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

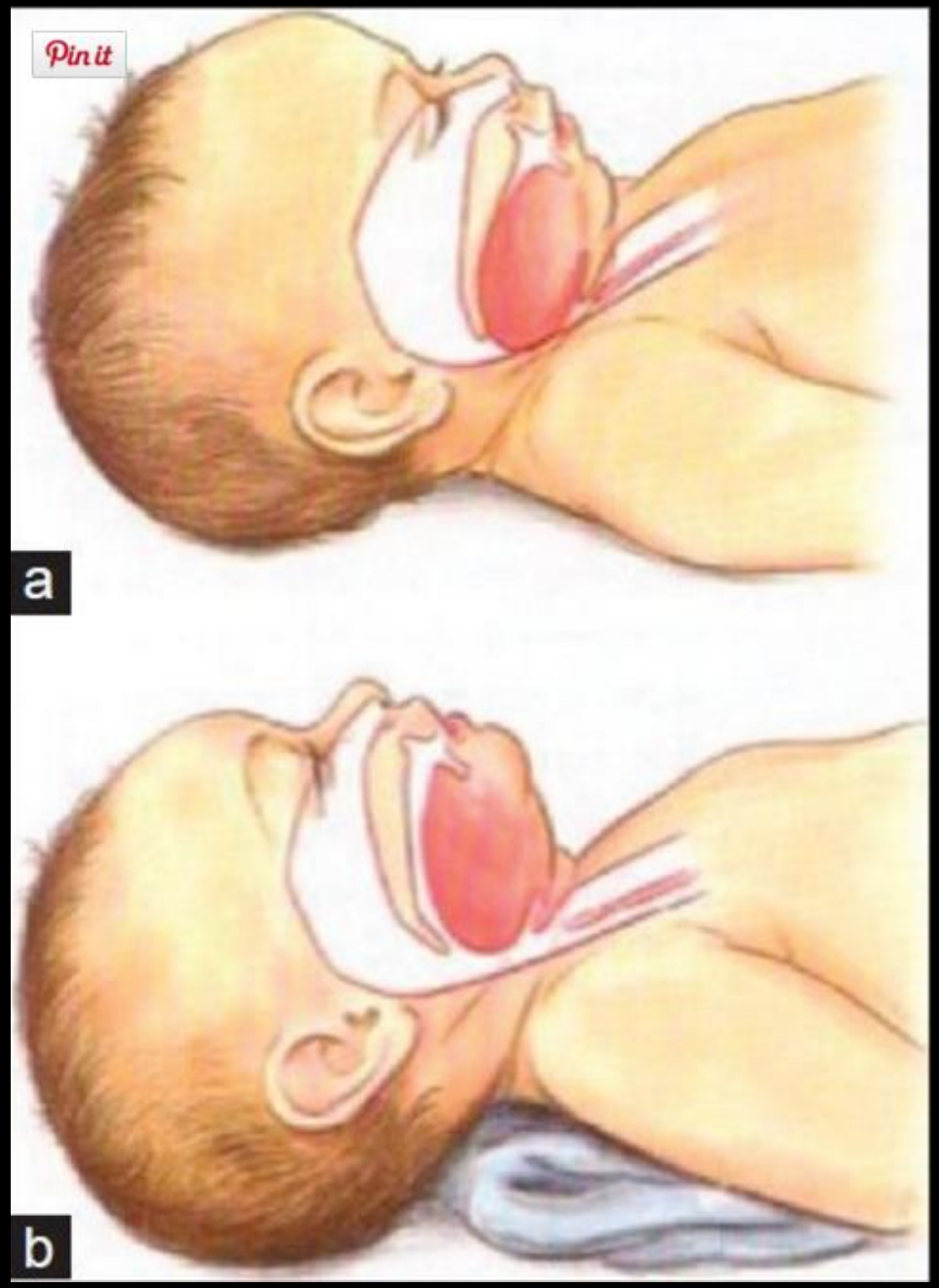
- Refreshing Airway knowledge
  - Key factors
- Routine ETT care for paediatrics
- The equipment details
- ‘Normal’ paediatric settings
- Concerning signs & troubleshooting
- Resources

