GUIDELINE

Pierre Robin Sequence (PRS) /Robin Sequence (RS)

Scope (Staff):	Nursing and Medical Staff
Scope (Area):	NICU KEMH, NICU PCH, NETS WA

CAHS commits to being a child safe organisation by applying the National Principles for Child Safe Organisations.

Read the full statement here:
CAHS Child Safe Organisation Commitment Statement.

This document should be read in conjunction with this disclaimer

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Aim

To provide standardized management and follow up to infants and families of infants with Pierre Robin Sequence (PRS) or more recently known Robin Sequence (RS)

Risk

Infants with PRS may not receive appropriate inpatient management and follow-up if a standardised management plan is not followed.

Background

The term Pierre Robin sequence (PRS) was first introduced by Pierre Robin in 1923, defined as the presence of micrognathia leading to glossoptosis and resulting in upper airway obstruction. Presence of cleft palate is not necessary for clinical diagnosis of PRS/RS, however, is seen in 50-70% of PRS/RS cases. PRS/RS affects males and females in equal numbers, with an estimated prevalence of about 1 in 8,000 live births. PRS/RS has a wide spectrum of phenotypes with varying degrees of airway obstruction at different levels.

Many infants with PRS/RS have additional associated syndromes which further complicates the diagnosis and standardisation of management. Airway obstruction is thought to worsen in the first few weeks of life and improves thereafter as the mandible growth accelerates around 18-24 months of life. Infants with PRS/RS often have difficulty in feeding due to upper airway obstruction leading to poor suck swallowing coordination, cleft lip or palate, associated function weakness of upper airway muscles, etc. Achieving adequate growth with a safe feeding method is paramount for infants with PRS/ RS. A multidisciplinary approach is crucial in the management of patients with PRS/RS to obtain safe airway management, palate closure, satisfactory growth, and providing integrated follow-up care.

Antenatal Consultation

PRS/RS is difficult to diagnose on routine ultrasound imaging during pregnancy and hence many cases are diagnosed after delivery. If the diagnosis of micrognathia is suspected or known antenatally the mother should be offered an antenatal consultation with a Neonatal Consultant to develop a Neonatal Management Plan.

Clinical Description

The diagnosis of PRS/RS can be established based on the characteristic clinical trio of

- Micrognathia (MMD>4mm)
- Glossoptosis (tongue verticalization with forward movement limitation)
- Airway obstruction/respiratory difficulty.

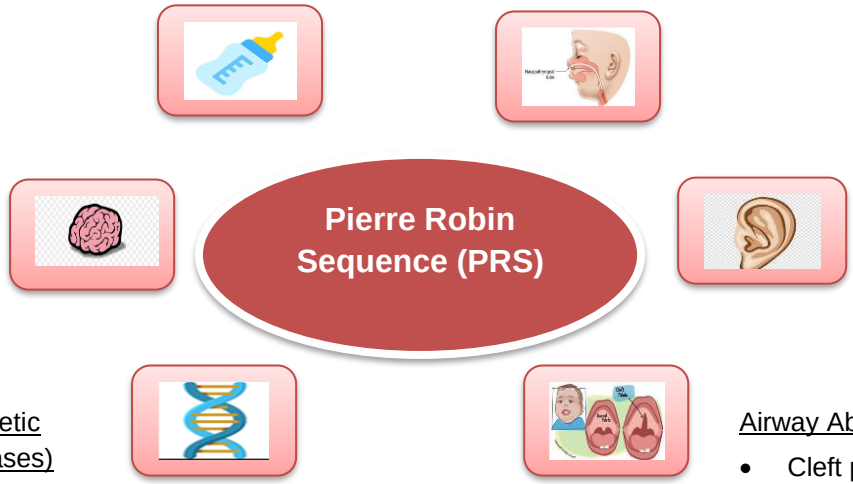
Common clinical features and medical complications in PRS/RS:

Feeding and Growth

- Swallowing discoordination
- Poor suck swallow coordination in presence of cleft
- Aspirations due to upper airway weakness
- Poor weight gain
- Gastroesophageal reflux
- Hyponatremia due to losses in excessive secretion

Respiratory Features

- Obstructive sleep apnoea
- Severe obstruction may not be associated with desaturation
- Worsening of airway obstruction in first 4-6 weeks of age
- Associated severe desaturation with obstructive episodes.
- Risk of aspiration pneumonia



