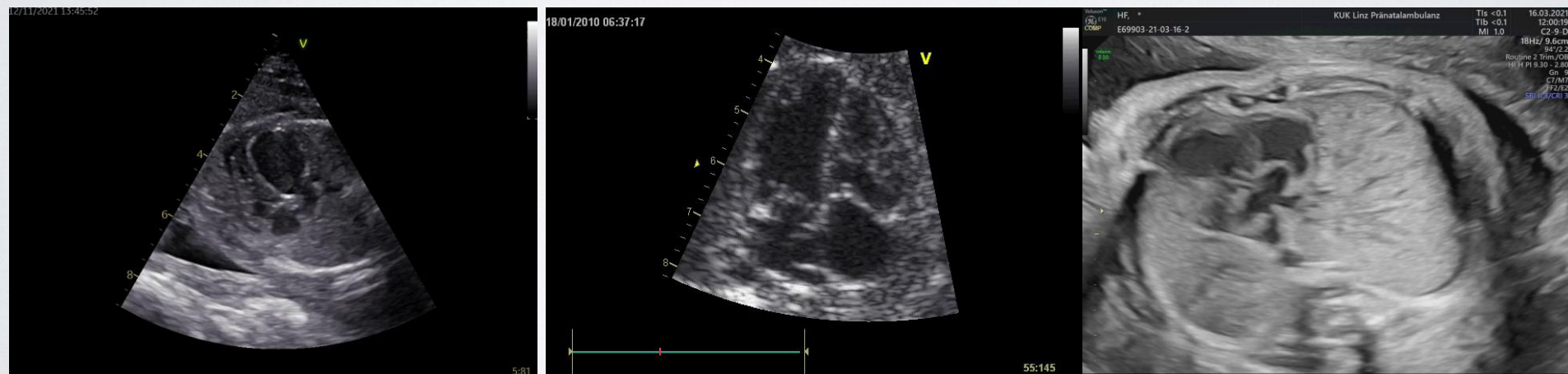


FETAL CARDIAC INTERVENTIONS

LINZ - EXPERIENCE

CHILDREN'S HEART CENTER LINZ
KEPLER UNIVERSITY HOSPITAL

ANDREAS TULZER, M.D., PHD.
PROF. GERALD TULZER, M.D.



