

# Ventilating the paediatric patient

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# Acknowledgements

- Kate Leutert – NE PICU Children's Hospital Westmead
- Dr. Chloe Tetlow – VMO Anaesthetist and Careflight

# Overview

- Refreshing Airway knowledge
  - Key factors
- Routine ETT care for paediatrics
- The equipment details
- 'Normal' paediatric settings
- Concerning signs & troubleshooting
- Resources

# The paediatric airway

- Age and size matter
  - It's all about the weight!
- Weight estimate formula:  $(\text{Age} + 4) \times 2$ 
  - Heaps of medical calculation apps available for free
- All the normal things we would think about in an adult, we need to think about in a child
  - Patient positioning
    - Obstruction
  - Using airway adjuncts
  - Always remember the good old LMA

# The differences #1

- Big tongues
- Small mandible
- Highly compliant (easy to kink)

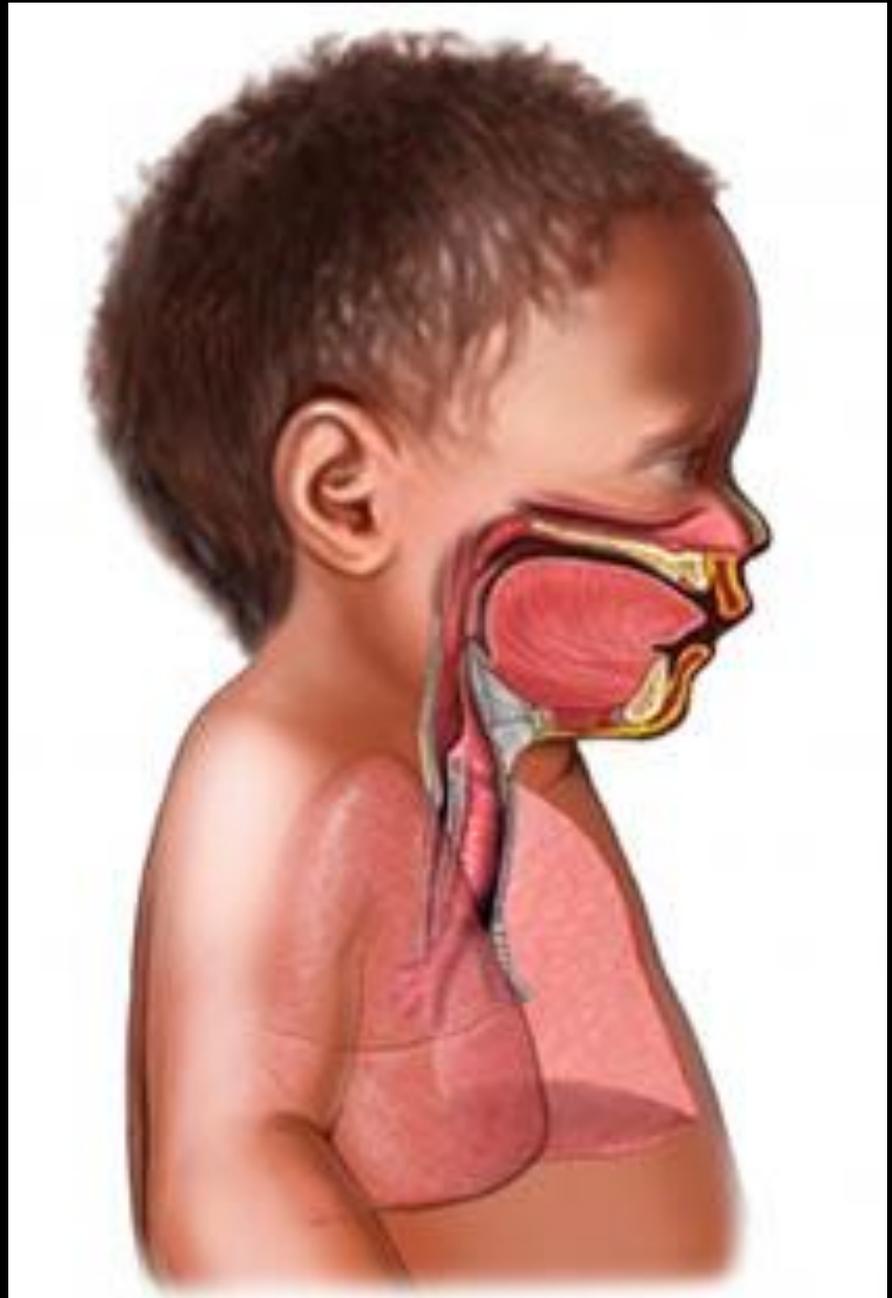
*Pin it*

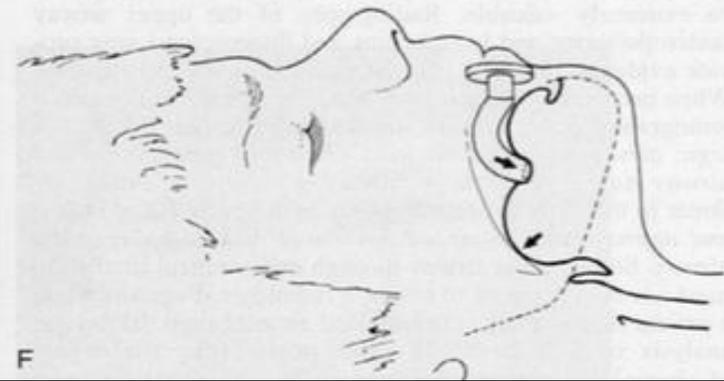
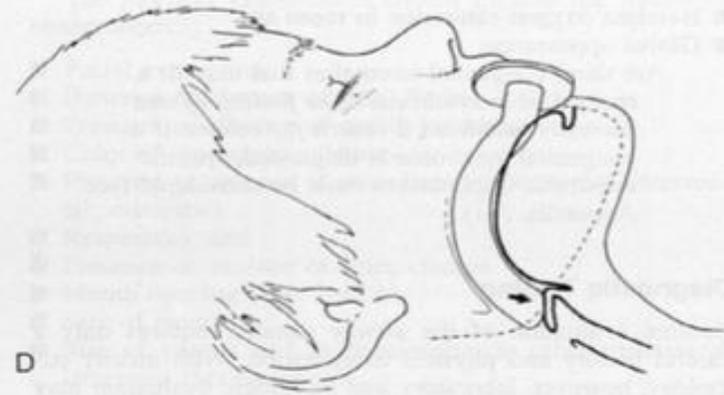
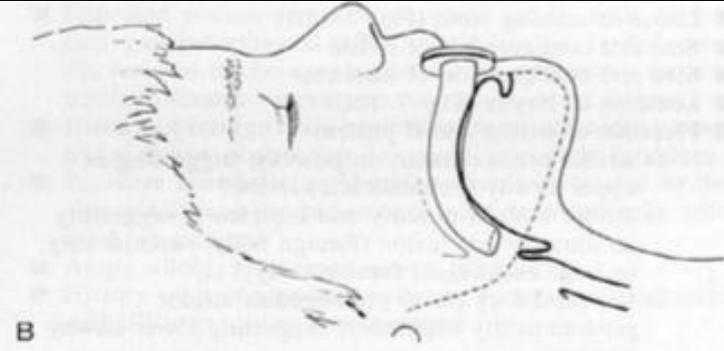


