Surgical Nightmare: Managing in-situ PDA stent

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Case presentation:

- 5-month-old female child,
- Chief complaints:
  - Dyspnea,
  - Bluish discoloration of finger tips and lips while excessively crying and
  - failure to thrive.
- Past history:
- K/c/o Tricuspid Atresia Type 1 B, absent pulmonary valve with Patent ductus arteriosus diagnosed on 2nd day of life.
- Underwent PDA stenting on 5th day of life, 2 stents were placed, 2nd stent placed due to stent migration into LPA; covering aortic end of PDA.

- Clinical Examination:

  HR= 130-140/min,

  SpO_2= 84-86% on room air

  CVS: Continuous systolic murmur

- 2D ECHO:
  - PDA stent in situ, with restricted flow across the stent to LPA,
  - Ends of stent seen protruding into LPA and arch of aorta respectively,

Cardiac CT Angiogram:

- Tip of the PDA stent is at the origin of LPA reaching up to the inferior wall of LPA.
- Narrowing at the origin of LPA from MPA with Post stenotic dilatation (7.6 mm distal to stent)
- Aorta: the tip of the PDA stent is protruding into the arch of the aorta

- Diagnosis: K/C/O Tricuspid Atresia Type:1, S/P PDA stenting, stent migration to LPA with LPA stenosis.
- Treatment is univentricular palliation,
- Step I: currently, known as Bi-directional Glenn Shunt (anastomosis between SVC and RPA)
- Step II: Completion Fontan at 4-5 years of age, a corrective surgery, flow of IVC will be directed to RPA.

Bi-directional Glenn (BDG) Shunt with PDA stent removal.

Surgical Challenges:

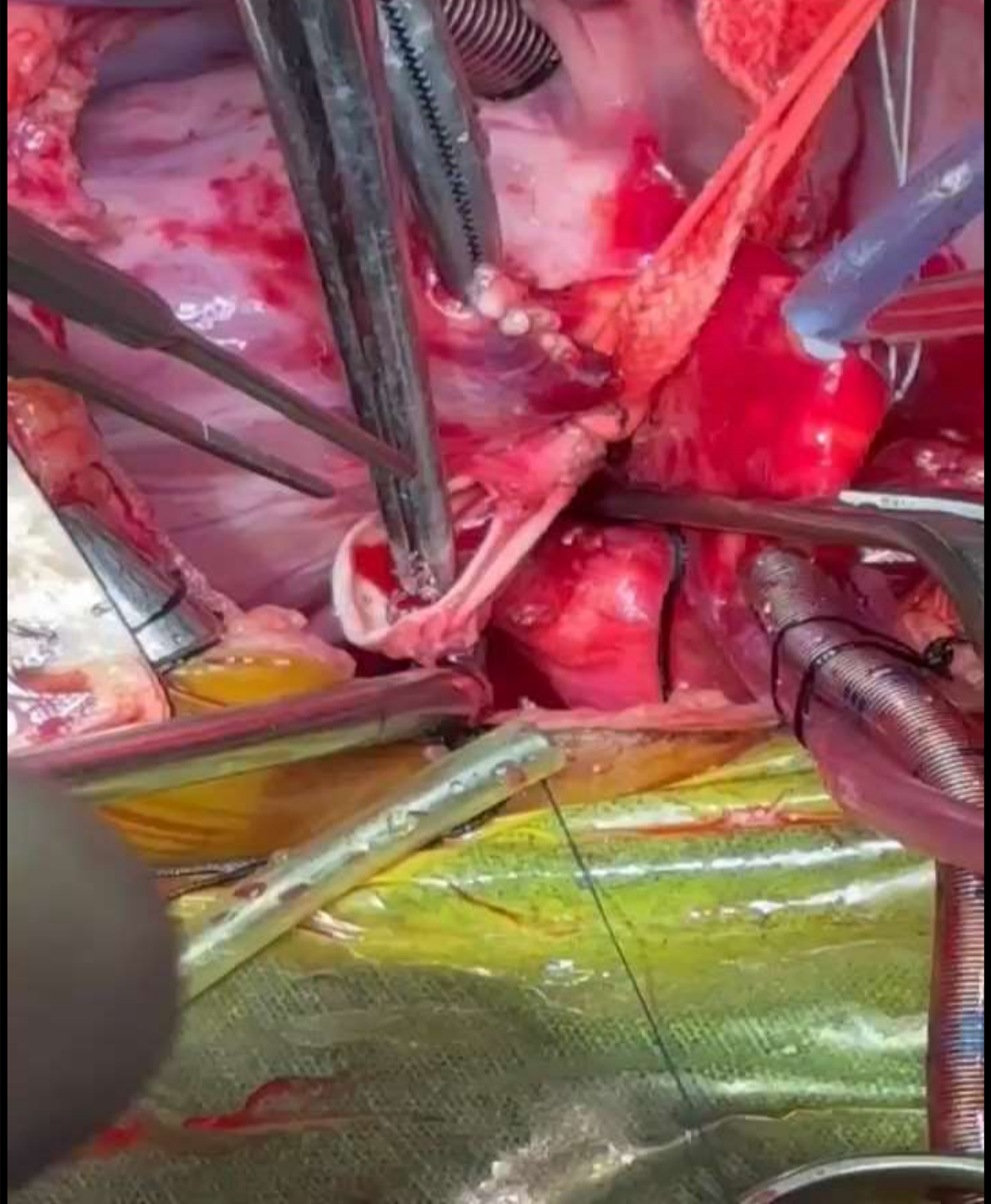
1. BDG is usually done without cardiopulmonary bypass (CPB). Removal of the PDA stent necessitated use of CPB.
2. Patent PDA can cause Pulmonary flooding (↑ PBF) during CPB, leading to severe pulmonary edema, intrapulmonary hemorrhage.
3. Endothelization of the stent with adhesions makes stent removal difficult.
4. PDA Stent removal necessitated the opening of the aortic arch. This makes interruption of circulation necessary to allow for aortic repair in a bloodless field.
5. Total Circulatory Arrest (TCA) is necessary with cerebral protection strategies to prevent neurological damage.

