

Neonatal Cardiac Case

Oct 2018

Thanks to Dr Martyn Lethbridge from Dept of Anaesthesia in Perth Childrens Hospital for sharing this.

Disclaimer / Pre-amble

- These cases have been de-identified to protect the identity of the patient and the treating teams.
- These are all real cases and real ROTEMs. The individuals involved in these difficult cases have agreed to anonymously share these with us – thank you for your generosity.
- Successful management of the bleeding patient involves much more than just administration of blood products.
- The primary aim of these cases is to teach the use ROTEM guided blood product therapy. We have deliberately not included a lot of detail about some of the other aspects of management which might detract from this focus.



CARDIAC/VASCULAR ROTEM TRANSFUSION ALGORITHM (2017)



Maintain: Temp >36 C, pH >7.2, iCalcium >1 mmol/L, Platelets >70, Hb >70 g/L
Only consider APTT and INR in the presence of heparin and warfarin.

Adjust dose of blood products for patients <30kg after consulting senior clinician

Repeat ROTEM test 10 mins after EACH intervention

IS THERE CLINICALLY SIGNIFICANT BLEEDING?

YES
High risk of Fibrinolysis?
Consider Tranexamic Acid if not already given

ROTEM Result in 4 mins

Observe

IS INTEM CT > 205 sec? AND
IS HEPTEM CT < 205 sec?

YES
Heparin effect if differ by more than 20%

Protamine 0.5-1 mg/kg

RETEST

ARE INTEM & HEPTEM CT both > 205 sec?

YES
Possible excess protamine (can impair platelet function up to 6 hours)

Re-test in 10 min

RETEST

IF SEVERE BLEEDING, PROCEED WITH ALGORITHM

IS FIBTEM A5 < 10 mm?

YES
Low Fibrinogen

Cryoprecipitate 5 Units Apheresis
IF FIBTEM A5 < 6 mm may need > 5U of Cryo. Re-dose may be required. Ensure platelets also available in case needed

RETEST

IS FIBTEM A5 ≥ 10 mm? AND
IS EXTEM A5 < 35 mm?

YES
Poor Platelet Contribution

1 Pool Platelets
If chronic renal dysfunction also consider DDAVP 0.3 mcg/kg. Ensure FFP "ready to thaw" in case needed

RETEST

IS FIBTEM A5 ≥ 10 mm? AND
IS EXTEM CT > 90 sec?

YES
Low Coagulation Factors

FFP 2-4 units or Prothrombinex 25 U/kg if volume overloaded. Call Haematologist "on-call" to release

RETEST

CLOT LYSIS INDEX IS EXTEM ML ≥ 5 %?

YES
Hyperfibrinolysis

Additional Tranexamic acid 1 gm. Adjust subsequent dose for renal dysfunction

RETEST

STILL BLEEDING? Make stronger clot:

- Give Cryo to FIBTEM A10 > 15 mm
- Give platelets to EXTEM A10 > 50 mm or consider Platelet Function testing (in hours)
- Consider FFP to shorten clotting time to EXTEM CT < 80 sec

- IF STILL BLEEDING:
- Consider SURGICAL PROBLEM and discuss with surgeon and blood bank/haematologist (rFVIIa)
 - Re check temperature, pH, iCalcium, platelets and haemoglobin
 - Consider other contributors to bleeding
 - platelet inhibitors (do Multiplate Platelet Function test)
 - Consider VWD, warfarin (INR), clexane etc.



When clinically possible always complete the algorithm in a stepwise manner and check the ROTEM between steps as indicated. This reduces unnecessary transfusion especially of FFP.

ROTEM ANALYSIS AND TREATMENT PLAN

Nurse or JMO to circle algorithm used then insert results from ROTEM Next circle range (action red range) and use algorithm to create a plan.