The paediatric airway

- Age and size matter
  - It’s all about the weight!
- Weight estimate formula: (Age + 4) x 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)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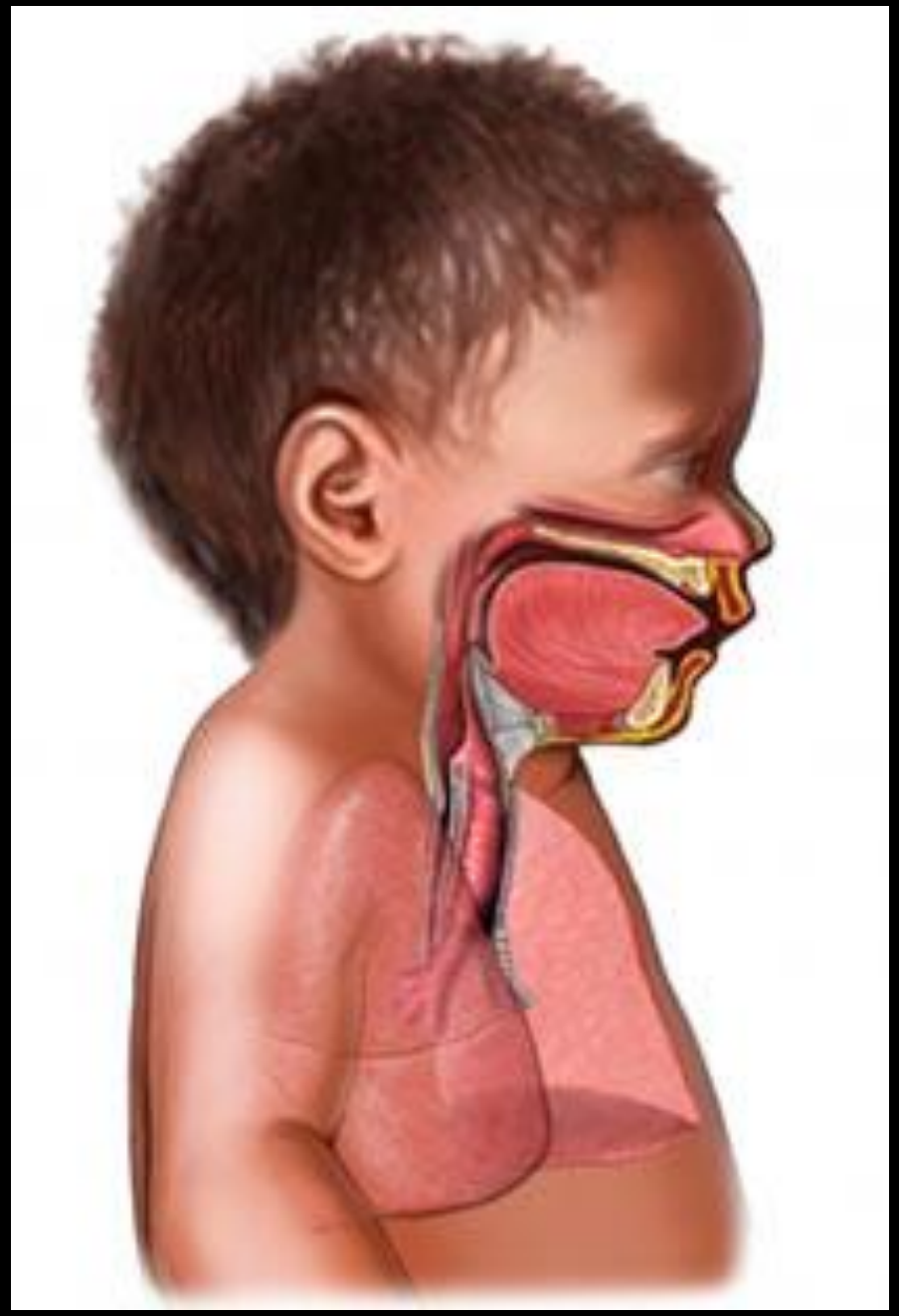

