

CARDIOLOGY 2023

26th Annual Update on Pediatric and
Congenital Cardiovascular Disease



Wyndham Grand Rio Mar
Puerto Rico Golf and Beach Resort
Río Grande, Puerto Rico

February 2023

Strategies and Outcomes for Tetralogy of Fallot Repair in Middle Income Countries

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Director Congenital Heart Institute

Fundación Cardioinfantil – La Cardio

Bogotá, Colombia.

No Disclosures

31 de julio de 1959





Tetralogy of Fallot repair Evolution

1. The Era of Pathologic Anatomy (Before the 1940s)
2. The Era of Clinicophysiology and Surgery (1940s to 1970s)(WWII)
3. The Infant Era (1970s to 1990)
4. The Current Era of Cardiac Development (1990s and Beyond)



Blalock -Taussig-Thomas anastomosis in 1944 (Potts, Waterston etc)



September 1956

Complete Anatomical Correction of the Tetralogy of Fallot Defects

Report of a Successful Surgical Case

C. WALTON LILLEHEI, M.D.; MORLEY COHEN, M.D.; HERBERT E. WARDEN, M.D.; RICHARD L. VARCO, M.D.



Figure 6. C. Walton Lillehei, MD. Used with permission from the Lillehei Heart Institute at the University of Minnesota.

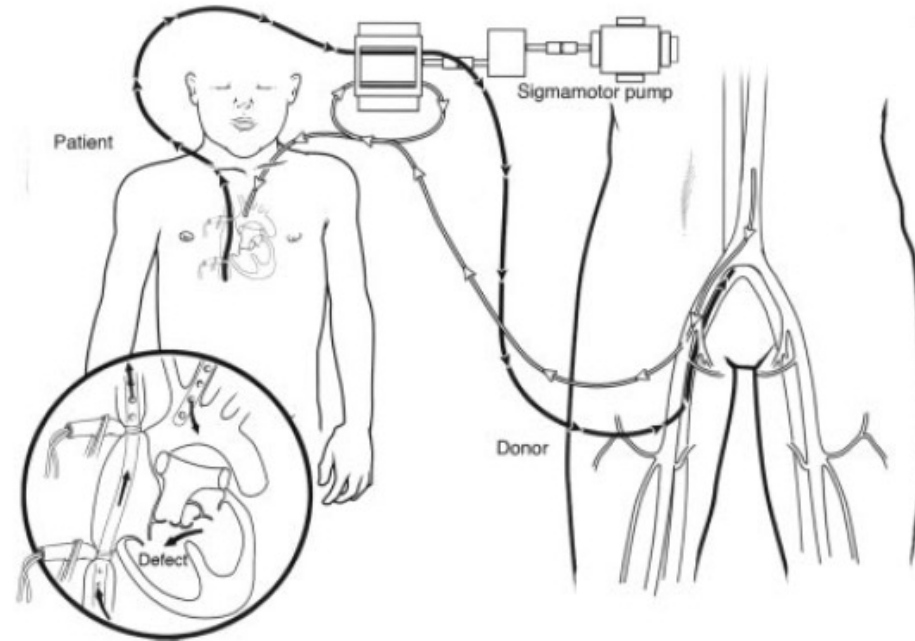


Figure 7. Diagram of the cross circulation technique used by C. Walton Lillehei in 1954–1955. Either the mother or the father of the patient was a donor.

N=11 Mortality 4 (36%)



John W. Kirklin Mayo Clinic

First ToF repair using extracorporeal circulation 1955



Figure 4. John H. Gibbon, MD. Courtesy of Thomas Jefferson University Archives and Special Collections.

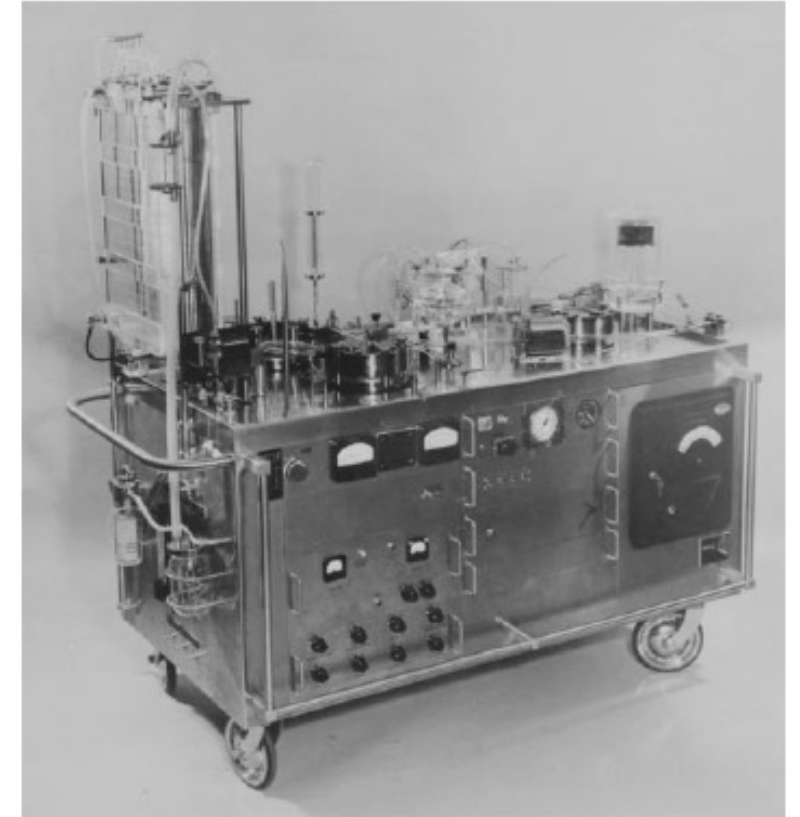


Figure 11. The Mayo-Gibbon heart-lung machine. Used with permission from the Mayo Historical Unit, Mayo Clinic, Rochester, Minn.

Development of Pediatric Cardiac Surgery across the world

Canada

Maude Abbott 1939

Bigelow 1952 Hypothermia

G Trusler, W. Mustard (1963)

United State

Mc Lean 1918 (Heparin)

Gross 1938 (PDA ligat.