Case Selection

25 weeks

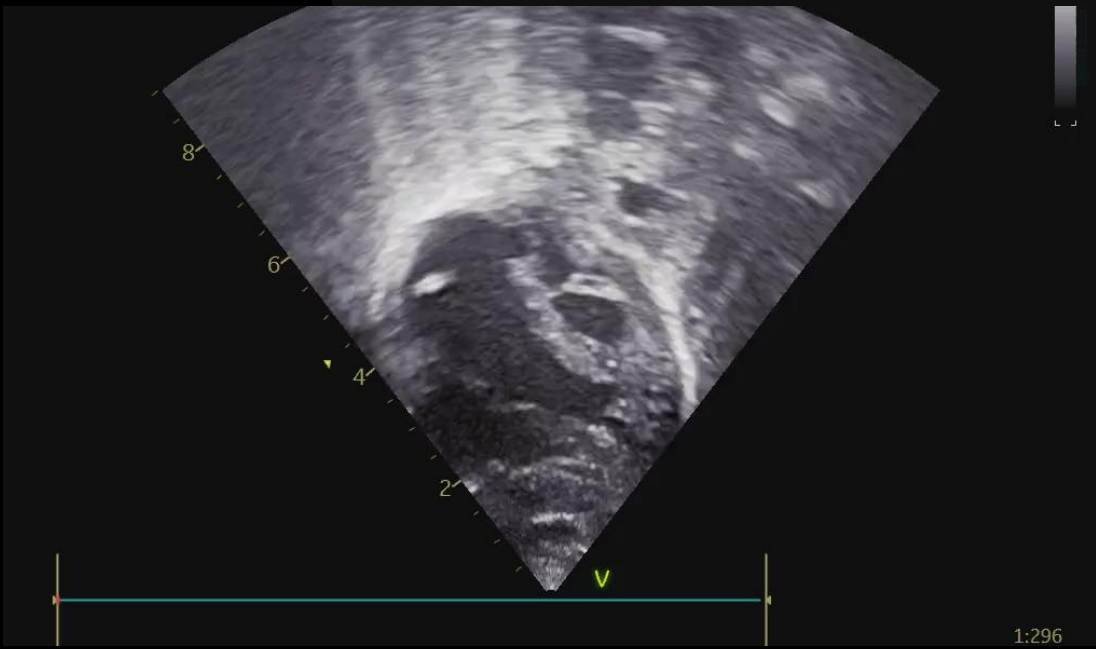


Natural History

29 weeks



Newborn

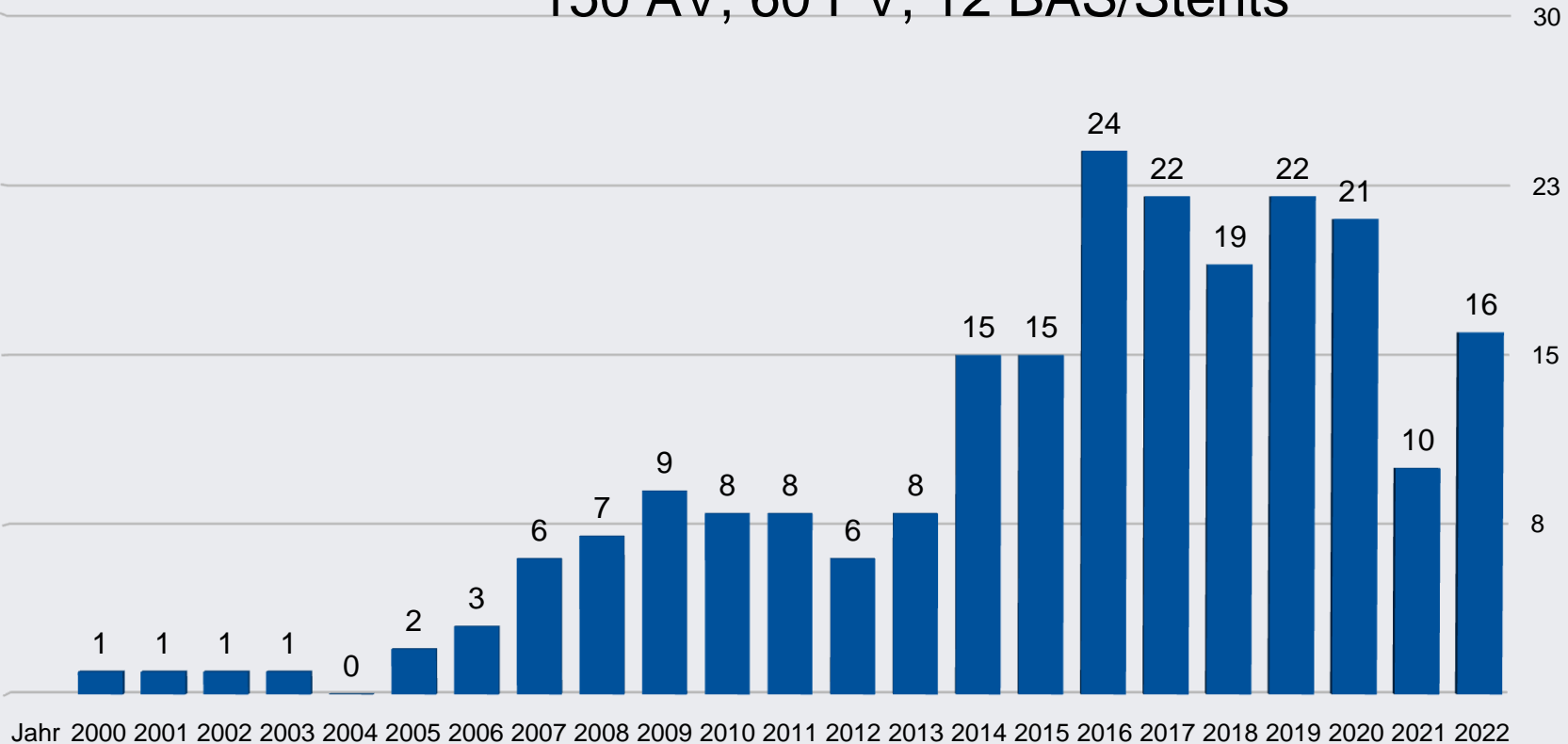


Prenatal Cardiac Interventions CHC LINZ-AUSTRIA

(n=222, until 10/2022)

