Management of Upper Airway Obstruction in a local hospital without tertiary paediatrics

Title:	**Guidelines for the Management of Upper Airway Obstruction (UAO) in Local Hospital (without tertiary paediatrics)**
Version:	**Version 1**
Supersedes:	New guideline
Application:	RMCH / MCS The guideline is intended for use by any hospital team caring for infants, children and young people under 16 years age across the Paediatric Critical Care Network in the North-West (England) & North Wales region.

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Ratified by:	North-West (England) & North Wales Paediatric Critical Care Operational Delivery Network (NW & NW PCC ODN) North-West (England) Surgery in Children Operational Delivery Network (NW & NW SiC ODN)
Date of Ratification:	10.08.23
Signed off by:	RMCH (Host Trust): Paediatric Policies & Guidelines Committee
Date of Ratification:	8.12.23

Issue / Circulation Date:	**8.12.23**
Circulated by:	**North-West (England) & North Wales PCC & SiC ODN** **RMCH/MCS Policies and Guidelines Group (PGG)**
Dissemination and Implementation:	NWTS & Network circulation lists to regional colleagues Available via MFT policy Hub
Date placed on NWTS website:	December 2023

Planned Review Date:	**3 years** ie December 2026
Responsibility of:	Clinical lead North-West (England) & North Wales Paediatric Critical Care Network, NWTS guideline lead consultant

Minor Amendment (If applicable) Notified To:	
Date notified:	

EqIA Registration Number:	**2023-172**

1. Detail of Procedural Document

Guidelines for Management of Upper Airway Obstruction (UAO) in a District General Hospital

2. Equality Impact Assessment

EqIA registration Number for RMCH: **2023-172**

3. Consultation, Approval and Ratification Process

This guideline was developed with input from:

· North West (England) and North Wales Paediatric Transport Service (NWTS).

- North West (England) and North Wales Paediatric Critical Care Operational Delivery Network
- North West (England) and North Wales Surgery in Children ODN
- Representatives from Local Hospitals and paediatric tertiary centres within the North West (England) & North Wales Paediatric Critical Care networks above.

These guidelines were circulated for comments to colleagues in North West and North Wales Paediatric Critical Care ODN on 30th June 2023, and the Surgery in Children ODN on 3rd July 2023.

All comments received have been reviewed and appropriate amendments incorporated.

These guidelines were ratified by PCC ODN on: 10th August 2023

For ratification process for network guidelines see appendix 1.

4. Disclaimer

These clinical guidelines represent the views of the North West (England) and North Wales Paediatric Transport Service (NWTS) and the North West and North Wales Paediatric Critical Care Operational Delivery Network (PCCN). They have been produced after careful consideration of available evidence in conjunction with clinical expertise and experience.

It is intended that trusts within the Network will adopt this guideline and educational resource after review and ratification (including equality impact assessment) through their own clinical governance structures.

The guidance does not override the individual responsibility of healthcare professionals to make decisions appropriate to the circumstances of the individual patient.

Clinical advice is always available from NWTS on a case by case basis.

Please feel free to **contact NWTS (01925 853 550)** regarding these documents if there are any queries

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MANAGEMENT OF ACUTE STRIDOR PATHWAY - Details Page 7 & 8.
'Westley' score may be used but **does not replace clinical acumen**.

MILD
Normal RR
No recession
No stridor at rest
Seal like barking cough
SpO_2 > 95% in air
Normal HR
Alert and active
Croup score 0 – 1*

MODERATE
Barking cough; stridor at rest
↑RR; mild ↑WOB
↓AE but easily audible
SpO_2 > 93% in air
Moderate ↑HR
Alert, may be distressed but can be comforted
May include Croup score 2 – 4*

SEVERE
Apathetic, restless or exhausted
Stridor at rest
↑RR > 70/min
Severe recession (may ↓ if exhausted)
↓AE & not easily audible
SpO_2 < 93% in air
↑HR
May include croup score ≥ 5*

Avoid distressing child ie do NOT examine throat
Reassurance
ORAL Dexamethasone 0.15mg/kg
Discharge with safety netting
Consider admitting: Chronic lung disease; cardiac, neuromuscular pts

Do **NOT** examine throat
Dexamethasone 0.15—0.6 mg/kg max 12 mg per dose.
Route: ORAL / IV, use least invasive route
Adrenaline nebulizer 0.5 mL/kg 1:1,000 (max 5 mL)

CALL FOR SENIOR HELP:
Local senior paed/anaesthetic/ consider ENT
Stay with the child
Minimal interventions
Do NOT examine throat

Observe for 2-3 hours & **re-assess**

Manage as 'Severe' if **NO** improvement.
Consider CXR (including neck) + AXR to check for FB
No benefit in further steroids acutely for majority but repeat doses may be considered† at 8-12 hrly intervals

Adrenaline nebuliser
0.5mL/kg 1:1,000 (max 5mL)
Repeat Adrenaline Neb PRN.
AND
Dexamethasone 0.6mg/kg PO/IV (max 12mg per dose)
OR Budesonide 2mg Neb**

GOOD RESPONSE: close observation for 2-3 hours & **re-assess**
Requires close monitoring on HDU

POOR RESPONSE?
Repeat Adrenaline neb in 20-30 mins or earlier if clinical indicated

Consider intubation to protect airway
Discuss with NWTS
DO NOT DELAY INTUBATION:
Prep. for difficult airway including potential for front of neck access: checklist on Page 9

WESTLEY CROUP SCORE[5]
***Croup score** is an aid for clinical assessment, not a replacement.

