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DISCLOSURES

Edwards Consultant

Medtronic Consultant (...2016)

Siemens Advisory Board

3DRA Cookbook

- **Indication**
- **Radiation**
- **Workflow** contrast, merge, post processing
- **Cases**
- **Conclusion**

3DRA during **CATH-INTERVENTION**

Indication

3DRA Indications

... to perform safe, targeted intervention

for every intervention from 2 to 130 kg

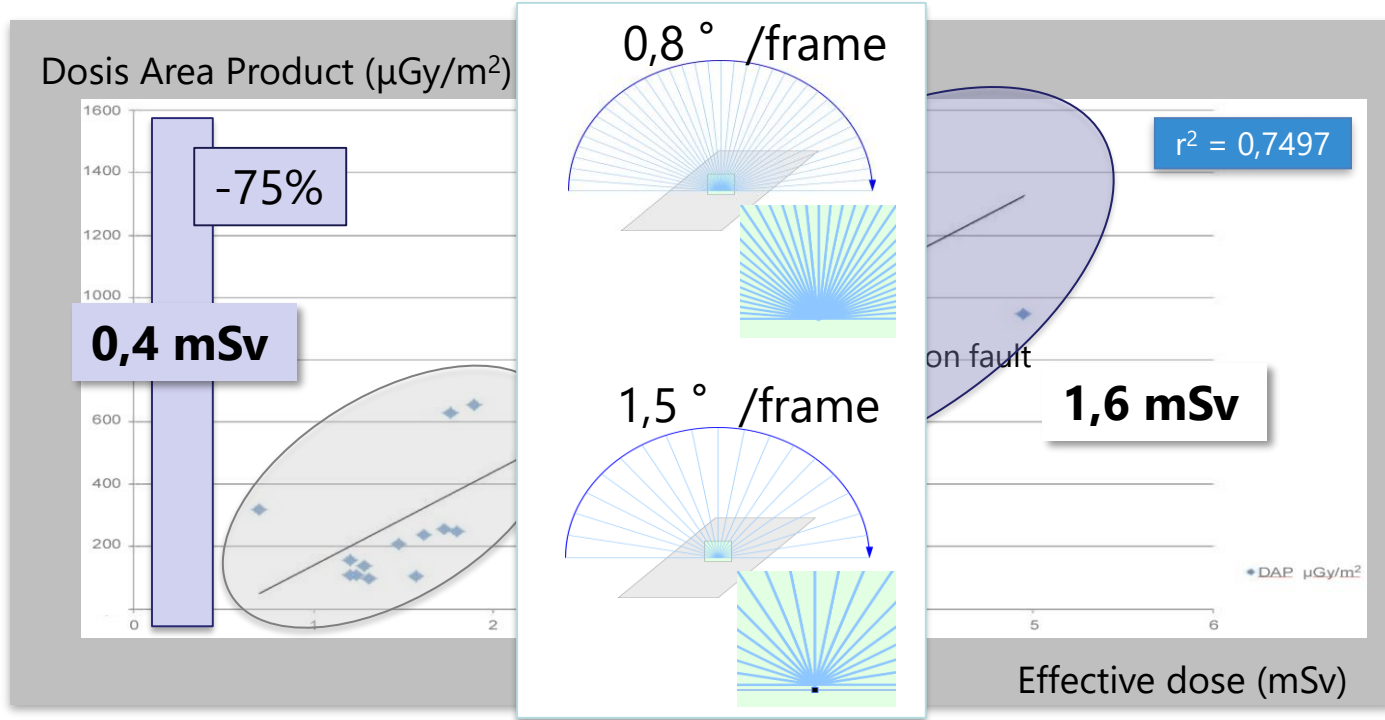
but not in : vAS / vPS / ASD / PDA

3DRA during **CATH-INTERVENTION**

Radiation

3DRA

RADIATION



3DRA during **CATH-INTERVENTION**

Workflow

Contrast Pre-Filling
Of compartment

Acquisition Time

C-arm-rotation 5 seconds

LV : 6s pump contrastinjection (1s xray delay)

RV : 5s manual contrastinjection (1s before LV, Stop +3)

-2

-1

0

1

2

3

4

5

Respiratory Arrest and Pacing

Start Pacing

Stop Ventilation

Stop Pacing

Start Ventilation

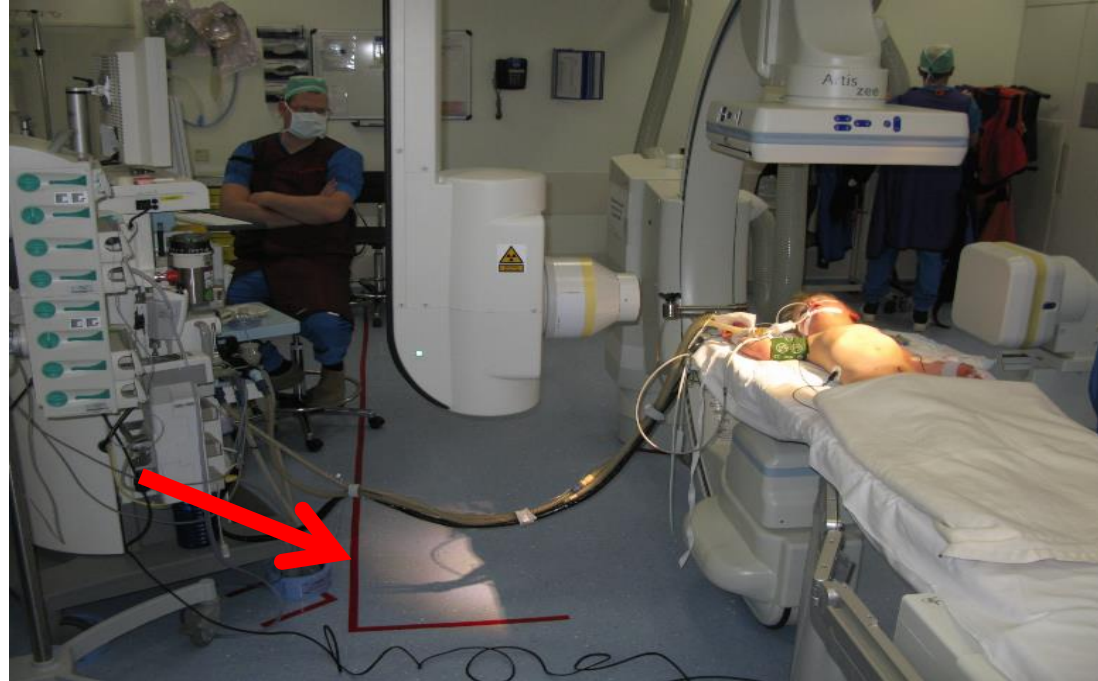


WORKFLOW 3DRA VENTILATION

Long ventilation tubes

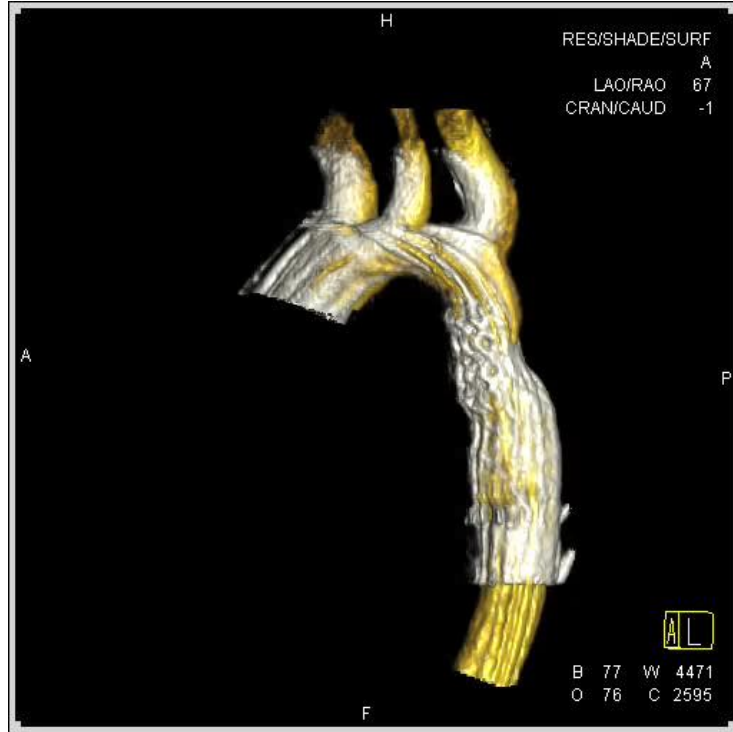
Dead volume no problem

Respiratory arrest



3DRA

RAPID PACING ?