Long Term Developmental Concerns

- Speech delay
- Rhinolalia in speech common
- Eating disorder
- Cognitive delay

Other

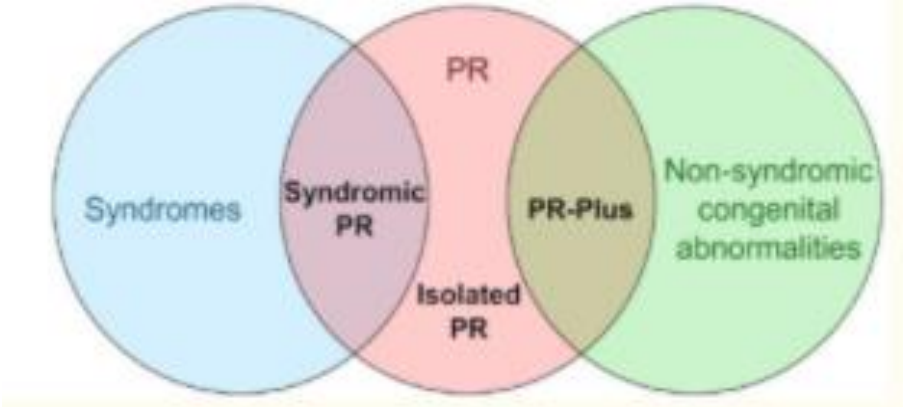
- Middle ear dysfunction (80% cases)
- Vision issues (10-30% cases)

Common associated genetic conditions (in 60-80 % cases)

- Stickler syndrome
- Chromosome 22q11.2 deletion syndrome (velocardiofacial syndrome)
- Treacher Collins syndrome
- Partial trisomy 11q;
- Trisomy 18 syndrome;
- Cerebro-costo-mandibular syndrome
- Catel Manzke syndrome

Airway Abnormalities

- Cleft palate with or without cleft lip (50-70% cases)
- Upper airway obstruction at glossptosis level
- Laryngomalcia
- Tracheo-bronchomalacia
- Synchronous airway lesions (SALs) causing multilevel obstruction, more common in associated syndrome



Initial Neonatal Management

- Admit to the NICU following birth and when stabilised transfer to 3B PCH for ongoing management. Clinical examination of the baby by the Senior Registrar or Neonatal Consultant to evaluate for syndromic association and refer to genetics for inpatient review if concerns.
- Severe cases of upper airway obstruction may require Intubation. Consider alterative airway devices for difficult airways, refer to Difficult Airway (Neonatal)
- Cardiorespiratory monitoring, nursed in the prone position. If clinically significant airway obstruction despite prone position, consider inserting Nasopharyngeal Airway (NPA) (Appendix 1) or supporting airway with CPAP/NIV.
- Complete microarray (parental consent required)
- Clinical evaluation for the severity of micrognathia; Discuss with parents the need for clinical photos and obtain consent. Contact PCH Clinical Photography (extension 60357) for 3D facial photos when inpatient at 3B.
- Referral and assessment of suck feeding by the feeding team and experienced bedside nurse (Appendix 2)
- All infants to be referred to ENT for a Flexible Nasopharyngeal Endoscopy (FNE) in the first week of life (Appendix 3)
- All infants to be referred to the PCH Respiratory Team for an inpatient sleep study at 7- 10 days of age. Aim to do a diagnostic sleep study in half supine and half prone sleep. The sleep study can be organised as a daytime study on the ward with adequate sleep scientist support. Refer to the sleep study request form in Appendix 4.
- Inpatient referral from 3B to Plastic Surgeons for review of retrognathia/micrognathia.