Blalock, Taussig, Thomas 1945(BTS)

Gibbon, Lillehei, Kirklin 1958 (ECC)

Lillehei Zoll 1952 (Pacemaker)

Rashkind 1966 (atrioseptostomy)

Dammon Muller 1952 (PA Banding)

Sweden

Crafford Co Ao 1944

Senning (Atrial switch)

France , UK, Germany, Italy

D Ross Homograft 1962

Fontan Kreutzer

Dobost

Brock

New zealand

Barrat Boyes 1958 ECC

Homografts 1962



Development of Pediatric Cardiac Surgery in South America. (Closed surgery) (Late 40's)

Colombia

G. Humphreys, 1948 (PDA)

Rueda 1952 BTS



Brazil

Azarias de Brito 1946 (PDA)

Domínguez Pinto 1948 (BTS)

Chile

Amestri 1943 (PDA)

Argentina

Enrique Finochietto 1941 (PDA)

Albanese 1946 Ao Co BT Shunt

Development of Pediatric Cardiac Surgery in South America. (Open heart Surgery)(late 50's)

Colombia

Dennis Melrose

Bejarano , Ramirez Villegas,
Montoya. 1959 ECC
PS, ADS

Perú

Ricardo Tole 1959, 1960

Chile

Helmut Jaeger 1957(ASD)

Bolivia

Loma Peña
y Lillo

Venezuela

Ruben Jaen Centeno 1958
Gustavo Garcia Galindo. ECC 1961

Brazil

Felipozzi 1,955 PE ECC

Zerbini, Bittencourt,
and Jatene (ECC)
Zerbini 1960 T o Fallot

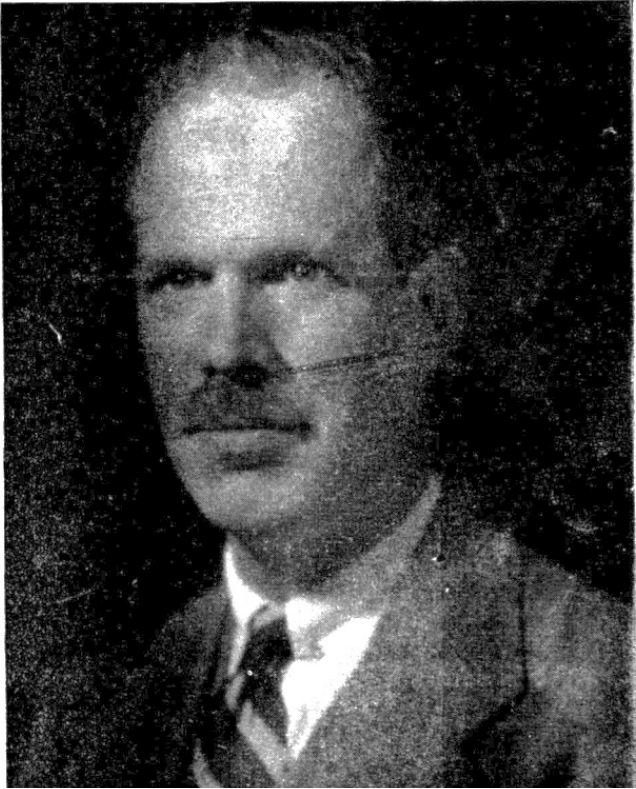
Uruguay

Juan Carlos Abó y
Roberto Rubio ECC
1959,1960

Argentina

Mario Brea, Tricerri 1958 ECC.