Surgical Procedure:

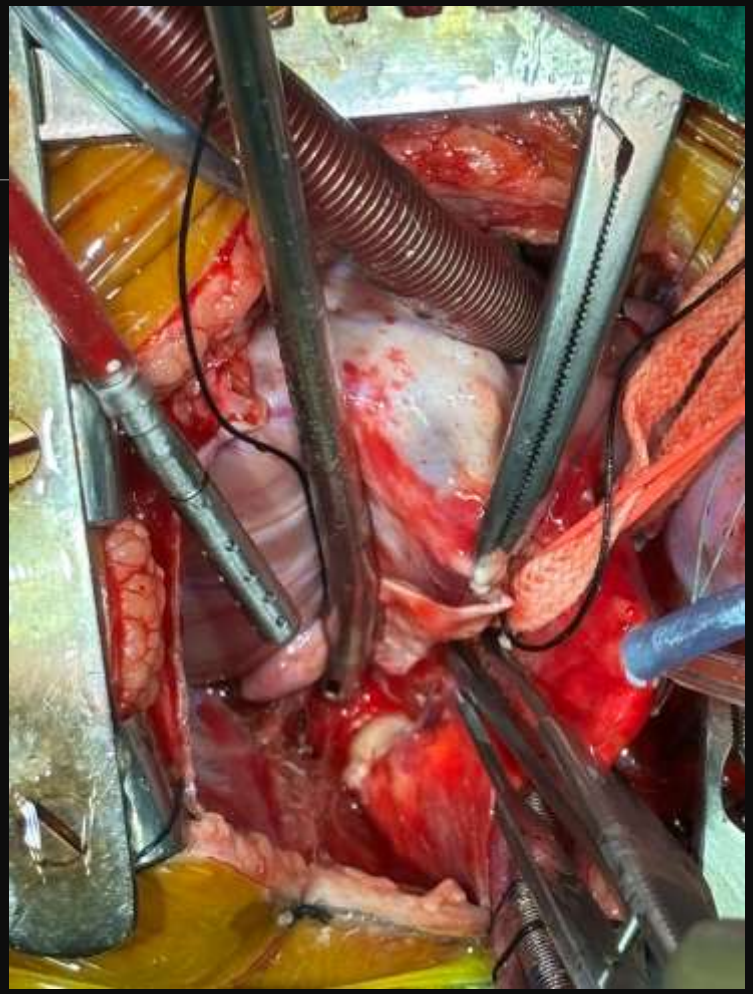
- Midline sternotomy
- Cannulation was done in Ascending Aorta (12 Fr), SVC (12 Fr) and IVC (18 Fr) for CPB.
- Both branch pulmonary arteries, just at take-off were dissected free, mobilized, and looped with umbilical tapes.
- Tapes were snug closed at the initiation of CPB to protect lungs on Bypass.

