Nasopharyngeal tube – Clinical Practice Guideline
EVIDENCE TABLE

NOTE:

- Different Institutions and countries have varying methods of making or providing a Nasopharyngeal airway. Literature has been included in this evidence table if the artificial airway maintains the basic principle of bypassing the level of airway obstruction at the base of the tongue, but ending before the epiglottis.
- Conditions in infants causing Upper airway obstruction (UAO) at the level of the base of the tongue are relatively rare, and therefore large systematic reviews and randomised controlled trials are not available for this group.

Reference *(include title, author, journal title, year of publication, volume and issue, pages)*	**Method**	**Evidence level** *(I-IV)*	**Summary of recommendation from this reference**
Abel, F., Bajaj, Y., & Wyatt, M. ***The successful use of the nasopharyngeal airway in Pierre Robin Sequence: an 11-year experience.*** *Arch Dis Child 2012 97 pp 331-334*	*A Retrospective review of 104 cases of PRS over 10 years*	IV	• *A standard protocol for management of UAO was used for all admissions over the 10-year period.* • *A custom made Nasopharyngeal Airway (NPA) was fashioned from a cut down endotracheal tube (ETT).* • *Much of the UAO that occurs in PRS is at the level of the tongue base.* • *Treatment aims to move the tongue base out of the airway.* • *Prone positioning has been used to displace the tongue from the airway & is non invasive with minimal morbidity.* • *NPA required in more severe cases, but allows for natural growth and resolution to occur without unnecessary surgical interventions such as glossoplexy or mandibular distraction.* • *Nasopharyngeal Airway (NPA) successfully treated 80% of patients with moderate or severe UAO.* • *Those who did not achieve relief from UAO were referred to Surgeons for consideration of a tracheostomy (only 13% required tracheostomy)* • *An NPA was required for an average of 8 months with a range of 6 weeks – 27 months)* • *89% of patients required an NPA for less than 12 months.* • *An NPA can be used safely & successfully in the majority of patients with UAO related to PRS.*

Anderson, K.D., Cole, A., Chuo, C. B., and Slator, R. ***Home Management of upper Airway Obstruction in Pierre Robin Sequence Using a Nasopharyngeal Airway.*** *Cleft Palate-Craniofacial Journal 2007 44(3) pp269-273*	*Retrospective review over a 3.5 year period*	*IV*	• *Nasopharangeal tube (NPT) used to alleviate more severe obstruction* • *NPT are fashioned from Endotracheal tubes (Portex) with size and length determined according to infants weight (method of making tube different to RCH, but overall principle of alleviating UAO the same)* • *NPT relieves UAO in infants with Pierre Robin Sequence (PRS). Modified tube decreases airway resistance. Tube changes, fixation and management of the airway with a NPT easier for use in the home environment.* • *Revision of management protocol and grading of PRS cases, often allows management in the home environment, although previous authors have mixed results, and have advised against use* • *Infants are graded using clinical examination & oxygen saturation monitoring.* • *NPT removal considered after target weight gain of 3.5kg & satisfactory Sao2 monitoring.* • *Parents are trained to manage the NPT & feeding tubes in the home environment and is signed off on competencies to manage them.*
Chang A.B., Masters I.B., Williams G.R., et al. ***A Modified Nasopharyngeal Tube to relieve high upper Airway Obstruction.*** *Pediatric Pulmonology 2000 29:299-306*	*Retrospective review of a treatment modality*	*IV*	• *Upper Airway Obstruction (UAO) leads to hypoxia, hypercapnia, corpulmonale, Failure to thrive and Gastro Oesophageal Reflux (GOR), Hypertension and Cardiac failure, neurological impairment and death.* • *A modified NasoPharyngeal Tube relieved high UAO and surgical intervention was not required.* • *Weight gain significantly improved once a NPT airway was used* • *Required for median of 6 months but sometimes as long as 12 months* • *Safe and easy to use* • *Less airway resistance to a full NPT* • *UAO naturally resolves as the infant grows*