Management of Palate/Cleft lip

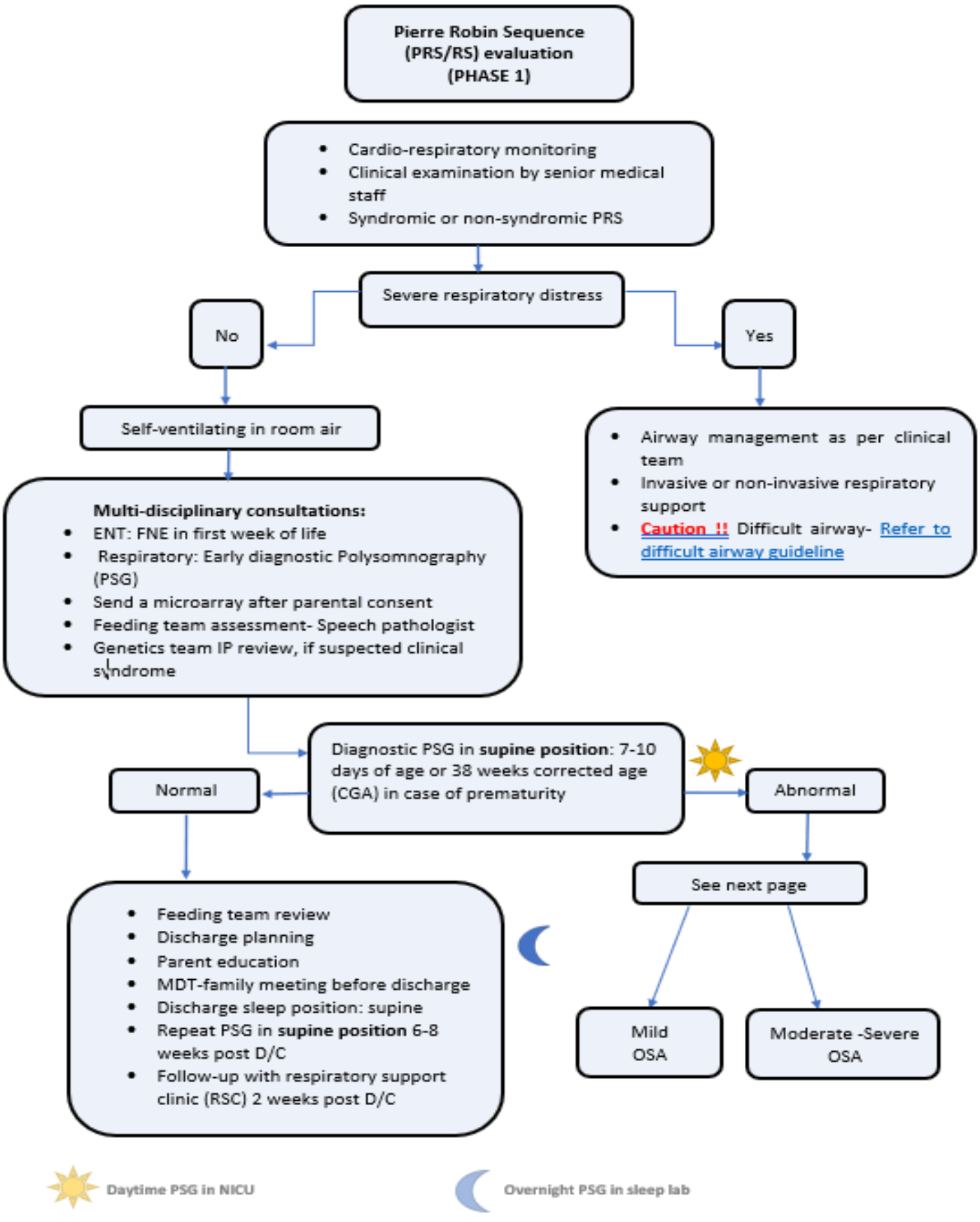
Refer to the Neonatal Cleft Lip and Palate guideline.