No Rapid Pacing



With Rapid Pacing

WORKFLOW 3DRA RAPID PACING

Electrode

Bard 4Fr bipolar

Pacing site:

RA/RV/LA/LV

oesophageal (TCPC, CVL 3DRA)

Pacing rate:

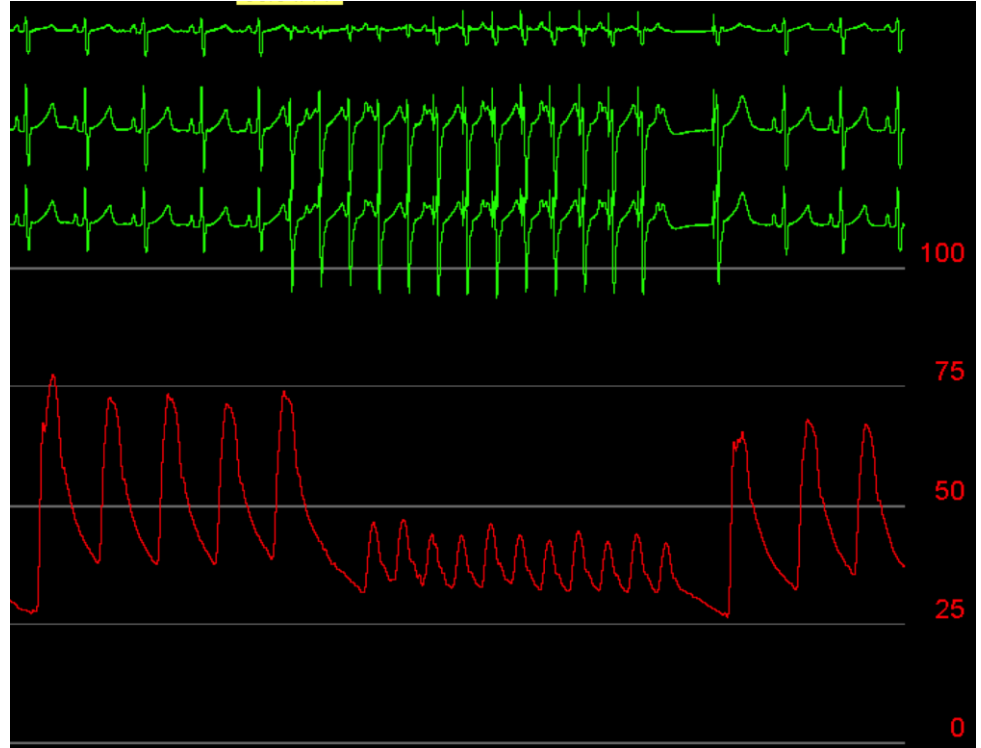
decrease RR by 50%

start 160/min (160)

increase +20/min (+10)

up to 240/min

AICD ready



WORKFLOW 3DRA CONTRAST

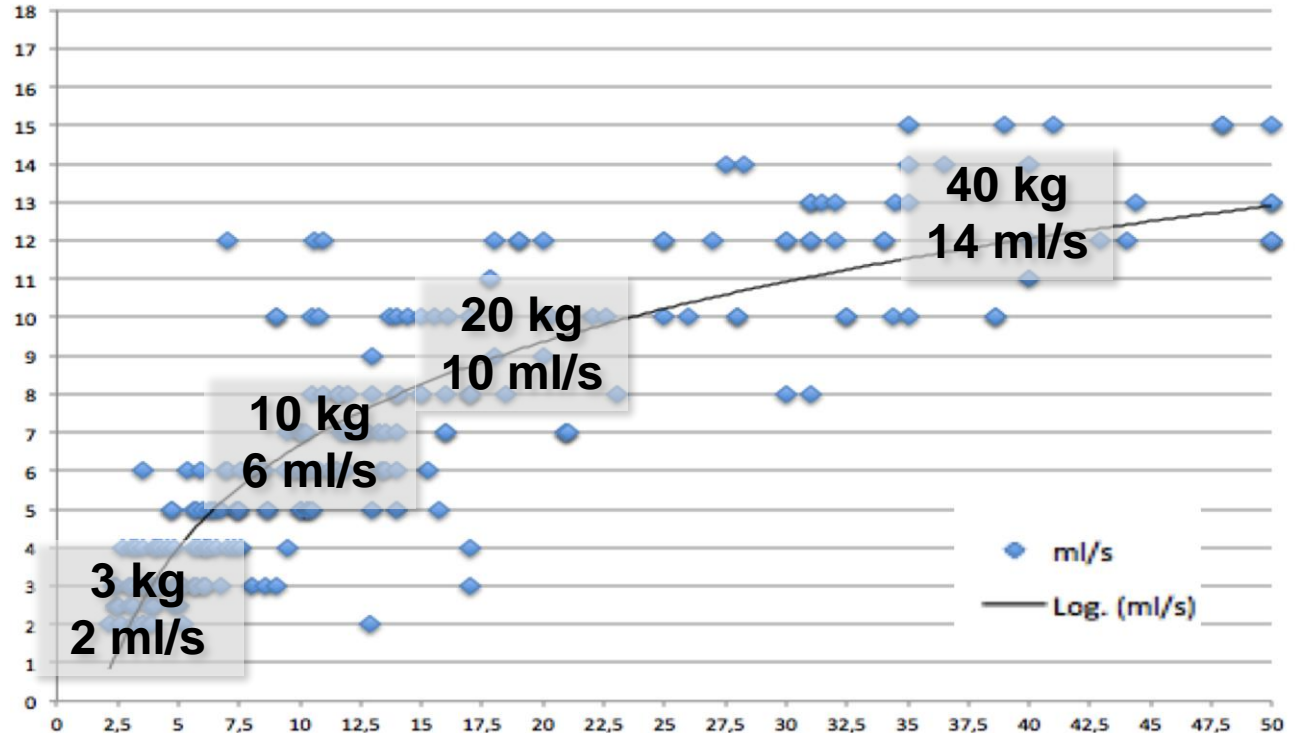
Contrast

60% dilution

Calculate ml/s

amount per C.O.

Xray delay !



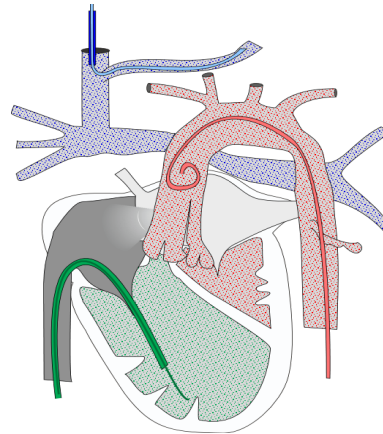
3DRA CONTRAST

PCPC, 10kg

four 2D angios biplane

PCPC	10ml
LV	15ml
AoAsc	15ml
Collaterals	20ml

Total 60ml

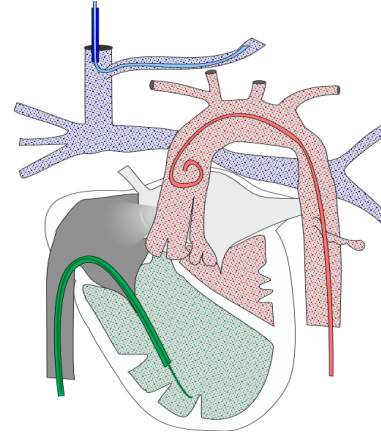
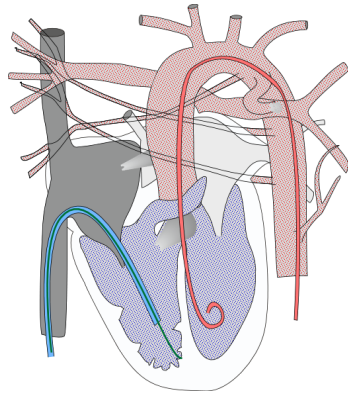
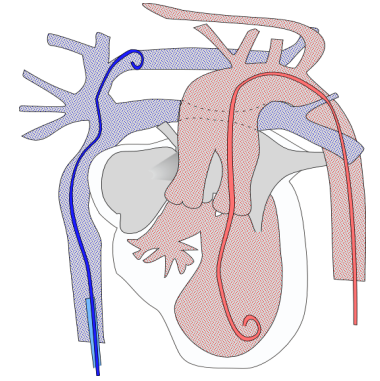
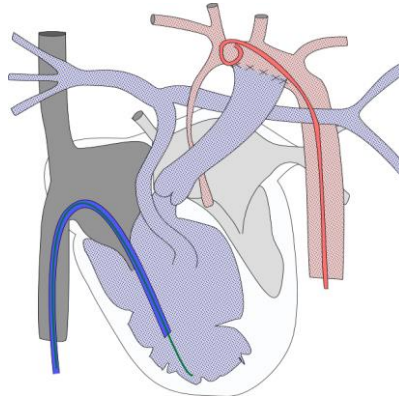
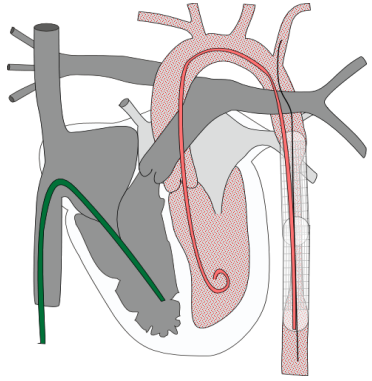


one 3D angio (6ml/s per C.O.)