STRIDOR	
0 = none	
1 = when agitated	
2 = audible at rest	
RECESSION	
0 = none	
1 = mild	
2 = moderate	
3 = severe	
AIR ENTRY on auscultation	
0 = Normal, including sleep	
1 = Decreased with agitation	
2 = Decreased at rest	
CYANOSIS	
0 = none	
4 = with agitation	
5 = at rest	
CONSCIOUSNESS LEVEL	
0 = normal	
5 = altered mental state	
TOTAL SCORE =	**/17**

** **Adding nebulised Budesonide to Dexamethasone does NOT provide additional benefit.**
† Evidence is limited, but repeat steroids after 12 hours or sooner have been used (clinician preference)

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SEVERE UPPER AIRWAY COMPROMISE
Details on pages 7 & 8

MAINTAINING OWN AIRWAY?

YES

DO NOT UPSET THE CHILD!

CALL FOR SENIOR HELP IMMEDIATELY:
Local emergency medicine / paediatrics / anaesthetics / ENT

Stay with the child. Do NOT examine throat

Allow the child to adopt their favoured position to keep airway open (with parent's help)
Follow acute stridor pathway: assess severity

CONSIDER:
Adrenaline Neb: 0.5 mL/kg **1:1,000** (max 5mL)
AND
Dexamethasone 0.6mg/kg (max 12 mg per dose) by least invasive route ORAL / I V
ALTERNATIVE Budesonide 2mg nebuliser if oral dexamethasone not tolerated

POOR RESPONSE OR PERSISTING AIRWAY CONCERNS?

ASSESS & PREPARE FOR INTUBATION TO PROTECT AIRWAY IN CASE REQUIRED = DIFFICULT AIRWAY WITH POTENTIAL NEED FOR FRONT OF NECK ACCESS:
see guidance Page 9
Consider discussing with NWTS but
DO NOT DELAY INTUBATION IF NEEDED
https://www.nwts.nhs.uk/clinicalguidelines

NO

CALL FOR URGENT SENIOR HELP
ANAESTHETIC, ENT, PAEDIATRIC / EMERGENCY MEDICINE &
VIA CARDIAC ARREST CALL

IF FOREIGN BODY suspected:

Seek **URGENT ENT SUPPORT**

Avoid intubation if possible, but may be needed

Consider CXR (including neck) & AXR once airway stable

See 'NWTS Button Battery' guideline

https://www.nwts.nhs.uk/clinicalguidelines/regionalguidelines-a-z

ONCE AIRWAY SECURED.
Insert NGT, aspirate & place on free drainage to decompress stomach
CXR to check ETT & NGT position & check if any foreign body
Send bloods including cultures
Send respiratory viral screen &
ET aspirate for M, C & S
Assess if IV antimicrobials are required

** **Adding nebulised Budesonide to Dexamethasone does NOT provide additional benefit.**
† Evidence is limited, but repeat steroids after 12 hours or sooner have been used (clinician preference)

Useful Emergency Drugs - Quick Reference

This is guidance for the management of critically unwell children and does not override local policies.

If in doubt please refer to the BNFc, 'Crash Call' or local guidance.

Dexamethasone: Mild: 0.15mg/kg (Max 12 mg / dose)
Moderate: 0.15-0.6 mg/kg (max 12 mg / dose)
Severe: 0.6 mg / kg (Max 12 mg per dose).
Preferably given via least invasive route, i.e. oral (or IV if available)
Repeat doses 0.15 –0.3 mg/kg (max 12 mg/dose) can be given 8 - 12 hourly
Reduction in clinical symptoms seen by 2 hours with further beneficial effect noted up to 10 hours following administration.

Budesonide Nebuliser: 2 mg nebuliser, can be given with adrenaline nebuliser in emergency
Can be repeated every 12 hours.