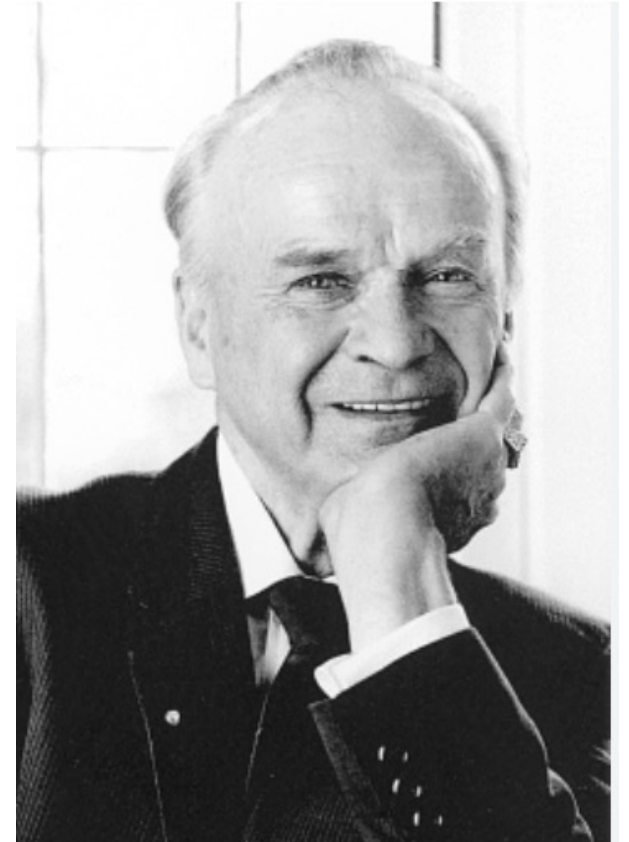




George Humphreys

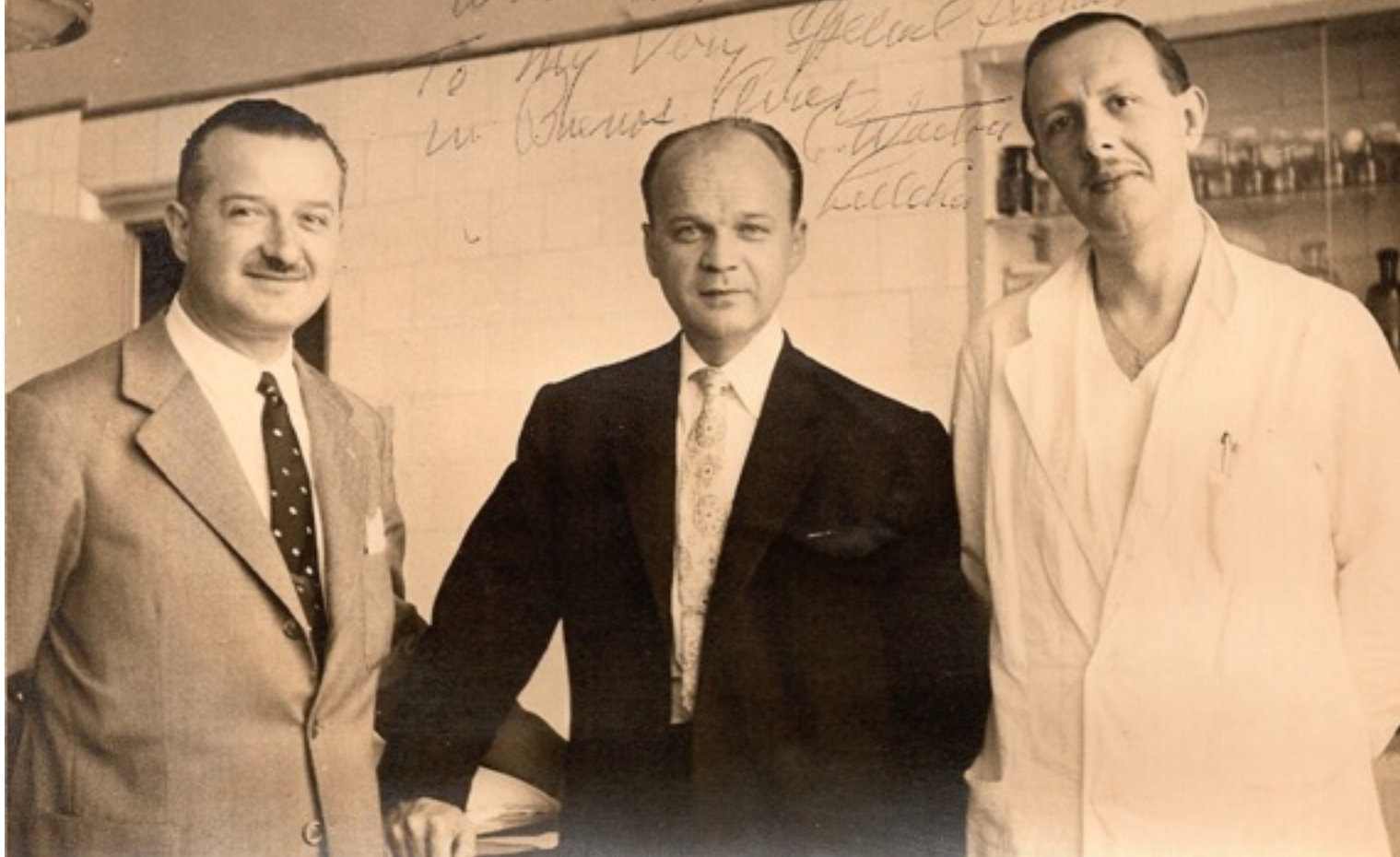


Dennis Melrose



Walton Lillehei

The first repair operation was performed by Lillehei in 1954 using cross-circulation and a transventricular approach to the ventricular septal defect closure and trans-annular patching.



Dres. Arengüren, Lillehei, Pisanú en Argentina 1956

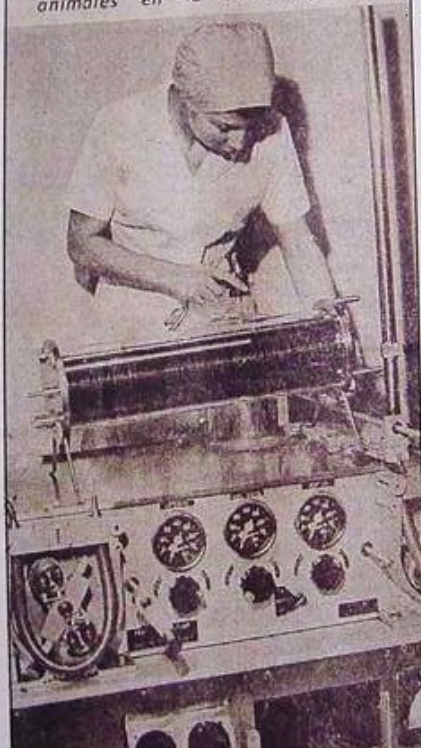


Colombia 1959



Transplantarán Válvula de Corazones en Bogotá

Uno de cada mil colombianos padece afecciones cardíacas. — Ensayos con animales en la Fundación Shaio.



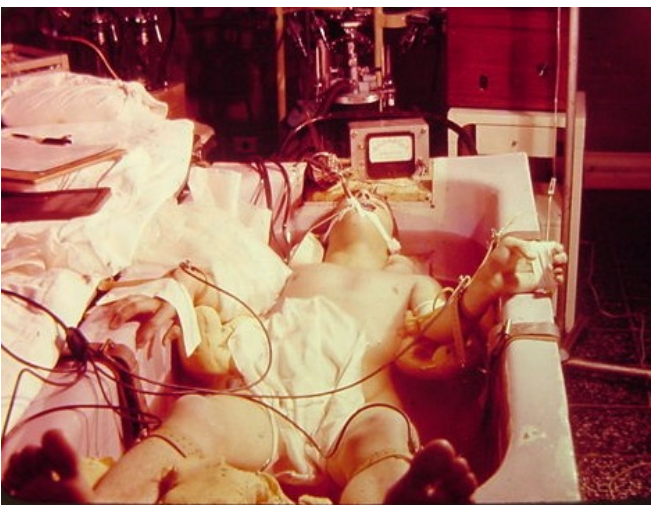
ESTE ES EL CORAZON ARTIFICIAL que se usará para reemplazar al corazón del ser humano y lo mantendrá sin circulación sanguínea mientras se realizan intervenciones quirúrgicas. El mismo aparato será utilizado la semana próxima cuando los cirujanos de la Fundación Shaio harán trasplantes de