VCS	15ml
Anonyma	15ml
LV	36ml
Asc	15ml

**Total 81ml 60%
48ml pure**

3DRA MULTIPLE CONTRAST LOCATIONS



3DRA

MIP

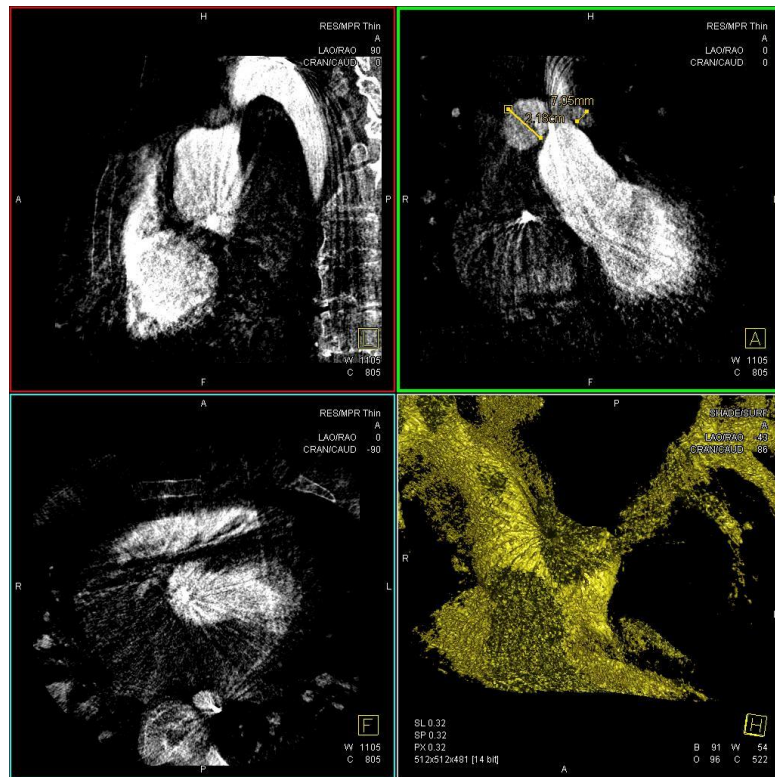
MIP

2D way to look at 3D imaging

measurements in correct plane

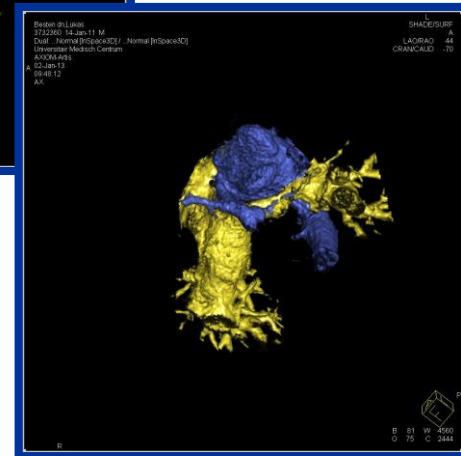
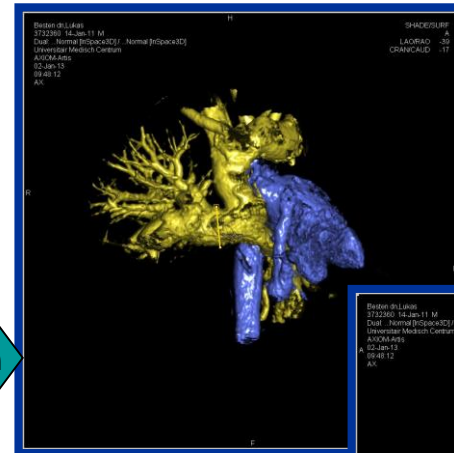
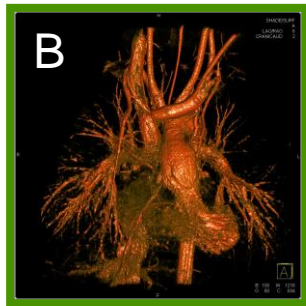
independent from post processing “fake”

another tool in the ordinary 3D box

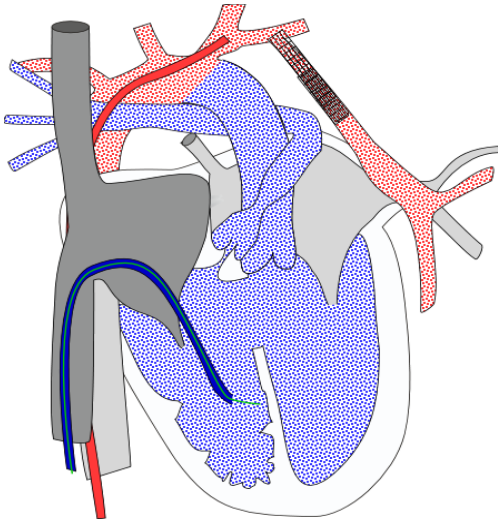


3DRA

MERGE



3DRA OCCULT LPA



3DRA

MERGE

rotational angio

RV : long sheath 5Fr, pacing lead
4Fr, 2ml/s, 230/min

AoAsc : Pigtail 4Fr, 2ml/s

3DRA

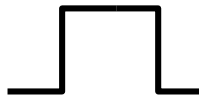
HOLLOW FIGURE

Threshold :

Ramp



Trapezoid



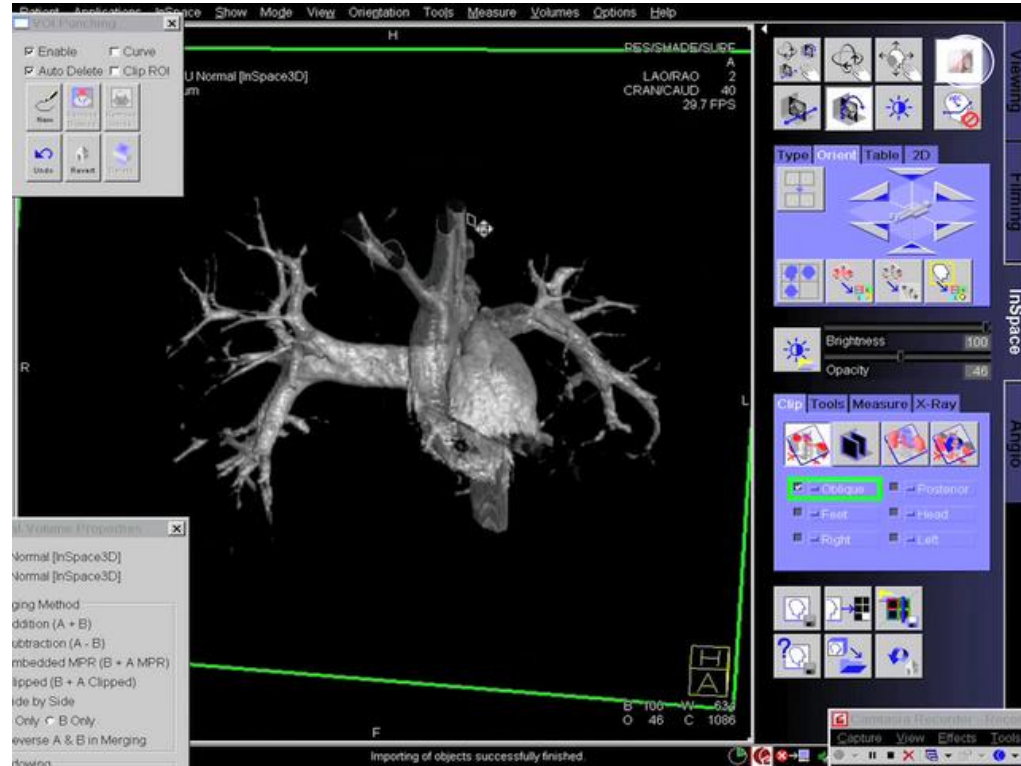
Clipping :

6 planes

unlimited angulations

Measure :

In clipping plane



3DRA

ROADMAP

Roadmapping :

Project 3DRA on A plane

B plane ? NO !

Safe contrast

revalidate position by control angio

anatomic shift by stiff wires ...

entrance in ostia “made easy”

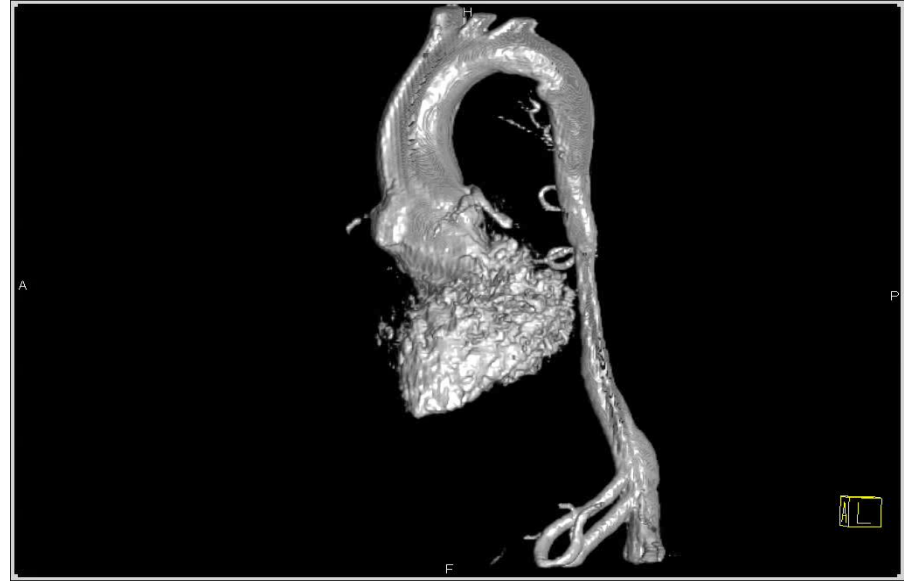
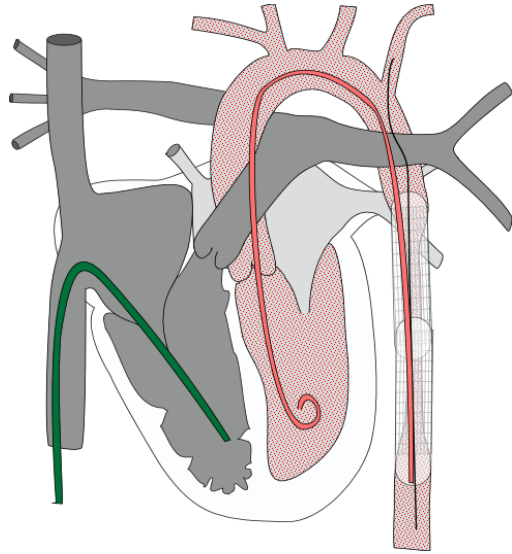


