Role of Surgery in Ventricular Septal Defect with Pulmonary Hypertension

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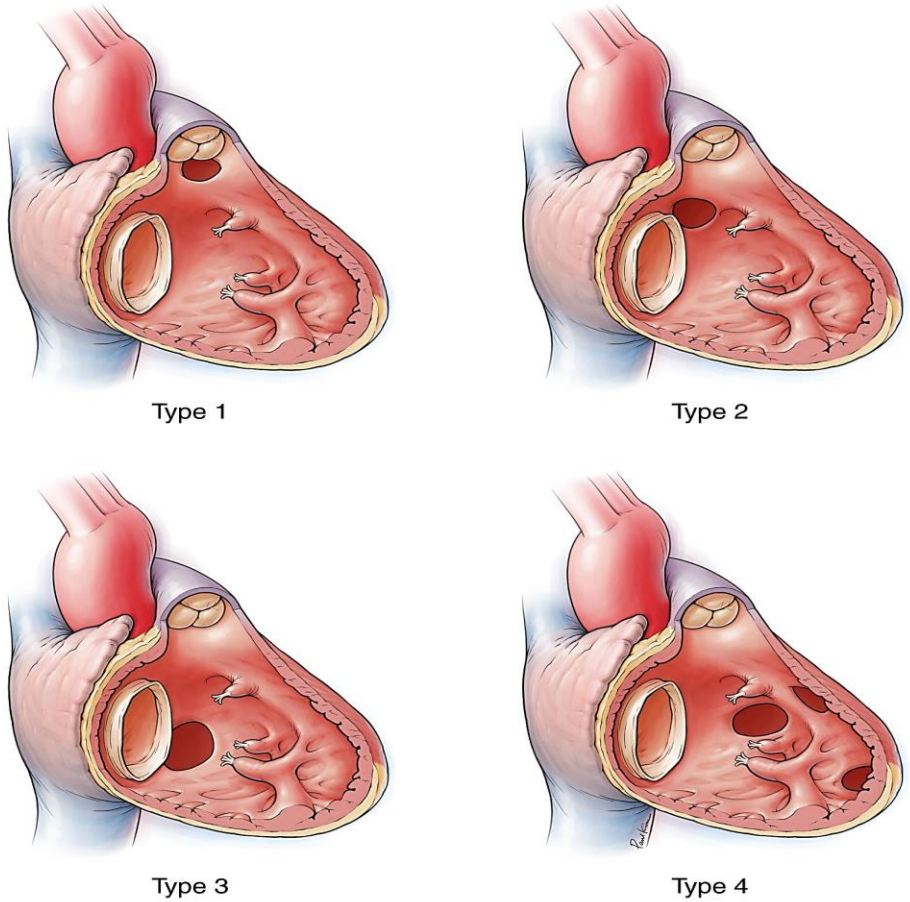
Introduction

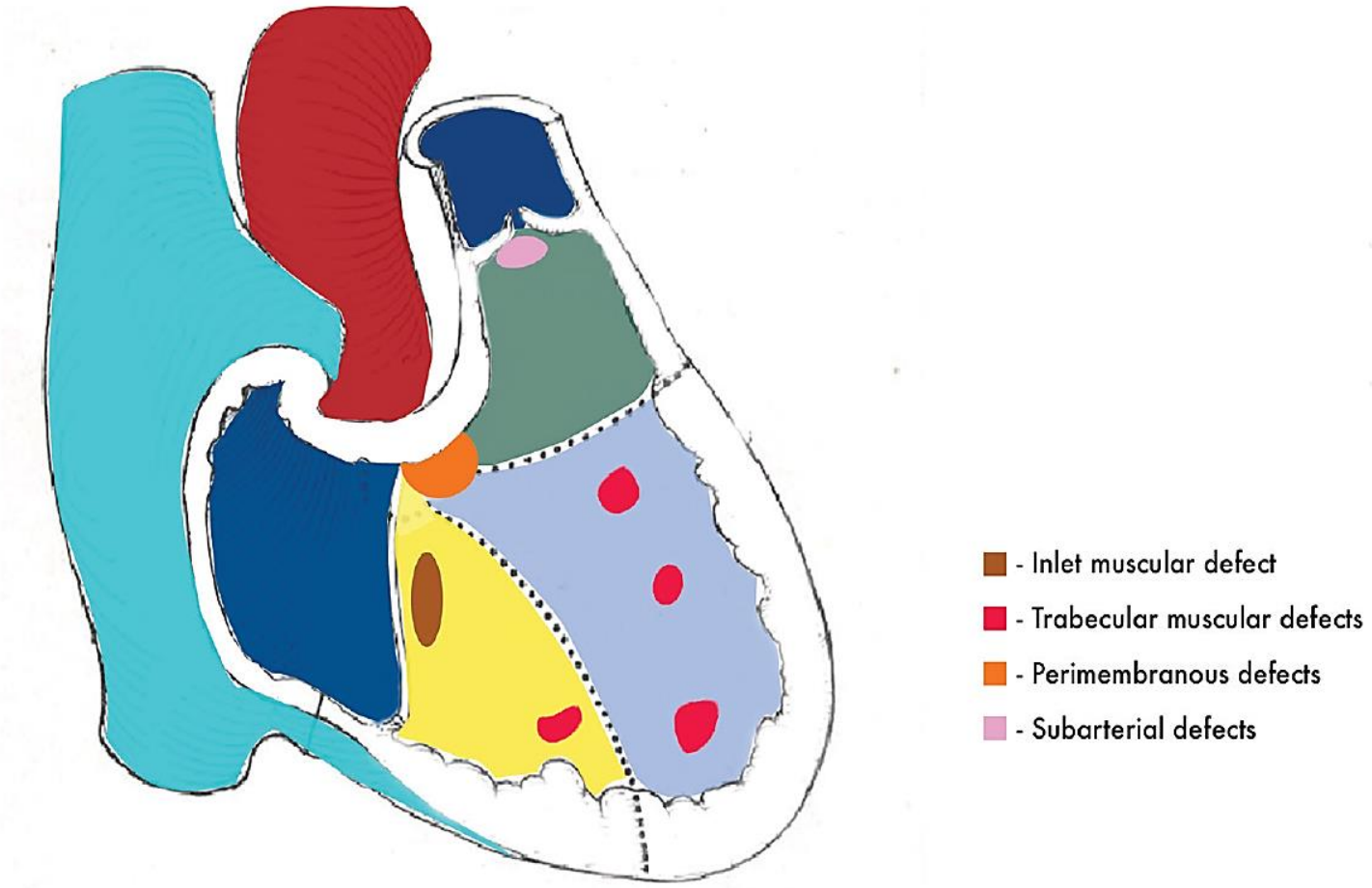
- On the spectrum of congenital heart diseases, Ventricular Septal Defect (VSD) is the most common congenital heart defect (CHD)
- VSD may occur as a primary anomaly, with or without additional major associated cardiac defects.
- It may also occur as a of a wide variety of intracardiac anomalies, including tetralogy of Fallot (TOF), complete single component atrioventricular (AV) canal defects, transposition of great arteries, and corrected transpositions.
- Isolated VSD occurs in approximately 2-6 of every 1000 live births and accounts for more than 20-25% of congenital heart diseases.