** **Adding nebulised Budesonide to Dexamethasone does NOT provide additional benefit.**

Adrenaline Nebuliser: 0.5mL / kg (Max 5mL) 1:1,000 Adrenaline
Use undiluted if > 2mL total
If total dose less than 2mL: make up to total 2 mL with 0.9% sodium chloride
Can be repeated after 20 -30 minutes
Can be used sooner if in extremis at clinicians discretion

Induction of Anaesthesia

Fentanyl (induction agent): 1-2 microgram/kg/dose
For easier administration / dose volumes:
Take 2 mL fentanyl (50 microgram/mL) and make up to total 10 mL with 0.9% sodium chloride. Final concentration fentanyl = 10 microgram / mL

Ketamine (induction agent): 1-2 mg/kg/dose
For easier administration / dose volumes use 10 mg/ml concentration
NB ketamine and fentanyl use lower dose in extremis: less likely to trigger cardio-vascular deterioration / collapse

Rocuronium (neuromuscular blocker): 1 mg/kg/dose
Always draw up more than one dose of each agent

'Dilute' Adrenaline IV: Take 0.1 mL/kg (10 micrograms/kg) from Minijet syringe 1:10,000 adrenaline
Using 3-way tap makes drawing up doses easier especially in small child / infant
Make this up to 10 mL with 0.9% sodium chloride MAX: 1mg in 10mL i.e. neat
Use 1-2 mL aliquots to maintain BP

Fluid bolus: 10 mL/kg ideally balanced crystalloid (Hartmann's solution or Plasmalyte 148)

Further Information

Management of a child with upper airway compromise should be by a combined senior team, which can include (but not limited to) Emergency Medicine, Anaesthetics, ENT and Paediatrics. Intubation may be the definitive management to protect an acutely compromised airway but this takes time to prepare so must considered early.

Focused history can help to establish the likely cause of obstruction. Specific questions should include[2]:

- Patient age
- Speed of onset
- Precipitating events such as feeding, agitation, history of choking episode/possible aspiration.
- Associated symptoms that may include fever, drooling, cough, reluctant to eat or drink
- Concise past medical history i.e. neonatal period (ever intubated), past history upper airway obstruction including severe 'snoring', history of neck/chest surgery, known allergies, previous intubation (any age)
- Previous difficult airway (eg difficult laryngoscopy or multiple attempts before successful intubation)

Upper airway obstruction may occur at any level, from nares and lips down to the subglottis. **Obstruction at or below the level of glottis / cords can be acutely life threatening. AVOID examining throat as may trigger obstruction**

Patient Assessment

Children presenting with upper airway obstruction can be at risk of sudden decompensation. Those with suspected upper airway obstruction should be triaged urgently and be *fully assessed and treated within 30 minutes*[1].

Level of obstruction helps with differential diagnosis, and it is essential to decide if stertor or stridor is heard.

Stertor: is a snoring inspiratory sound, due to vibration of pharyngeal tissues (nasopharynx, oropharynx and soft palate), and signifies upper airway collapse and subsequent turbulent flow. May be seen in children with decreased conscious state, pharyngeal hypotonia or swallowing problems. It is only heard in inspiration. Common causes are adenotonsillar hypertrophy +/- Obstructive Sleep Apnoea (OSA), large tongue, hypotonia, Pierre-Robin syndrome or cranio-facial syndromes.

Stertor usually responds to positioning +/- airway adjuncts eg nasopharyngeal airway

Stridor: high pitched sound and is due to an obstruction above, at or below the cords. Inspiratory stridor is due to obstruction above or at level of the cords (supraglottis), biphasic at level of the cords or subglottis or extra-thoracic trachea, and expiratory the obstruction is tracheal and/or bronchial (ie intrathoracic). It usually does NOT respond to positioning OR airway adjuncts. Airway adjuncts may precipitate complete obstruction.

Degree of obstruction	Clinical signs
Mild	Cough, hoarse voice, no respiratory distress
Moderate	Stridor when agitated Moderate respiratory distress, i.e. Mild intercostal/subcostal recession Tachypnoea
Severe	Stridor at rest Severe respiratory distress i.e. severe intercostal and subcostal recession, nasal flaring and severe tachypnoea.
Imminent complete	Cyanosis and/or SpO_2 <90% Agitation or lethargy
Complete	Respiratory arrest followed by cardiac arrest

Assessment of the severity of obstruction[4]:

N.B. There are some situations where a child may not show increased work of breathing, such as:

- Exhaustion and collapse (end-stage)
- Known severe neuromuscular weakness
- Upper airway obstruction resulting from CNS depression

Hypoxia despite supplemental oxygen in upper airway obstruction means the child is in extremis or peri-arrest. This is an emergency.

Management of Upper Airway Obstruction in a local hospital without tertiary paediatrics

General Management Principles

1. **Avoid causing distress:** this can result in sudden airway occlusion.

- Nurse with the parent/guardian and minimise interventions to minimise distress. Oxygen/nebs do not need to be forced on the face but can be 'wafted' nearby if necessary.
- Do **not** examine the oropharynx unless absolutely critical for management; this can be dangerous.
- Examine the child in the position in which they are most comfortable.
- Avoid unnecessary investigations; i.e. X-Rays only if significant indication that will alter acute management eg potential foreign body.
- **Avoid IV** access **unless absolutely essential**. If IV access is felt essential it must be obtained by most skilled person with supporting teams including senior anaesthetist present. Consider need for ENT presence.
- Do **not** swab or send secretions (i.e. for respiratory viral screen) until assessed as safe to do so by a senior clinician (ideally consultant).