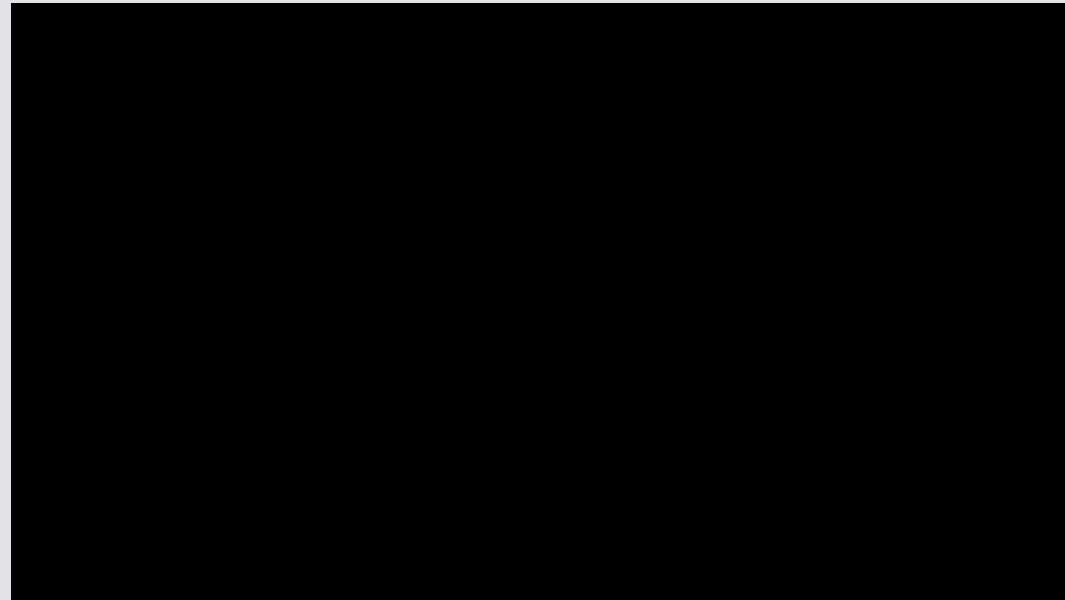


150 AV, 60 PV, 12 BAS/Stents



Prenatal Valvuloplasty: Technique

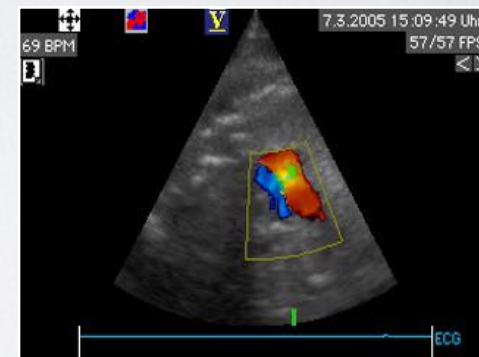
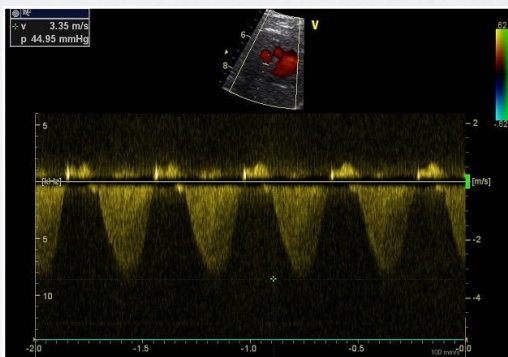
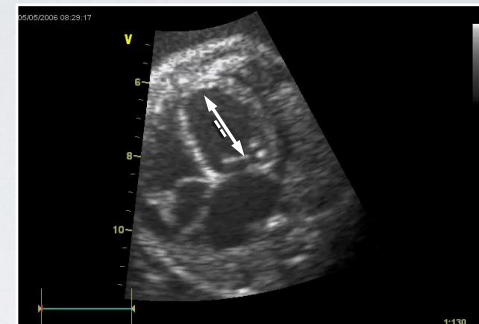
- General anesthesia of the mother without separate anesthesia of the fetus
- Puncture of the heart under ultrasound guidance with 17, 18 or 19 gauge needles
- 3, 3,25, 3,5, 4, 5 mm balloon catheter
- Balloon/valve ratio (1-)1,2-1,5



EVOLVING - HLHS

- dilated poorly contracting LV with EFE
- reverse aortic arch flow
- monophasic LV inflow
- left to right shunt at FO

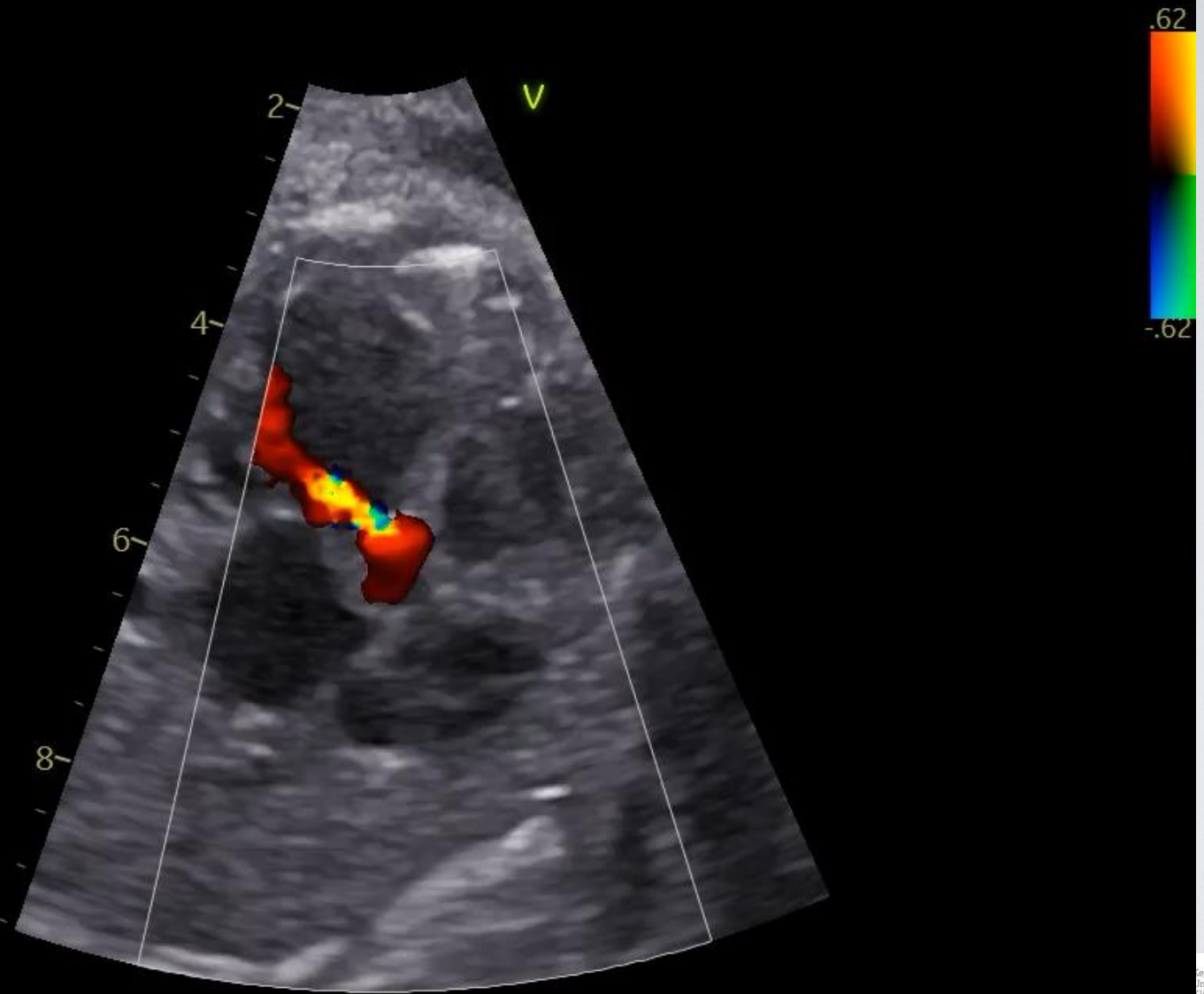
salvagable?