Date: / / Time:

ALGORITHM USED (circle one):

CARDIAC/VASCULAR or GENERAL/OBSTETRIC

- For CARDIAC/VASCULAR start here and do all:
 - INTEM CT = Below 205 / 205 & Above
 - HEPTEM CT = Below 205 / 205 & Above

- For GENERAL/OBSTETRIC start here (this section only):
 - EXTEM A5 = Below 35 / 35-40 / Above 40
 - FIBTEM A5 = Below 10 / 10-15 / Above 15

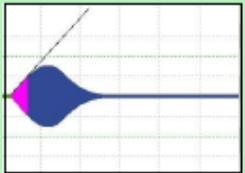
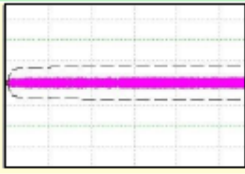
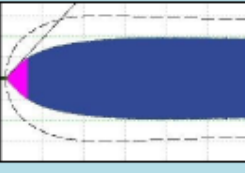
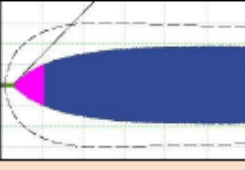
- EXTEM CT = Below 80 / 80-90 / Above 90
- EXTEM ML = Below 5 / 5 & Above

Management Plan:

Please stick this label in the patients progress notes

This paediatric algorithm should be used in conjunction with the PCH Critical Bleeding Protocol.

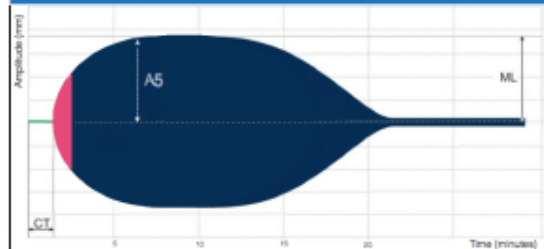
Only treat abnormal values if active bleeding or at high risk of bleeding. Repeat ROTEM analysis 10 mins after intervention to assess response.

	ABNORMAL ROTEM	CRITERIA	DIAGNOSIS	INTERVENTION	Notes
FIBRINOLYSIS		Trauma within 3 hrs EXTEM A5 \leq 35mm or FIBTEM CT $>$ 600s Maximum Lysis \geq 5%	Hyperfibrinolysis	Tranexamic acid 15mg/Kg	MAX1g bolus Initial dose over 10 mins then 2mg/kg/hr over 8 hrs Consider repeat bolus dose if pt has lost $>$ 1 blood volume since last dose
FIBRINOGEN		FIBTEM A5 \leq 10mm	Low fibrinogen	Cryoprecipitate 5ml/Kg	Order 1 bag (35ml) / 5Kg
PLATELETS		EXTEM A5 \leq 35mm and Normal Fibrinogen FIBTEM A5 \geq 10mm	Low platelets	Platelets 10ml/Kg	Ensure fibrinogen corrected first FIBTEM A5 \geq 10mm
FACTORS		EXTEM CT $>$ 90s and Normal Fibrinogen FIBTEM A5 \geq 10mm	Low coagulation factors	FFP 15ml/Kg	Ensure fibrinogen corrected first FIBTEM A5 \geq 10mm Add fibrinogen if EXTEM CT $>$ 140s

KEY COMPONENTS

FIBTEM A5 Amplitude 5mins post CT	Fibrinogen concentration and function
EXTEM A5 Amplitude 5mins post CT	Fibrinogen and platelet concentration and function
EXTEM CT Clotting time	Thrombin generation
ML % Maximal lysis	Degree of fibrinolysis over temogram

ROTEM



PAEDIATRIC ORDERING GUIDE

Kg	PRBC	CRYO	PLT	FFP
<10	1	2	1	1
10-20	2	4	1	1
20-40	3	6	1	2
>40	4	8	1	3
Notes	250ml/unit	35ml/pack	178ml/pack	AB FFP 285ml/pack

History

- This is a tricky one to interpret as it is both a paediatric case and a cardiac case.
- I am neither a cardiac nor paediatric anaesthetist so please send in any comments if you have any!
- I don't have a paediatric cardiac ROTEM algorithm so have included the draft PCH childrens paediatric general ROTEM algorithm and the Cardiac ROTEM algorithm from Prince of Wales
- Great case and lots to learn! Thanks Martyn!

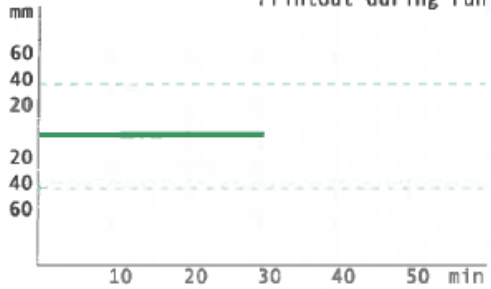
History

- 3.5 kg neonate
- Surgical repair congenital heart disease
- Temogram 1 – On bypass, prior to coming off
 - Rotem to assess likely product needs.