Types of VSD

- VSDs are commonly classified into small, moderate and large defects by comparing the defect size with aortic root.
- Small defects carry good prognosis with high chances of spontaneous closure, whereas most of moderate and almost all of large VSDs need to be closed.
- Large untreated VSDs are complicated by congestive cardiac failure, severe pulmonary hypertension, recurrent pneumonia, failing to thrive, infective endocarditis, aortic valve prolapses and aortic regurgitation. But in infants, they are presented with respiratory symptoms and poor growth
- Severe pulmonary hypertension was reported in 22.4% of VSD and it is mainly seen on a large VSD.

VSD Nomenclature and Classification of The Society of Thoracic Surgeons Congenital Heart Surgery Database





- Gold standard treatment of moderate and large defect is surgical patch closure with large success rate and low complications.
- Surgical closure of VSD is one of the most common open-heart procedure performed in paediatric cardiac surgery.

- Among congenital cardiac defects, after bicuspid valve, VSD are the most commonly encountered.
- Most of the moderate and almost all large VSD needs to be closed.
- Perimembranous VSD are the most common type of VSD.

Guideline for VSD

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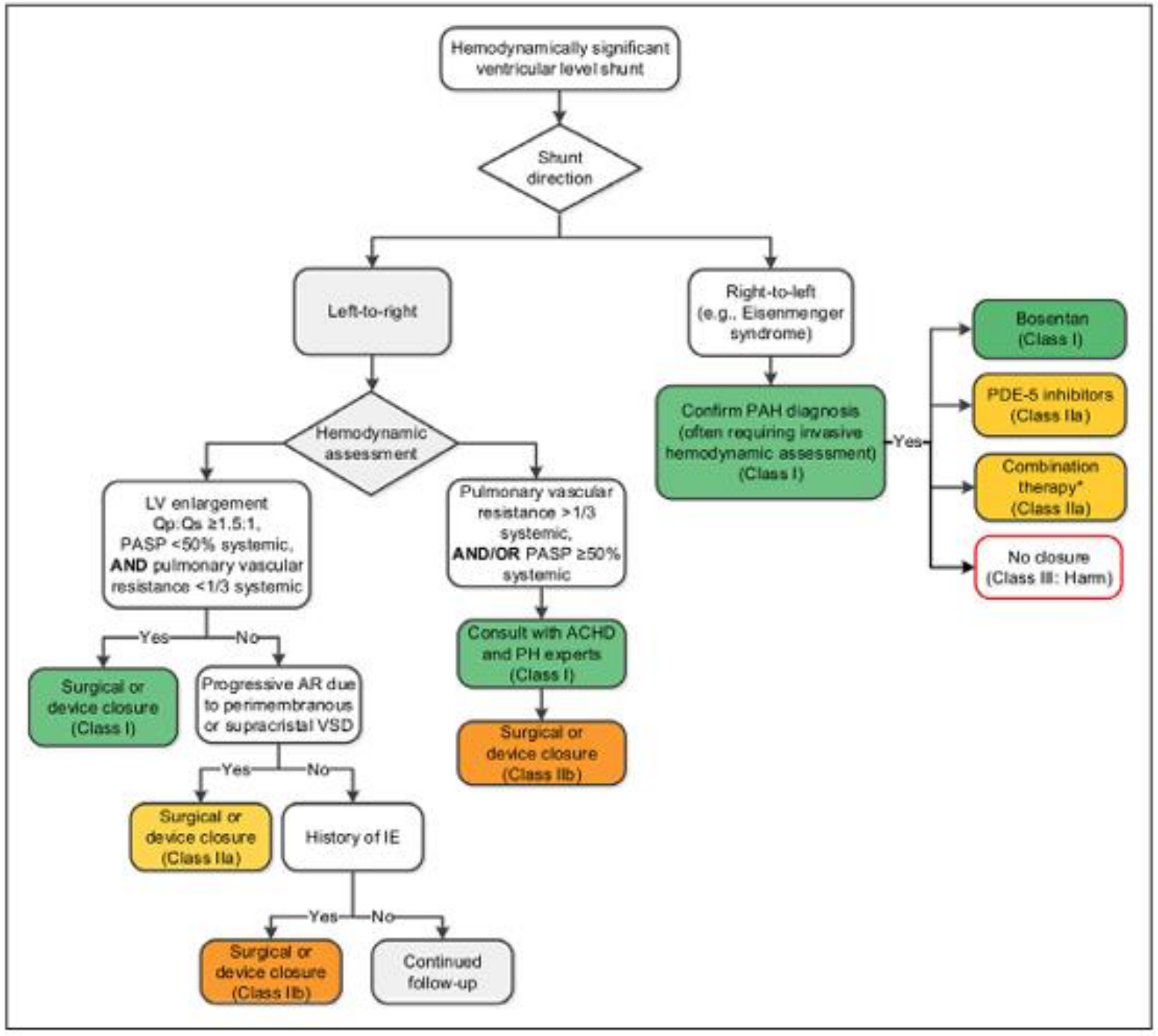
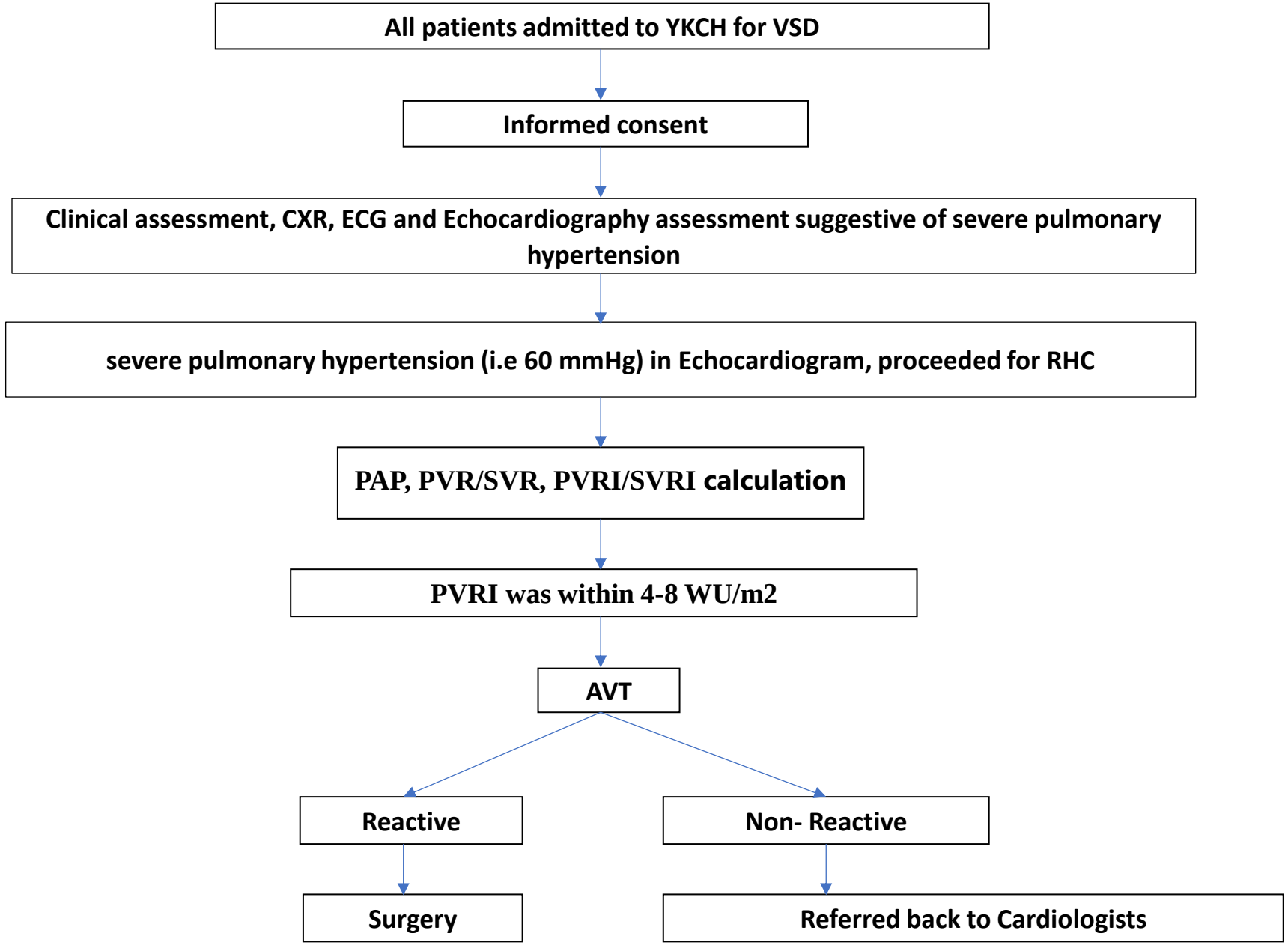
- Perimembranous VSD are the most common type of VSD.