TCA:

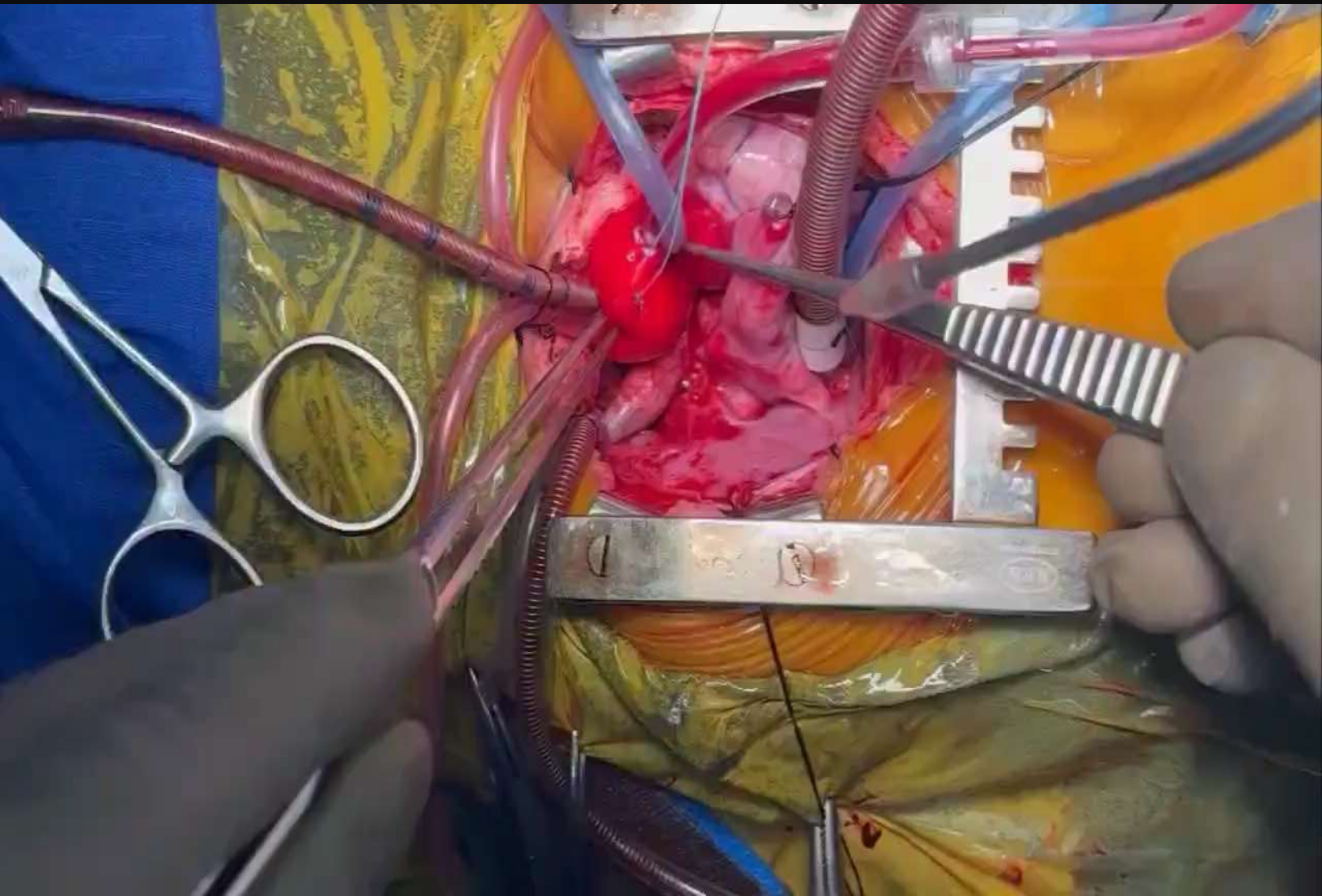
- Brain can tolerate lack of circulation for up to 40 mins when core body temperature is cooled to 18˚-20˚C.
- Additional cerebral protection strategies: By regional head cooling with ice packs, Inj. Thiopentone, Inj. Methylprednisolone was given.
- Whole body circulation interrupted after cardioplegic arrest.
- PDA dissected free from surrounding tissues along its entire course.
- LPA end of PDA cut opened, stent mobilized, and extracted from LPA.
- Attempts to pull the aortic end were difficult due to dense adhesion, meticulous adesiolysis was done.
- Aortic arch opened along the lesser curvature, stent was removed completely.