ROTEM 1

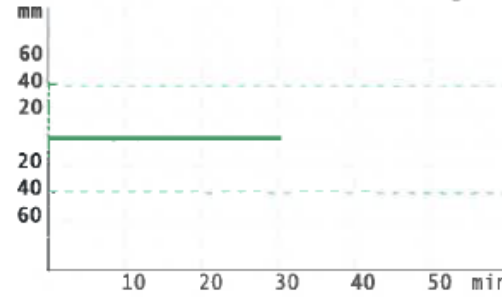
FIBTEM

Printout during run!



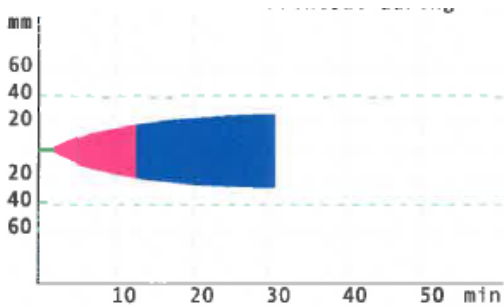
1 FIBTEM C [default]	
RT:	00:31:58 ST:
CT	: *2174 S
A5	: mm
A10	: mm
MCF	: mm
ML	: %

INTEM



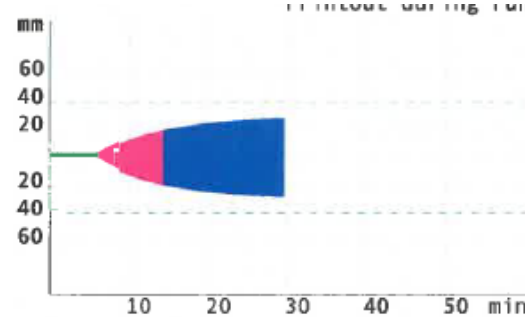
3 INTEM C [default]	
RT:	00:30:49 ST:
CT	: *2090 S
A5	: mm
A10	: mm
MCF	: mm
ML	: %

EXTEM



2 EXTEM C [default]	
RT:	00:31:17 ST:
CT	: 150 S
A5	: 13 mm
A10	: 19 mm
MCF	: * 27 mm
ML	: * 0 %

HEPTEM

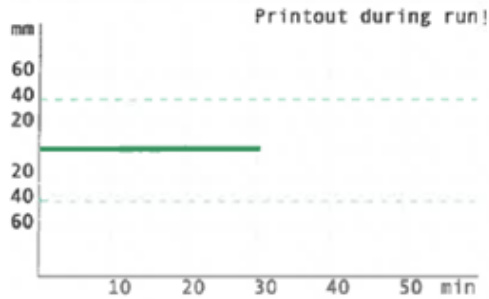


4 HEPTEM C [default]	
RT:	00:30:01 ST:
CT	: 405 S
A5	: 15 mm
A10	: 22 mm
MCF	: * 29 mm
ML	: * 0 %

**FIBTEM A5 = 0mm, EXTEM CT = 150s, EXTEM A5 = 13mm
INTEM CT = n/a HEPTEM CT = 405s**

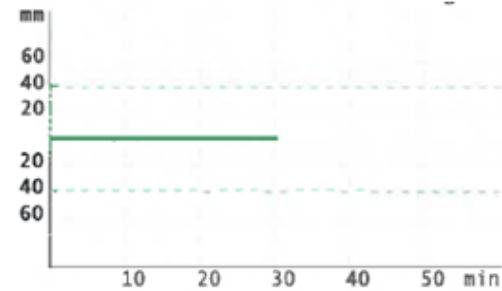
This one is pretty tricky – the patient is a neonate and they are on cardiac bypass with high dose heparin!
However have a go and try and interpret this before you go on!