**a**



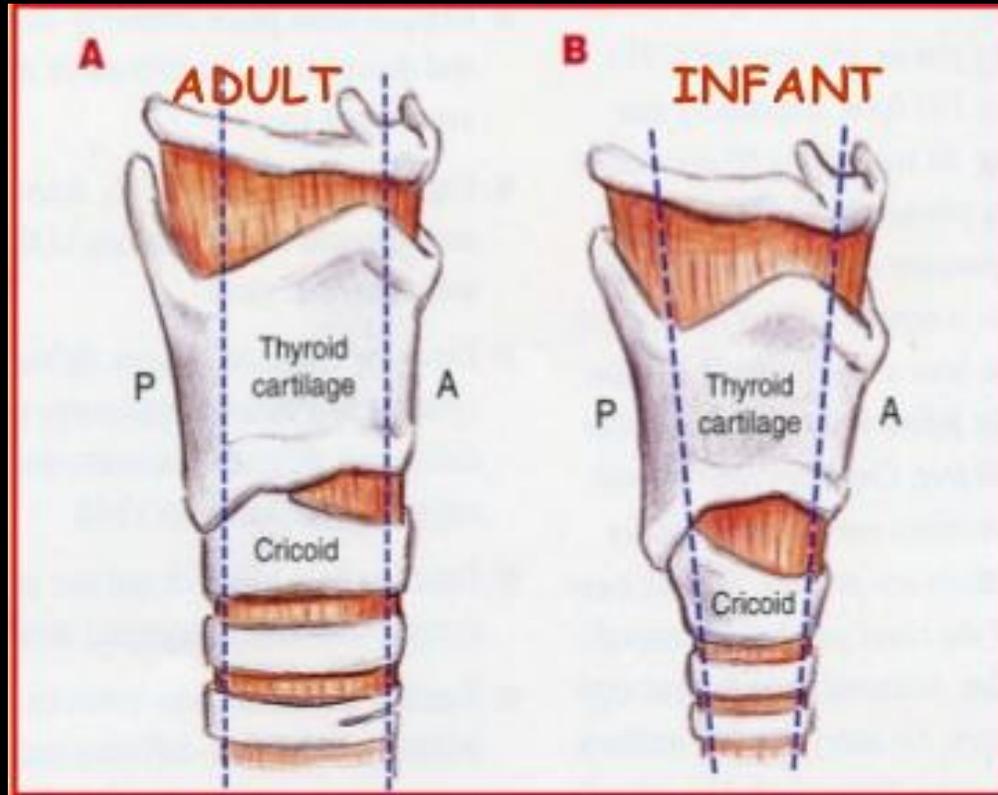
**b**





# The differences #2

- Larynx is like a funnel

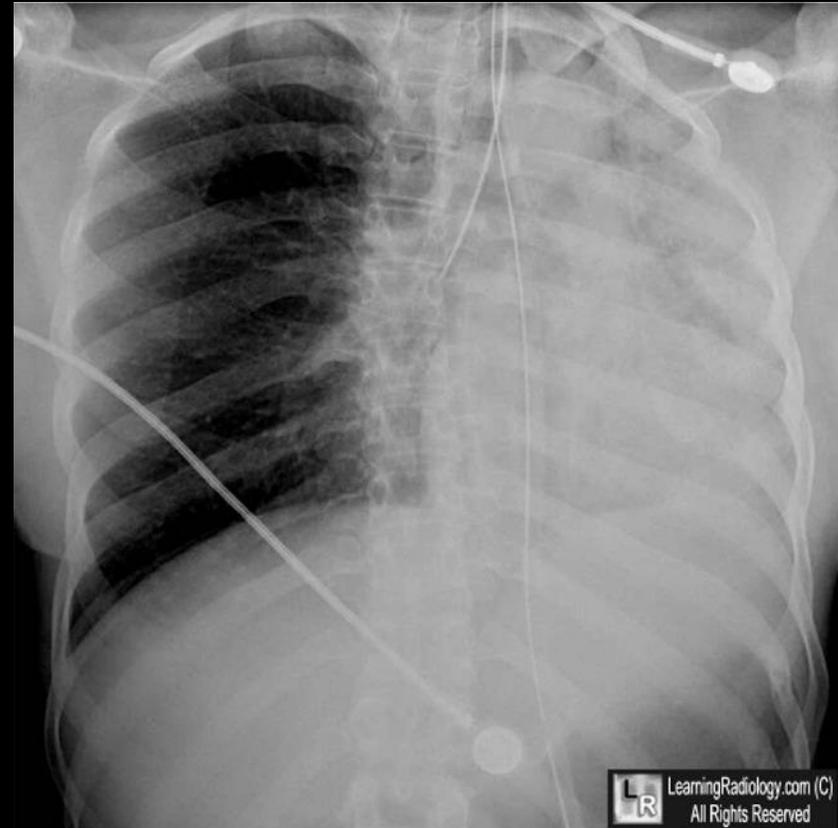


# Why does this matter?

- The narrowest part of the airway is the cricoid (below the level of the cords)
- Potential for ischaemia/oedema
  - Post extubation croup or oedema
- Cuffed ETT = Vigilance +++ for cuff pressures
- Uncuffed ETT = airway leak at 20-30cm pressure

# The differences #3

- The right main bronchus comes off the trachea at a less acute angle...



# Securing your ETT

The only right way is the way where it doesn't  
fall out.