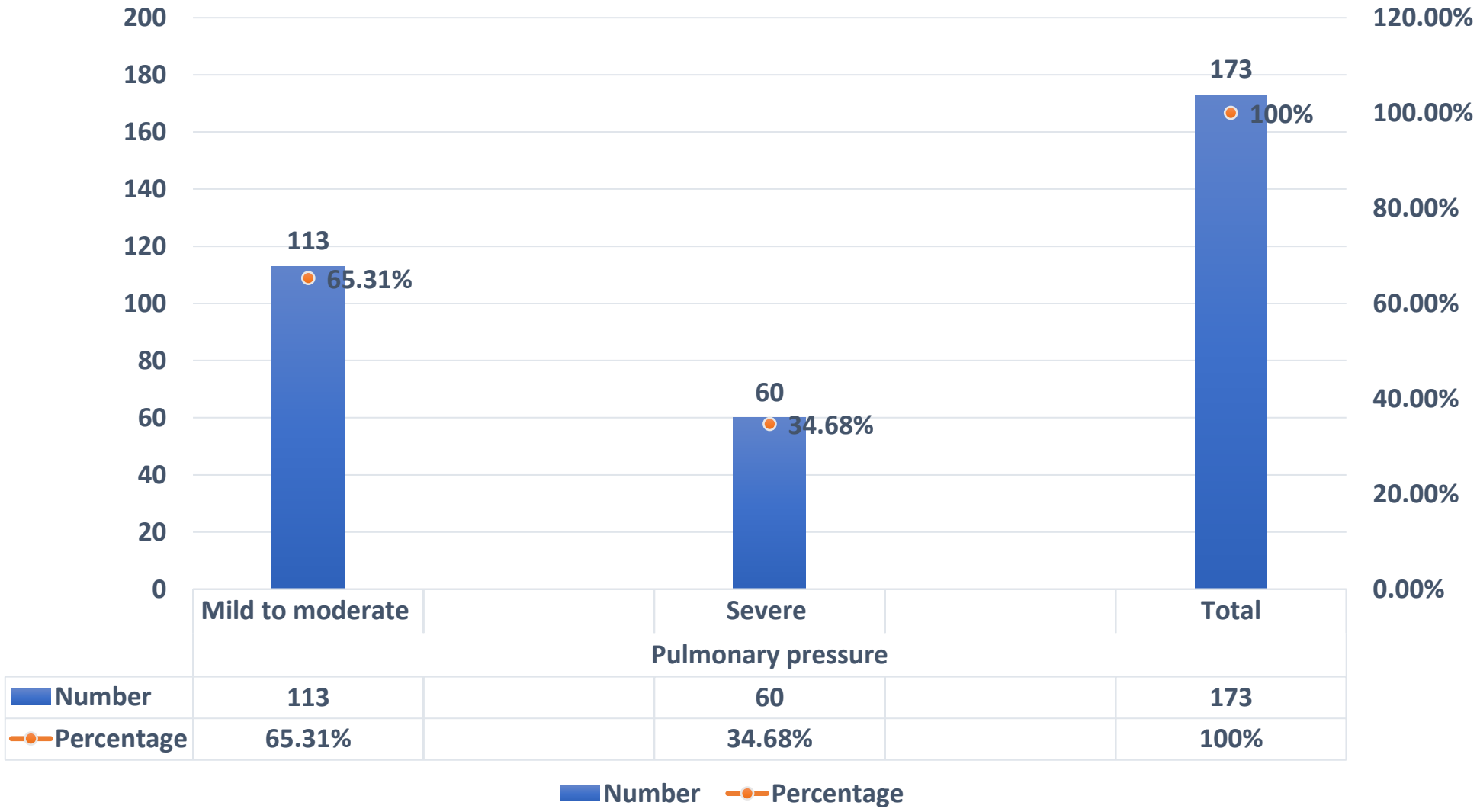


- In Myanmar, the incidence is in line with global estimates accounting for 20-30% of all congenital heart diseases.
- In Myanmar, since many patients come with late presentation, surgical management of VSD with pulmonary hypertension is challenging.
- Most VSD patients arrive at health centers lately with varying degree of PAH. Total 329 VSD had been operated at Yankin Children hospital within 3 years contributing 35.8% of all open heart operations in children (congenital heart disease patients).
- According to the data from 2016, among 173 operated VSD patients, 147 patients(85%) were more than 2 years of age associated with PAH.