HACE 50 AÑOS

31 de julio de 1959

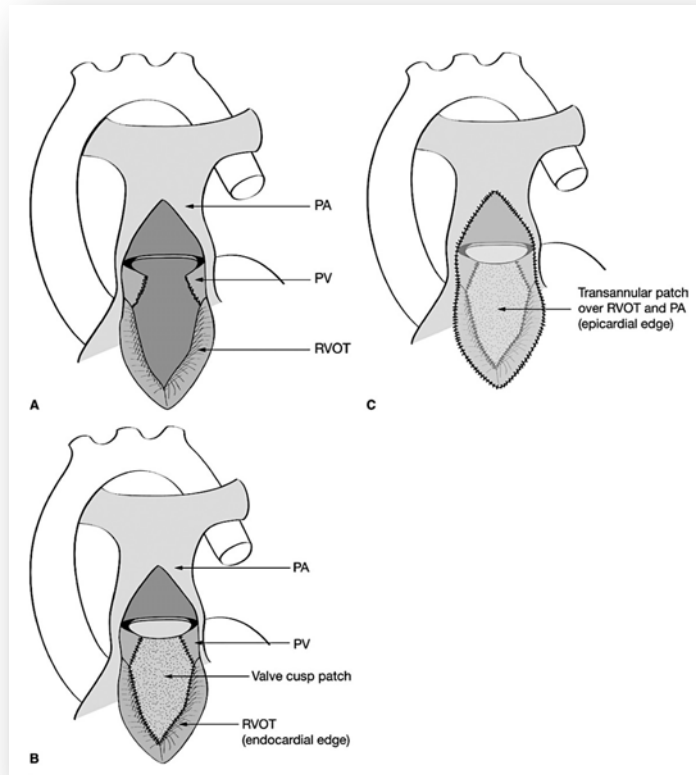


Condecoración a científicos. En la clausura del Symposium del Corazón, al cual asistieron cardiólogos de todo el mundo, varios fueron condecorados por sus méritos. En la foto, el coronel Alfonso Rueda impone la condecoración a los doctores Walton Lollehey y Demetrio Sodi.



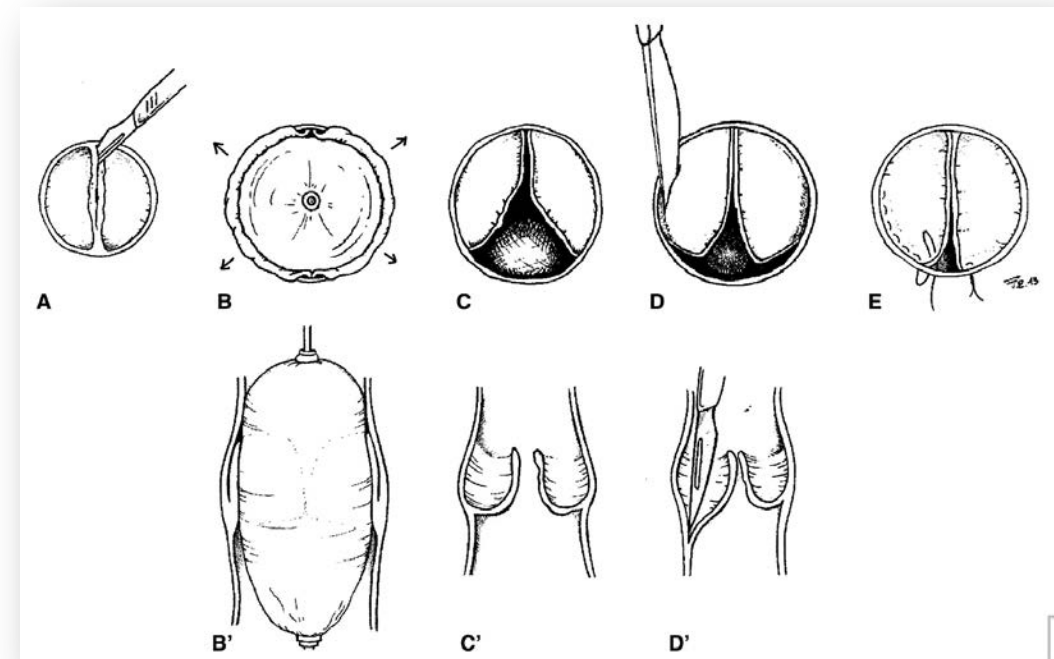
Pulmonary valve cusp augmentation with autologous pericardium may improve early outcome for tetralogy of Fallot

Petros Anagnostopoulos, MD,^a Anthony Azakie, MD,^a Shobha Natarajan, MD,^b Nelson Alphonso, MD,^a Michael M. Brook, MD,^b and Tom R. Karl, MD^a



Evolving strategies for preserving the pulmonary valve during early repair of tetralogy of Fallot: Mid-term results

Vladimiro L. Vida, MD, PhD,^a Alvisse Guariento, MD,^a Biagio Castaldi, MD,^b Matteo Sambugaro, MPH,^c Massimo A. Padalino, MD, PhD,^a Ornella Milanese, MD,^b and Giovanni Stellin, MD^a



Webinars (COVID)

Fetal Heart Society
https://fetalheartsociety.org

Speakers

Panelists

Moderator

An Integrative Review of Tetralogy of Fallot with Absent Pulmonary Valve
Thursday, June 10, 2021
17:30 Los Angeles • 20:30 New York • 8:30 June 11 - London

A FREE live fetal educational webinar.
The presentation will be recorded and available for viewing on the FHS website.

Register at: <http://www.fhsociety.com/june2021fetalheartwebinar>



DukeMedicine + Duke Children's
Duke Adult Congenital Heart Center

Adult Congenital Heart Association

Growing Older in Tetralogy of Fallot: What Do I Need to Know?

Richard A. Krasuski, M.D.
Professor of Medicine and Pediatrics
Director of the Adult Congenital Heart Disease Program
Director of Hemodynamic Research
Duke University Health System

CONGENITAL

AATS
Global Grand Rounds Webinars



AATS | Tetralogy of Fallot with Pulmonary Atresia ...

Visitor

Heart UNIVERSITY
WEBINAR SERIES

Contemporary questions in Tetralogy of Fallot: How can we avoid poor outcomes late after repair?
Register today to join us for the first webinar in this NEJM series.