# ETT Care

- Tapes need to be changed BD & PRN
- The ETT needs to be moved (if oral) to prevent pressure injuries
- Cuff pressures need to be checked every shift or after any changes to ETT to ensure appropriate level of inflation (<15cmH20)

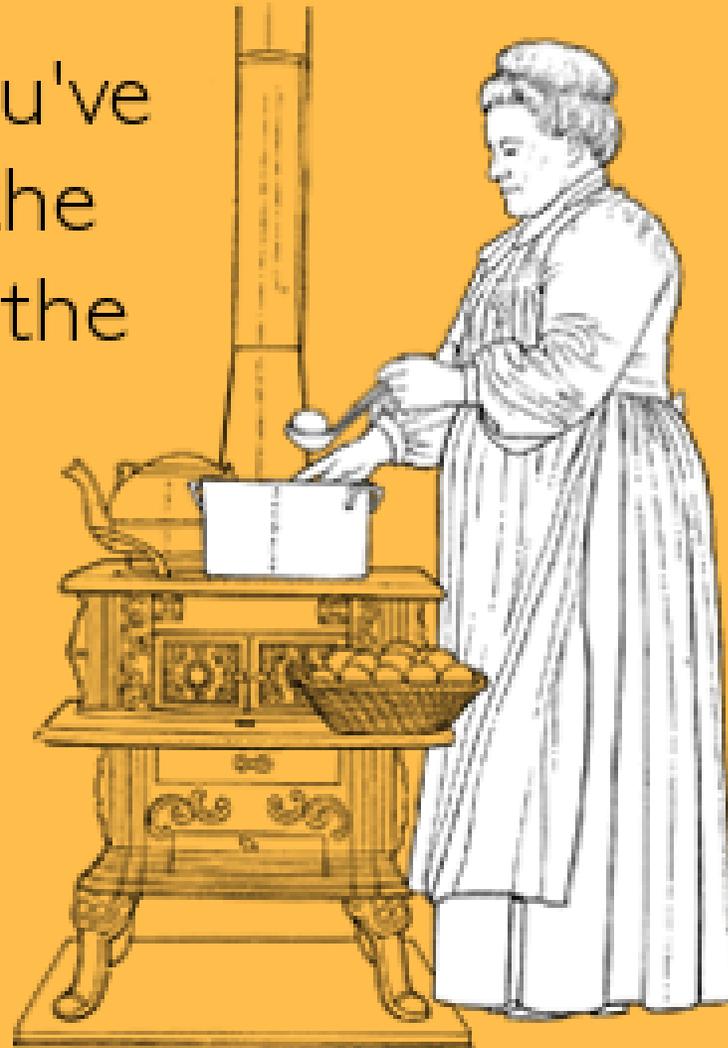


# Suctioning

- Suctioning needs to be attended to clear secretions and prevent ETT occlusions
- Open suction technique
  - 2/3 people
  - Pre-oxygenate
  - Suction catheter needs to be inserted to no more than 0.5 cm beyond the tip of the ETT
  - Maximum suction -200mmHg