3DRA during **CATH-INTERVENTION**

Workflow

Case related

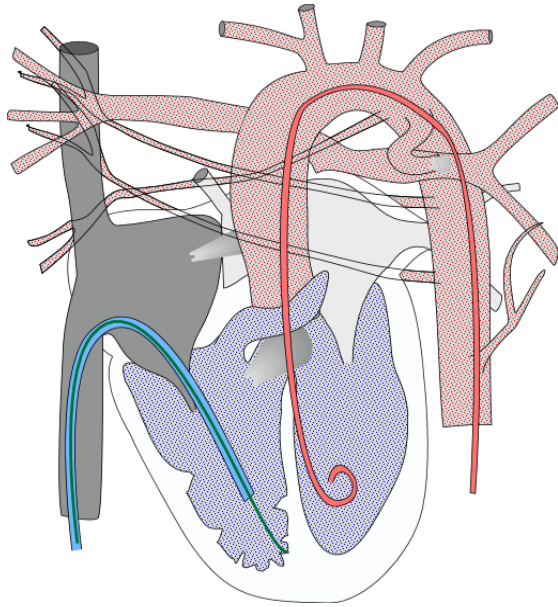
3DRA MID AORTIC SYNDROME



Spatial Resolution ? *every single intercostal artery visible !*

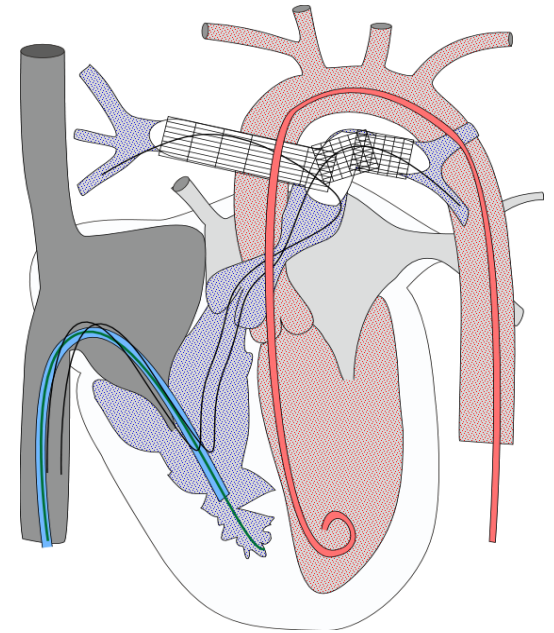
3DRA WORKFLOW

TOF



PA VSD

PPS



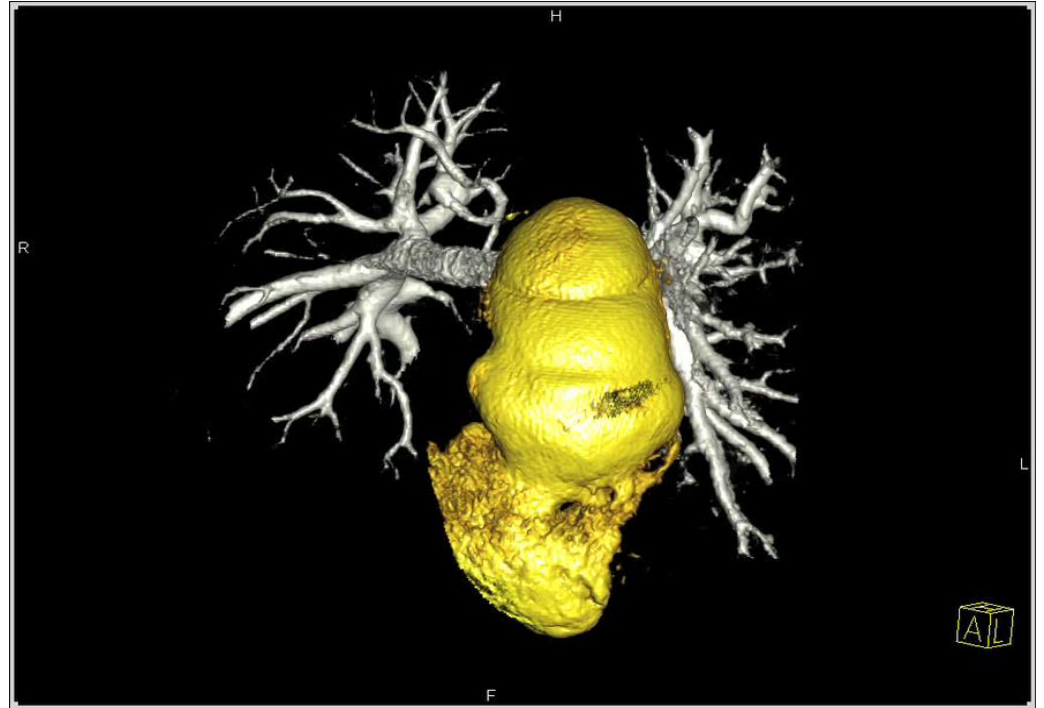
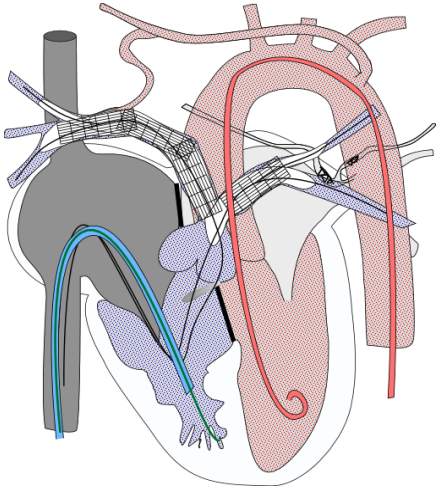
3DRA

MINISCULE NATIVE PA

3 year and many Stents later

Correction :

VSD Patch, RV-PA Contegra



3DRA OCCULT LPA

3,5 kg, 3 1/2 month old

Increase RVOTO

3DRA

trc bcc sin 24ml

RV 20ml

4ml/s

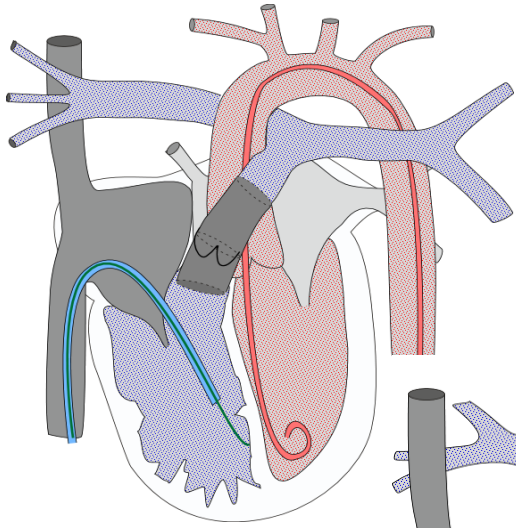
1s xray delay

contrast 60%,

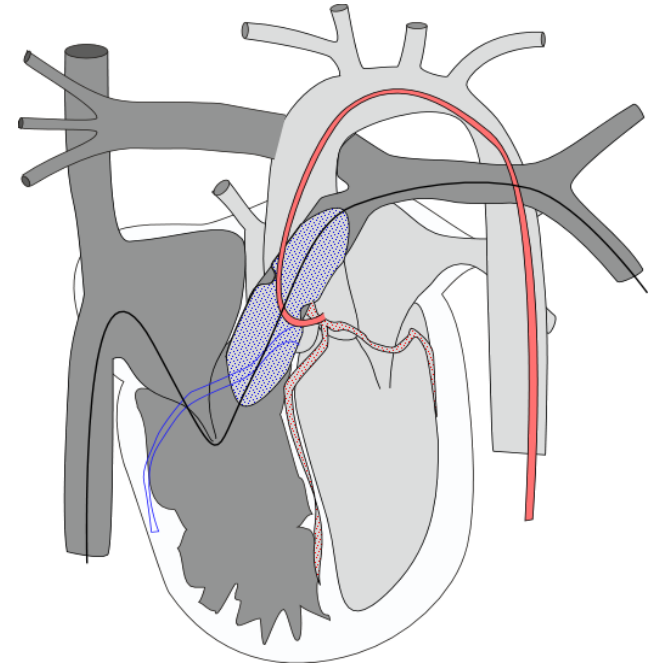
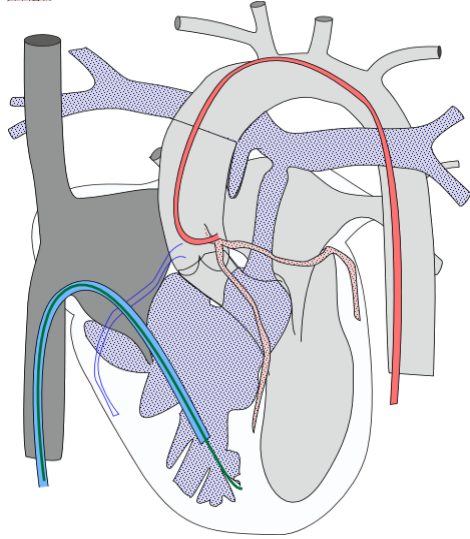
rapid pacing RV 220/min