- LV long-axis
- LV pressure

HEMODYNAMIC GOAL OF FAV

13/10/2022 09:16:14



CRITICAL AS + HYDROPS

- IUD and neonatal mortality: **close to 100%**

Vogel M et al: J Am Coll Cardiol. 2011 Jan 18;57(3):348–55

Mallmann MR et al: Fetal Diagn Ther. 2019 Oct 8;1–8

- Fetal intervention in CAS with hydrops: L

Ultrasound Obstet Gynecol 2021; 57: 119–125

Published online in Wiley Online Library (wileyonlinelibrary.com). DOI: 10.1002/uog.22138

Fetal aortic valvuloplasty may rescue fetuses with critical aortic stenosis and hydrops

A. TULZER¹®, W. ARZT² and G. TULZER¹

- N=14
- Hydrops resolved in 9 (IUD:3, NND:2)
- **Alive and biventricular: 6 (42%)**



Case Selection

24 weeks + hydrops

30 weeks

FAV



Newborn

Age: 5 years

No intervention!



FAV - Complications?

N= 144 procedures

- Procedure related mortality:
 - 8% overall
 - 14 % early (8/57)
 - **3.4% recent (3/87) $p < 0.027$**
 - Bradycardia: 33% (unchanged)
 - Pericardial effusions: 14%
 - LV thrombus: 14%



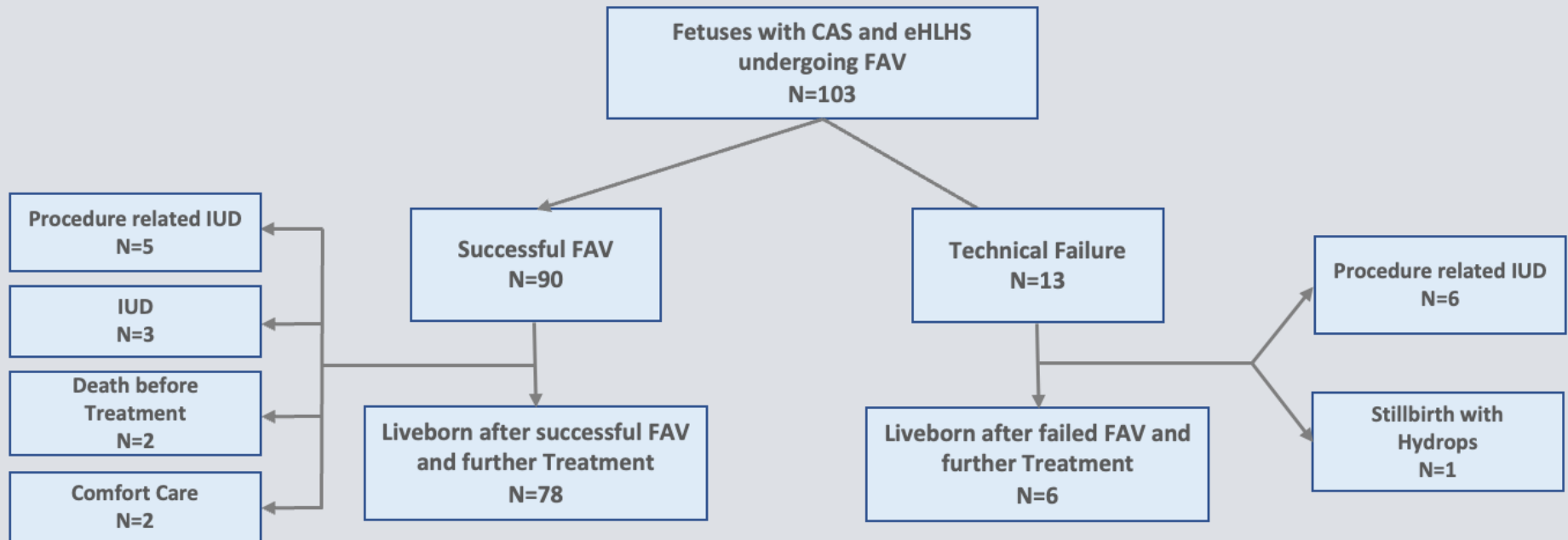


Valvuloplasty in 103 fetuses with critical aortic stenosis: outcome and new predictors for postnatal circulation