2. **Severe or life-threatening obstruction** may be acutely but **temporarily** (1-2 hours) **improved** with **nebulised adrenaline**. Repeat as needed; it may be given every 20-30 mins or more if benefits outweigh risks (i.e. avoidance of intubation).

3. **Steroids** can be effective but take time to be work (up to 4 hours) and will not give immediate relief. Dual steroid therapy i.e. Dexamethasone and Budesonide concurrently has no proven benefit.

4. Identify and treat the specific cause.

NB: Adrenaline nebulisers can give immediate improvement but it will subside over relatively short period of time. Steroids take time to work but the improvement should last longer.
2-3 adrenaline nebulisers may be needed (with increasing time interval between) until full clinical effect of steroids are seen. If needing more frequently or stridor rebounding quickly then may need intubation.

At every stage consider if intubation is needed .
Intubation should be considered as potentially difficult and high risk.
Preparation of equipment and personnel takes time, so plan early

Choice of steroid: Rates of reattendance, readmission and length of stay are reduced by corticosteroid use in croup. Dexamethasone (0.15-0.6 mg/kg MAX 12 mg/dose) is recommended as it has a longer half-life than prednisolone. Evidence suggests the higher dose 0.6 mg/kg Dexamethasone is more effective in moderate - severe croup hence recommendation in this guidance. Repeat doses 0.15mg/kg (MAX 12mg / dose) can be used dependent on clinician preference.
Budesonide is probably as effective as higher dose dexamethasone but is more costly and is more challenging to administer reliably as dose given via nebuliser. It can be co-administered with an adrenaline nebuliser.

Indications for Intubation in upper airway obstruction

1. Progressive respiratory failure
   - Hypoxia (SpO_2 < 92% despite high flow O_2 via face mask > 5L/min)
   - Exhaustion / tiring
   - Rising CO_2 : only check blood gas if 'safe' / child can tolerate capillary sample being taken
   NB if normally would not tolerate this = warning sign!
2. Fall in conscious level
3. Inhalational injury or ingestion caustic substance

NWTS Paediatric Intubation including Difficult Airway Guideline is available at

http://www.nwts.nhs.uk/clinicalguidelines

PLUS use the intubation checklist for upper airway obstruction (see page 9)

Intubation and Post-Intubation Guidance

Induction and Intubation = one-way

Unlikely that 'waking up' = viable option —> plan appropriately

- Anticipate a difficult airway: discuss airway plan and check equipment available prior to induction. Ensure ENT consultant present when appropriate.
- Use a cuffed ETT and do not cut ETT.
- Use an intubation checklist [see page 9 and NWTS Paediatric Intubation and Difficult Airway Guideline https://www.nwts.nhs.uk/clinicalguidelines]
- Pre-oxygenate with 100% oxygen. However, do not persist if child does not tolerate.
- Avoid distressing child by holding a mask over their face, just hold nearby.
- Induction: IV rapid sequence is preferred (using fentanyl / ketamine / rocuronium) especially if the child is in extremis, and there is a significant aspiration risk.
- Gas induction may allow the maintenance of spontaneous ventilation for as long as possible, however, may be difficult (eg induction may take long period of time due to reduced TV / UAO; volatile may lead to hypotension—be prepared if this option used)

Post-intubation and Preparation for Transfer

- Confirm ETT position clinically (chest rise, end-tidal CO_2, auscultation) and on CXR.
- Ensure minimal leak around ETT.
- Secure with Melbourne ETT strapping [see NWTS guideline: How to tape an ET tube ***http://www.nwts.nhs.uk/clinicalguidelines***].
- Place nasogastric tube, aspirate the stomach and put on free drainage (to reduce diaphragmatic splinting and improve ventilation).
- Use adequate sedation and neuromuscular relaxant to ensure safety of ET tube
- Optimise ventilation: always use PEEP (usual PEEP 6 cm H_2O), TV 6-8 mL/kg, rate as appropriate for age of patient. Check blood gas when possible.
- Send bloods including cultures and send respiratory viral screen
- Suction may be needed (often need to instill 1-2 mL 0.9% sodium chloride before suction).
- If possible send ET aspirate for M, C & S
- Review whether IV antimicrobials required
- Ensure all notes including drug chart, observation chart and blood results are copied.
- Update or inform NWTS.