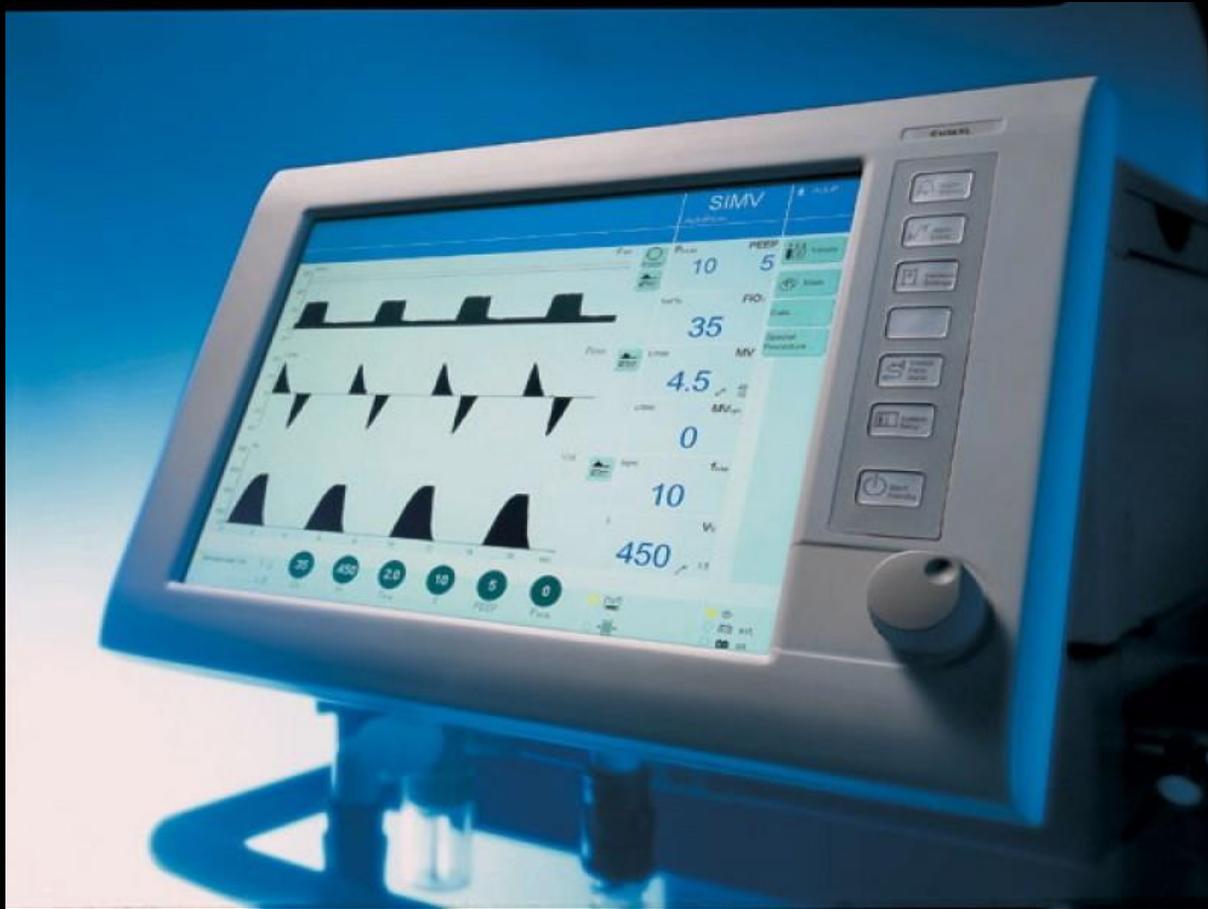


Congratulations! You've  
just jumped out of the  
Frying pan and into the  
fire!!!!



somee cards  
user card

# Ventilator equipment



- Our normal equipment is suitable for 10kg and up.
- If we have a child <10kg – you need to use an infant circuit
- NICU use the infant circuits on their draeger ventilators – so are a great resource for setting up
- There is an option for a different flow sensor with the infant circuit.. more about this later

# Setting the Ventilator

# Start / Standby

New Patient

Current Patient

Ventilation begins with the pre-configured start up settings

Ventilation

Start

Standby

Patient



Adult



Ped.

SIMV	AutoFlow	PSupp.	VT	600 L	PEEP	5 cmH2O
ATC	On	8.0	Tinsp	1.7 sec.	O2	100 Vol.%
Application	tube		f	12 bpm	PSupp.	15 cmH2O

## Start / Standby

New  
Patient

Current  
Patient

Ventilation begins with the pre-configured start up settings

Ventilation

Start

Standby

Patient



Adult



Ped.

SIMV	AutoFlow	PSupp.	VT	.050 L	PEEP	5 cmH2O
ATC	On	5.0	T <sub>insp</sub>	0.70 sec.	O <sub>2</sub>	100 Vol.%
Application	tube		f	29 bpm	PSupp.	15 cmH2O

# Which mode?

- Much like in the adult world, it will depend on who you ask
  - Age & weight
  - Reason for intubation and ventilation
  - Underlying co-morbidities
- Either SIMV or PCV
- In small children NOT A SPONTANEOUS MODE

# Why not?

- Spontaneous breaths rely on the patient triggering ventilator
- This is measured via flow
- The flow rates are much smaller in children
- Often not big enough to be detected by our 'adult' flow sensor
- Neonates / very small children circuits use flow sensors at the end of the ETT

# What settings?

- Tidal volume: 6-8mls/kg
- Respiratory rate:
  - Infant: 25-35 (<1 year)
  - Toddler: 20-30 (1-4 years)
  - Child: 15-25 (5-12 years)
- Minute volume:
  - 3-6l/min
- PEEP:
  - Standard start at 5 → 7-8. Rarely above. A massive PEEP would be 10

# What do we assess?

- Same documentation/assessment as with adults
- Auscultate and check ETT routinely 4/24
- Monitor Saturations and EtCO<sup>2</sup> continuously
- BP and HR – take changes (even small) in heart rate seriously

# Complications of ventilation in children

- **Atelectasis** (*lack of suctioning, physiotherapy, positioning/movement, inadequate volumes*)
- **Post extubation stridor** (*ETT too big, cuff over inflation, laryngospasm*)
- **Pneumothorax** (*R main bronchus intubation, too much volume*)
- **Accidental extubation** (*patient/family/nurses/doctors/ETT inappropriately secured*)
- **Ventilator associated pneumonia** (*Physio, oral care, suctioning, aspiration*)

