

CASE SKELETON;**Tetralogy for urgent non cardiac surgery PBLD:****TEACHING OBJECTIVES:**

To understand the principles of preparation of the pediatric cardiac patient for non cardiac surgery in the urgent setting.

To explain the principles of management of the stabilized and non stabilized cardiac patient in the emergency setting.

To review management of cyanotic spells in the infant with unrepaired tetralogy

SCENARIO:

A two month old 4.5 Kg male infant born at term with tetralogy of fallot followed by cardiology, stabilized on beta blocker therapy (propranolol 4mg TDS); no previous anesthetics, presented with vomiting and moderate lethargy for surgical repair of a strangulated umbilical hernia. SO₂ % previously 88% now 85% on room air.

Describe your assessment and preparation of this child for surgery

The surgeon states operation is required within one to two hours

Hx;**Exam;****Ix;** Cardiology consult? EKG? Re-Echo?

Preparation;

O2

I/V Fluids; how much?

Meds; which drugs would you prepare and what doses would you be prepared to administer?

What are the benefits and disadvantages of Esmolol over propranolol I/V?

Stage 1

Prior to induction;

HR 162; BP 55/26; RR 57; SO2 85% Temp 37.4 C

How would you induce this infant?

Etomidate?

Ketamine?

Propofol +/- phenylephrine?

Would anyone consider a regional anesthetic?

Following induction;

HR 155; BP 52/21; SO2 88%

Following intubation the baby desaturates to 72%.

How would you respond?

What is the differential diagnosis?

How does the end tidal CO2 waveform behave during this event?

Stage 2

After your maneuvers the SO₂ rises to 95%

Surgery is commenced

HR 176 BP 51/21 SO₂ 95%

An N/G is passed (one in situ removed for intubation) and a large volume of fluid is suctioned from the stomach.

Ten minutes later The SO₂ decreases to 68 %.

HR 184 BP 44/19 SO₂ 68 %

How do you manage this?

After this response;

HR 142 BP 63/27 SO₂ 94 %

Stage 3

The surgery is completed, you extubate the infant and take the child to recovery. Hand over and all is well. Five minutes later there is an overhead code page to recovery.

You arrive in recovery and see your infant is limp with a dark purple color and the recovery nurse is attempting mask ventilation. The HR is 60 and SO₂ and BP are unrecordable.

How do you respond?

Case Discussion;

SCENARIO:

A two month old 4.5 Kg male infant born at term with tetralogy of fallot followed by cardiology, stabilized on beta blocker therapy (propranolol 4mg TDS); no previous anesthetics, presented with vomiting and moderate lethargy for surgical repair of a strangulated umbilical hernia. SO₂ % previously 88% now 85% on room air.

Describe your assessment and preparation of this child for surgery

The surgeon states operation is required within one to two hours

Hx; Occurrence/frequency of spells. Fever, lung function, vomiting, Frequency of wet diapers, Medication dosage.

Exam; Vital signs, severity of cyanosis, systolic murmur/thrills, respiratory exam

Ix; EKG; Echo; Cardiology consult
Electrolytes, BSL, CBC (polycythemia X 2), (ABG?)

Preparation;

O₂

I/V Fluids 10-20ml/kg

Meds; which drugs would you prepare and what doses would you be prepared to administer?

Replace oral beta blocker with I/V propranolol because of vomiting. In consult with cardiology; 0.01mg/Kg starting dose. Can increase to 0.1 mg/Kg.

Alternatively Esmolol; 0.05mg/Kg loading dose over 3 minutes then infusion at 100-200 mcg/Kg/min. (1/2 life is 9 mins).

What are the benefits and disadvantages of Esmolol over propranolol I/V?

Stage 1

Before induction

Vital signs; HR 162; BP 55/26; RR 57; SO2 85% Temp 37.4 C

How would you induce this infant?

Following induction

HR 155; BP 52/21; SO2 88%

Following intubation the baby desaturates to 72 %.

How would you respond?

100% O2

Hand ventilate high frequency gentle but adequate TV breaths

Look and listen bilaterally

In response, SO2 drops to 65% then increases to 95%. (Initially the SO2 will decrease before increasing due to the increasing pulmonary bed compression).

What is the differential diagnosis?

Issue that atelectasis involves a right to left shunt and additionally a tet baby has an intrinsic right to left shunt due to pulmonary outflow track obstruction.

How does the end tidal CO2 waveform behave during this event?

Diagram of end tidal-arterial CO₂ differences in patients with right to left shunting:

Stage 2

After your maneuvers the SO₂ rises to 95%

Surgery is commenced

HR 176 BP 51/21 SO₂ 95%

An N/G is passed (one in situ removed for intubation) and a large volume of fluid is suctioned from the stomach.

Ten minutes later The SO₂ decreases to 68 %.

HR 184 BP 44/19 SO₂ 68%

How do you manage this?

As above for stage 1; does not improve
Volume How much? (Wasn't enough given earlier)?
Beta Blocker. Which one? Dose?
Phenylephrine Dose?

In response;

HR 142 BP 63/27 SO₂ 94%

Stage 3

The surgery is completed, you extubate the infant and take the child to recovery. Hand over and all is well. Five minutes later there is an overhead code page to recovery.

You arrive in recovery and see your infant is limp with a dark purple color and the recovery nurse is attempting mask ventilation.

HR 60; SO₂ and BP are unrecordable

How do you respond?

Treatment of hyper cyanotic spell;

Principles;

Avoid decreasing SVR.

Avoid increasing PVR. (Both increase R to L shunt).

Avoid agitation

Avoid air bubbles in I/V tubing

TREATMENT

-Maneuvers

-Oxygen

-Morphine sedation

-Pressors (phenylephrine)

References

1. **Moss and Adams' Heart disease in Infants, Children and Adolescents. Sixth edition, Volume two. Lippincott Williams and Wilkins 2001. Chapter 42.**
2. **Anesthesia for Congenital Heart Disease. Andropoulos DB, Stayer SA, Russell IA. Blackwell Futura 2004. P438-439.**
3. **Comprehensive Surgical Management of Congenital Heart Disease. Jonas RA. Hodder Arnold 2004. Chapter 16.**
4. **The relationship between the arterial to end-tidal PCO₂ difference and hemoglobin saturation in patients with congenital heart disease. Anesthesiology 1991, 75: 210-216.**

Summary information with kind permission from the files in the Heart Center Encyclopedia Cincinnati Children's Hospital Medical Center;-

What is tetralogy of Fallot?

Tetralogy of Fallot (TOF) is a cardiac anomaly that refers to a combination of four related heart defects that commonly occur together. The four defects include:

1. **Pulmonary stenosis** (narrowing of the pulmonary valve and outflow tract or area below the valve, that creates an obstruction (blockage) of blood flow from the right ventricle to the pulmonary artery)
2. **Ventricular septal defect (VSD)**
3. **Overriding aorta** (the aortic valve is enlarged and appears to arise from both the left and right ventricles instead of the left ventricle as occurs in normal hearts)
4. **Right ventricular hypertrophy** (thickening of the muscular walls of the right ventricle, which occurs because the right ventricle is pumping at high pressure)

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Question 1; Describe your assessment and preparation of this child for surgery?

Question 2; which drugs would you prepare for induction and what doses would you be prepared to administer?

Question 3; What are the benefits and disadvantages of Esmolol over propranolol I/V if beta blockade is required?

Question 4; Following intubation the baby desaturates to 72%. How would you respond?

Question 5; What is the differential diagnosis?