Guidelines: ***www.nwts.nhs.uk/clinicalguidelines***

Intubation and Difficult Airway Guideline and LocSIPPS both include intubation checklist

Button Battery Guideline

How to tape an ET tube

Emergency management of blocked tracheostomy

Education: ***www.nwts.nhs.uk/education-website***

Recorded sessions: intubation including difficult airway, ventilation strategies, management of upper airway obstruction, button battery, emergency tracheostomy change

Login details for education site are available from your nursing and medical PCC ODN links

OR via email: info@nwts.nhs.uk

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NWTS Paediatric Intubation and Difficult Airway Guideline is available at http://www.nwts.nhs.uk/clinicalguidelines

PRE-INTUBATION PREPARATION CHECKLIST		
Personnel	• Preferably **2 anaesthetists**, including a local anaesthetist who has the most experience in managing paediatric airways. • **ENT Consultant** in case emergency front-of-neck access (FONA) required. • **Theatre Practitioners** scrubbed and ready at the bedside in case FONA required.	☐ ☐
Place	• If time and clinical condition allows, **move to a fully-equipped environment** which is mostly likely to be an anaesthetic room/operating theatre. • **If unable to safely move patient, equipment must move to patient**	☐
Planning	**Assess likelihood of difficult airway**: • Patient anatomy (e.g. syndrome, deformities) • Known previous difficult intubation: check available notes, ask next-of-kin & d/w NWTS if known to NWTS and/or tertiary teams. • NWTS can access tertiary hospital notes to check grade laryngoscopy / airway difficulties and how these were managed • Disease factors (infection, trauma, suspected anaphylaxis, foreign body inhalation).	☐

Equipment	• Ensure equipment available for airway plans A-D (endotracheal tubes, laryngoscopes, supraglottic airway devices, face masks, adjuncts, front of neck access) **NWTS intubation guideline / LocSIPPS for intubation include size chart**
	• Endotracheal tubes:
	  ◦ Cuffed preferably, uncuffed only if unable to intubate with cuffed.
	  ◦ Do NOT cut the ETT.
	  ◦ Variety of sizes. Expect may need to use a smaller size than usual.
	  ◦ Cuffed ETT can be used instead of tracheostomy tubes (if no appropriate sized tracheostomy tube available).
	  ◦ Croup ET tubes are available in size 2.5 and 3.0 uncuffed (longer ETT than usual size 2.5 or 3.0). NB they may be difficult to order.
	  ◦ End-tidal CO_2 connected to anaesthetic circuit
	• Fibreoptic scope +/- rigid bronchoscope (appropriate sizes)
	• Large orogastric tube or suction catheter to decompress stomach post I&V
		☐
		☐
		☐
		☐

Emergency drugs	• Fluid bolus: 10 mL/kg • Dilute adrenaline (0.1 mL/kg 1:10,000 or 10 microgram / kg made up to 10mL with 0.9% sodium chloride). Aliquots 1-2 mL of this dilution may be needed to manage hypotension around induction • Resus dose adrenaline i.e. 0.1 mL/kg 1:10,000 • NB bradycardia at induction usually due to hypoxia in paediatrics	☐
Back-up plan	Consider options if difficulty with intubation/oxygenation arises. Unlikely to be appropriate to wake up, as airway obstruction will persist. **See NWTS intubation/difficult airway guidelines @ http://www.nwts.nhs.uk/clinicalguidelines**	☐

Management of Upper Airway Obstruction in a local hospital without tertiary paediatrics

Potential Causes of Upper Airway Obstruction

This table is a diagnostic aid to help determine the most likely cause of upper airway obstruction and its specific management. It is important to differentiate between stertor and stridor (see page 7)