A. TULZER¹, W. ARZT², R. GITTER¹, E. SAMES-DOLZER³, M. KREUZER³, R. MAIR³
and G. TULZER¹

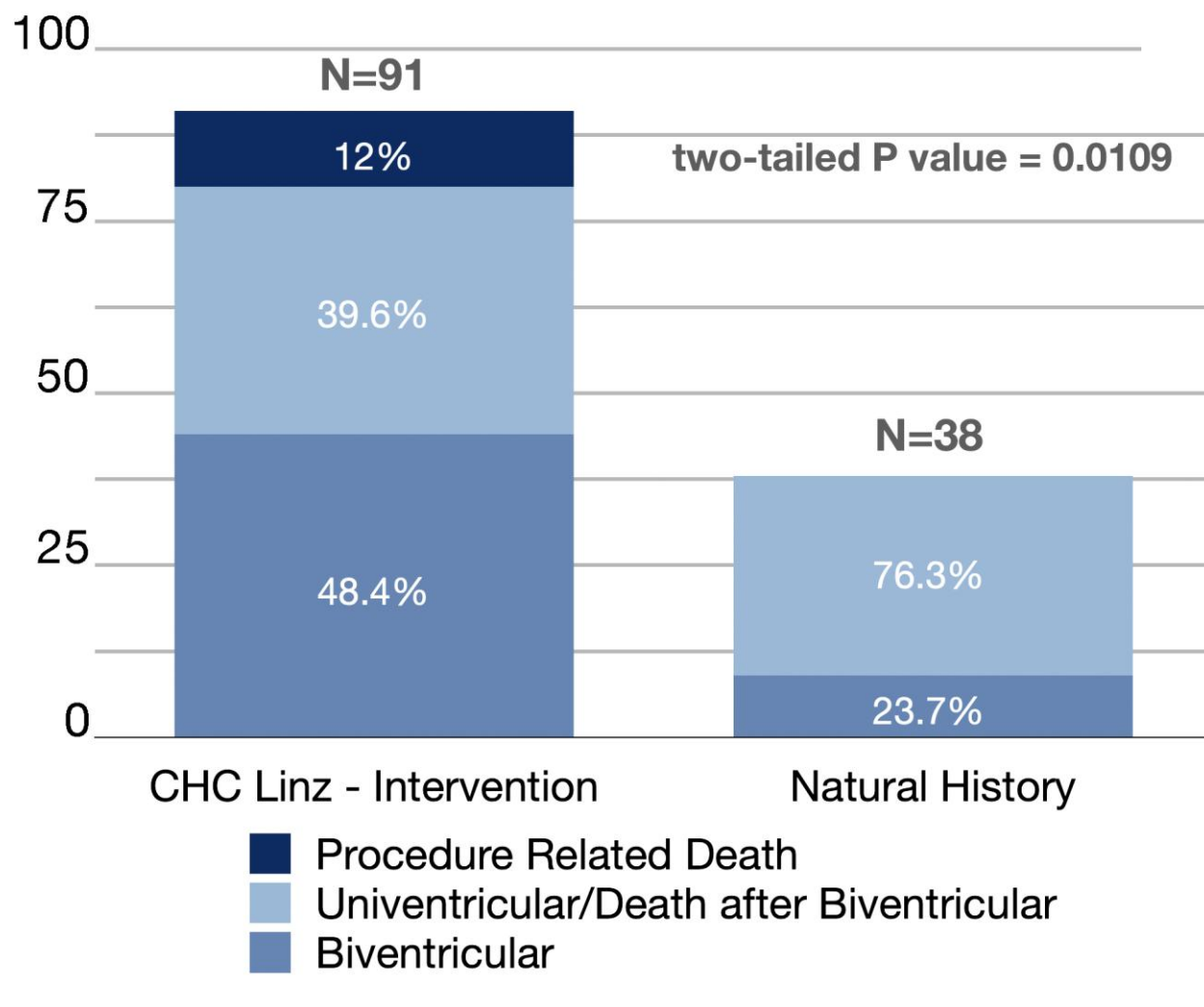
¹Children's Heart Center Linz, Department of Pediatric Cardiology, Kepler University Hospital, Medical Faculty of the Johannes Kepler University, Linz, Austria; ²Institute of Prenatal Medicine, Kepler University Hospital, Medical Faculty of the Johannes Kepler University, Linz, Austria; ³Children's Heart Center Linz, Department of Pediatric Cardiac Surgery, Kepler University Hospital, Medical Faculty of the Johannes Kepler University, Linz, Austria

FAV - Linz 2001-2020



Tulzer A, Arzt W, Gitter R, Sames-Dolzer E, Kreuzer M, Mair R, Tulzer G. Valvuloplasty in 103 fetuses with critical aortic stenosis: outcome and new predictors for postnatal circulation. *Ultrasound Obstet Gynecol.* 2022 May;59(5):633-641. doi: 10.1002/uog.24792. Epub 2022 Apr 11. PMID: 34605096; PMCID: PMC9324970.

Results CHC Linz vs. „Natural-History“



Tulzer A, Arzt W, Gitter R, Sames-Dolzer E, Kreuzer M, Mair R, Tulzer G. Valvuloplasty in 103 fetuses with critical aortic stenosis: outcome and new predictors for postnatal circulation. *Ultrasound Obstet Gynecol.* 2022 May;59(5):633-641. doi: 10.1002/uog.24792. Epub 2022 Apr 11. PMID: 34605096; PMCID: PMC9324970.

