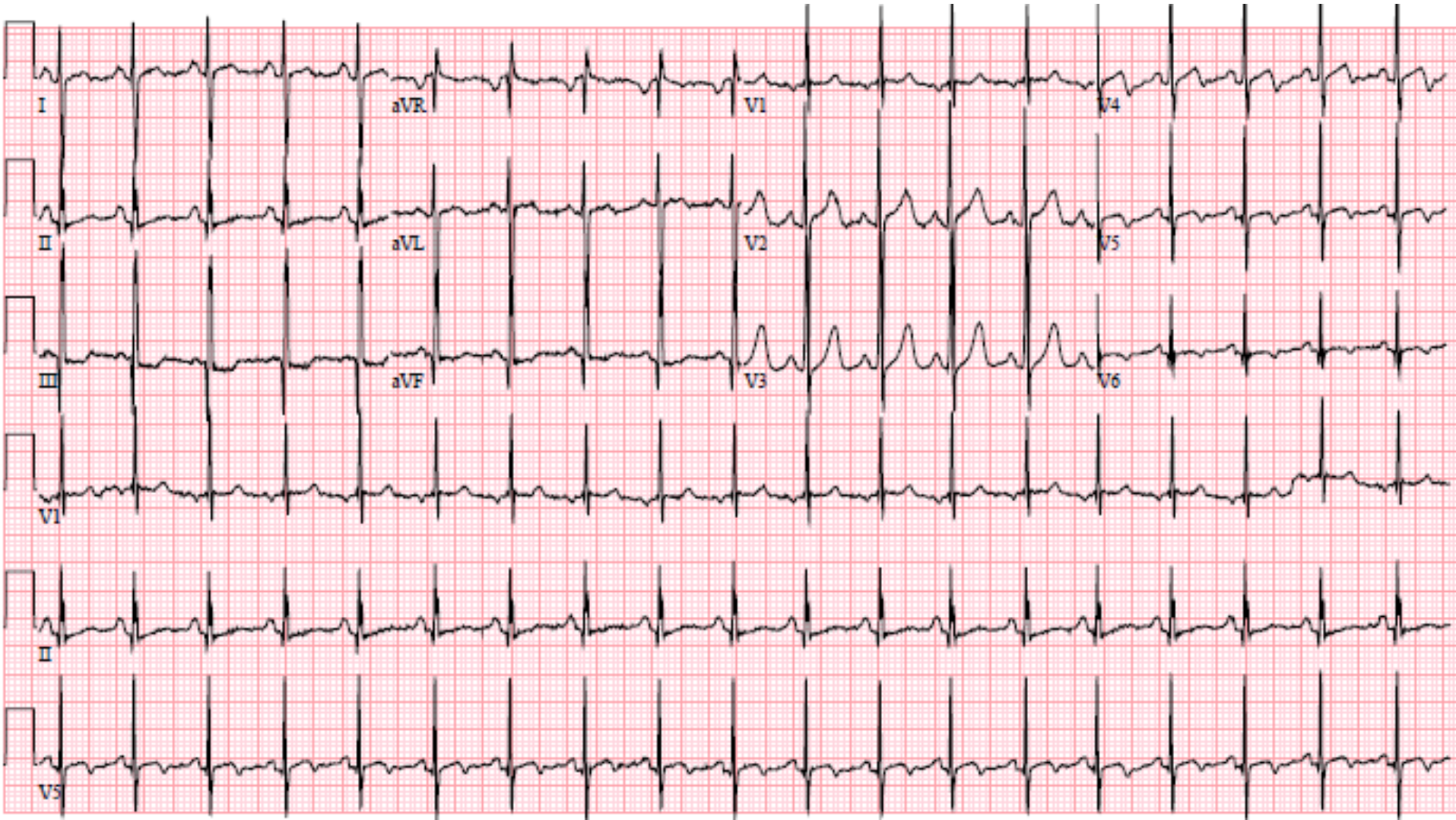
A 6 month old comes into your peds clinic for routine 6-month well-child check. She appears well with normal HR, RR, and BP. She is growing well and meeting all developmental milestones. You hear a heart murmur on physical exam, and note this has been appreciated on previous exams. You get an ECG to reassure yourself, seen below. You recheck her vital signs and notice her O2 sat is 92-94%.

1) There are at least 4 abnormalities on this ECG. Name at least 2 of them (1 point; 2 points if you get all 4 abnormalities)

2) Given the constellation of abnormalities and the quality of the murmur, you hypothesize that this child likely has a cardiac malformation with some sort of left-to-right shunt. What in the history is inconsistent with this? (2 points)



1) There are at least 5 abnormalities on this ECG. Name at least 2 of them (1 point; 2 points if you get all 5 abnormalities)

i) Right axis deviation. QRS is more downward than upright in lead I, indicating net ventricular forces are toward patient's right.

Ii) Upright T waves in lead V1. In a child <10years old, this is suggestive of RVH.

iii) Inverted/biphasic T waves in leads V5 and V6. T waves should ALWAYS be upright in the lateral precordial leads, except in the first 72 hours of life when the T waves often take on a bizzare configuration. This finding is consistent with myocardial/pericardial disease and/or left ventricular strain.

iv) Borderline right atrial enlargement. Those P waves in lead II are nearly 3 little boxes (3mm) tall, suggestive of right atrial enlargement.