Diagnosis	History/clinical findings	Specific treatment
Viral Croup Laryngotracheobronchitis *Most common cause*	Typical age 6m – 3yrs Incidence increase late autumn/early winter Coryzal, barking cough, hoarse voice. Inspiratory stridor, Low-grade fever Common pathogens: Parainfluenza type 1, RSV, Adenovirus, Influenza A or B)[7]	Steroids as previously listed. +/- Nebulised Adrenaline Anaesthetic review **See acute stridor pathway on page 4**
Bacterial tracheitis	Peak incidence 3- 8yrs. Similar to croup, but more unwell. Common organisms: Staph aureus, Strep pyogenes, Moraxella catarrhalis, H influenzae	Urgent anaesthetic review Often require intubation Intravenous antibiotics
Abscess; retropharyngeal, peritonsillar, infectious mononucleosis, Ludwig's angina	Neck pain, swelling Dysphagia, trismus Systemically unwell/fever Torticollis	Intravenous antibiotics +/- Surgical drainage Discuss with ENT colleagues
Foreign body inhalation **See NWTS Button Battery guideline https://www.nwts.nhs.uk/clinicalguidelines**	Peak incidence 1-2yrs. Often sudden, unexplained onset of symptoms, eg coughing, choking. Child well prior to onset. Imaging may identify object include CXR (including neck) & AXR	Avoid intubation if possible Encourage cough. Back blows/ abdominal thrusts (APLS) for complete obstruction (e.g. unable to speak/cough, apnoea) ENT surgeon review ASAP
Inhalational injury	Airway swelling following exposure to heat +/- particulate matter that may progress rapidly. Significant history: enclosed space, prolonged evacuation time, loss of consciousness, fatalities in the same incident[9] Exam.: voice change, facial burns, soot in nose/ mouth/sputum, ↑carboxyhaemoglobin levels	Early intubation ALWAYS use an **uncut** endotracheal tube (to allow for further swelling/oedema and prevent accidental extubation)
Anaphylaxis	Tongue/lips/uvula/facial oedema +/- urticaria Secondary to trigger (may be known) usually occurs within 30 mins exposure	ABCDE assessment Adrenaline nebuliser **APLS algorithm for anaphylaxis**
Trauma	Rare in children, blunt or penetrating injury e.g. toddler falls with fork in mouth OR ingestion caustic substance eg bleach	Urgent review by anaesthetist and ENT consultant with surgical airway skills
Hereditary angioneurotic oedema 1st episode usually < 15 yrs.	Family hx . May be triggered by dental work Acute onset localised non-pitting, non-pruritic, non-erythematous angioedema commonly affecting, eyelids, lips and tongue. Airway oedema at the level of larynx causes stridor, dysphagia, voice changes	Urgent review by anaesthetist, may need intubation. C1 esterase inhibitor or FFP NB Does not respond to adrenaline, steroids or anti-histamines
Epiglottitis	Peak incidence 2- 8yrs. Probably unvaccinated. Acute, rapidly progressive, life-threatening. 'Toxic' appearance, ↑fever, stridor & drooling	Urgent anaesthetic review Often require intubation Intravenous antibiotics

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Differentials for Chronic or Recurrent Stridor

Children may present with acute stridor on the background of a pre-existing structural abnormality of the upper airway. This abnormality may be congenital or acquired[3].

Assessment and initial management of these children remains the same as in acute stridor.

Congenital causes of stridor[1]	
Laryngomalacia	Often presents in the neonatal period but generally resolves by 12-18 months of age. It tends to be worse during feeds and when lying supine.
Tracheomalacia	Stridor often presents in expiration and may have a croup-like cough. Rarely resolves by 12 months, most symptomatic into early childhood.
Vocal cord paralysis	May be associated with cardiac or neurological malformations or secondary to trauma at birth (such as a forceps delivery). Can be unilateral (present with hoarseness, aspiration risk) or bilateral (stridor, respiratory insufficiency, recurrent LRTI).
Vascular rings	Cause external compression of the trachea. Can be isolated or associated with other cardiac abnormalities.
Subglottic stenosis	May be congenital or acquired (see below).
Tracheal Stenosis	May be congenital or acquired
Infantile haemangioma	Usually worsens during first few months of life, approximately 50% associated with cutaneous haemangiomas. Symptoms worse with crying or straining.
Micrognathia	May be isolated or associated with syndrome eg Pierre-Robin, Treacher Collins and Hallermann-Streiff
Bronchogenic cyst (rare)	Tend to present in second decade, but may be rapidly enlarging in infancy.
Acquired causes of stridor	
Vocal cord dysfunction	Often presents as recurrent acute episodes of stridor and respiratory distress. More pronounced with exercise, resolved during sleep.
Vocal cord paralysis	May be idiopathic, iatrogenic or caused by neurological abnormality/injury.
Severe Obstructive Sleep Apnoea	secondary to adenotonsillar hypertrophy Commonly present due to an acute infective exacerbation and may present management challenges. Often have typical history of snoring +/- apnoea
Laryngo-tracheal stenosis	Secondary to endotracheal intubation especially traumatic or prolonged , but may occur after non-traumatic or brief intubation. Other causes: blunt trauma to neck, external compression of the airway and gastroesophageal reflux
Recurrent respiratory papillomatosis	Secondary to Human Papilloma Virus (HPV).
Tumour	Any tumour eg mediastinal cyst, teratoma, lymphoma, that compresses the airway. Majority are intrathoracic, extrinsic to the airway, & cause expiratory stridor.
Hypocalcaemic laryngeal spasm (rare)	Associated with vitamin D deficiency, metabolic or endocrine disorders (e.g. renal failure, hypoparathyroidism).