Methodology

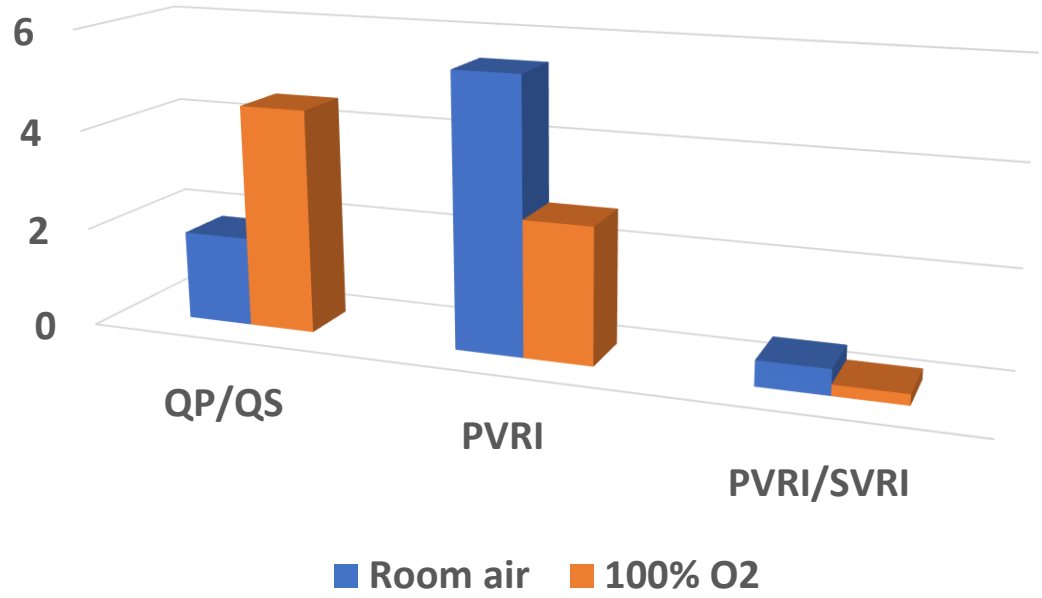


Pre operative echocardiogram



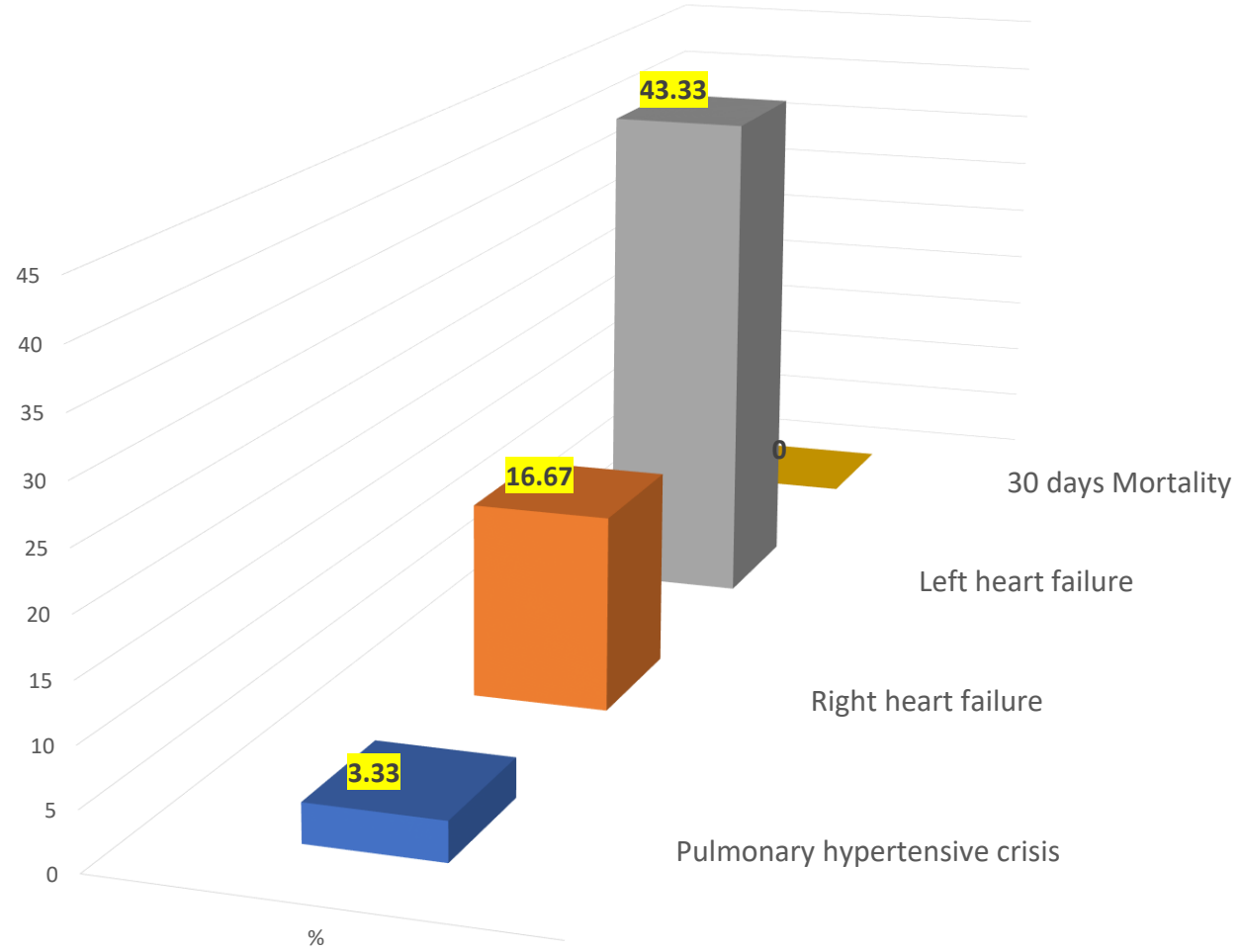
Right heart catheterization

Haemodynamics	Room air	100% O2	Mean difference	`Pair test
QP/QS	1.8	4.5	2.77	t = 7.707
PVRI	5.49	2.73	2.76	t = 13.24
PVRI/SVRI	0.51	0.219	0.3	t = 13.89