Gardiner et al. Natural history of 107 cases of fetal aortic stenosis from a European multicenter retrospective study. *Ultrasound Obstet Gynecol.* 2016 Sep;48(3):373-81.

Fetal PA/IVS - CPS



Determinants of Outcome in Fetal Pulmonary Valve Stenosis or Atresia with Intact Ventricular Septum

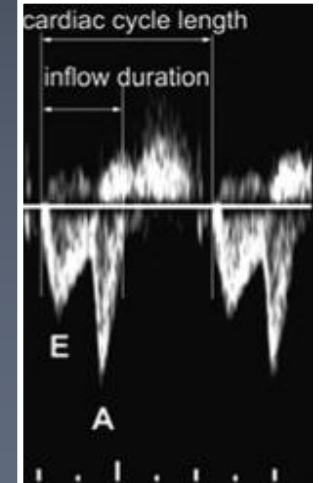
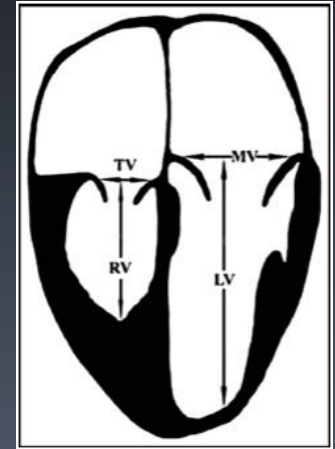
Kevin, Fournon, Masaki, Smallhorn, Chaturvedi, Jaeggi -
Toronto / Montreal

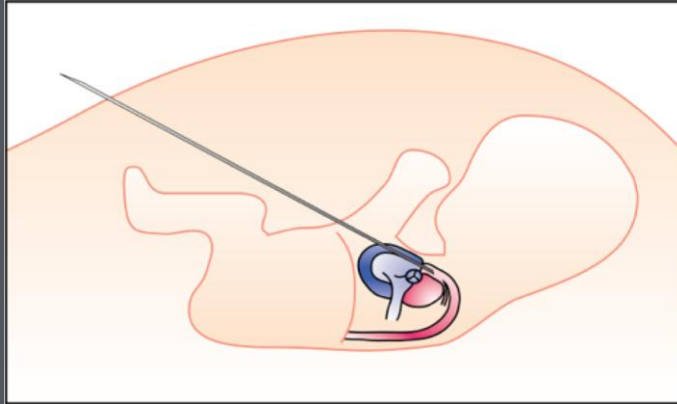
Am J Cardiol 2007;99:699-703

Prediction of a non - biventricular outcome:

- TV / MV ratio < 0.7
- RV / LV length ratio < 0.6
- TV inflow duration < 31.5%
- Presence of sinusoids