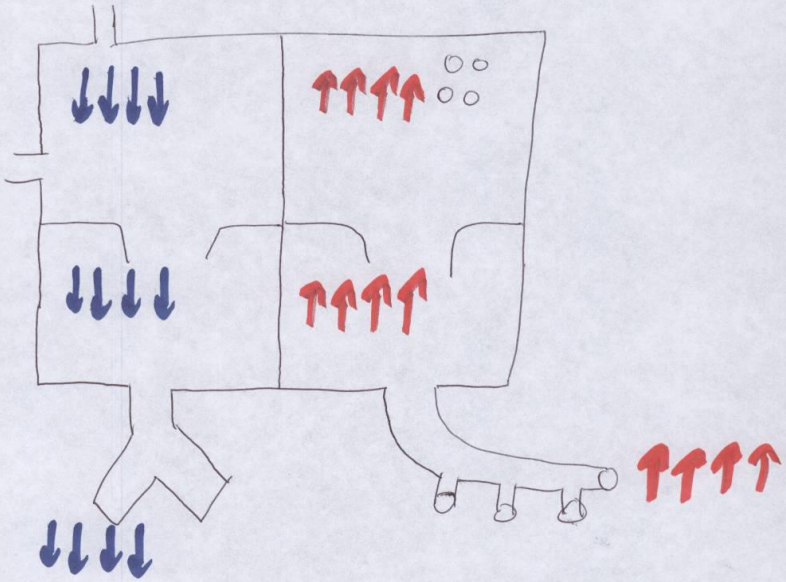
v) Are those deep Q waves in lead III? If so, they are suggestive of LVH. Q waves ≥5mm deep in the inferior leads or lateral precordial leads are suggestive of LVH.

2) Given the constellation of abnormalities and the quality of the murmur, you hypothesize that this child has a cardiac malformation with some sort of left-to-right shunt. What in the history is inconsistent with this? (2 points)

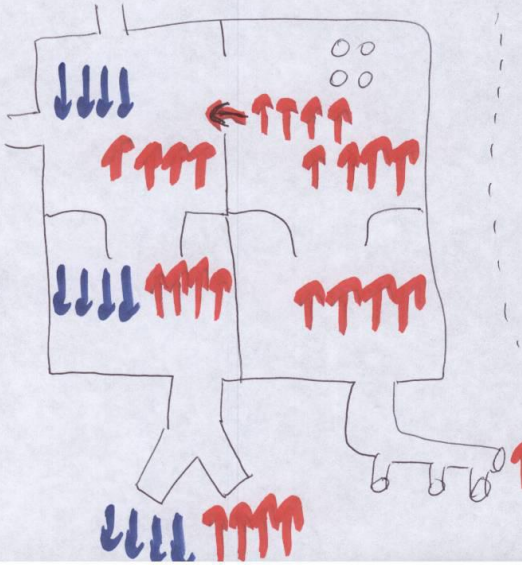
Having a low O2 sat is very unusual for a pure left-to-right shunting lesion (e.g. ASD, VSD, PDA). Pure left-to-right shunts create pulmonary overcirculation (too much blood going to lungs), but should not create hypoxemia unless there is so much pulmonary overcirculation as to cause florid pulmonary edema. The child's normal vital signs otherwise and the fact she's growing and developing well make florid pulmonary overcirculation very unlikely. Hypoxemia with a murmur and very abnormal ECG strongly suggest either a right-to-left shunt (e.g. Tetralogy of Fallot) or some sort of "mixing" lesion where blue and red blood mix, then go out to both circulations (e.g. tricuspid atresia, hypoplastic left heart, total anomalous pulmonary venous return). See diagram on final slide.

This patient actually had total anomalous pulmonary venous return (TAPVR).

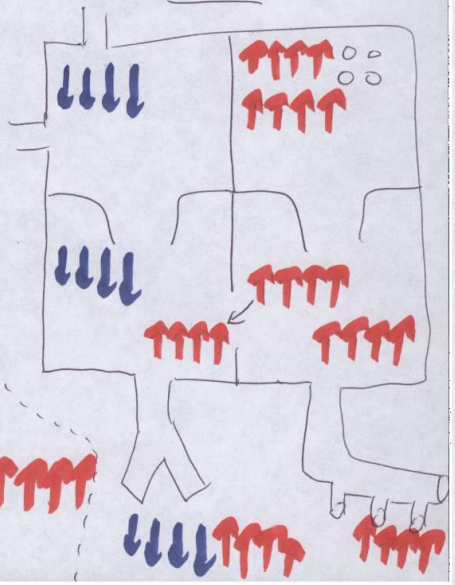
Normal



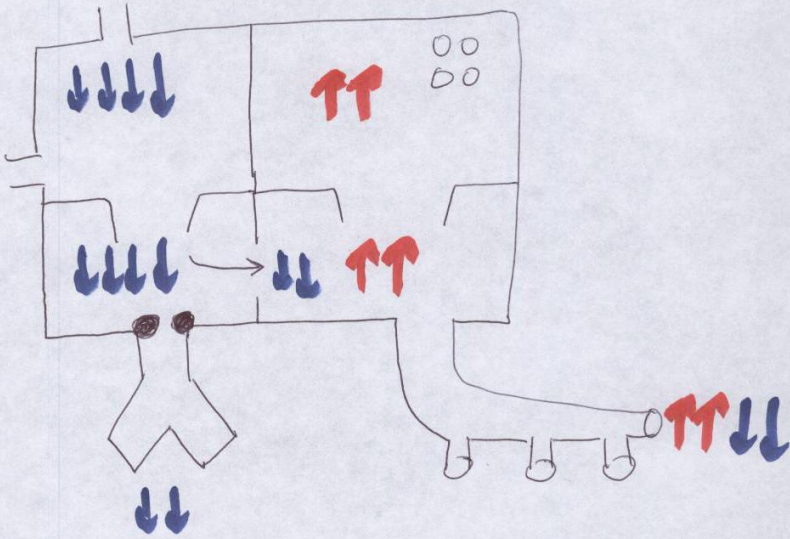
ASD



VSD



Right-to-left shunt: ToF



Mixing lesion: TAPVR