Contemporary Questions in Congenital Heart Disease











Wednesday, May 6, 2020
11:30 AM - 1:30 PM EDT

WORLD UNIVERSITY FOR PEDIATRIC AND CONGENITAL HEART SURGERY

Curriculum Webinar
Tetralogy of Fallot: The Basics

Limited spaces available
Click to register

Save The Date!
Saturday, October 31, 2020
13:00-15:30 GMT
9-11:30 ET (Montreal)

Chairs

Elizabeth Stephens
Rochester, USA

Krishna Jayar
New Delhi, India

Sivakumar Sankaranarayanan
Kuala Lumpur, Malaysia

Adult Congenital Heart Association

Tetralogy of Fallot

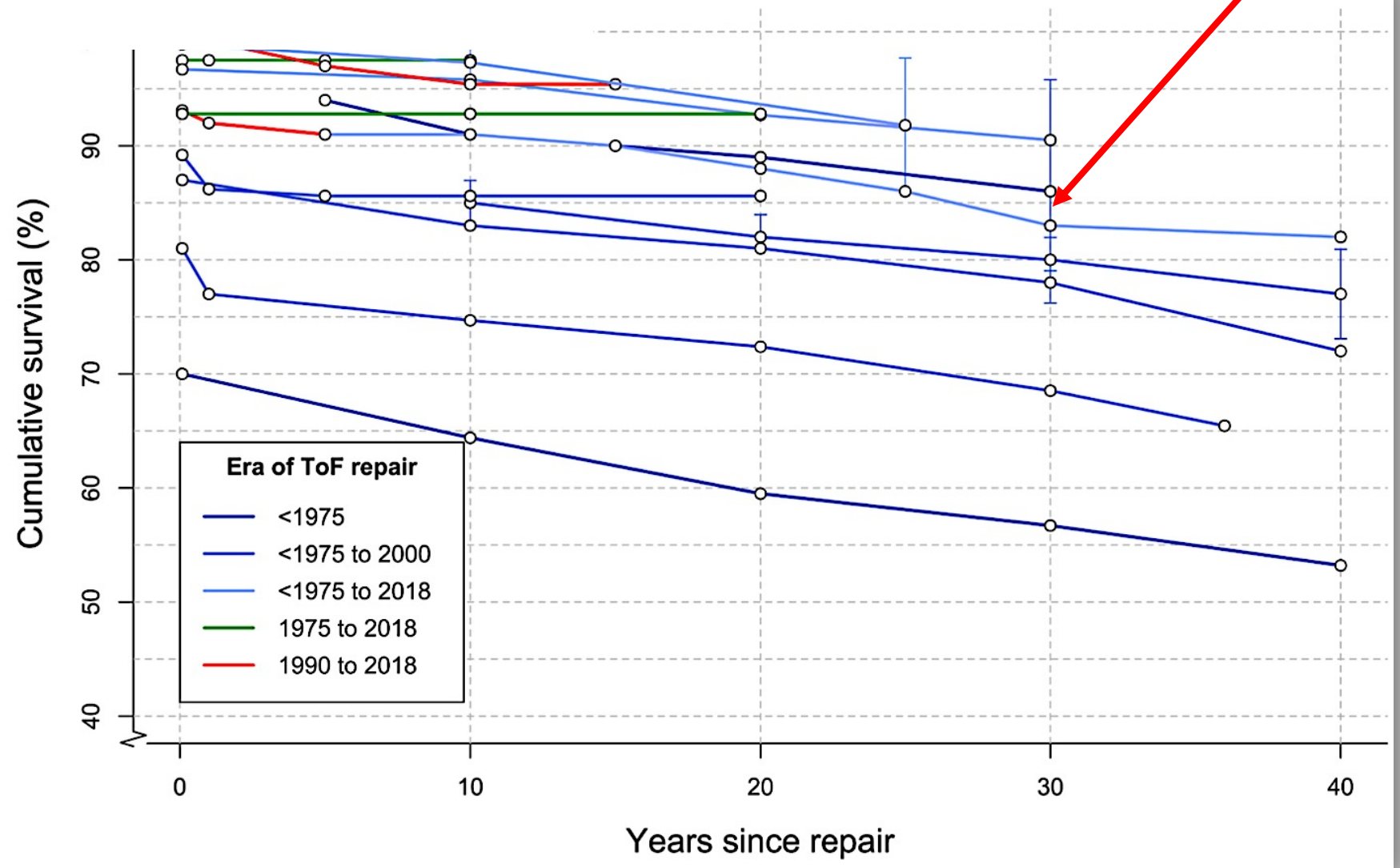
Marlon S. Rosenbaum, M.D.
Director, Adult Congenital Heart Disease
Columbia University Medical Center
New York, New York

▶ 1:03:31

Current outcomes and treatment of tetralogy of Fallot [version 1; peer review: 2 approved]

Jelle P.G. van der Ven ^{ib} 1-3, Eva van den Bosch^{1,2}, Ad J.C.C. Bogers³, Willem A. Helbing^{1,4}

EACTS and STS have reported a peri-operative mortality below 3% in recent years



Results of reparative surgery for tetralogy of Fallot: data from the European Association for Cardio-Thoracic Surgery Congenital Database[†]

George E. Sarris^{a,*}, Juan V. Comas^b, Zdzislaw Tobota^c and Bohdan Maruszewski^c

Tetralogy of Fallot Repair in Developing Countries: International Quality Improvement Collaborative

 Check for updates

Nestor Sandoval, MD, Marisol Carreño, MD, William M. Novick, MD, MS, Ravi Agarwal, MD, Iftikhar Ahmed, MBBS, FCPS, Rakhi Balachandran, MD, Maria Balestrini, MD, K. M. Cherian, MD, Ulisses Croti, MD, PhD, Xinwei Du, MD, Kimberlee Gauvreau, ScD, Do Thi Cam Giang, MD, Ramkinkar Shastri, MD, and Kathy J. Jenkins, MD, MPH

Survey of multinational surgical management practices in tetralogy of Fallot

Sara Hussain¹, Osman Al-Radi², Tae-Jin Yun³, Zhongdong Hua⁴, Budi Rahmat⁵, Suresh Rao⁶, An Qi⁷, Charles Fraser⁸, Yves d'Udekem⁹, Quazi Ibrahim¹⁰, Ingrid Copland¹⁰, Richard Whitlock¹¹ and Glen Van Arsdel¹

Outcome after surgical repair of tetralogy of Fallot: A systematic review and meta-analysis