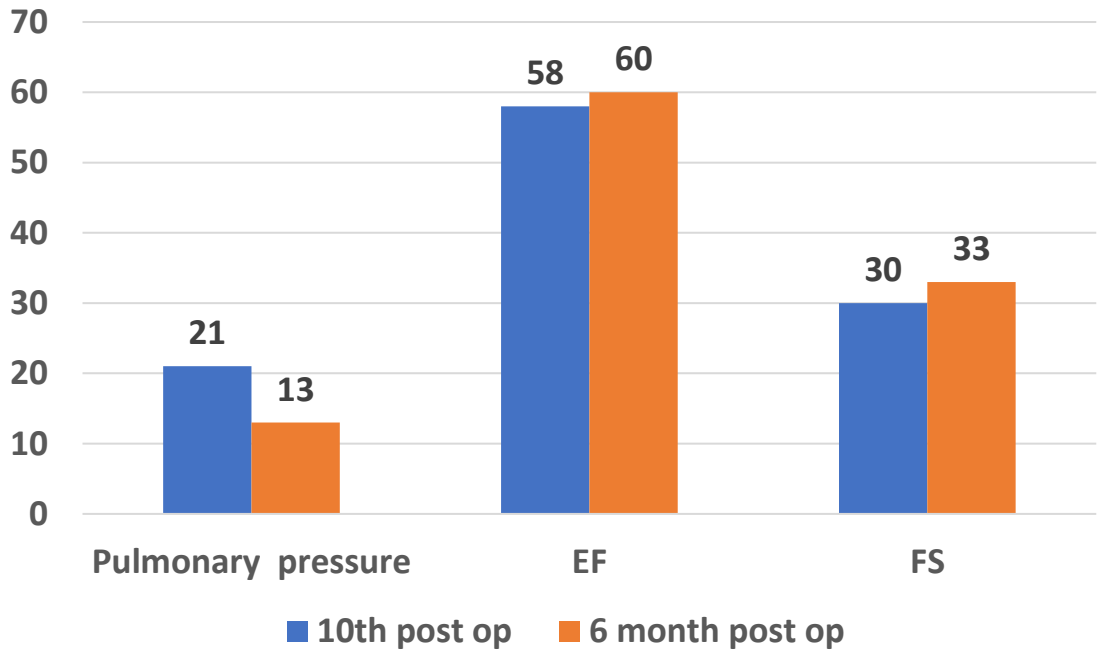
- All patients admitted to YKCH for VSD were assessed thoroughly including CXR, Echocardiogram.
- If Echocardiogram revealed severe pulmonary hypertension (i.e 60 mmHg), the patients were proceeded for RHC.
- PAP, PVR/SVR, PVRI/SVRI were calculated.
- When PVRI was within 4-8 WU/m2, Vasoactive reactivity test (AVT) was continued.
- After AVT showed reactivity, the patients underwent surgery. If not, the patients were referred back to cardiologists.

Post operative complications



Comparison of Cardiac Status between preoperative and postoperative periods

Variables	10th post op	6 month post op	P value
Pulmonary pressure	21	13	$p < 0.05$
EF	58	60	$p > 0.05$
FS	30	33	$p < 0.05$