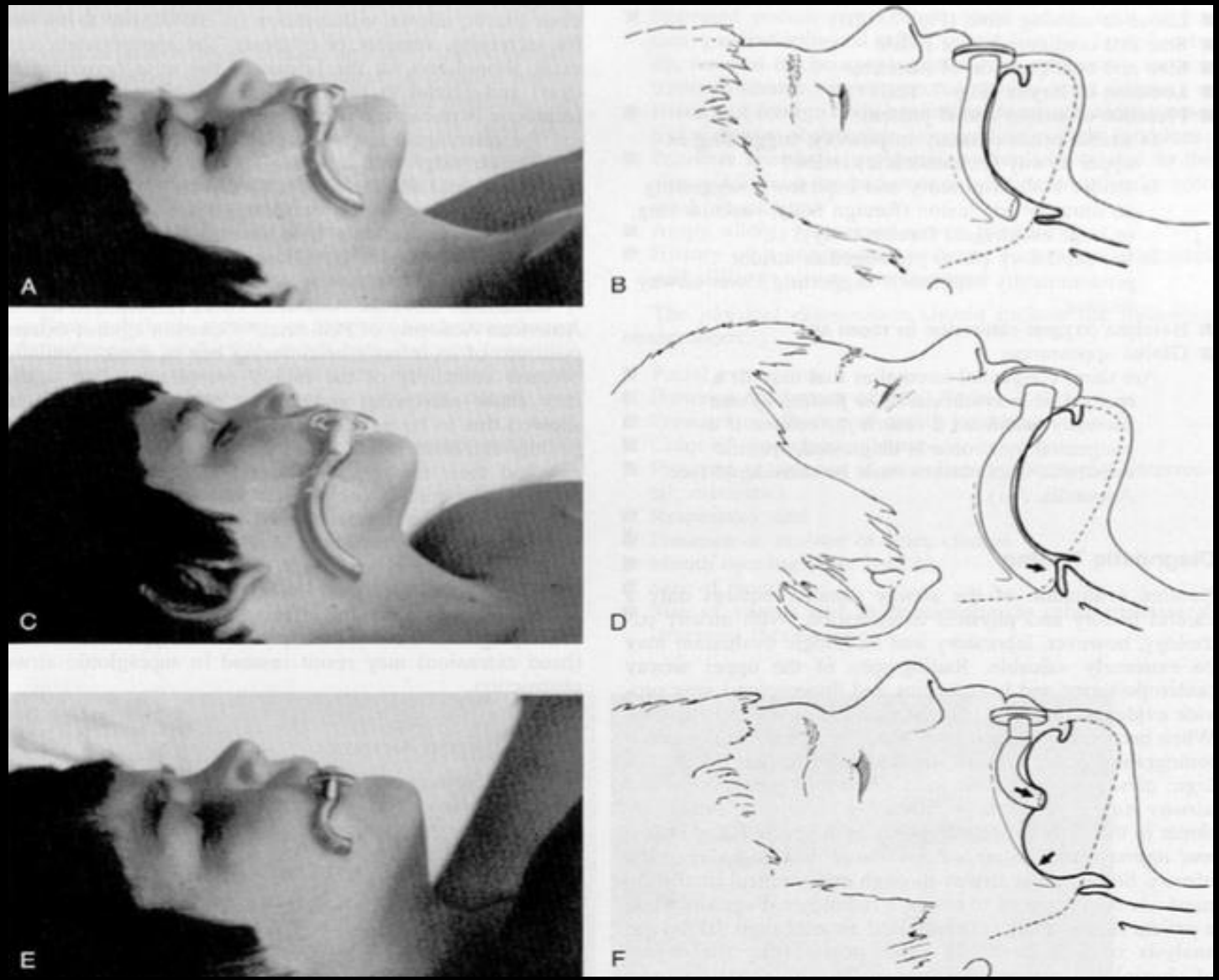
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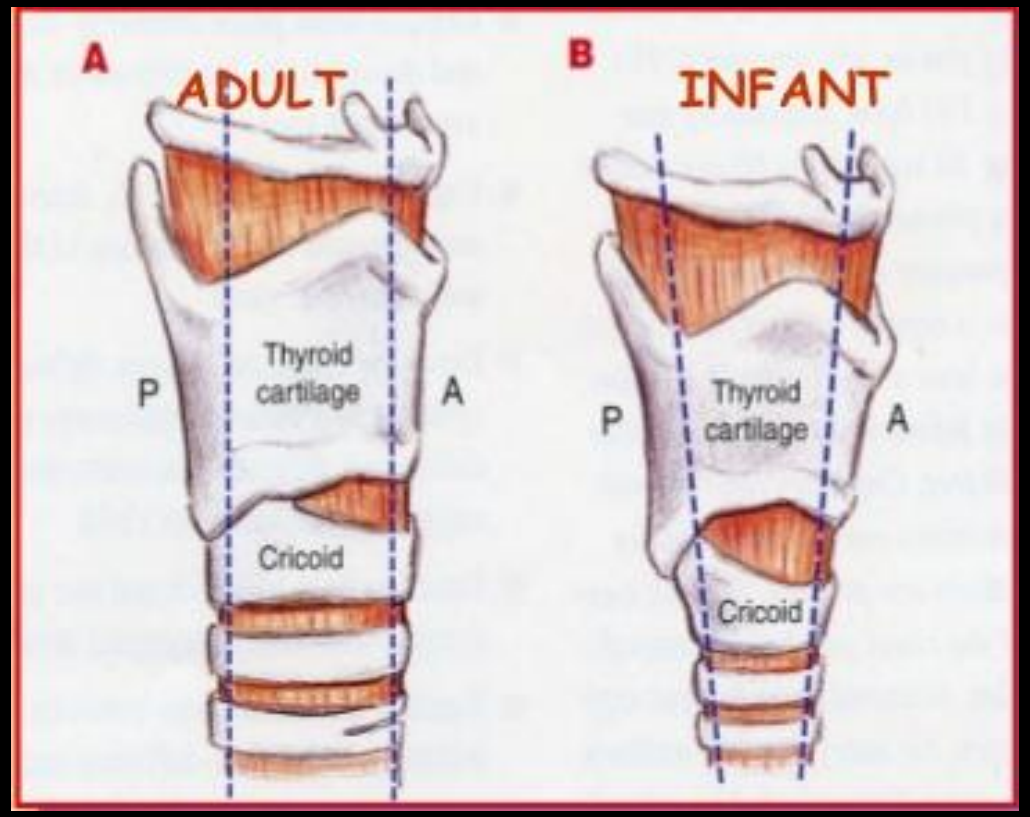
The differences #2