FIBTEM



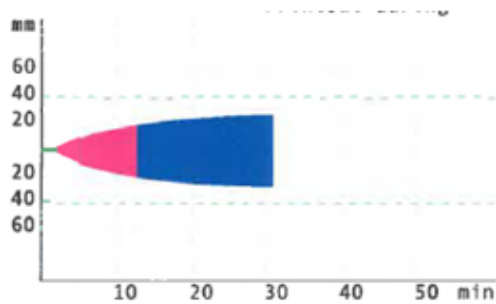
1 FIBTEM C [default]	
RT:	00:31:58 ST:
CT	: *2174 S
A5	: mm
A10	: mm
MCF	: mm
ML	: %

INTEM



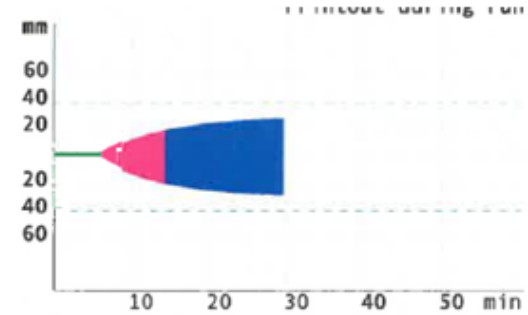
3 INTEM C [default]	
RT:	00:30:49
CT	: *2090
A5	:
A10	:
MCF	:
ML	:

EXTEM



2 EXTEM C [default]	
RT:	00:31:17
CT	: 150
A5	: 13
A10	: 19
MCF	: * 27
ML	: * 0

HEPTEM



4 HEPTEM C [default]	
RT:	00:30:01
CT	: 405
A5	: 15
A10	: 22
MCF	: * 29
ML	: * 0

**FIBTEM A5 = 0mm, EXTEM CT = 150s, EXTEM A5 = 13mm
INTEM CT = n/a HEPTEM CT = 405s**

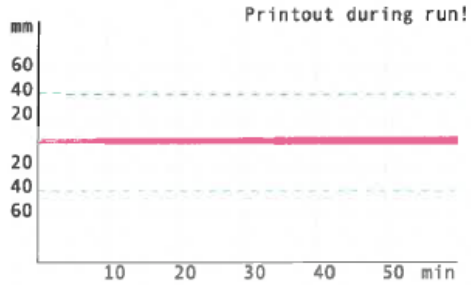
Interpretation

- Fibtem A5 – unrecordable – this patient is going to need fibrinogen and probably a lot!
- Extem A5 – 13mm – also extremely low more than you'd expect from low fibrinogen so will almost certainly also need platelets too.
- Prolonged CTs – Hard to interpret as pre-protamine – probably need to reassess after protamine & fibrinogen / platelets.

- Temogram 2 – After 5ml/kg Cryoprecipitate, prior to protamine.

ROTEM 2

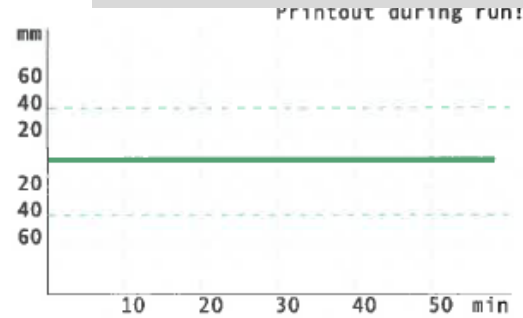
FIBTEM



1 | FIBTEM C [default]

RT:	01:03:51	ST:
CT	: 602	S
A5	: 2	mm
A10	: 2	mm
MCF	: 2	mm
ML	: * 1	%
CFT	:	S
A20	: 3	mm

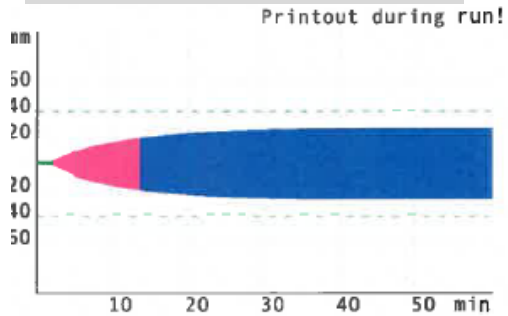
INTEM



3 | INTEM C [default]