If 3/4 were present: *Sensitivity: 100%*
 Specificity: 75%





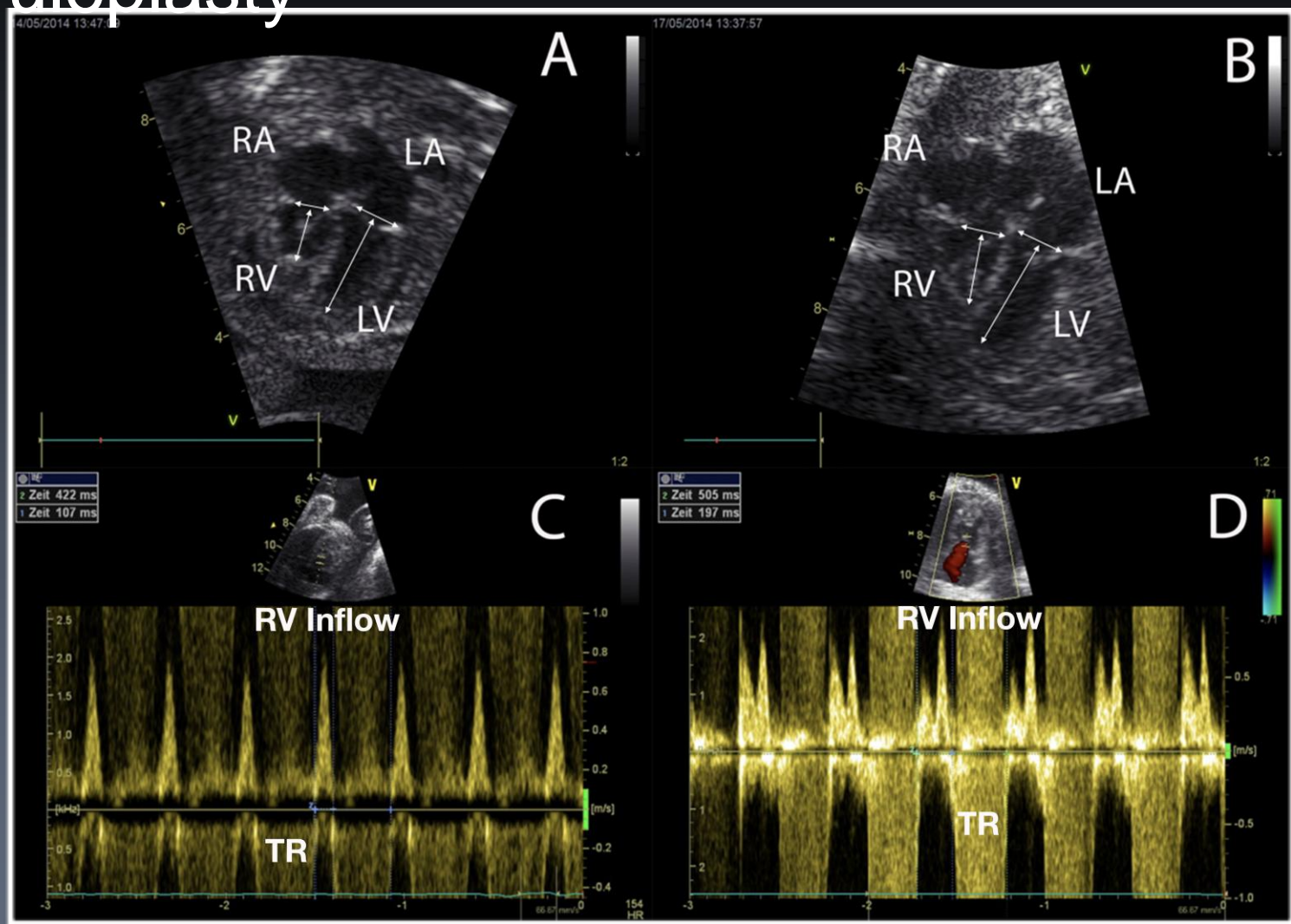


Immediate effects and outcome of *in-utero* pulmonary valvuloplasty in fetuses with pulmonary atresia with intact ventricular septum or critical pulmonary stenosis

A. TULZER¹ , W. ARZT², R. GITTER¹, C. PRANDSTETTER¹, E. GROHMANN¹, R. MAIR³ and G. TULZER¹

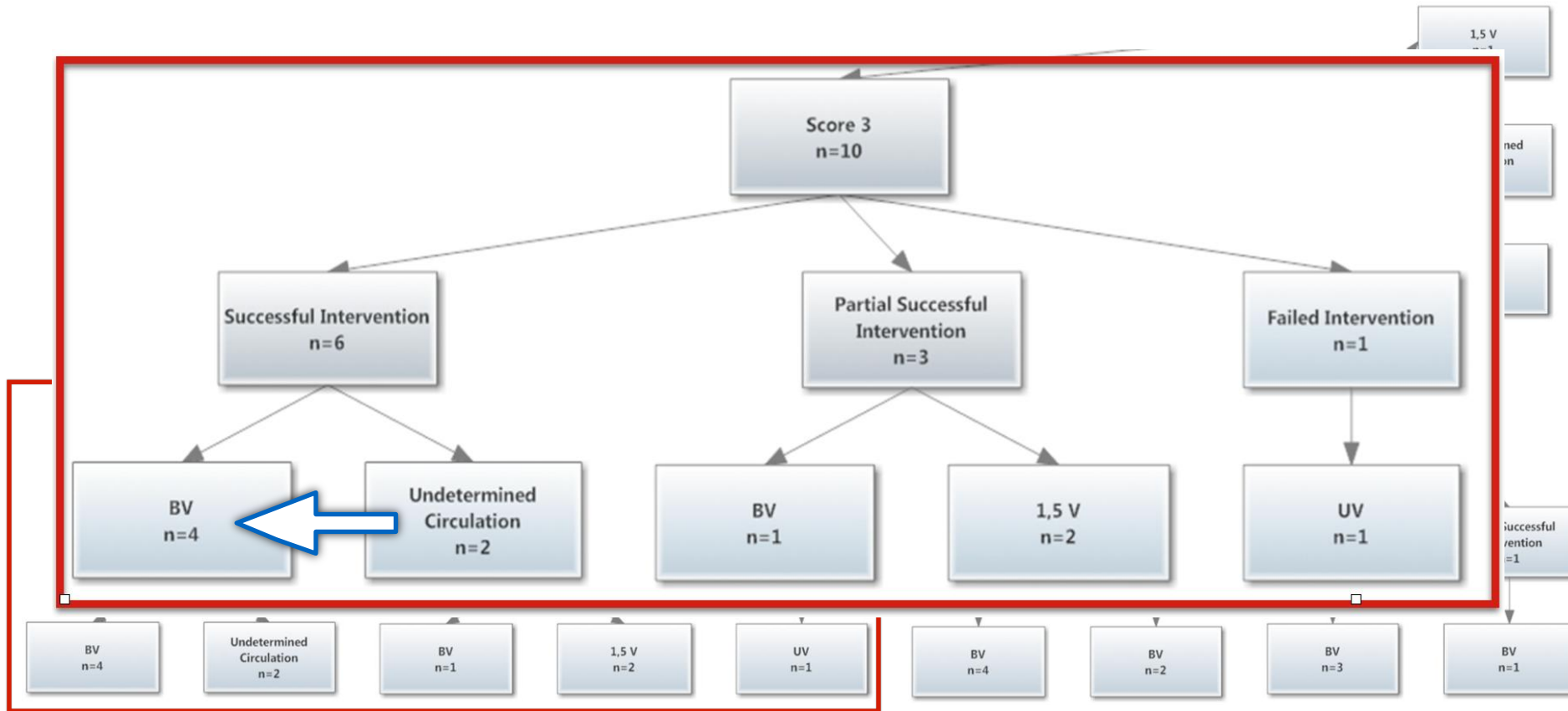
- 35 fetal pulmonary valvuloplasties in 23 fetuses
 - 8 CPS, 15 PAIVS
- Median GA at intervention: 28+4 weeks (23+6 to 32+1)
- Median GA at birth: 38+2 weeks (30+1 to 40+4)