Chigurupati R., Massie J., Dargaville P. and Heggie A. ***Internal Mandibular Distraction to relieve airway obstruction in infants and young children with micrognathia.*** *Pediatric Pulmonology 2004 . 37:230-235*	*Case series of effectiveness of Internal mandibular distraction*	IV	• *Airway obstruction common complication in children with PRS, Treacher Collins and Nager syndrome* • *Early recognition and treatment of UAO due to micrognathia may avert serious long term sequale such as cor pulmonale and developmental delay* • *MDO may prevent need for tracheostomy* • *Multidisciplinary approach* • *Most common treatment methods are prone positioning, nasopharyngeal airway and tracheostomy.* • *Improved oral feeding after distraction* • *Difficult to predict who's airway obstruction will improve spontaneously* • *Airway size and dimensions of the mandible do not predict need for intervention* • *Investigations that assess airway function are more helpful than anatomical assessments alone*
Cole A., Lynch P., Slator R., & Phil D. ***A New grading of Pierre Robin Sequence*** *Cleft palate – Craniofacial Journal 2008 45(6)603-606*	*Case series demonstrating a method of grading severity of PRS*	*IV*	• *PRS is a combination of Micrognathia, Cleft palate and Glossoptosis with varying degrees of feeding difficulties and upper respiratory obstruction. These babies are at a high risk of Failure to thrive.* • *Feeding difficulties in PRS often not recognised in grading of severity, and grading is often done retrospectively.* • *Advocate Prospective classification of severity of PRS.* • *This author prospectively categorises into 3 grades. Done in the maternity unit, and guides the management regime.* • *Grade 1: Nursed side to side – Glossoptosis mild and inconsistent. RDS in supine position mild. Orally fed, but weight gain watched. If weight gain drops the baby is reclassified into grade 2.* • *Grade 2: Nasogastic feeding and Nursed side to side: Intermittent RDS, failure to thrive or RDS after an oral feed* • *Grade 3: Nasopharyngeal airway, Nasogastric feeding and side to side nursing: moderate to severe upper airway obstruction* • *Some babies require regrading over time and careful monitoring following allocation to a grade is fundamental* • *Grading leads to clearer management & greater awareness of the nature of each individual babies problems.*

Evans, K. N., Sie, K. C., Hopper, R. A. et al ***Robin Sequence: From Diagnosis to Development of and Effective Management Plan.*** *Pediatrics 2011 127(5) pp 936-948*	*Review article*	*IV*	• *2 main problems in PRS – feeding difficulties and UAO* • *Without treatment infant may succumb to asphyxia, hypoxia, respiratory failure, cor pulmonale, malnutrition and death.* • *Significant airway obstruction may present after the newborn period, and may become more noticeable in the second month of life.* • *First line management is prone positioning* • *Ongoing monitoring of breathing, feeding and growth is critical.* • *When prone positioning fails UAO may be relieved by placement of a nasopharyngeal airway (NPA).* • *Obstruction relieved by breaking the seal between the tongue and the posterior pharynx* • *Relief of UAO, normalisation of O2 saturation and weight gain have been well described with nasopharyngeal airway use* • *Transition to the home environment possible when parents comfortable with tube care.* • *Nasopharyngeal airway is now viewed as a safe and effective option for infants with PRS in many institutions.*
Lidskey M.E., Lander T.A., Sidman J.D. ***Resolving feeding difficulties with early airway intervention in Pierre Robin Sequence.*** *The Laryngoscope (2007) 118 pp120-123*	*Retrospective review of timing and intervention with Distraction osteogenesis with relation to long term feeding support.*	*IV*	• *Timing of airway intervention is an important factor when trying to prevent feeding problems due to UAO.* • *Feeding difficulties in PRS are characterised by low oral intake, feeds exceeding 30 min, fatigue, coughing, gagging, and vomiting. These difficulties are hypothesised to occur secondary to UAO.* • *Feeding difficulties can be resolved with early airway intervention* • *Feeding difficulties are due to micrognathia and glossoptosis* • *Problematic Oral intake is not due poor swallowing (reported by some), as feeding improves with surgical airway intervention* • *PRS babies divided into two groups – syndromic (sPRS) and isolated PRS (iPRS). (Isolated PRS is not associated with a known syndrome)* • *iPRS fare better with conservative treatment than sPRS* • *In iPRS early airway intervention dramatically reduces the need for feeding intervention (such as gastrostomy)* • *In i PRS delaying airway intervention increases the need for g-tube placement for long term eating problems even after resolving UAO.* • *PRS patients need more radical airway intervention, and are more likely to need g-tube placement regardless of the timing of airway intervention.* • *Tracheostomy considered last resort due to complications & co morbidities* • *MDO fewer complications and higher success rate.*