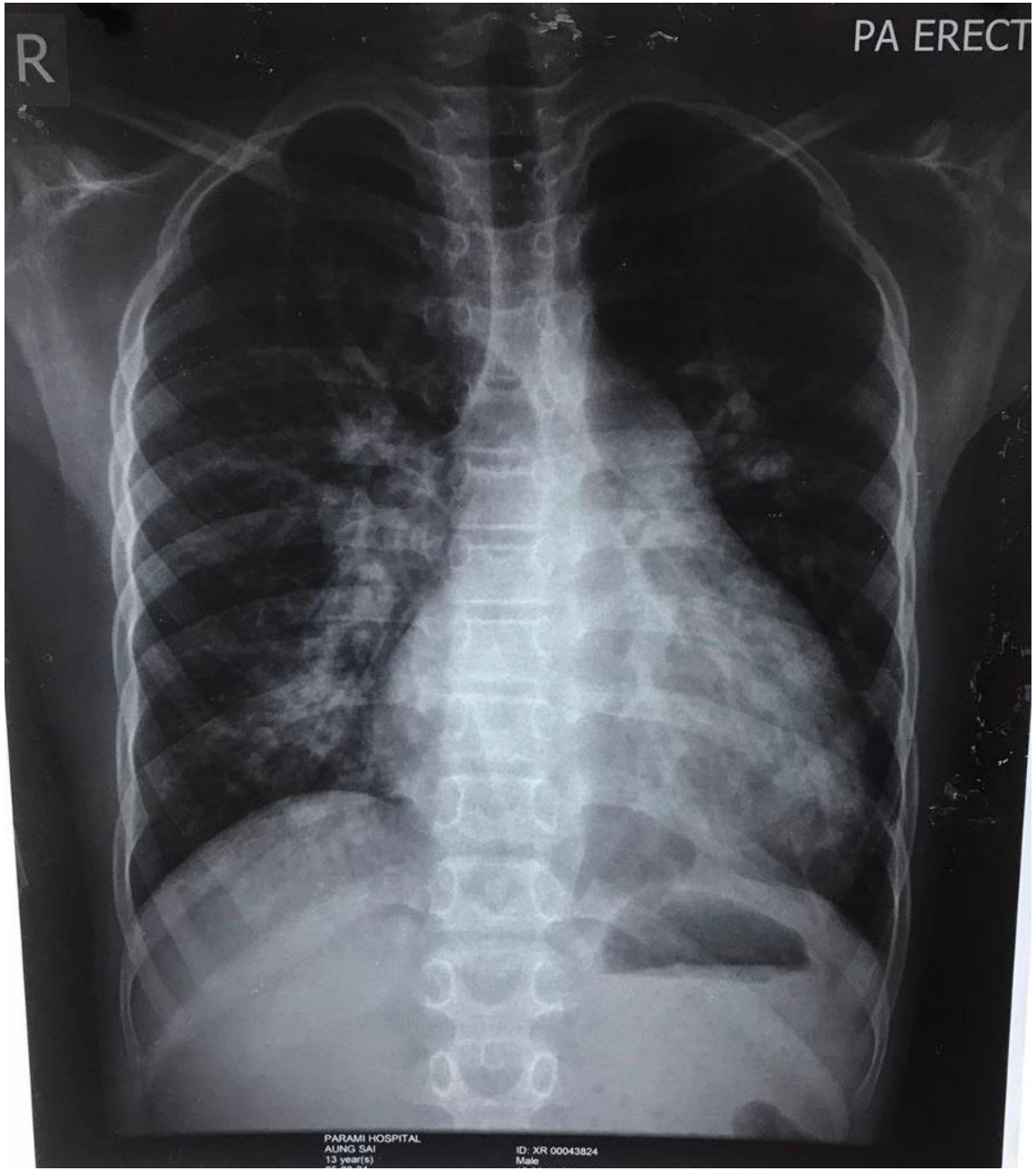
Very huge VSD

- 13 yr old boy with known case of Congenital heart disease 8 yrs ago
- Failed to take medical care due to financial/family problems
- Dyspnoea off and on in his childhood and more severe during the last 2 months with palpitation +, no other symptoms
- Failure to thrive for his own age
- Consulted and hospitalized at Taunggyi hospital and he was referred to YGH for further treatment.
- Immunization history said to be completed.

On exam

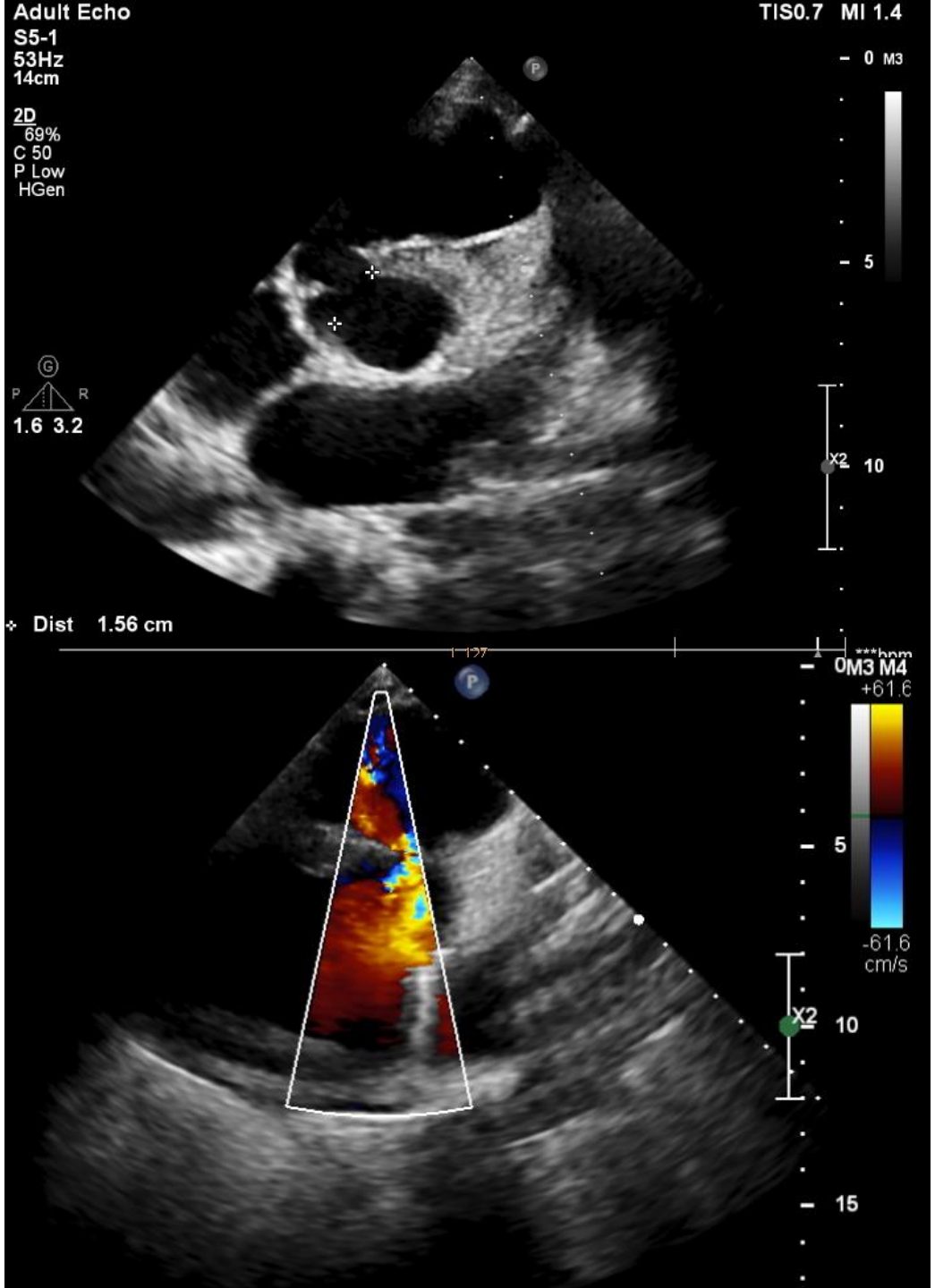
- GC fair
- T- Normal, Anaemia -, Jaundice –
- BP – 100/60 mmHg
- HR – 98/min
- Ht – holosystolic murmur, G VI with thrills, heaving apex beat
- Lungs – VBS +

CXR (PA)