RT:	01:02:41	ST:
CT	: *4008	S
A5	:	mm
A10	:	mm
MCF	:	mm
ML	:	%
CFT	:	S
A20	:	mm

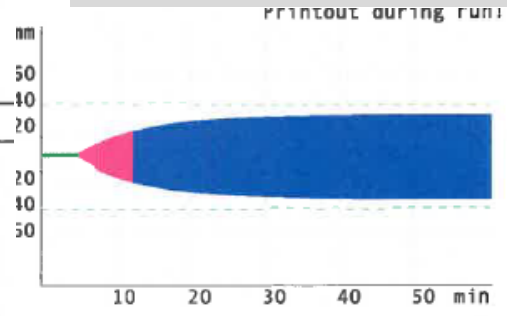
EXTEM



2 | EXTEM C [default]

RT:	01:03:10	ST:
CT	: 166	S
A5	: 13	mm
A10	: 19	mm
MCF	: 27	mm
ML	: * 1	%
CFT	: 696	S
A20	: 24	mm

HEPTEM



4 | HEPTEM C [default]

RT:	01:01:53	ST:
CT	: 337	S
A5	: 16	mm
A10	: 23	mm
MCF	: 32	mm
ML	: * 0	%
CFT	: 447	S
A20	: 30	mm

FIBTEM A5 = 2mm, EXTEM CT = 166s, EXTEM A5 = 13mm

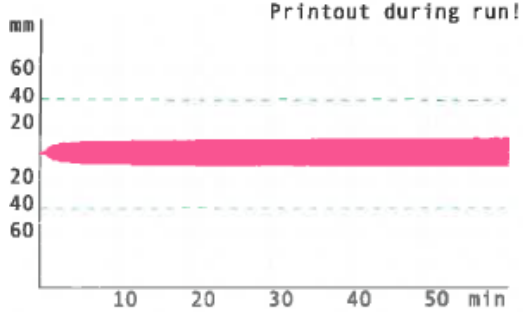
INTEM CT = n/a HEPTEM CT = 337s

Still pre-protamine so hard to interpret long CT's
Almost no improvement with cryo 5ml/kg
Still needs a lot more fibrinogen and probably a dose of platelets

- Temogram 3 – After 20ml/kg Cryo, 20ml/kg Platelets and Protamine given.

ROTEM 3

FIBTEM

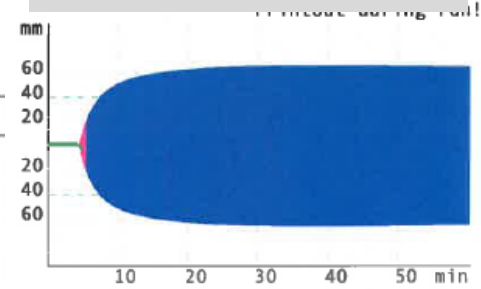


1 | FIBTEM C [default]

RT: 01:03:28 ST:

CT	:	65	S
A5	:	8	mm
A10	:	9	mm
MCF	:	9	mm
ML	:	* 0	%
CFT	:		S
A20	:	9	mm

INTEM

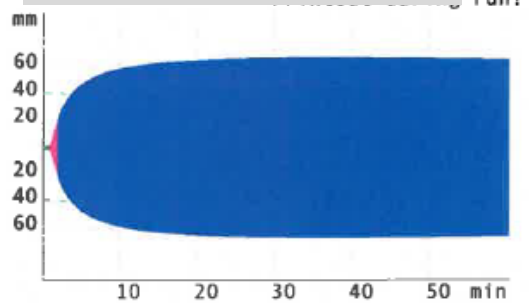


3 | INTEM C [default]

RT: 01:02:17 ST:

CT	:	303	S
A5	:	50	mm
A10	:	59	mm
MCF	:	67	mm
ML	:	* 2	%
CFT	:	63	S
A20	:	65	mm

EXTEM

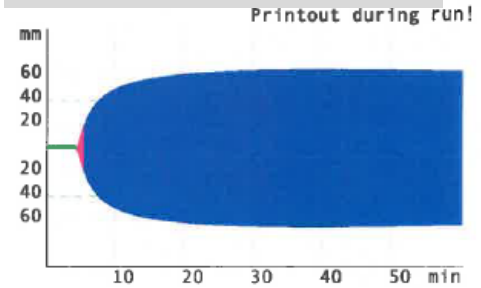


2 | EXTEM C [default]

RT: 01:02:46 ST:

CT	:	69	S
A5	:	51	mm
A10	:	60	mm
MCF	:	67	mm
ML	:	* 2	%
CFT	:	57	S
A20	:	66	mm

HEPTEM



4 | HEPTEM C [default]

RT: 01:01:28 ST:

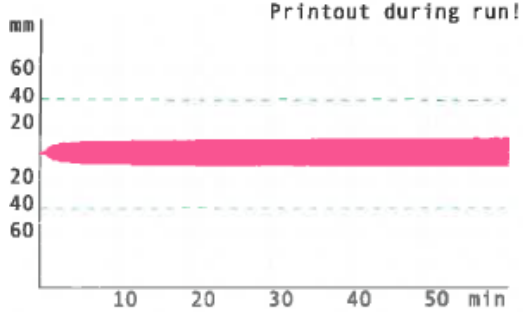
CT	:	296	S
A5	:	49	mm
A10	:	58	mm
MCF	:	66	mm
ML	:	* 2	%
CFT	:	65	S
A20	:	64	mm

**FIBTEM A5 = 8mm, EXTEM CT = 69s, EXTEM A5 = 51mm
INTEM CT = 303s HEPTEM CT = 296s**

Have a go at interpreting this yourself!

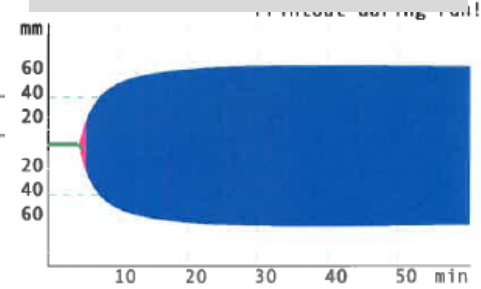
ROTEM 3

FIBTEM



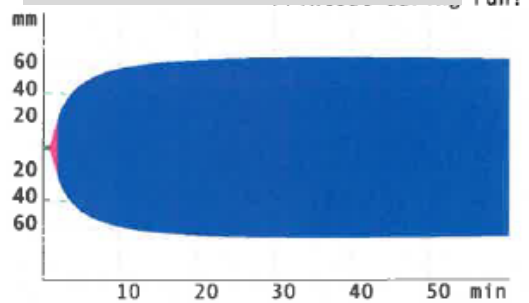
1 FIBTEM C [default]			
RT:	01:03:28	ST:	
CT	: 65	S	
A5	: 8	mm	
A10	: 9	mm	
MCF	: 9	mm	
ML	: * 0	%	
CFT	: :	S	
A20	: 9	mm	

INTEM



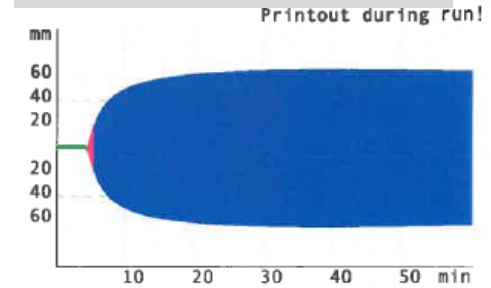
3 INTEM C [default]			
RT:	01:02:17	ST:	
CT	: 303	S	
A5	: 50	mm	
A10	: 59	mm	
MCF	: 67	mm	
ML	: * 2	%	
CFT	: 63	S	
A20	: 65	mm	

EXTEM



2 EXTEM C [default]			
RT:	01:02:46	ST:	
CT	: 69	S	
A5	: 51	mm	
A10	: 60	mm	
MCF	: 67	mm	
ML	: * 2	%	
CFT	: 57	S	
A20	: 66	mm	

HEPTEM



4 HEPTEM C [default]			
RT:	01:01:28	ST:	
CT	: 296	S	
A5	: 49	mm	
A10	: 58	mm	
MCF	: 66	mm	
ML	: * 2	%	
CFT	: 65	S	
A20	: 64	mm	

**FIBTEM A5 = 8mm, EXTEM CT = 69s, EXTEM A5 = 51mm
INTEM CT = 303s HEPTEM CT = 296s**

Heptem CT = INTEM CT – no need for more protamine
Fibtem A5 = 8mm – consider more fibrinogen if patient bleeding
Extem A5 = 51mm – very good
Extem CT = 69s – also very adequate

Take Home Points

1. Very low fibrinogen levels (e.g. fibtem A5<6mm) need larger doses of fibrinogen to correct the deficit.

Thanks again to Dr Martyn Lethbridge from the Dept of Anaesthesia Perth Childrens Hospital WA for sharing this case.