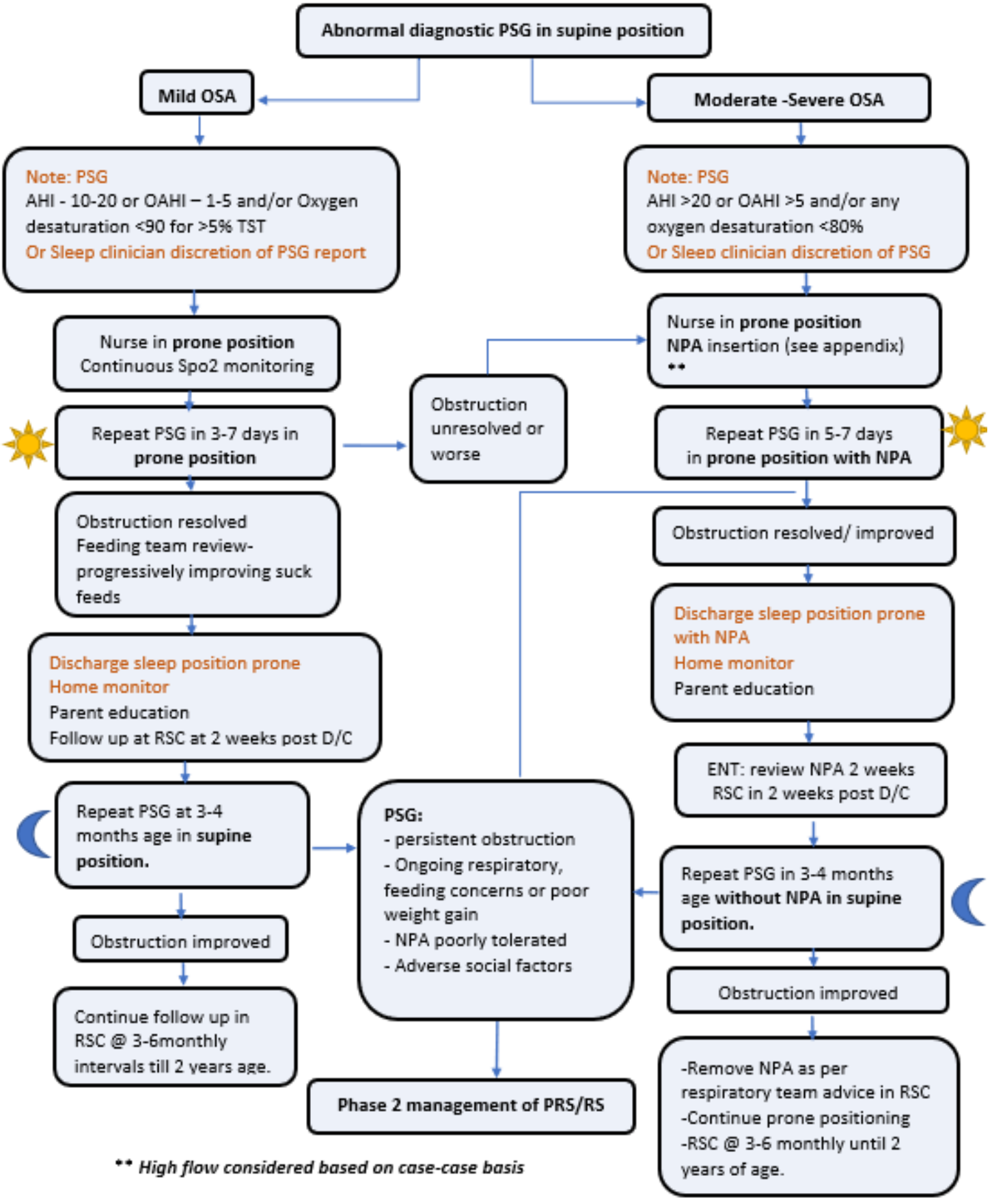
Management of upper airway obstruction and feeding:

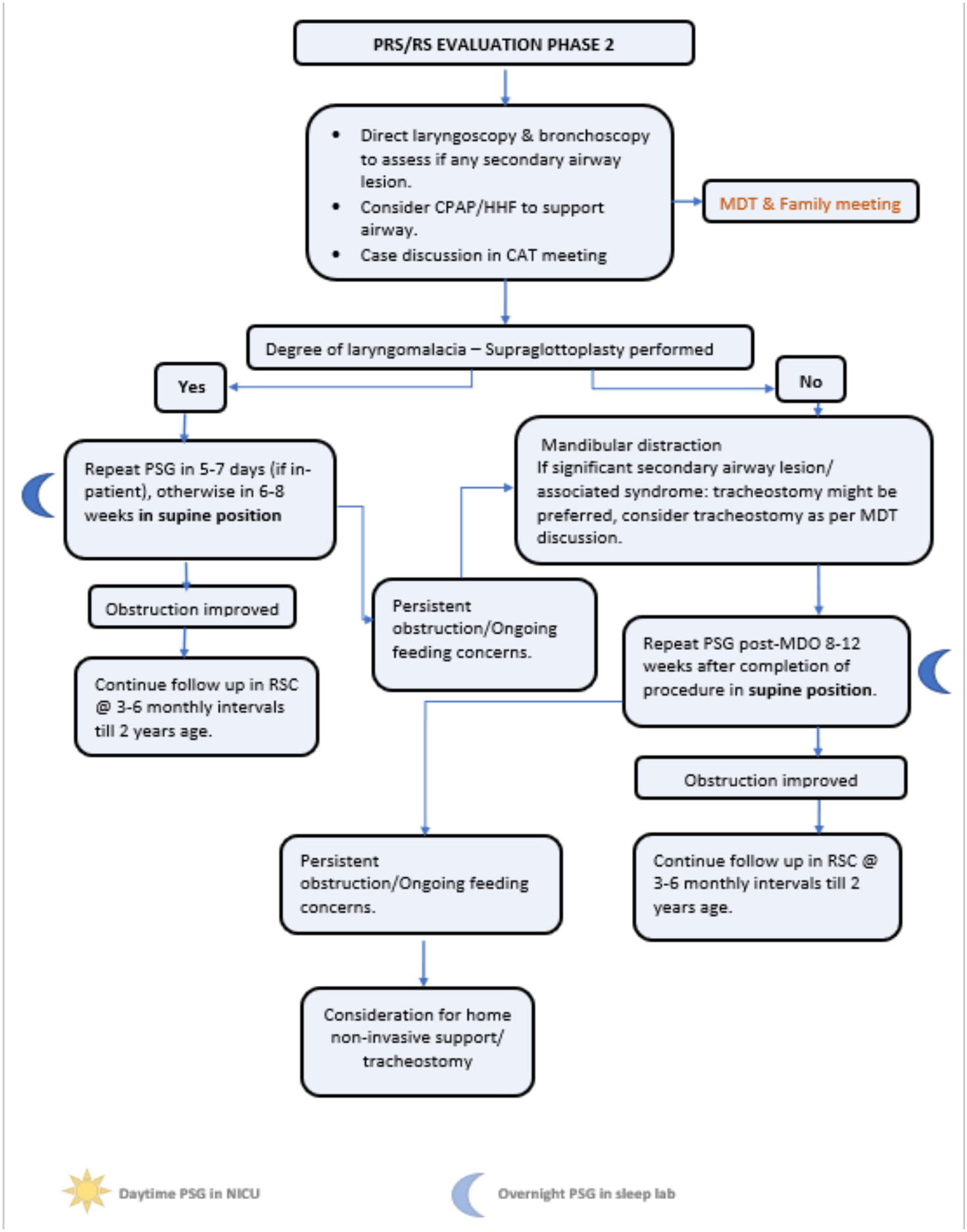
Ongoing management is based on the severity of obstruction as identified by PSG