Marques I. L., Bettiol H., De Souza L. et al ***Longitudinal study of the growth of infants with Isolated Robin Sequence considered being severe cases.*** *Acta Paediatricia (2008) 97 pp 371-375*	*Prospective longitudinal case series examining weight and length growth of severe cases of PRS with NPT and hyper caloric diet in the first 6 months.*	*IV*	• *PRS defined by retromicrognathia and Glossoptosis with or without cleft palate, is characterised by Upper airway obstruction and respiratory and feeding difficulties which are more frequent and more severe in the first months of life* • *Anomaly can be isolated RS, or as a component of a known syndrome or other malformations that do not characterize a known syndrome.* • *Clinical expression ranges from discrete respiratory and/or feeding difficulties to severe asphyxia crises requiring rapid medical intervention for survival.* • *Most frequent treatment modalities prone positioning, NPT, Glossopexy, tracheostomy and mandibular distraction* • *Few studies on growth in PRs in the literature* • *Advocate use of Feed facilitating techniques (FFT) such as pacifier, massage of tongue, manual support and stabilisation of mandible during feeding, long soft nipple with enlarged hole, rhythmic movement of the nipple in the mouth during feeding and nipple placement on the centre of the tongue.* • *FFT's can promote oral feeding and permit early removal of the feeding tube, avoiding possible surgeries of gastrostomy.* • *Use of NPT improves respiratory and feeding difficulties* • *Weight and length growth is impaired in PRS in the first 6 months of life.* • *Weight impairment suggests the need for a special diet in PRS babies to meet their caloric requirements* • *Use of FFT and hyper caloric diet was not sufficient to improve weight gain. Malnutrition persisted through the first 6 months of life.* • *Use of NPT and hyper caloric diet can improve weight gain* • *Length of time of use of NPT was shorter in babies that received the hyper caloric diet.* • *Mandibular distraction improved respiratory difficulties but not feeding difficulties.*

Marques I.L., Monteiro L. C. S., De Souza, L. et al ***Gastroesophageal reflux in severe cases of Robin Sequence treated with Nasopharyngeal Intubation.*** *The Cleft Palate – Craniofacial Journal 2009 46(4) pp 448-453*	*Longitudinal Prospective case series looking at the relationship between PRS, GOR and NPT use*	*IV*	• *GOR significantly higher in babies with PRS at 2 and 4 months of age, but no GOR present at 6 months* • *Presence of respiratory obstruction is the most important factor in predisposing infants to GOR than presence of feeding tubes.* • *Improvement of respiratory difficulties will lead to improvement in feeding difficulties* • *Opening of airways in combination with antireflux medication reduces GOR in PRS* • *Relief of respiratory discomfort and improvement in oral feeding occurred in 90% cases after insertion of NPT.* • *Non-surgical procedures effective in improving respiratory and feeding difficulties.* • *90% of babies exclusively oral feeding at 70 days with NPT insitu.* • *Some authors suggest Motor dysfunction of upper digestive tract in infants with PRS* • *Authors Suggest PRS babies have a predisposition to abnormal Gastroesophageal reflux. Theorise that Respiratory obstruction and inspiratory effort cause increased intrathoracic negative pressure triggering Gastroesophageal reflux* • *GOR improves after treatment with mandibular distraction and alleviation of respiratory obstruction* • *GOR difficult to diagnose in PRS as vomiting, regurgitation and poor weight gain can result from work of breathing with consequent oropharyngeal dysphagia.* • *Dysphagia aggravated tongue position & cleft palate which predisposes ineffective oral suction and excessive air swallowing during feeds.*
Parhizkar, N., Saltzman, B., Grote, K., Starr, J., Cunningham, M., Perkins, J., Sie, K. (2011) ***Nasopharyngeal airway for management of airway obstruction in infants with micrognathia****. Cleft Palate-Craniofacial Journal, 48(4) pp478-482*	*Retrospective case series*	*IV*	• *35 infants during the study period from 1996-2006 with a variety craniofacial anomalies and upper airway obstruction (51.4% of whom had the diagnosis of Pierre Robin sequence) were treated with nasopharyngeal airway (NPA) during infancy* • *Advantages of NPA are that it is a non-surgical procedure and does not require anaesthesia, and that these patients may be discharged home and followed as outpatients.* • *Most patients with an NPA insitu require feeding intervention.*