3DRA WORKFLOW

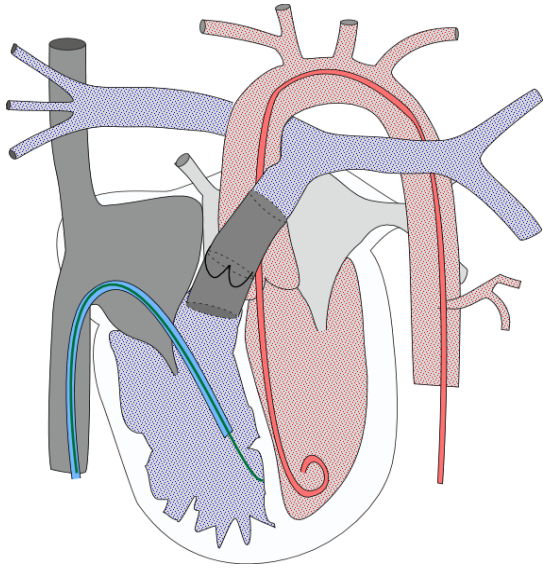


PPVI



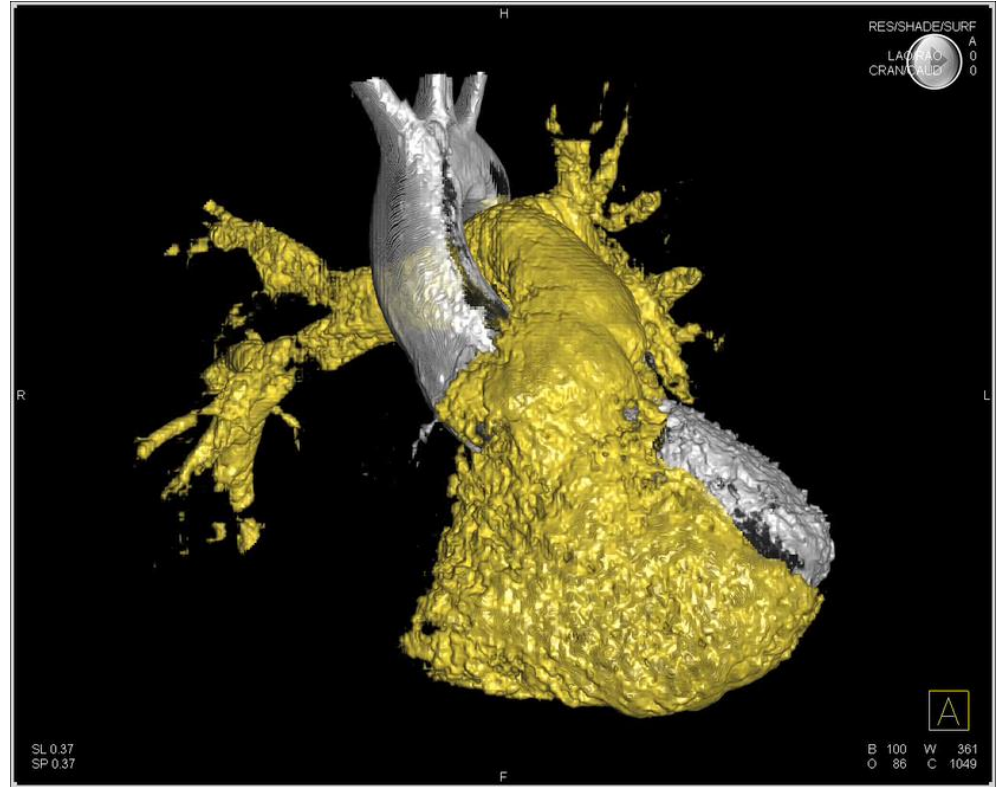
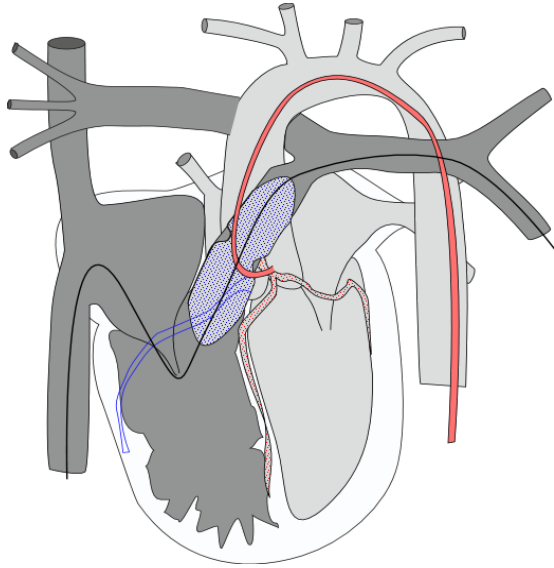
3DRA

PPVI

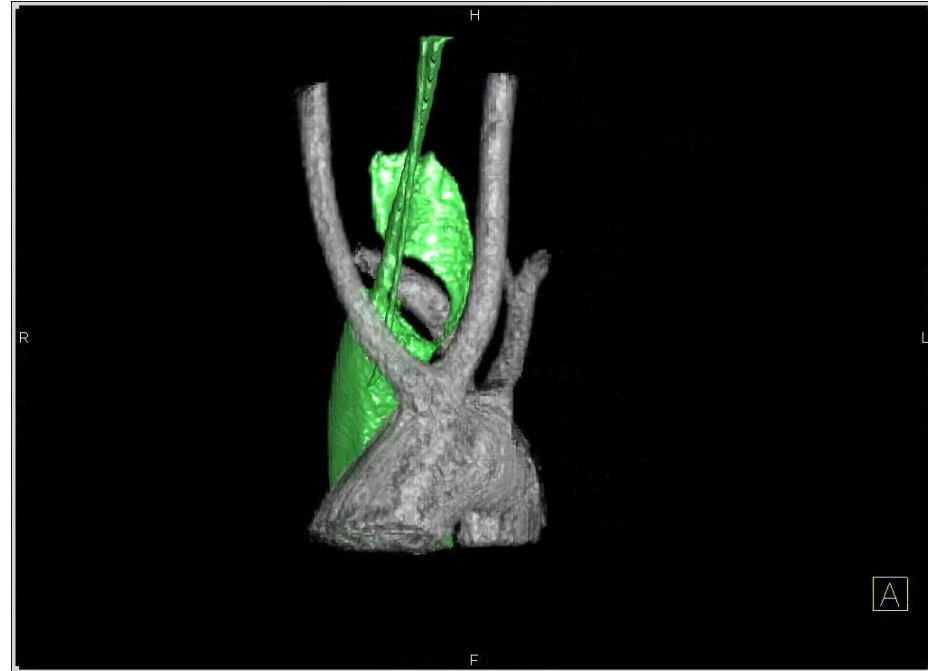
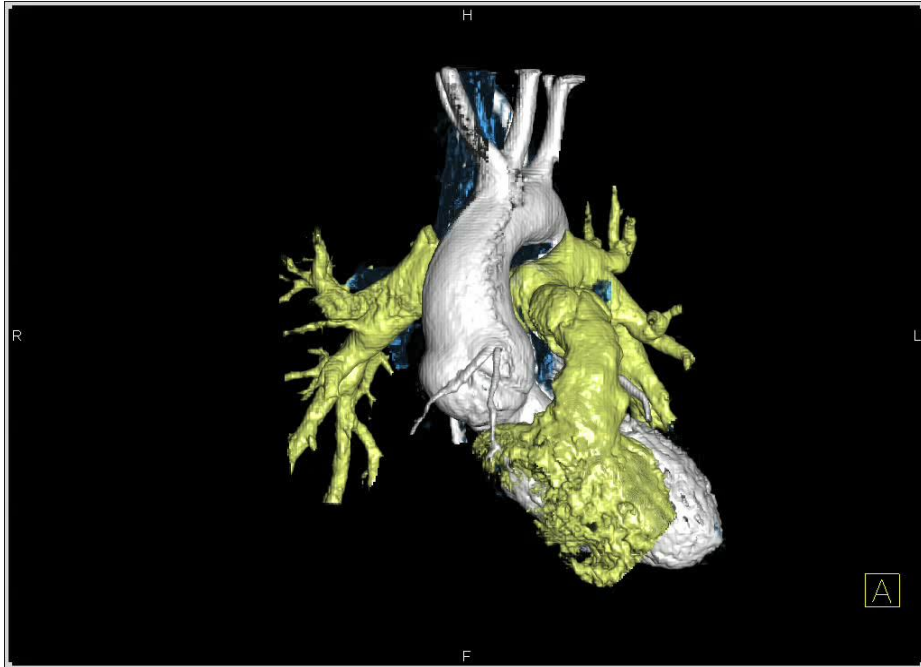