 Check for updates

Jamie L. R. Romeo, MD, MSc,^a Jonathan R. G. Etnel, MD,^a Johanna J. M. Takkenberg, MD, PhD,^a Jolien W. Roos-Hesselink, MD, PhD,^b Wim A. Helbing, MD, PhD,^{c,d} Pieter van de Woestijne, MD,^a Ad J. J. C. Bogers, MD, PhD,^a and M. Mostafa Mokhles, MD, PhD^a

The Society of Thoracic Surgeons Congenital Heart Surgery Database: 2019 Update on Outcomes and Quality

Jeffrey P. Jacobs, MD, John E. Mayer, Jr, MD, Sara K. Pasquali, MD, MHS, Kevin D. Hill, MD, David M. Overman, MD, James D. St. Louis, MD, S. Ram Kumar, MD, PhD, Carl L. Backer, MD, James S. Tweddell, MD, Joseph A. Dearani, MD, and Marshall L. Jacobs, MD

The World Society for Pediatric and Congenital Heart Surgery: 2021 Update of the World Database for Pediatric and Congenital Heart Surgery

James D. St Louis, MD¹, Luqin Deng, PhD², Claire Covington, MPA², Nicholas A. Timkovich, MSHI³, Danielle Crethers, BA¹, Craig S. Collum, MPH², John K. Pennington, MSHI², Taylor Broser², Robert J. Dabal, MD², Jeffrey P. Jacobs, MD⁵, James E. O'Brien, MD⁶, Erle H. Austin, MD³, Christo I. Tchernvenkov, MD⁴, and James K. Kirklin, MD²

The American Association for Thoracic Surgery (AATS) 2022 Expert Consensus Document: Management of infants and neonates with tetralogy of Fallot

 Check for updates

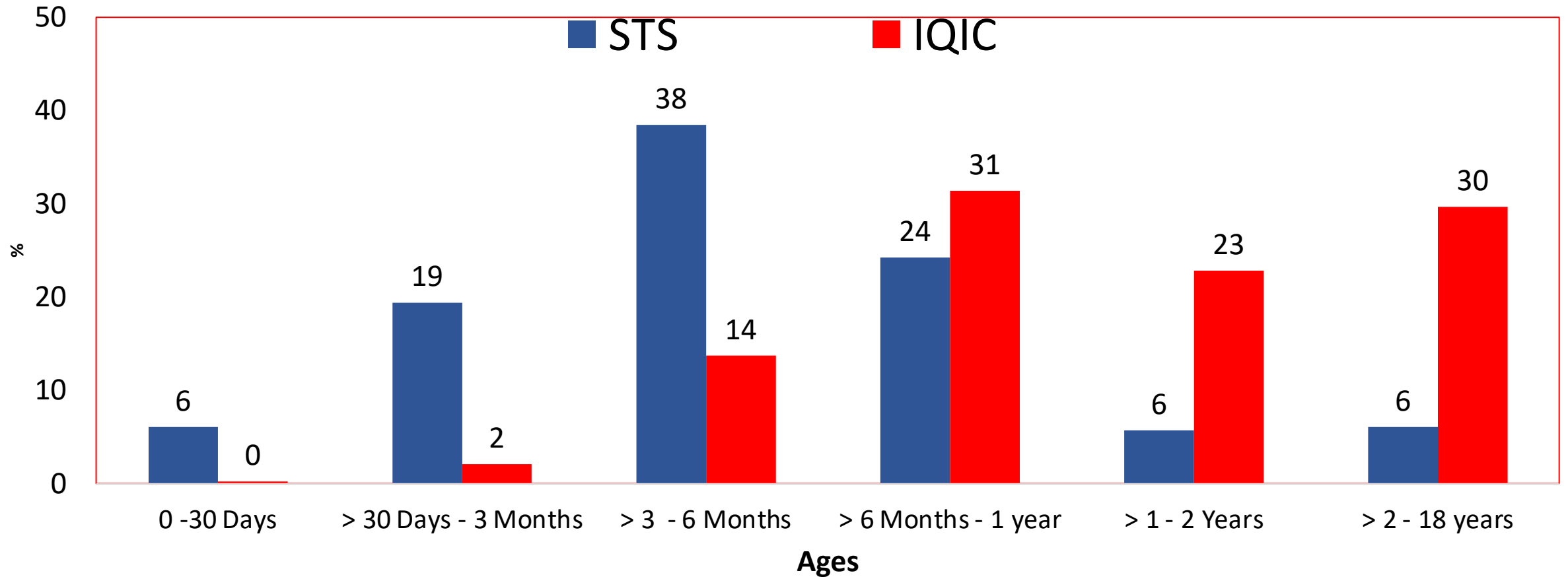
Expert	Jacob R. Miller, MD, ^a Elizabeth H. Stephens, MD, PhD, ^b Andrew B. Goldstone, MD, PhD, ^c
Consensus	Andrew C. Glatz, MD, MSCE, ^d Lauren Kane, MD, ^e Glen S. Van Arsdel, MD, ^f
Panel:	Giovanni Stellin, MD, ^g David J. Barron, FRCS(CT), ^h Yves d'Udekem, MD, PhD, ⁱ
	Lee Benson, MD, ^j James Quintessenza, MD, ^k Richard G. Ohye, MD, ^l Sachin Talwar, MS, MCh,
	FIACS, ^m Stephen E. Fries, MD, MSc, ⁿ Sitaram M. Emani, MD, ^o and Pirooz Eghtesady, MD, PhD ^a

Tetralogy of Fallot repair around the World

Database	Number of patients	Mortality %	T A P %	Age months	Age at the Repair
STS (2010-2022)	4.869	1.3	52-66		77% younger 1 year
EACTS CDB (2012)	6.656	2.47	57.5		
WDPCHS (2022)	3.082	2.1	?		
IQIC. (2018)	2.164	3.3	-	12 m	71% older than 6 M.
Multinational survey (2019)	1.800/year		43 -47	Older 3 m	
Systematic Review Metanalysis (2022)	21,427	2.84	49	0.5+2.5	
FCI (2022)	556	3.9- 1.9	47%	19.7	