R
PA ERECT
PARAMI HOSPITAL
AUNG SAI
13 year(s)
ID: XR 00043824
Male

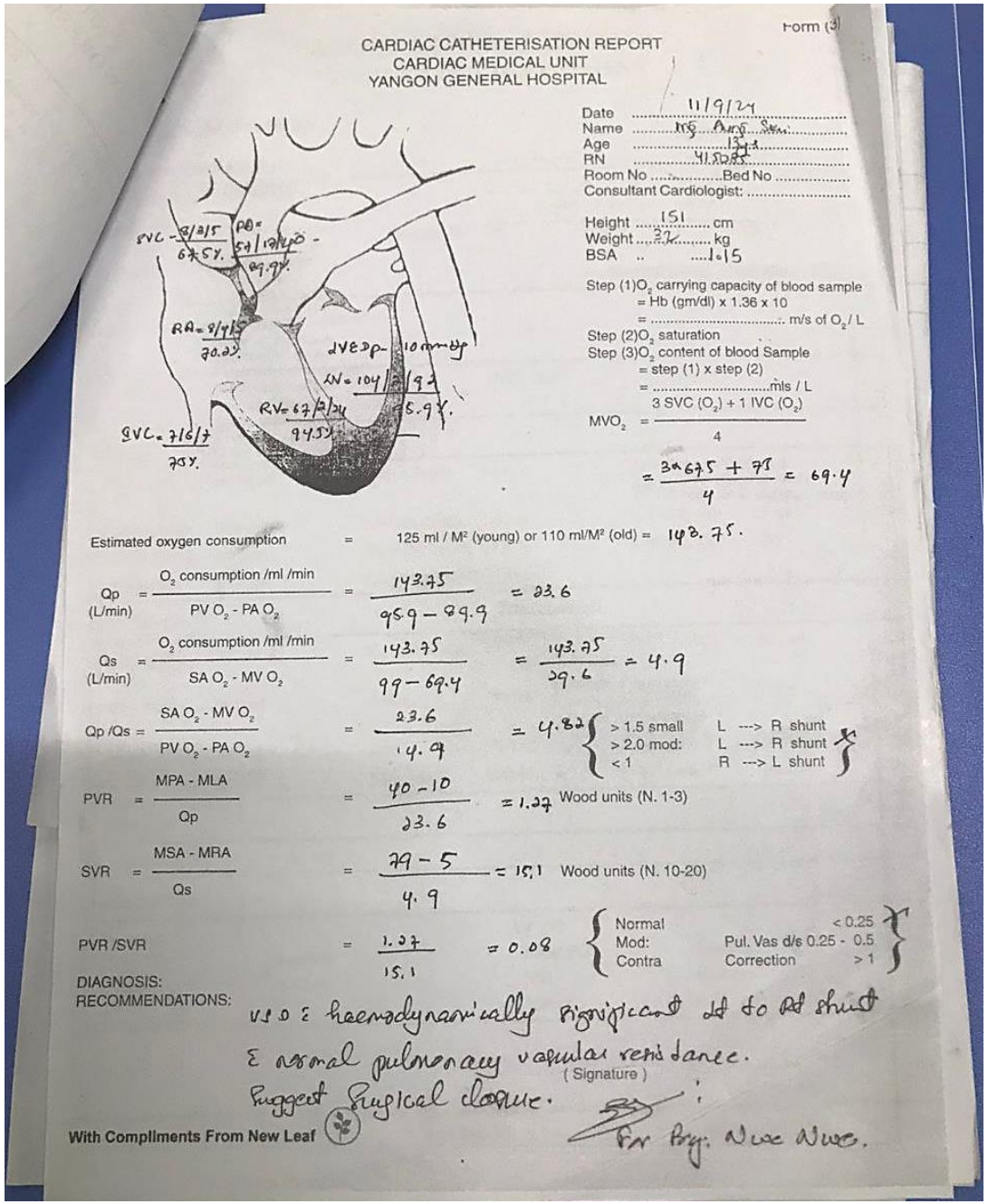
Echocardiogram

- Large perimembranous, subaortic and muscular VSD



RHC

Haemodynamics	
QP/QS	4.82
PVRI	1.27
PVRI/SVRI	0.08



Form (3)

CARDIAC CATHETERISATION REPORT
CARDIAC MEDICAL UNIT
YANGON GENERAL HOSPITAL

Date 11/9/24
Name M/S Aung Sw...
Age 13 y.
RN 41...
Room No ... Bed No ...
Consultant Cardiologist: ...

Height 151 cm
Weight 37 kg
BSA .. 1.15

Step (1) O_2 carrying capacity of blood sample
= Hb (gm/dl) x 1.36 x 10
= ..... m/s of O_2 / L
Step (2) O_2 saturation
Step (3) O_2 content of blood Sample
= step (1) x step (2)
= ..... mls / L

$$MVO_2 = \frac{3 \text{ SVC } (O_2) + 1 \text{ IVC } (O_2)}{4} = \frac{3 \times 67.5 + 75}{4} = 69.4$$

Estimated oxygen consumption = 125 ml / M² (young) or 110 ml/M² (old) = 143.75.

$$Qp\ (L/min) = \frac{O_2 \text{ consumption /ml /min}}{PV\ O_2 - PA\ O_2} = \frac{143.75}{95.9 - 89.9} = 23.6$$

$$Qs\ (L/min) = \frac{O_2 \text{ consumption /ml /min}}{SA\ O_2 - MV\ O_2} = \frac{143.75}{99 - 69.4} = \frac{143.75}{29.6} = 4.9$$

$$Qp/Qs = \frac{SA\ O_2 - MV\ O_2}{PV\ O_2 - PA\ O_2} = \frac{23.6}{14.9} = 4.82$$

> 1.5 small L ---> R shunt
> 2.0 mod: L ---> R shunt
< 1 R ---> L shunt

$$PVR = \frac{MPA - MLA}{Qp} = \frac{40 - 10}{23.6} = 1.27 \text{ Wood units (N. 1-3)}$$

$$SVR = \frac{MSA - MRA}{Qs} = \frac{79 - 5}{4.9} = 15.1 \text{ Wood units (N. 10-20)}$$

$$PVR/SVR = \frac{1.27}{15.1} = 0.08$$

Normal < 0.25
Mod: Pul. Vas d/s 0.25 - 0.5
Contra Correction > 1

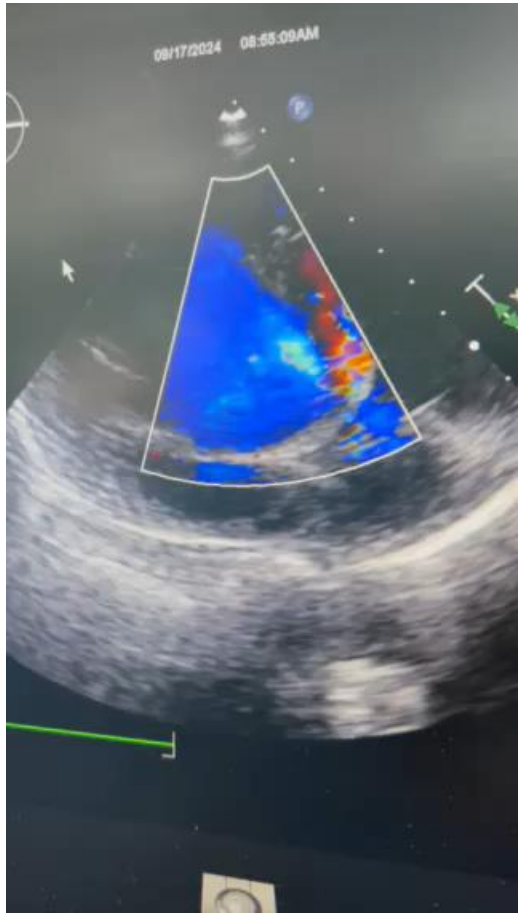
DIAGNOSIS:
RECOMMENDATIONS: VSD ε haemodynamically significant Lt to Rt shunt ε normal pulmonary vascular resistance. Suggest surgical closure.