3DRA

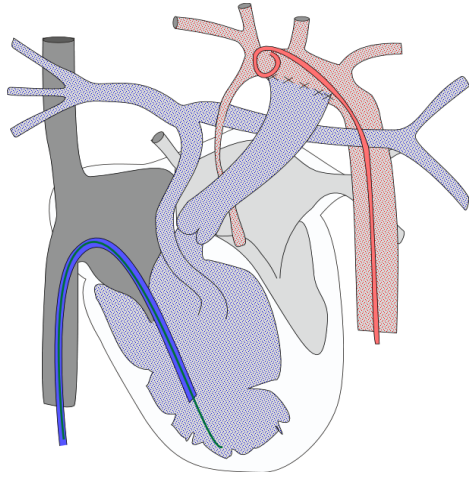
PPVI



3DRA PPVI, LUSORIC ARTERY

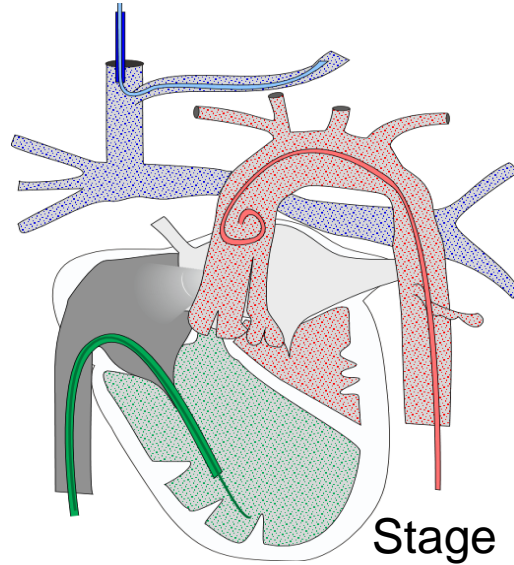


3DRA WORKFLOW

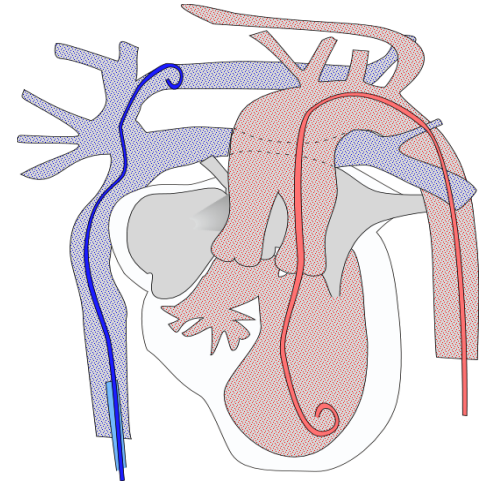


Stage I

SV



Stage II



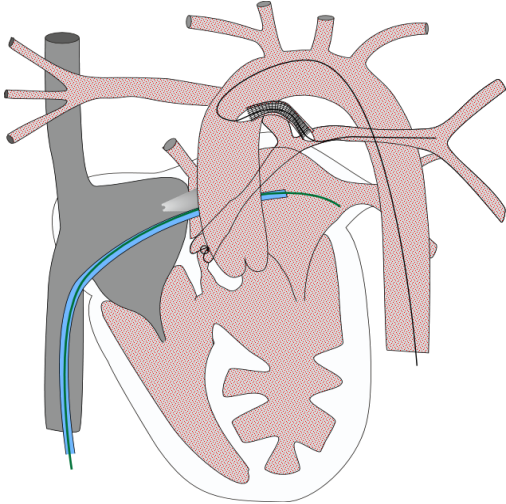
Stage III

STAGE I 3DRA IN SV

2,2 kg ccTGA, PA

cAP shunt occlusion

recanalisation



Pacing 260/min

Single location contrast

Image size: 480 x 480
View size: 1000 x 1305
W/L: 1300 W/W: 2017



0.0 Zoom: 724% Angle: 0
Fm: 1/248
Uncompressed
Location: RPS

0815982 (2 y , 24 d)
5s untriggered — 5s untriggered
1
8

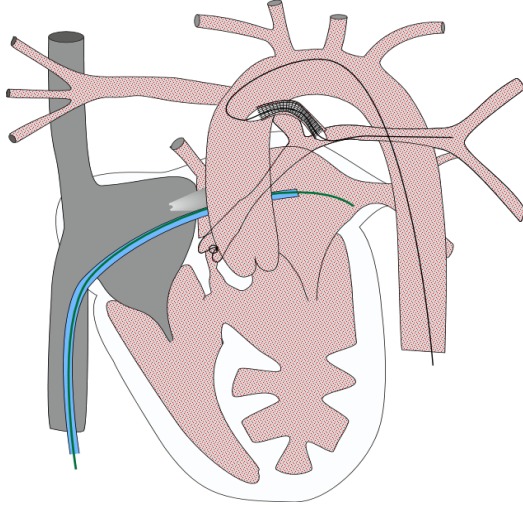
30.11.11 21:50:47
Made in 05837

STAGE I 3DRA IN SV

2,2 kg ccTGA, PA

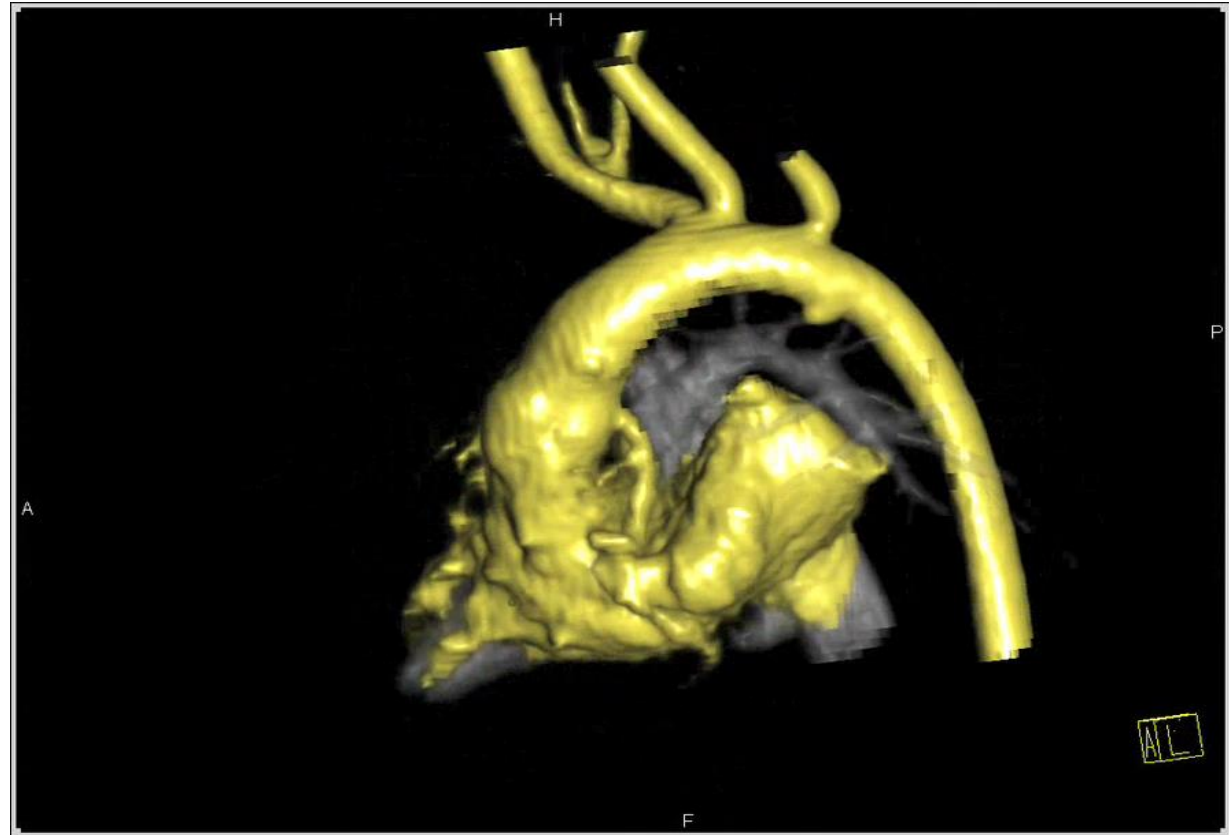
cAP shunt occlusion

recanalisation



Pacing 260/min