- Habib HF. Ann Thorac Surg 2010;90:813–20)
- Jacobs, J. Ann Thorac Surg 2019
- Sarris G. European Journal of Cardio-Thoracic Surgery 42 (2012) 766–774.
- St. Louis J.. World Journal for Pediatric and Congenital Heart Surgery 2022, Vol. 13(2) 137-145.
- Sandoval N. Ann Thorac Surg 2018;106:1446–51)
- Hussain S. Cardiology in the Young 2019 29: 67–70.
- Jamie I J Thorac Cardiovasc Surg 2020;159:220-36)

TOF Repair by Ages STS versus IQIC



Habib H et al. Ann Thorac Surg 2010;90:813–20

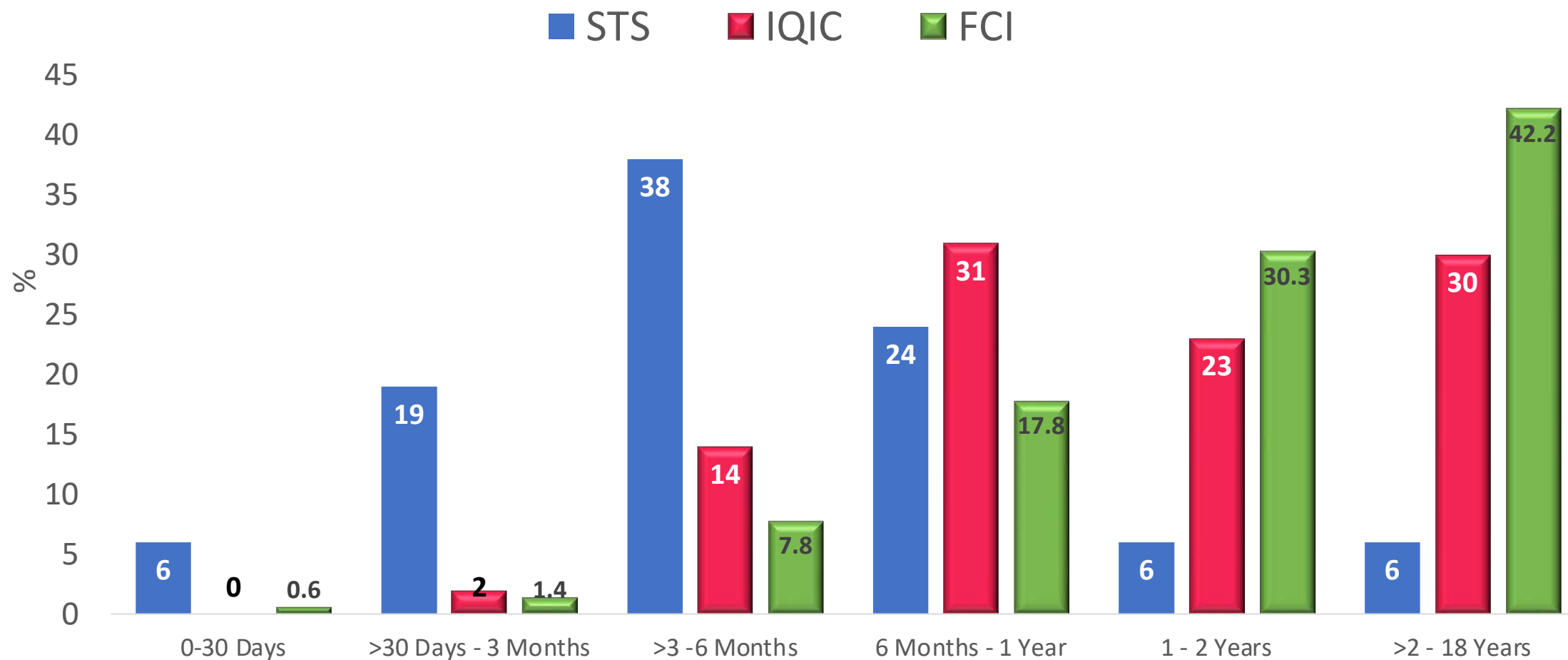
Sandoval N. Ann Thorac Surg 2018;106:1446–51)

Outcomes after TOF repair in 556 consecutive patients in a single institution in a Middle -Income Country 2001 -2022

Department of cardiac Surgery and
Congenital Heart Institute.
Fundación Cardioinfantil-La Cardio.
Bogotá, Colombia
2022