Salmon I.C.D.M and Marques, I.L. (2015) ***In situ and home care nasopharyngeal intubation improves respiratory condition and prevents surgical procedures in early infancy in severe cases of Robin sequence.*** *BioMed Research International, Volume 2015, Article ID 608905, 7 pages* *http://dx.doi.org/10.1155/2015/608905*	*Clinical Study*	*IV*	• *107 infants in a 7 year period with Robin Sequence, sever e respiratory symptoms and type 1 or 2 airway obstruction as classified with Sher, were treated with a nasopharyngeal airway (NPA).* • *Management with a NPA continues in hospital and then at home until a NPA was no longer required. Mean time with a NPA insitu was 57.4 +/- 37.6 days. There were no nasal injuries and no untoward incidences at home. NPA was safely managed at home by trained parents.* • *In this group studied, NPA improved respiratory difficulties and improved feeding difficulties with 85% of patients fed orally.* • *There was low morbidity and zero mortality in this group in the first year of life.*
Sher A. ***Mechanisms of airway obstruction in Robin sequence: Implications for Treatment.*** *Cleft palate Craniofacial Journal (1992) Vol 29 no.3* *(Classic article)*	*Retrospective review / Case series investigating the mechanism of airway obstruction from endoscopic investigations*	*IV*	• *Maturational differences in UAO improve as the neonate matures* • *Not all infants with PRS have airway obstruction* • *UAO becomes worse with Upper Respiratory Tract Infection (URTI)* • *Short term benefit in prone positioning – resistance to airflow least in the prone position* • *Positioning alone rarely effective long term* • *Upper airway obstruction in PRS is not always due to Glossoptosis. Other mechanisms have been found.* • *Types of airway obstruction divided into 4 grades. Grade 1 responds to interventions such as glossoplexy, whilst types 2, 3 & 4 need tracheostomy (NB: This is a classic article, and since then other interventions are now available).*

Shprintzen R.J. ***The implications of the diagnosis of Robin Sequence***. *Cleft Palate-Craniofacial Journal (1992) 29 no.3* *(Classic article)*	*Case series*		• *PRS a sequence, not a syndrome as there are multiple anomalies caused by one single anomaly of the mandible.* • *The primary anomaly of PRS is micrognathia and the cleft palate and upper airway obstruction are the consequences of the mandibular anomaly.* • *However the mandibular anomaly may have many different causes* • *Micrognathia does not always result in airway obstruction* • *Jaw will remain small throughout life if associated with a syndrome* • *If micrognathia due to the mandible positionally constricted in utero jaw catch up growth will occur* • *Strong association with sticklers syndrome* • *Obstructive apnoea not always accompanied by a stridor* • *Obstruction may be completely silent during periods of apnoea or dyspnoea* • *Chest will move during obstructive apnoea giving a false sign all is well* • *Prone positioning is of minimal help* • *Failure to thrive is almost always related to upper airway obstruction* • *Feeding problems should alert to breathing problems* • *Assumptions that feeding problems are due to the cleft palate are common* • *PRS babies swallow more air during feeding, and stop to breathe more frequently. This prolongs feeding times. More frequent burping required.* • *A long feed will burn off more calories than is consumed during the feed* • *An enlarged hole in the teat will speed up feeding* • *Hold nipple to the side of the mouth when feeding (to compensate for the cleft palate)*

Key abbreviations:

Gastro oesophageal Reflux (GOR)
Mandibular Distraction Osteogenesis (MDO) – *also known as Jaw distraction*
Nasopharyngeal Tube (NPT)
Pierre Robin Sequence / Syndrome (PRS)
Upper Airway Obstruction (UAO)
Upper Respiratory Tract Infection (URTI)
Feed facilitating techniques (FFT)

A guide to Levels of Evidence

Clinical Guidelines and parent information (Kids Health Info)
Royal Children's Hospital

The Hierarchy of Evidence

The Hierarchy of evidence is based on the National Health and Medical Research Council (2000) and Oxford Centre for Evidence-based Medicine Levels of Evidence (May 2001)

I Evidence obtained from a systematic review of all relevant randomised control trials.

II Evidence obtained from at least one properly designed randomised control trial.

III-1 Evidence obtained from well-designed pseudo-randomised controlled trials (alternative allocation or some other method).

III-2 Evidence obtained from comparative studies (including systematic reviews of such studies) with concurrent controls and allocation not randomised, cohort studies, case control studies, or interrupted time series with a control group.

III-3 Evidence obtained from comparative studies with historical control, two or more single–arm studies, or interrupted time series without a parallel control group.

IV Evidence obtained from case-series, either post-test or pre-test and post test.

V Expert opinion without critical appraisal, or based on physiology, bench research, or historically based clinical principles.

Kids' health info and clinical guidelines are based on reviews of the best available evidence. **Level 1 evidence represents the gold standard for intervention studies;** however it is not available for all areas of practice and for some factsheets it may be appropriate to utilise results from studies with lower levels of evidence. **Many factsheets may also be informed by experts in the field**, locally (RCH) and internationally – journal articles, expert opinion etc. This NHMRC hierarchy can be used to grade evidence. Please record details on the evidence table and return to Kids Health Info with your final draft. If you are basing parent info on a guideline, the Evidence Table will be the same.