Single location contrast

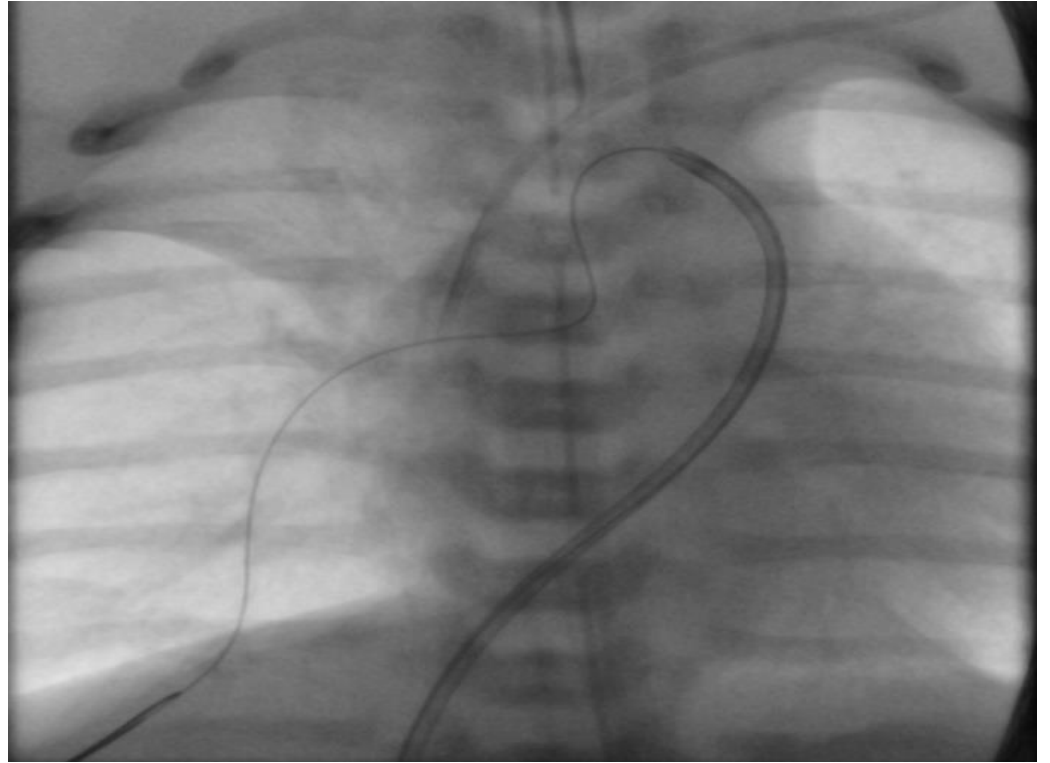


3DRA HLHS SANO SHUNT

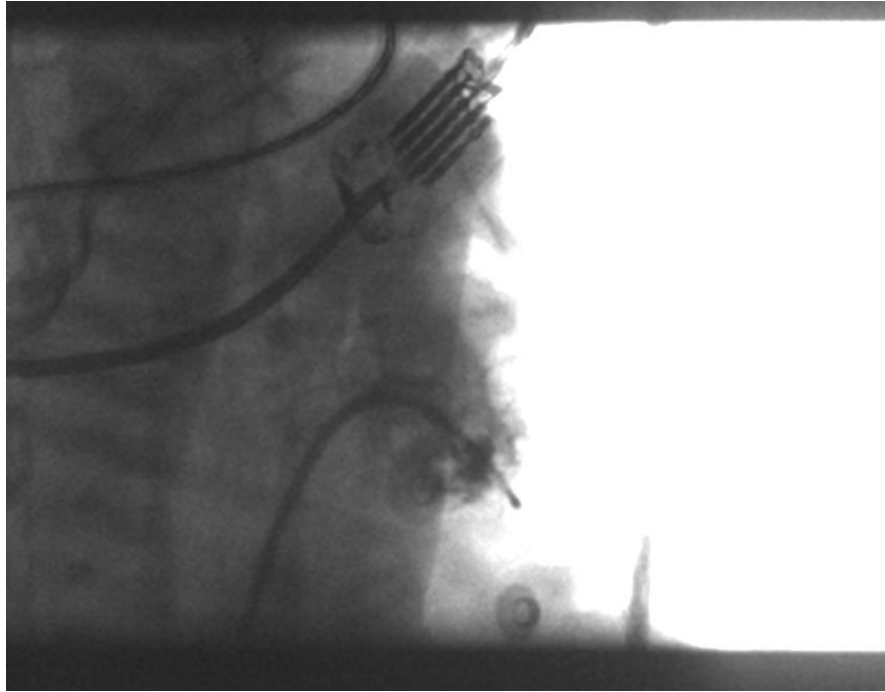
HLHS (3,2 kg)
Norwood I,
Sano shunt 5mm

3. d post op:
50-60% desaturation,
NorAdr

Biplane Angiography

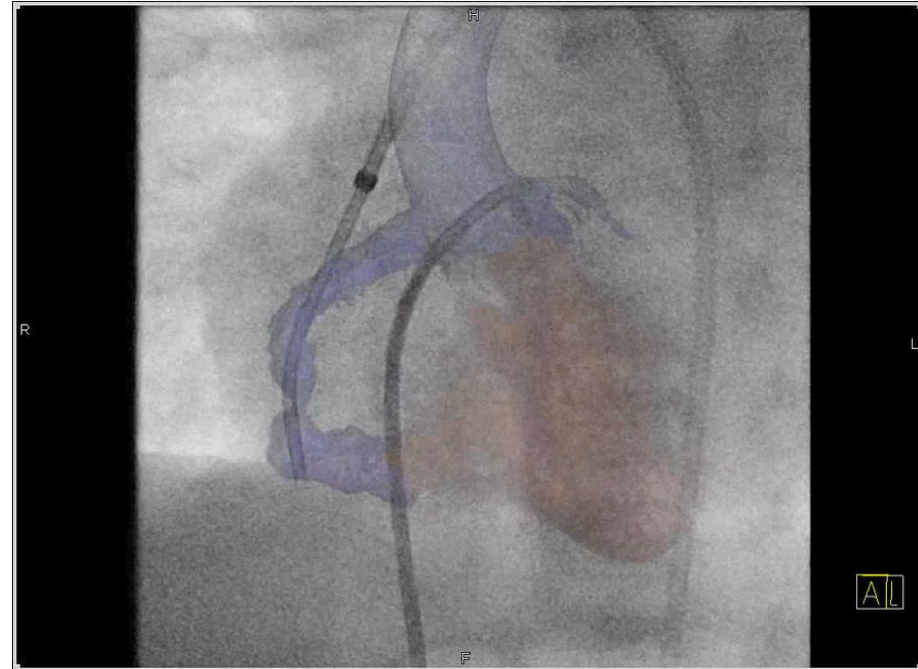


3DRA HLHS SANO SHUNT



3DRA

RCA – RV FISTULA





3DRA

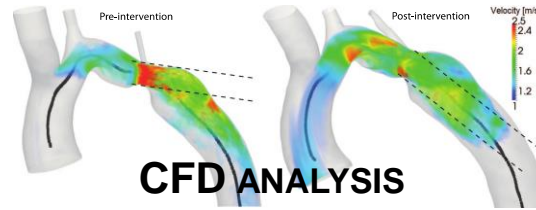
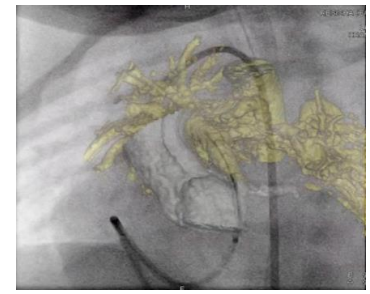
THAT'S IT ?

CTA

CMR

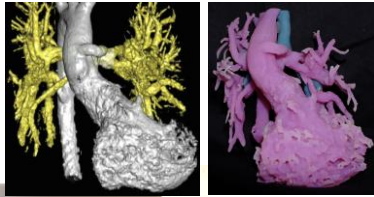
“OLD”
3DRA

3DRA CATH INTERVENTION

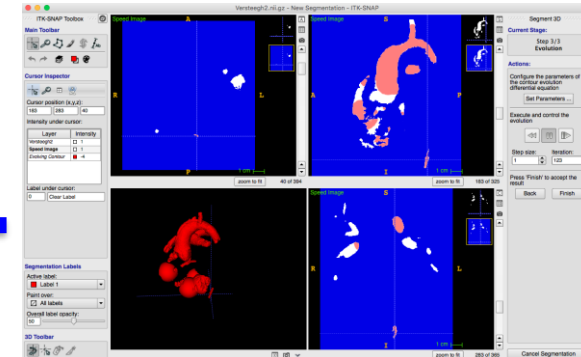


CFD ANALYSIS
STATIC / DYNAMIC
DEVICE PREDICTION
ANSYS

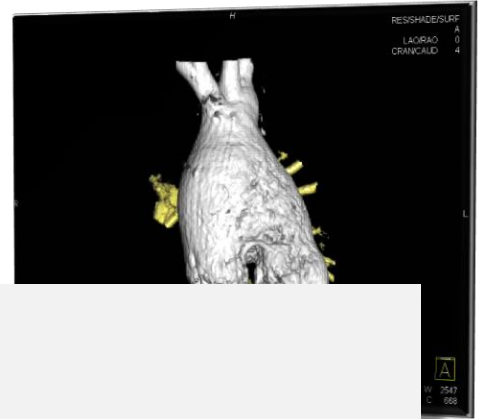
POST CATH :
PREPARE 3D PRINT



DICOM
TECHNICAL “STL”
MIMICS, ITK-SNAP



THE UTRECHT COOKBOOK : HOW TO DO 3DRA



THANKS to :