Age	Plain E.T.T. Internal Diameter (#ID, mm)	Length Oral (cm at	Length Nasal (cm at nose)	Microcuff Size (#ID, mm)	Bougie Size (Ch or FG)	LMA Size	Suction (Ch or FG)	Cricothyroid Needle (G)	Quicktrach (#ID, mm)
Preterm <2kg	2.0,2.5	6-7	7.5-9	-	5 = 1.7mm	1	6	18G =1.27mm	2.0
Preterm 2-4kg	3.0,3.5	7-8.5	9-10.5	3 (if >3kg)	5	1	6,7	18G	2.0
Term -3 months	3.5	8.5-10	10.5-12	3	5	1	7	16G =1.65mm	2.0
3 m- 1year	3.5,4.0	10-11	12-14	3, 3.5	5	1.5	7,8	16G	2.0
1 year	4.0, 4.5	11-12	14-15	3.5	5	1.5, 2	8,10	14G =2.11mm	2.0
2 year	4.5, 5.0	12-13	15-16	4.0	10=3.3mm	2	10	14G	2.0
3 year	5.0	13-14	16-17	4.0	10	2	10	14G	2.0
4-6 years	5.0, 5.5	14-15	17-19	4.5	10	2,2.5	10,12	14G	2.0
6 –8years	6.0, 6.5	15-16	19-21	5.0	15 = 5mm	2.5	12	14G	2.0
>8 years	6.5, 7.0,7.5	16-20	20-23	5.5	15	3	14	14G	2.0 (<35Kg) 4.0 (>35 Kg)

Appendix 1: Croup Severity Scoring Chart

Hospital No:	DOB:
Patient Name:	Date:

Paediatric Croup Score Chart

Complete score hourly

Clinical Sign		Score	Time											
Stridor	None	0												
	When agitated	1												
	At rest	2												
Recession	None	0												
	Mild	1												
	Moderate	2												
	Severe	3												
Air entry on auscultation	Normal	0												
	Decreased with agitation	1												
	Decreased at rest	2												
Cyanosis	None	0												
	With agitation	4												
	At rest	5												
Conscious level	Normal	0												
	Altered	5												
Total Score		**/17**												

Modified Westley Croup Score 0-1 = Mild 2-4 = Moderate ≥ 5 = Severe Manage as acute stridor

REFERENCES

1. Robert, P. (2013). Evaluation and management of upper airway obstruction. *Paediatrics and Child Health*. Volume 23 (7), p. 301-306.
2. Loftis, L.L. (2019). Emergency evaluation of acute upper airway obstruction in children. [online] Available at: https://www.uptodate.com/contents/emergency-evaluation-of-acute-upper-airway-obstruction-in-children [Accessed 10 July 2021].
3. Quintero, D.R. and Khoulood, F. (2018). Assessment of stridor in children. [online] Available at: https://www.uptodate.com/contents/assessment-of-stridor-in-children [Accessed 10 July 2021].
4. Médecins Sans Frontières, (2020). *Clinical guidelines – diagnosis and treatment manual*. [online] Available at: https://medicalguidelines.msf.org/viewport/CG/english/acute-upper-airway-obstruction-16685571.html [Accessed 10 July 2021].
5. Woods, C. (2018). Croup: clinical features, evaluation, and diagnosis. [online] Available at: https://www.uptodate.com/contents/croup-clincal-features-evaluation-and-diagnosis [Accessed 10 July 2021].
6. Maloney, E. and Meakin, G. (2007). Acute stridor in children. *Continuing Education in Anaesthesia, Critical Care & Pain*. Volume 7 (6), p. 183-186.

Clinical Guidelines consulted:

1. Children's Acute Transport Service (2020). *Clinical guidelines: Upper airway obstruction*. [online] Available at: https://cats.nhs.uk/wp-content/uploads/cats_uao_2020-.pdf [Accessed 10 July 2021].
2. Royal Children's Hospital Melbourne (2020) Clinical guidelines: Croup (Laryngotracheobronchitis). [online] Available at https://www.rch.org.au/clinicalguide/guideline_index/Croup_Laryngotracheobronchitis [Accessed 1 Aug 2021].
3. Starship Children's hospital (2020) Clinical guidelines: Croup [online] Available at: [online] https://starship.org.nz/guidelines/croup [Accessed 1 Aug 2021].
4. Alder Hey Children's Foundation Trust, Clinical guidelines: Croup [online], [Accessed 10 July 2021].

USEFUL LINKS

GUIDELINES: http://www.nwts.nhs.uk/clinicalguidelines

- Crashcall **https://www.nwts.nhs.uk/documentation/crashcall**
- Management of paediatric Intubation and difficult airway
- Management of Button Batteries Ingestion
- How to tape an oral endotracheal tube
- Emergency management of blocked tracheostomy

EDUCATION: *www.nwts.nhs.uk/education-website*
Recorded sessions: ventilation strategies, management of upper airway obstruction, management of button battery ingestion

Login details for education site are available from your nursing and medical PCC ODN links
OR via email: info@nwts.nhs.uk