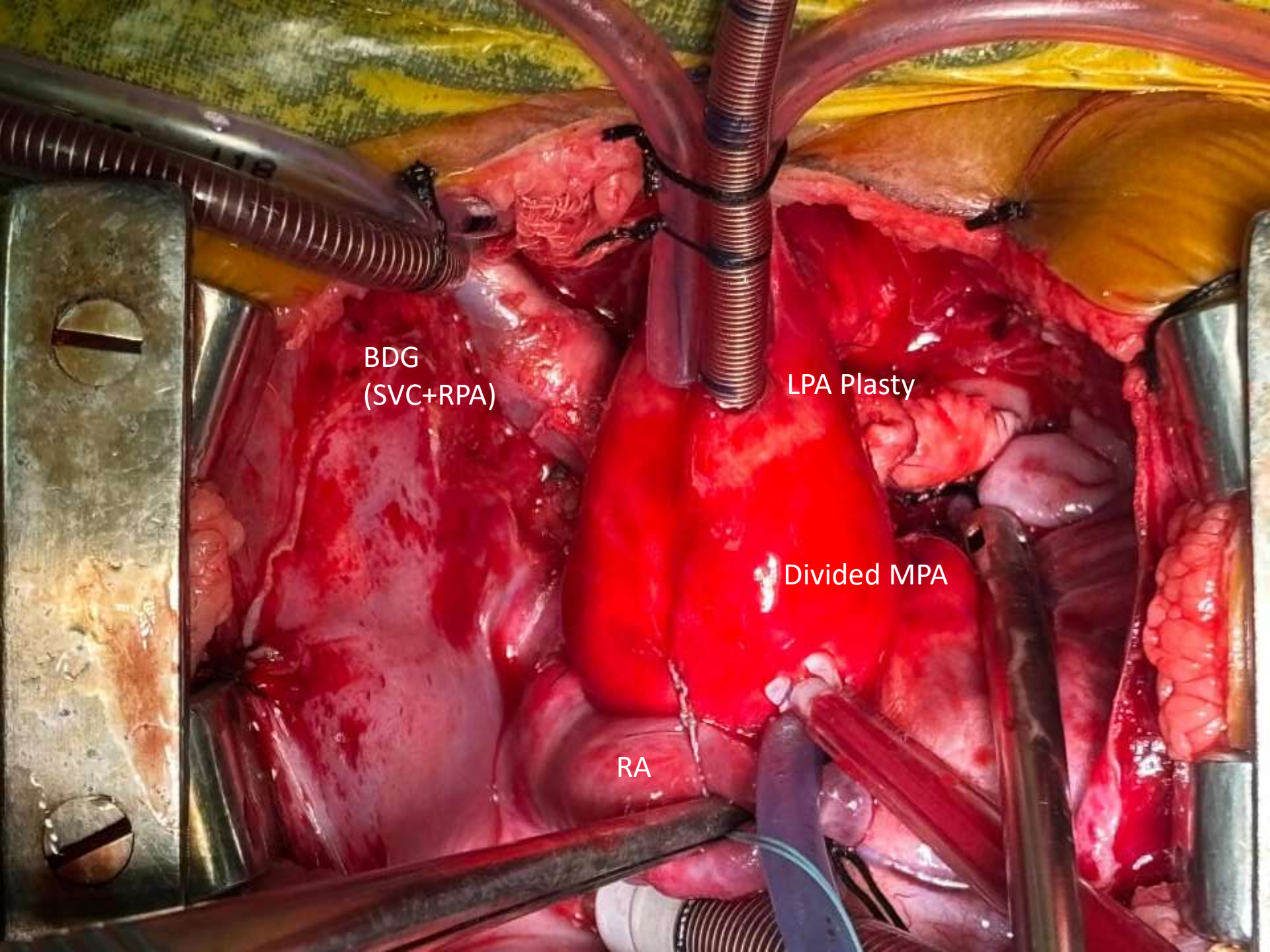


- Rent created in aortic arch wall was closed with bovine pericardium to avoid future constriction at the repair site.
- SVC disconnected from RA, RA end closed with prolene 6-0.
- SVC and RPA end-to-side anastomosis was done (BDG- connecting SVC to RPA).
- Stenotic segment of LPA enlarged with bovine pericardiam patch plasty.
- MPA was divided from PV annulus and was then closed.



- Patient rewarmed to 35^0 C and gradually weaned off from bypass.
- Total TCA time was 27 min.
- Sternotomy closed in layers and the child was shifted to recovery.
- Gradually inotropes were weaned off and the child was discharged home on postoperative day 9.