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# Signs and Symptoms

- Colour: Colour is a great indicator in a child
- Saturations – once they start to change, they will change rapidly:
  - Kids have only a fraction of the amount of alveoli of an adult
  - Small airways that are more prone to collapse
  - Small airways that, if occluded, have a big systemic effect
- Heart rate & BP: Heart rate changes are important to investigate

# Troubleshooting

- When in doubt, disconnect the patient from the ventilator and hand ventilate
- Call for help early
- Work out whether it is a patient or machine issue
- Ask an expert
  - NETS over the phone
  - Anaesthetic colleague
  - Very small baby - NICU

# In summary

- Don't assume kids are like small adults, it will get you in to trouble!
- Be aware of those key anatomical differences – it could help you with troubleshooting
- The same complications exist in children, but remember the issues around airway damage from ETT's
- There is plenty of help around (although it never feels like it at the time!) – use it!

# Resources

- The Royal Children's Hospital Melbourne

The screenshot shows the homepage of The Royal Children's Hospital Melbourne. At the top left is the hospital's logo, a stylized figure with colorful arms, and the text "The Royal Children's Hospital Melbourne". To the right of the logo is a navigation menu with links for "Home", "About", "News", "Careers", "Support us", "Contact", and "My RCH Portal". Below the logo is the tagline "A great children's hospital, leading the way". A secondary navigation bar contains "Health Professionals", "Patients and Families", "Departments and Services", "Research", and a search icon. The main content area features a large banner with a photograph of Christmas cards. One card in the foreground shows a cartoon bear wearing a Santa hat and holding a sign that says "merry christmas". To the right of the image is a red text box with the heading "Our Christmas range is here!" and the text "If the gift of giving is important to you, here's a great way to support the hospital this festive season." Below this text is a link "Find out more [here](#)". At the bottom of the page are four colored buttons: "Your guide to the RCH" (blue), "Kids health information" (yellow), "Clinical practice guidelines" (orange), and "My RCH Portal" (green).

- Medical calculation apps



- LITFL

TOPIC	HEADING, KEYWORDS	LITFL LINK
Airway, Paediatrics	Paediatric Airway	<a href="#">Paediatric Airway</a>
Paediatrics	coarctation of the aorta	<a href="#">coarctation of the aorta</a>
Paediatrics	congenital heart disease	<a href="#">congenital heart disease</a>
Paediatrics	croup	<a href="#">croup</a>
Paediatrics	Early Management of the Critically Ill Child	<a href="#">Early Management of the Critically Ill Child</a>
Paediatrics	epiglottitis	<a href="#">epiglottitis</a>
Paediatrics	inhaled foreign body	<a href="#">inhaled foreign body</a>
Paediatrics	newborn resuscitation, neonatal	<a href="#">newborn resuscitation, neonatal</a>
Paediatrics	Paediatric access options in cardiac arrest	<a href="#">Paediatric access options in cardiac arrest</a>
Paediatrics	Paediatric airway	<a href="#">Paediatric airway</a>

Showing 1 to 10 of 36 entries (filtered from 1,653 total entries) [Previous](#) [Next](#)



It is American – but it is still good!

• <https://www.openpediatrics.org/>

The screenshot shows the Open Pediatrics website homepage. At the top right, there are links for "Help" and "Login / Register". The main header features the "OPENPEDIATRICS™" logo and the tagline "The world's best practices, shared worldwide." Below the header is a navigation menu with "LIBRARY", "LEARNING", "COMMUNITY", "SUPPORT US", and "ABOUT US". A search bar labeled "Site Search" is positioned to the right of the navigation menu. A dropdown menu is open under "LIBRARY", showing options like "View All Topics", "BROWSE BY:", "Media Type", and "Most Recent". To the right of the dropdown, under "SPECIAL COLLECTIONS:", there are links for "World Shared Practice Forum", "Simulators", "Gegge's Heart Library", "Medical Calculators", and "Animations and Illustrations". The main content area features a large banner with the text "Join the global conversation." and "Monthly World Shared Practice Forums for physicians and nurses." Below this banner is a "Learn More" button. The banner image shows a signpost with arrows pointing to various cities: AMSTERDAM (2040 KM), TEHRAN (1377 KM), ROME (1377 KM), MOSKOW, LONDON, PARIS (2238 KM), BERLIN (1740 KM), and LYON (2013 KM). At the bottom of the page, there is a section titled "FEATURED RESOURCES".

Should be here in the next couple of weeks..

