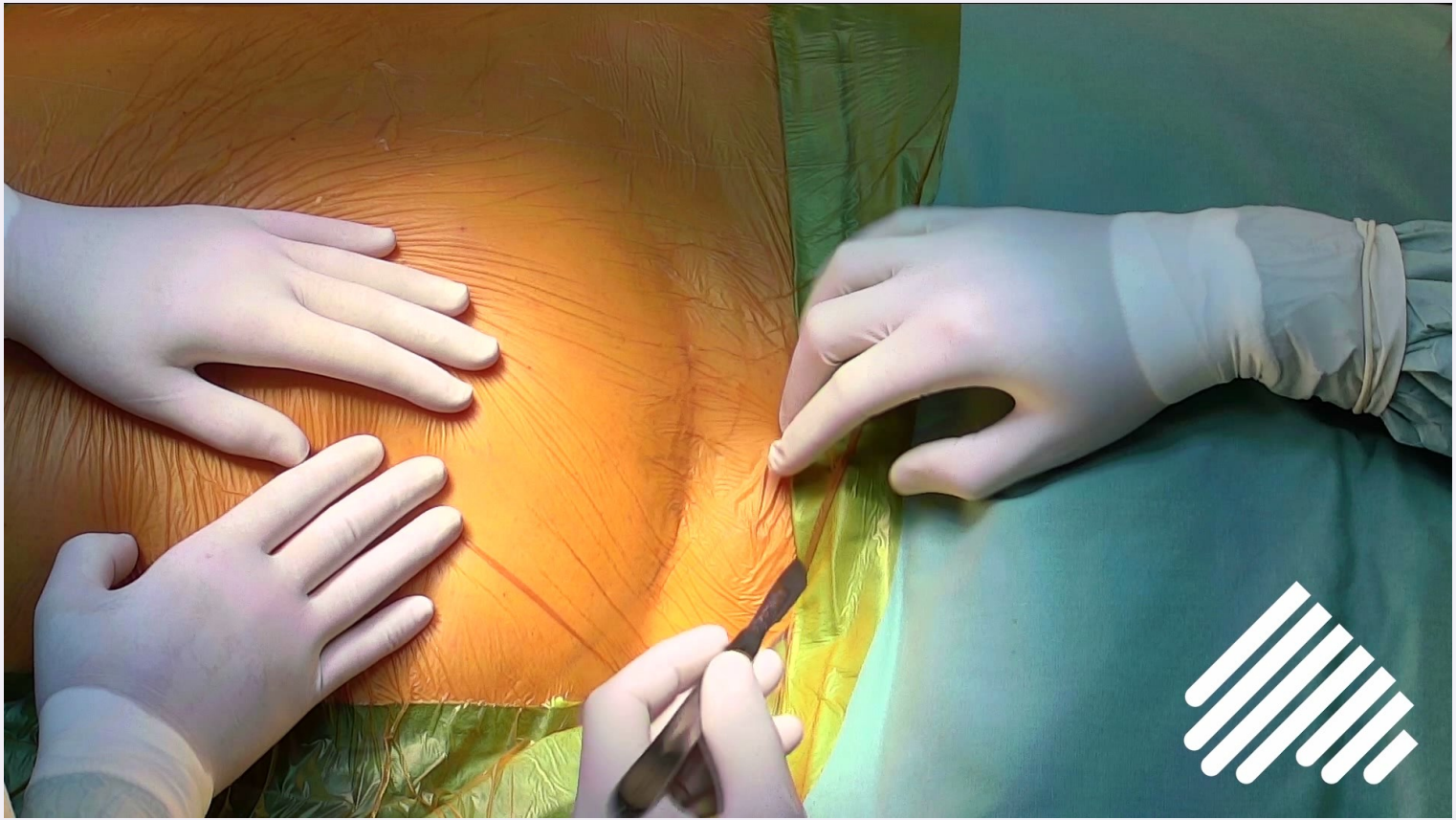
- brain death donor, non-beating heart donor

living donor

- better long-term results (immunologic matching, short cold ischemic time, better kidney quality)
- absolutely healthy donor
- living donor nephrectomy:
  - open laparotomy
  - laparoscopy
  - endoscopy, hand-assistated