3: Aimee, Francisco, Lee, Mario, Sebastian, Shak, Tom,
The Utrecht Team : Mirella, Hans



Gregor Krings

Children's Heart Centre, University of Utrecht, The Netherlands



Thank you for your attention !

workflow

challenging
not simple

properly done ...

multiple location injection
rapid pacing

visualization

entire anatomy (vessel - airway)
helps to be aware of structures next to your focus

Pitfalls

washout (DKS, anonyma)
heterogenic contrast density

Cons

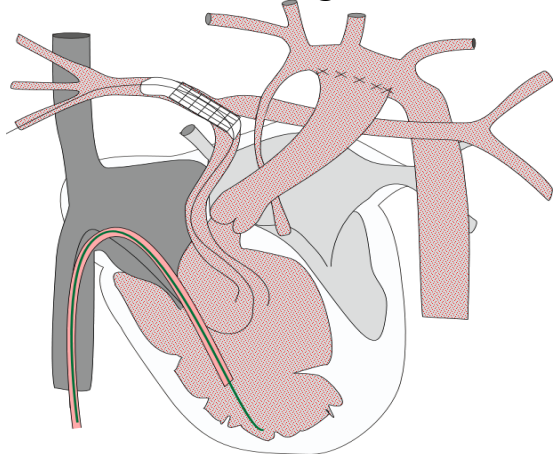
non dynamic information (wait ...!)
Roadmapping (3D background) “fixed”

STAGE I 3DRA IN SV

3,6 kg HLHS,

Sano shunt stenosis

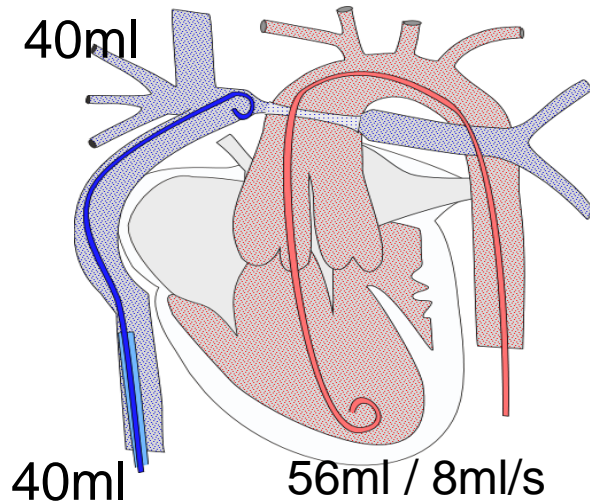
stenting



Pacing 230/min
Single location contrast

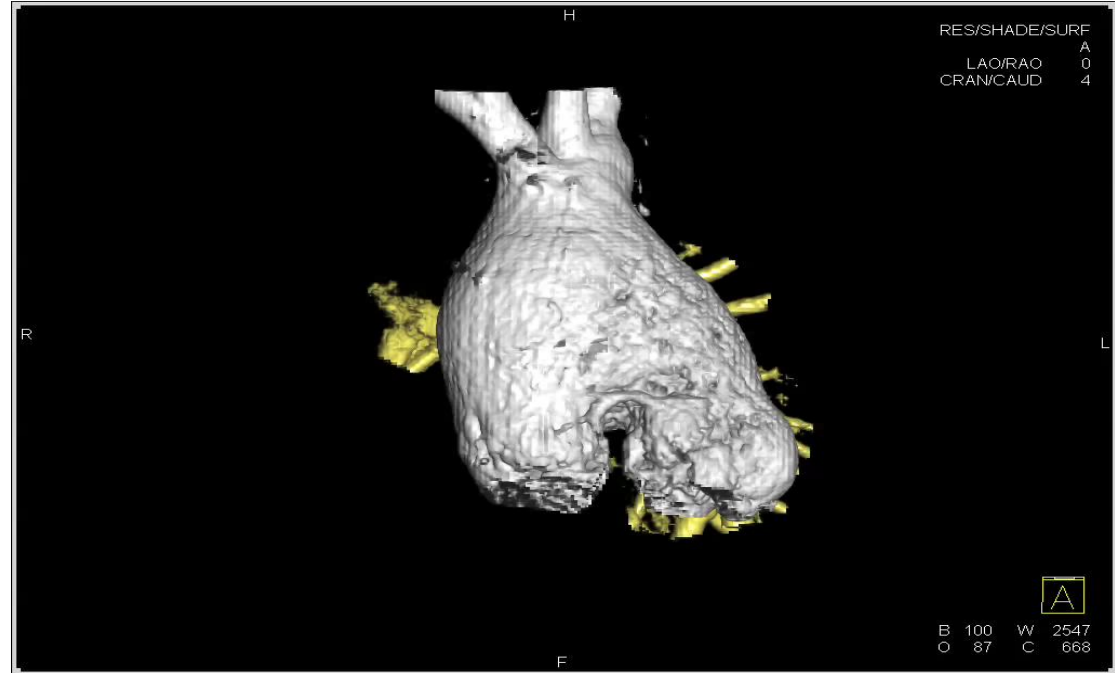


STAGE III 3DRA IN SV



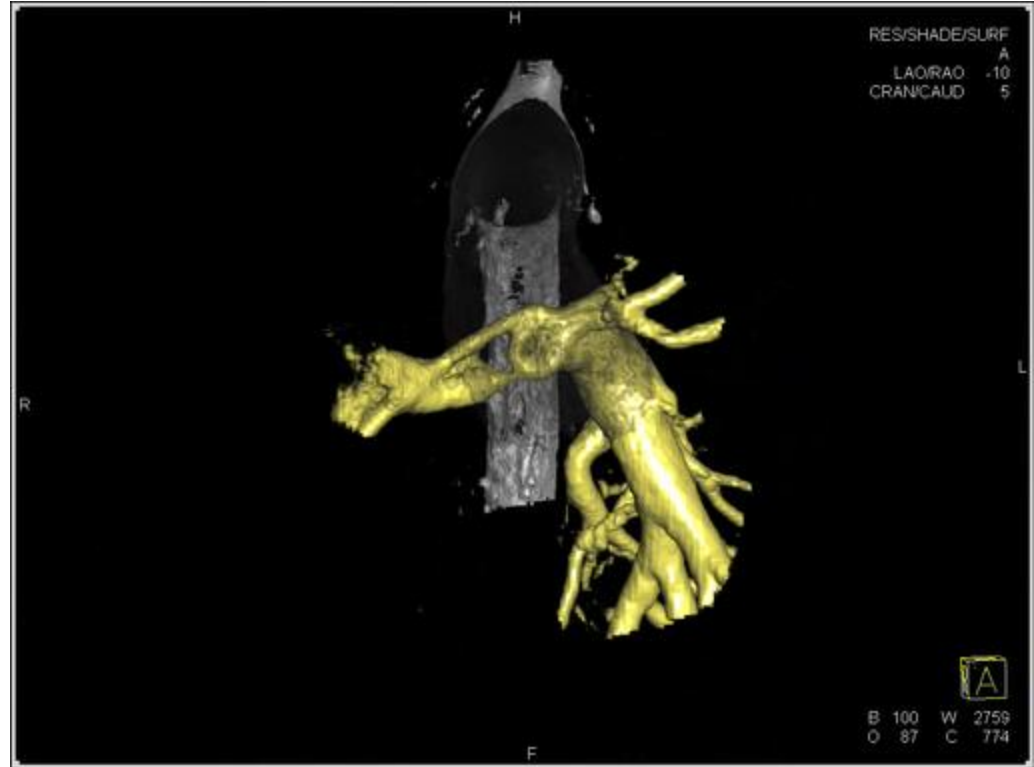
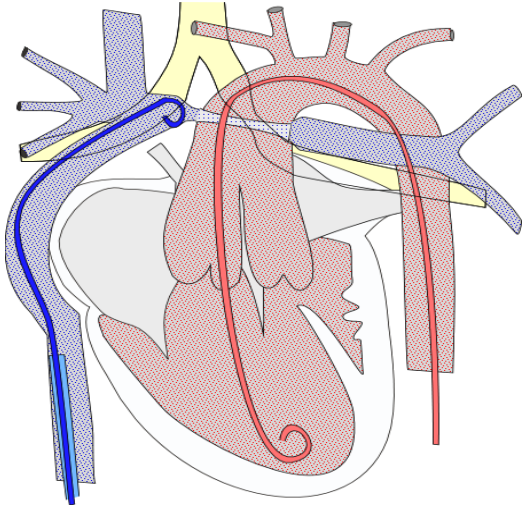
Pacing 230/min (PM)

Triple location contrast



STAGE III 3DRA IN SV

Post Processing :
make Airway visible



3DRA VSD