Total primary Repair by Ages



TAP 52-66% Mortality 2.47%

Mortality 3.3%

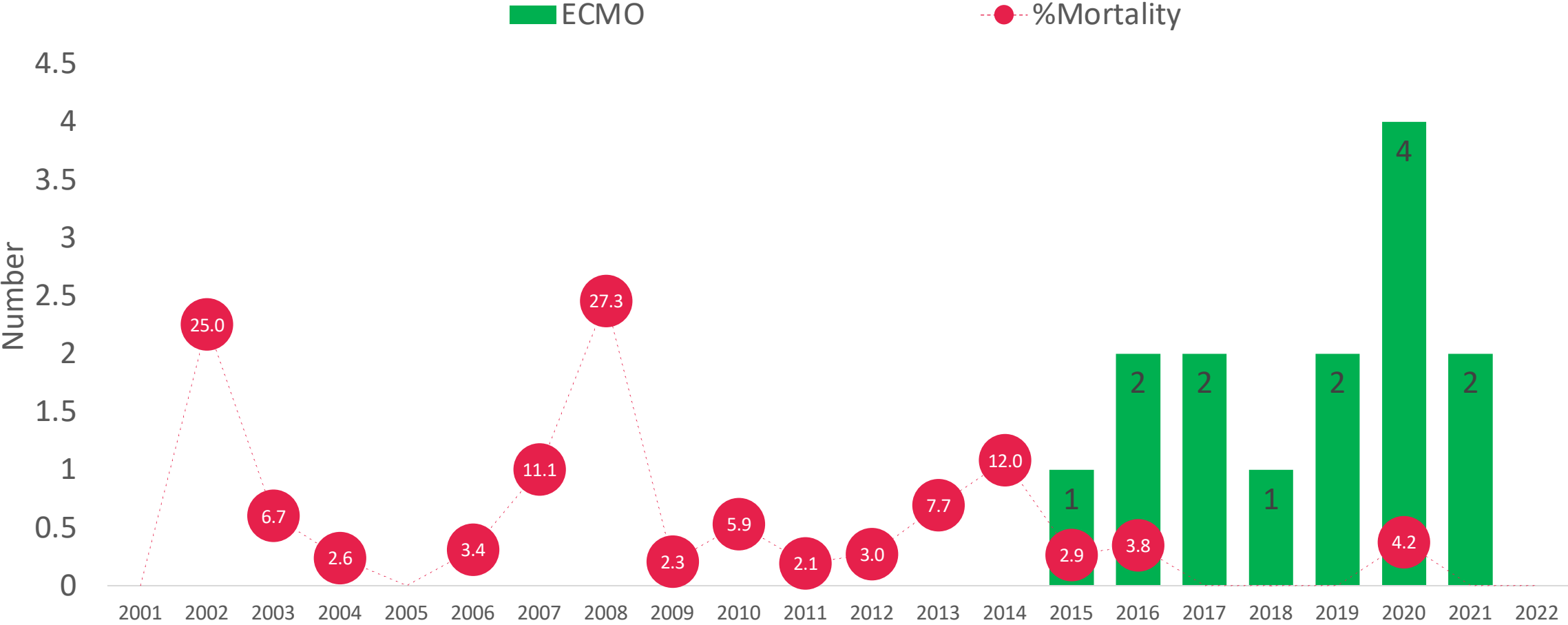
TAP 47%. Mortality 3.9% to 1.9%

Mortality analysis

Variable	Total N= 556	Alive n=534	Death n=22	Valor p
Preoperative				
Age in Months.	19,7(11,4-51,4)	19,4(11,4-51,4)	24,6(8,4-145,4)	0,781
Female	287(51,6)	274(51,3)	13(59,1)	0,520
Malnutrition %	319(57,4)	302(56,6)	17(77,3)	0,077
Oxygen Saturation	87(80-92)	92(88-95)	86(78-92)	0,005
Hematocrit %	44(39,5-50,4)	40,8(37-45,2)	43,3(37-51)	0,129
Intraoperative				
CPB Minutes	100(76-130)	99(75-130)	124(95-228)	0,004
Aortic Cross-Clamp Minutes	74(53-123)	74(53-95)	87,5(57-172)	0,081
Postoperative				
Surgical Infection	12(2,2)	12(2,2)	0	0,482
Mediastinitis	3(0,5)	3(0,6)	0	0,716
Neurologic event	6(1,1)	5(0,9)	1(4,6)	0,215
ECMO	14(2,6)	13(2,4)	1(4,6)	0,295



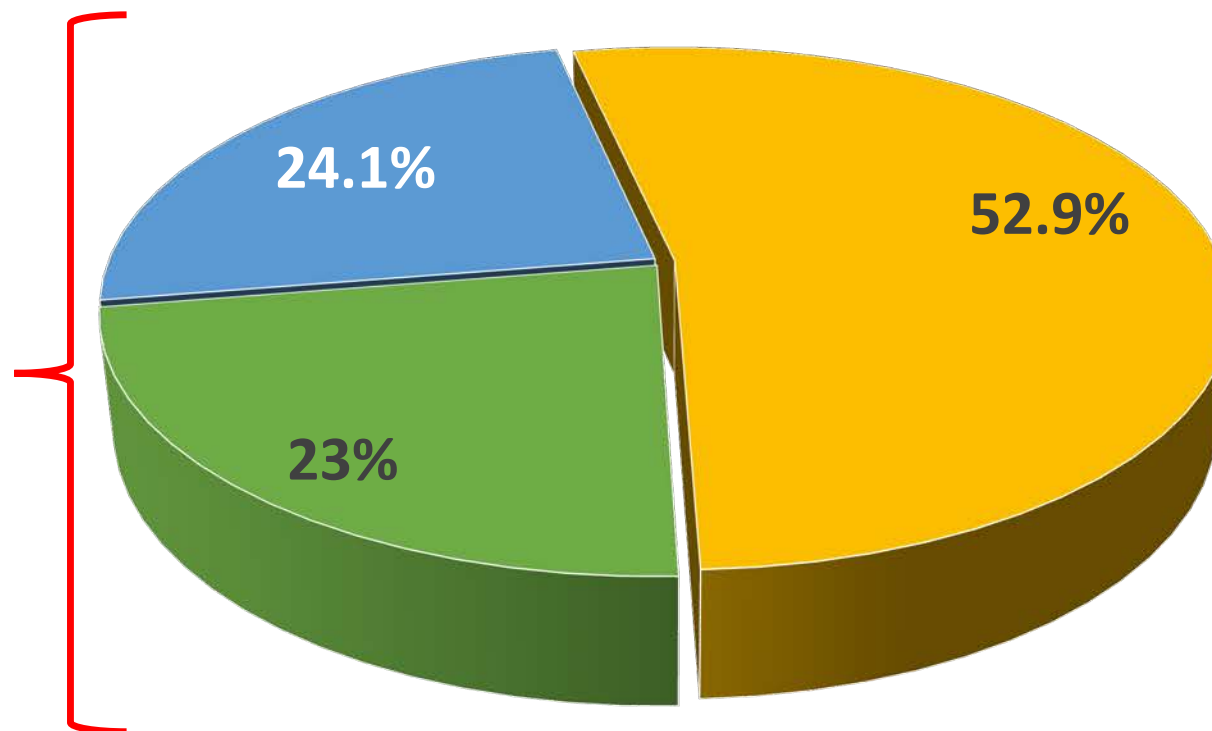
Outcomes after TOF repair in 556 consecutive patients operated in a single institution in a Middle -Income Country



Type of repair and early surgical outcomes.

From 2010-2022 (309 patients)

TAP
47%



■ Transannular patch + neovalve

■ Transannular patch with no valve

■ Valve preservation or Hegar Dilatation

Final words

- Difficulties and great challenges always bring progress, as occurred in pediatric heart surgery.
- Primary ToF repair is later in developing countries.
- The use of a TAP remains static over time. It is almost 50% of the cases.
- The use of a TAP may be due to the aggressive nature of many surgeons, who now prefer childhood repair over stage repair.?
- Could developing countries have less TAP due to late repairs?
- Webinars help improve knowledge, anywhere in the world.
- Each center must do what gives you the best results, depending on what your database tells you for the improvement of your patients and their families



Gracias