- Larynx is like a funnel



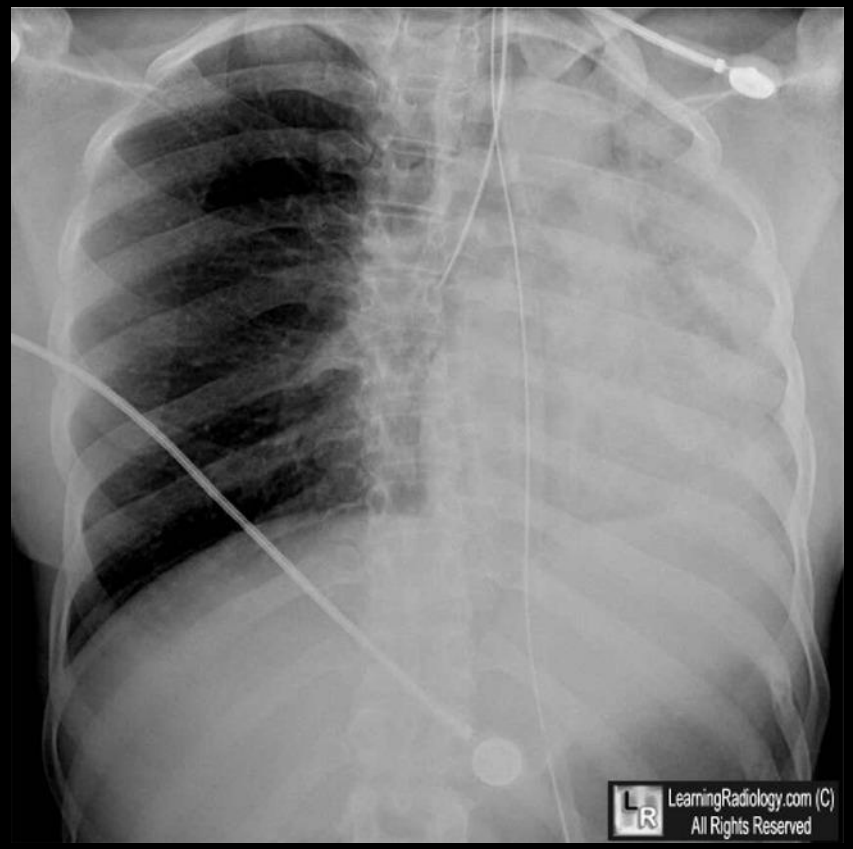
Why does this matter?

- 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!!!!