Immediate changes after fetal pulmonary valvuloplasty



Results - Outcome

- Median follow-up of 1,63 years (0,10 years to 16,36 years)



Tulzer A. et al. Immediate effects and outcomes after in-utero pulmonary valvuloplasty in fetuses with pulmonary atresia with intact septum or critical pulmonary stenosis. *Ultrasound Obstet Gynecol.* 2018 Mar 23;

HLHS WITH RESTRICTIVE/INTACT IAS



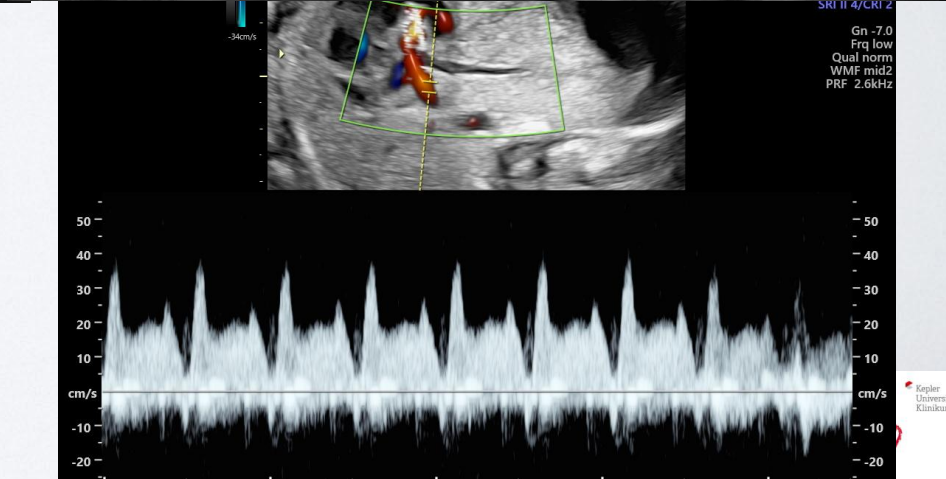
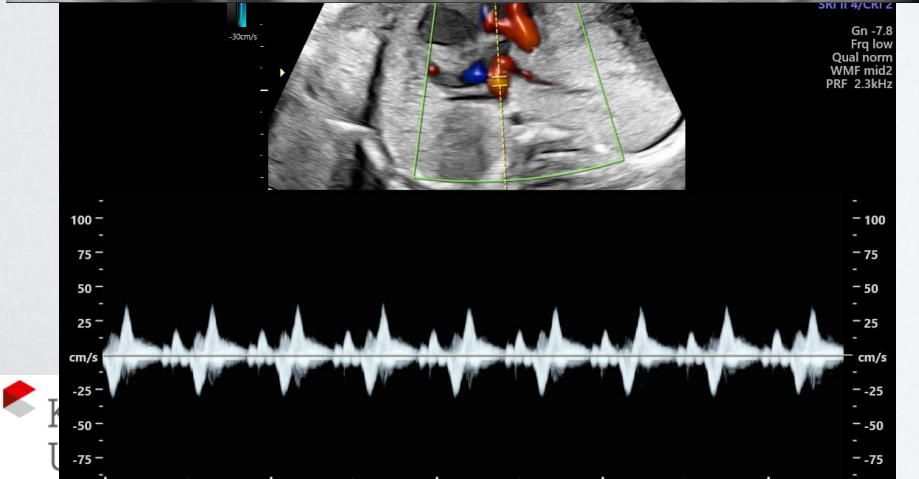
HLHS WITH RESTRICTIVE/INTACT IAS

- 6% of fetuses with HLHS, restrictive FO: 22%
- 1-year survival < 30%
- Secondary pulmonary damage - lymphagiectasia
- Emergency neonatal procedures
- Remaining high Mortality and Morbidity

A.P. Vlahos, J.E. Lock, D.B. McElhinney, M.E. van der Velde
Hypoplastic left heart syndrome with intact or highly restrictive atrial septum: outcome after neonatal transcatheter atrial septostomy
Circulation, 109 (2004), pp. 2326-2330

ATRIAL STENT

Voluson™ E10 COMP	HF, * E69903-21-03-16-2	KUK Linz Pränatalambulanz	TIs <0.1 Tlb <0.1 MI 0.7	16.03.2021 12:40:36 C2-9	Voluson™ E10 COMP	HF, * E69903-21-03-16-2	KUK Linz Pränatalambulanz	TIs 0.4 Tlb 0.4 MI 0.7	16.03.2021 12:32:36 C2-9-D
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HLHS WITH RESTRICTIVE/INTACT IAS

LINZ EXPERIENCE

- BAS only: 4 cases
- Stents: 8 cases:
 - 1 CAS: stent embolized to LV - liveborn: removed at Ross-Konno surgery
 - 4 late stents (35 - 38 weeks): 2 Death after Norwood, 2 alive after Glenn
 - 1 stent at 28 weeks: IUD unexpected
 - 1 still in utero
 - 1 lost to follow up

THANK YOU