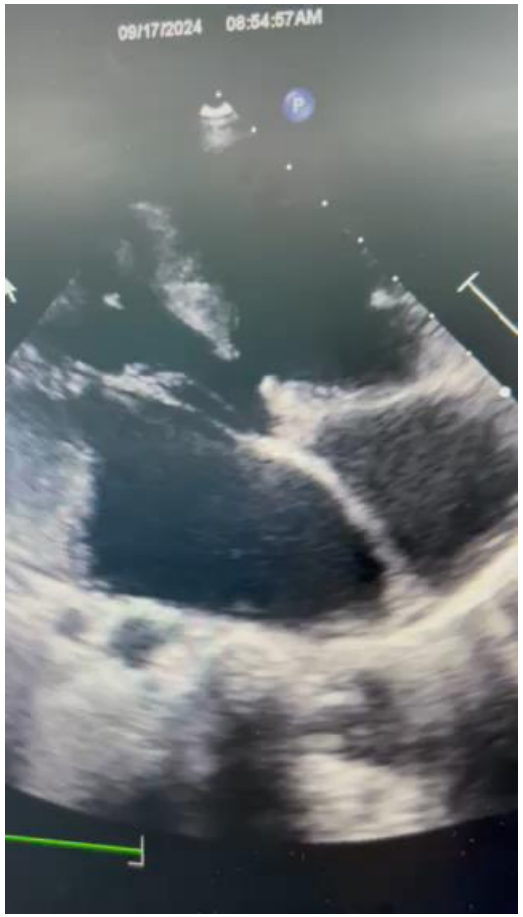
(Signature)

Dr Thy. Nwe Nwe.

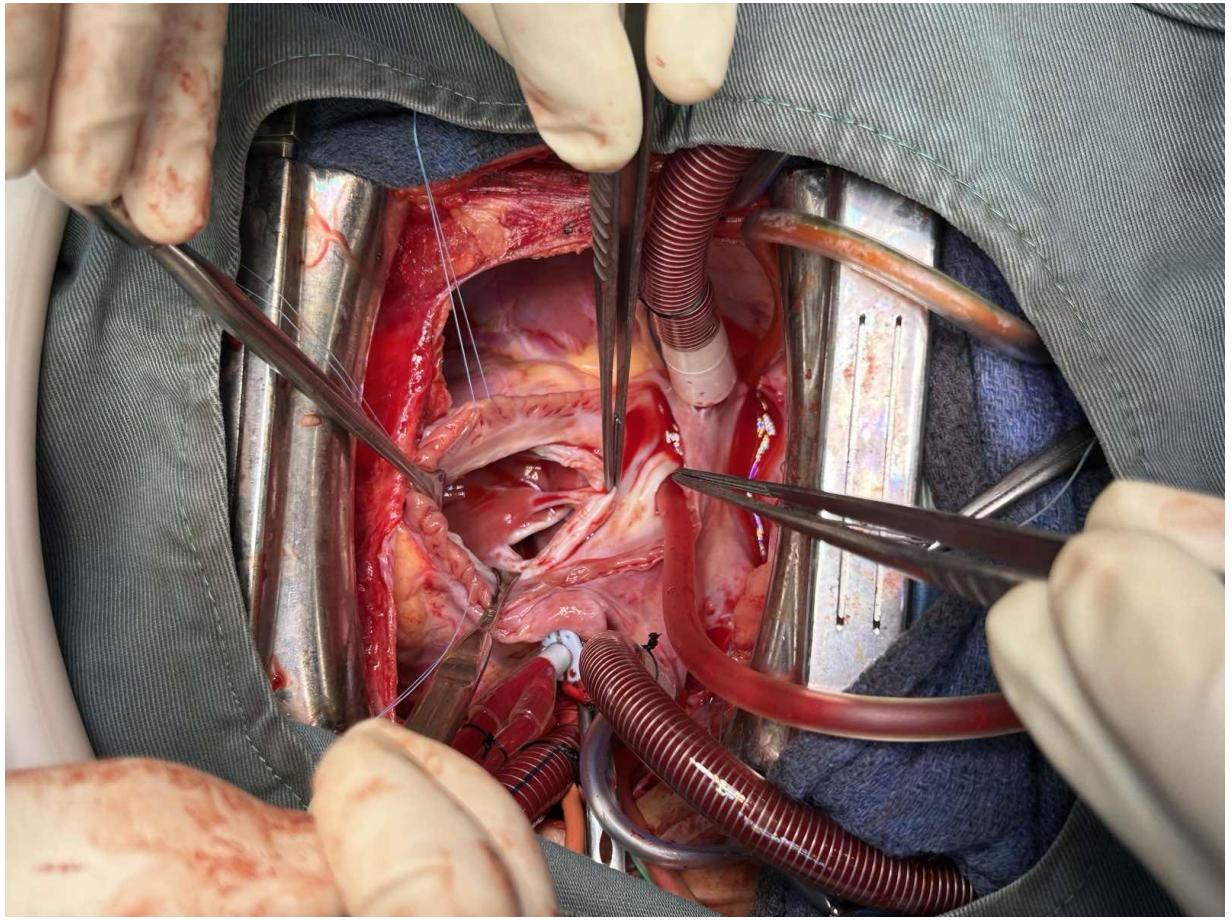
With Compliments From New Leaf

Intra operative TEE





Operative Finding



Post operation was uneventful.

Take home message

- Decision for operability of VSD with Severe PHT needs Multi-Disciplinary Team approach.
- Needs complete picture of clinical findings and all aspects of non-invasive evaluation and RHC (with AVT).
- Systematic approach to peri-operative management (eg: induction CPB, weaning CBP) are important.
- Anticipation of the problems, monitoring and timely intervention to prevent PH crisis are crucial to get the good outcome.
- Because of our heart team devoted to patient's care, good results were succeeded.
- Behind every good outcome we have done ,lies a vast expertise, deep knowledge and heavy responsibility.
- We all endure the physical strain – persistent back, shoulder, and elbow pain- from caring patient after patient, sometimes under pressure with very limited resources.

Thank You