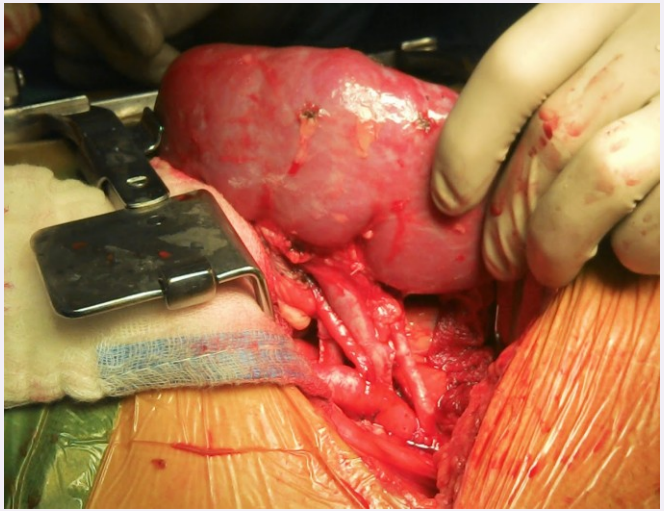


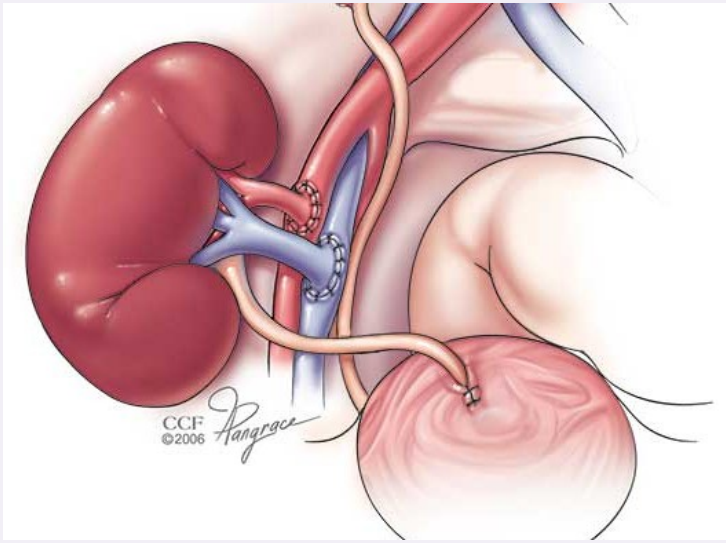
Laparoscopic live donor nephrectomy - video



Kidney transplantation - surgical technique

- heterotopic transplantation
- placement into the right/left iliac fossa
- renal vessels anastomosis on iliac vessels
- ureterovesical anastomosis





Kidney Transplantation - complications

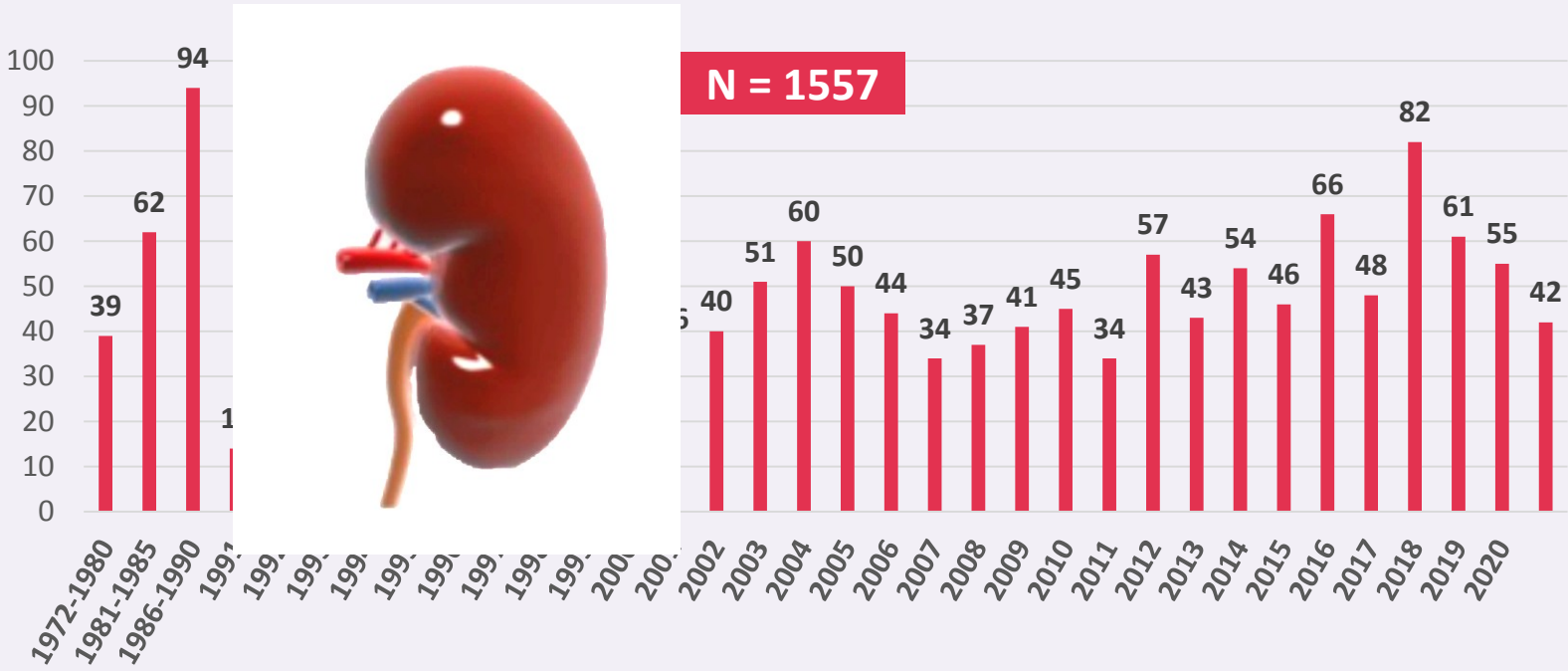
early:

- bleeding
- infection (wound, uroinfection)
- urine leak
- ureteral stenosis
- renal artery/vein thrombosis
- early rejection

late:

- lymph leak
- renal artery stenosis
- renal artery pseudoneurysm
- ureteral necrosis
- chronic rejection, CMV infection

Kidney transplantation - CKTCH Brno



living donor n = 39; endoskopic nephrectomy n = 22

1-year and 5-year graft survival - **92 % a 82 %**

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Immunosuppressive therapy after transplantations

longstanding

- heart, liver – all life
- kidney – during graft survival

different immunosuppressive protocols:

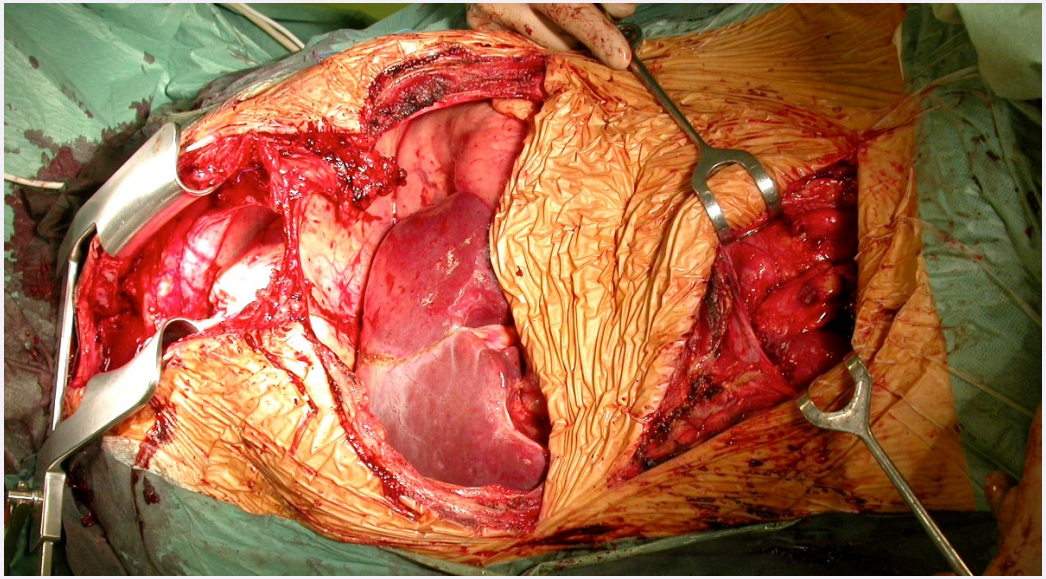
- induction (thymoglobulin, IVIG)
- CNI (cyclosporine, tacrolimus) + mykofenolate + corticosteroids
- mTOR (sirolimus, everolimus) + mykofenolate + corticosteroids

side effets:

- nephrotoxicity, diabetes, hypertension, infection, dyslipidemia, bone marrow suppression, neoplasms, osteoporosis, neurotoxicity

More organs transplantation - heart+liver+kidney – 04/2005

- cardiomyopathy
- toxonutritive cirrhosis
- chronic nephropathy
  + 18.10.2007 – hemorrhagic stroke



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Two organs transplantations – CKTCH Brno – n=56

liver + kidney: 32

- simultaneously 23
- subsequently 9

heart + kidney: 22

- simultaneously 9
- subsequently 13

heart + liver : 2

- simultaneously 1
- subsequently 1

died n=3

1x stroke (9y after Tx liver+kidney)

1x pneumonia (11y Tx liver+kidney)

1x pulm. embol.(1y Tx liver+kidney)

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Gravidity after liver transplantation

Pregnacy in 7 women after liver Tx - 14 children

Intended pregnacy – reduction of immunosuppressive therapy

All children healthy

Liver Tx in 17 years old
Three children - 10, 7 and 2y
after liver Tx

Liver Tx in 25 years old (1998)
11/2000 son – 1st child after liver Tx in CZ
9/2003 daughter

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Gravidity after heart transplantation

1st child – Praha, IKEM, 2y after heart Tx

2nd child – Brno, CKTCH, 19y after heart Tx

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