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	Tinsp	0.70	sec.	O2	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 $EtC0^2$ 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

- Medical calculation apps

- LITFL

TOPIC	HEADING, KEYWORDS	LITFL LINK
Airway, Paediatrics	Paediatric Airway	Paediatric Airway
Paediatrics	coarctation of the aorta	coarctation of the aorta
Paediatrics	congenital heat disease	congenital heat disease
Paediatrics	croup	croup
Paediatrics	Early Management of the Critically Ill Child	Early Management of the Critically Ill Child
Paediatrics	epiglottitis	epiglottitis
Paediatrics	inhaled foreign body	inhaled foreign body
Paediatrics	newborn resuscitation, neonatal	newborn resuscitation, neonatal
Paediatrics	Paediatric access options in cardiac arrest	Paediatric access options in cardiac arrest
Paediatrics	Paediatric airway	Paediatric airway

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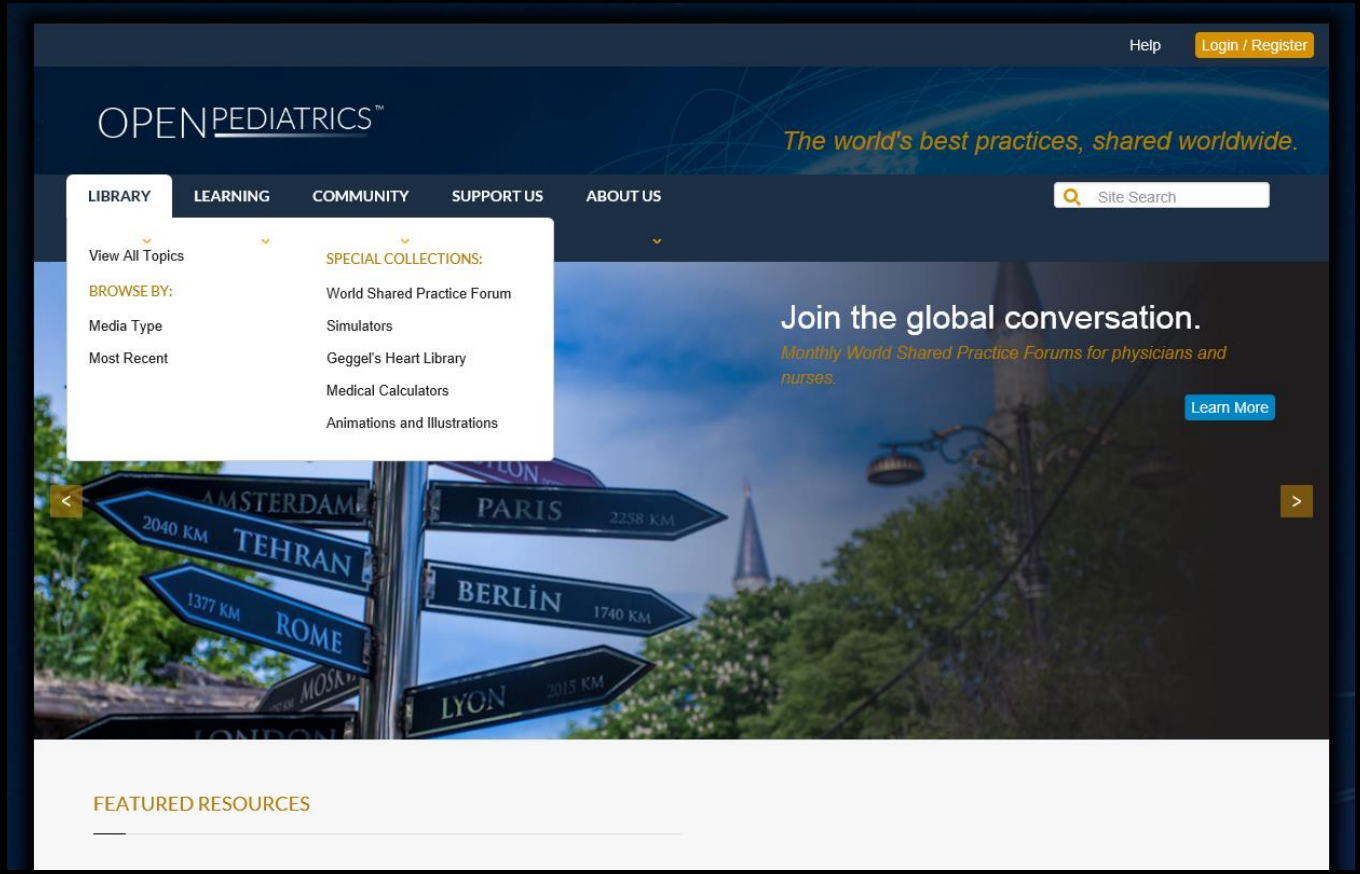
It is American – but it is still good!

- https://www.openpediatrics.org/



Should be here in the next couple of weeks…