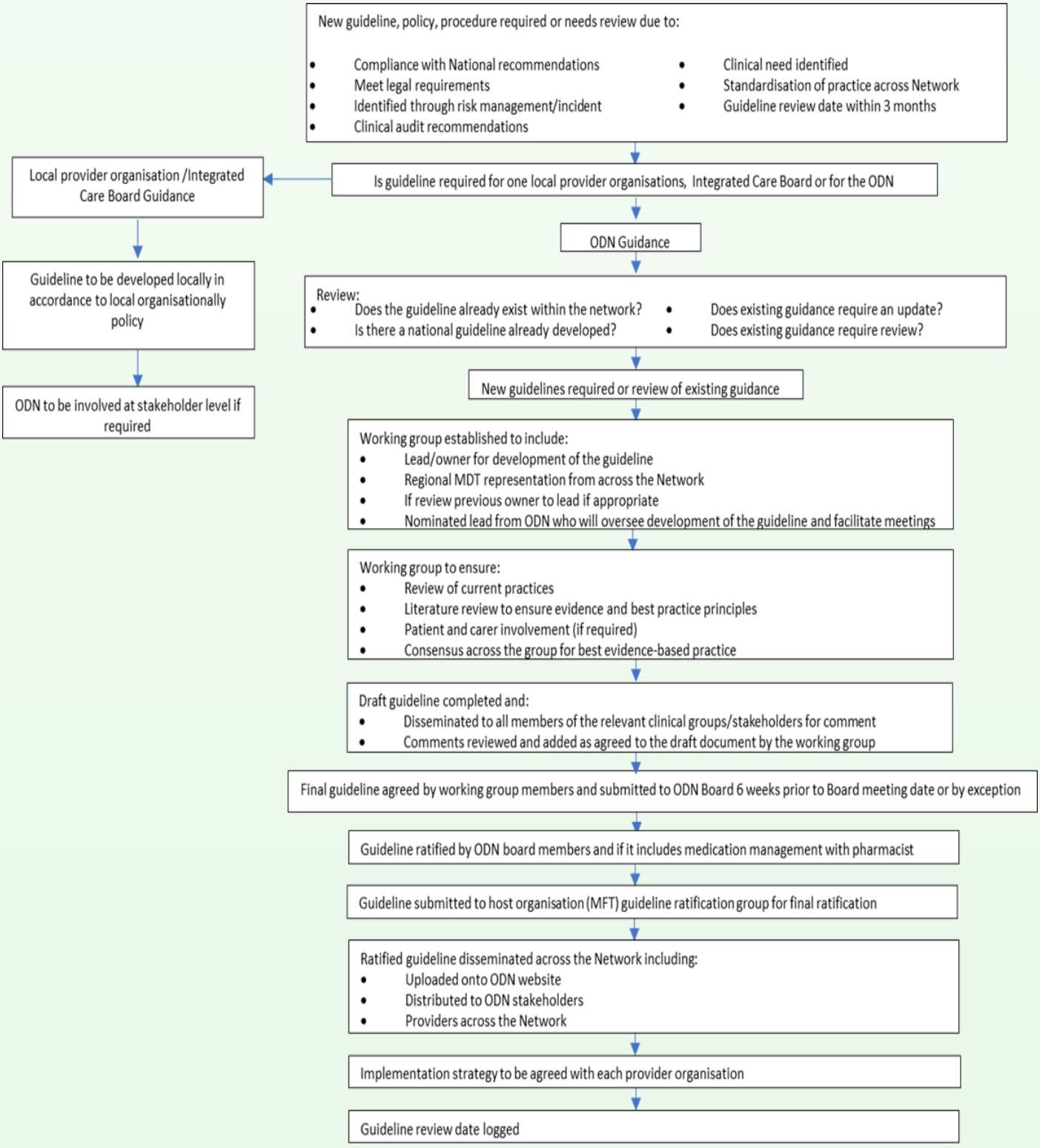
FOR DRUG DOSES:

British National Formulary for Children

Crashcall: link https://www.nwts.nhs.uk/documentation/crashcall

Management of Upper Airway Obstruction in a local hospital without tertiary paediatrics

Ratification Process



Further Resources

GUIDELINES FOR < 16 YEARS: ***www.nwts.nhs.uk/clinicalguidelines***

Crashcall: https://www.nwts.nhs.uk/documentation/crashcall intubation drugs / sedation regime / inotropes etc

NWTS LocSIPPS: includes checklists and sizes of ETT, suction, NGT, CVL & arterial lines

Guidelines include: intubation and difficult airway, how to tape an ETT, sepsis, insertion of intraosseous line, collapsed neonate or infant, STOPP tool and transfer

EDUCATION: ***www.nwts.nhs.uk/education-website***

Includes recordings of NWTS education eg management of upper airway obstruction, intubation, difficult airway including FONA

Login details for education site is available from your nursing and medical paediatric critical care (PCC) operational delivery network (ODN) links

OR via email: info@nwts.nhs.uk

CONTACT NUMBERS:
NWTS (North West (England) & North Wales Paediatric Transport Service) referrals: 08000 84 83 82
NWTS (North West (England) & North Wales Paediatric Transport Service) office: 01925 853 550
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NEXT REVIEW DUE: DECEMBER 2026

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Please visit NWTS website for the most up to date version of this guideline: www.nwts.nhs.uk