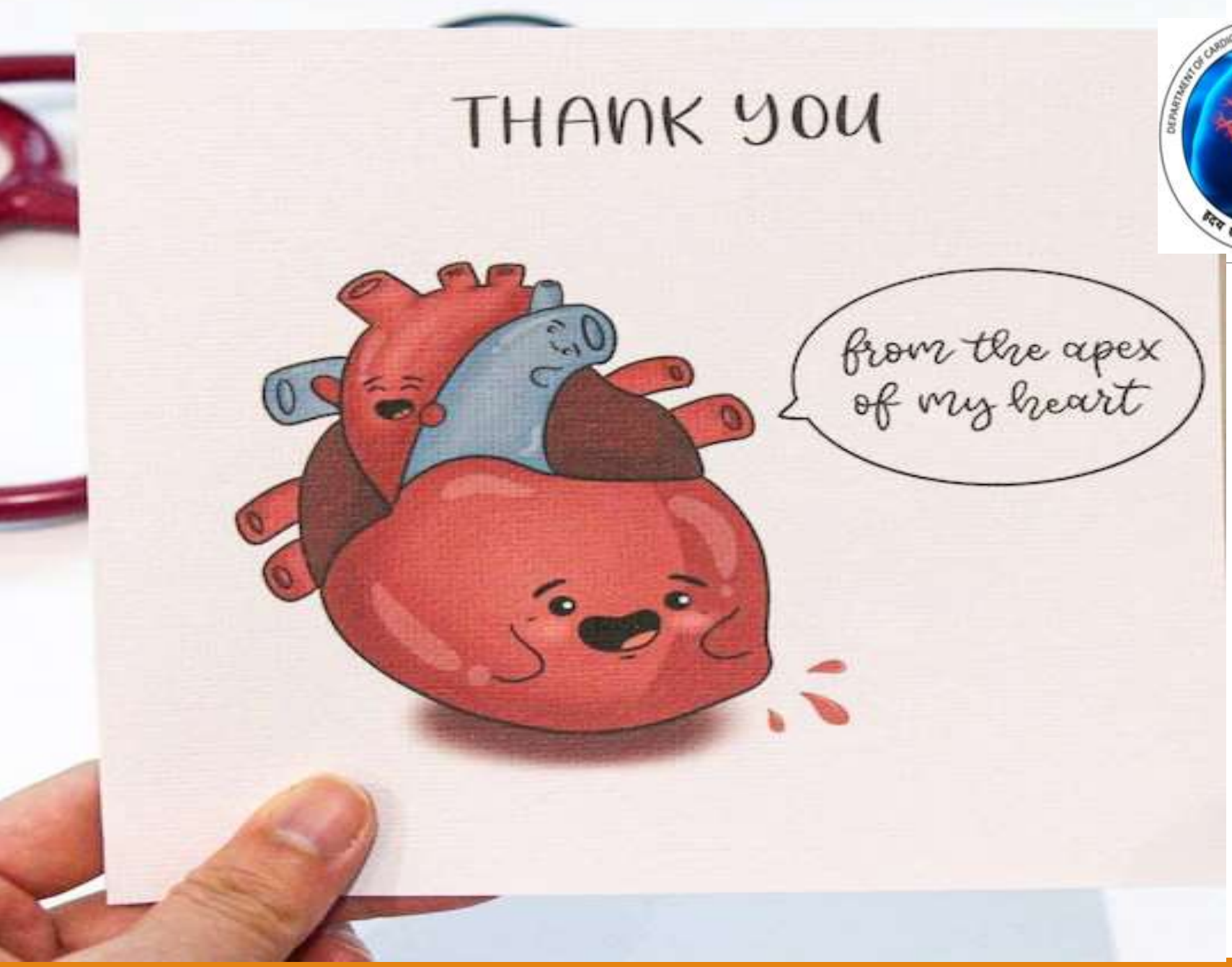



BDG
(SVC+RPA)
LPA Plasty
Divided MPA
RA

Discussion:

- Maintaining the patency of the patent ductus arteriosus (PDA) is essential for patients with duct-dependent cyanotic congenital heart diseases.
- Prostaglandin E1 infusion can keep the PDA patent for a few days.
- Blalock-Taussig shunt (BT shunt) is a surgical procedure creating artificial PDA for providing pulmonary blood flow until definitive surgery. However, it carries a higher risk if done in the neonatal period.
- Since the early 1990s, PDA stenting has been introduced as an alternative to Blalock-Taussig shunt.
- Advancements in coronary stent properties have made PDA stenting more popular.

- However, it has its own complications such as stent dislodgment, inadequate placement, and PDA perforation.
- Also it has introduced a new surgical subset of patients, who require additional PDA stent management during definitive surgeries.
- Typically, stents require crushing in instances of complications. However, in this exceptional case, we successfully managed the rare occurrence where the stent obstructed both the aorta and the LPA.
- Literature shows very few reported cases like this.


THANK YOU
from the apex of my heart