- Multidisciplinary approach/discussion relating to airway management at the fortnightly Complex Airway Team (CAT) Meeting
- All infants going home with a NPA to be assessed by ENT for pharyngeal dysphagia by Fiberoptic Endoscopic Evaluation of Swallowing (FEES) the week before discharge.
- Maintaining adequate weight gain is essential. Consider fortified feeds to supplement nutritional intake, to achieve adequate growth. Monitor serum sodium level (if concerns of excessive losses in secretions) and consider the need for sodium supplementation for adequate growth.

Sleep Studies (Polysomnography - PSG)




Abnormal diagnostic PSG in supine position
Mild OSA
Moderate -Severe OSA
Note: PSG
AHI - 10-20 or OAHI – 1-5 and/or Oxygen desaturation <90 for >5% TST
Or Sleep clinician discretion of PSG report
Note: PSG
AHI >20 or OAHI >5 and/or any oxygen desaturation <80%
Or Sleep clinician discretion of PSG
Nurse in prone position
Continuous Spo2 monitoring
Repeat PSG in 3-7 days in prone position
Obstruction unresolved or worse
Nurse in prone position
NPA insertion (see appendix) **
Repeat PSG in 5-7 days in prone position with NPA
Obstruction resolved
Feeding team review- progressively improving suck feeds
Obstruction resolved/ improved
Discharge sleep position prone
Home monitor
Parent education
Follow up at RSC at 2 weeks post D/C
Discharge sleep position prone with NPA
Home monitor
Parent education
ENT: review NPA 2 weeks
RSC in 2 weeks post D/C
Repeat PSG at 3-4 months age in supine position.
PSG:
- persistent obstruction
- Ongoing respiratory, feeding concerns or poor weight gain
- NPA poorly tolerated
- Adverse social factors
Repeat PSG in 3-4 months age without NPA in supine position.
Obstruction improved
Obstruction improved
Continue follow up in RSC @ 3-6monthly intervals till 2 years age.
Phase 2 management of PRS/RS
-Remove NPA as per respiratory team advice in RSC
-Continue prone positioning
-RSC @ 3-6 monthly until 2 years of age.
** High flow considered based on case-case basis
Daytime PSG in NICU
Overnight PSG in sleep lab


PRS/RS EVALUATION PHASE 2
Direct laryngoscopy & bronchoscopy to assess if any secondary airway lesion.
Consider CPAP/HHF to support airway.
Case discussion in CAT meeting
MDT & Family meeting
Degree of laryngomalacia – Supraglottoplasty performed
Yes
No
Repeat PSG in 5-7 days (if in-patient), otherwise in 6-8 weeks in supine position
Mandibular distraction
If significant secondary airway lesion/ associated syndrome: tracheostomy might be preferred, consider tracheostomy as per MDT discussion.
Obstruction improved
Persistent obstruction/Ongoing feeding concerns.
Repeat PSG post-MDO 8-12 weeks after completion of procedure in supine position.
Continue follow up in RSC @ 3-6 monthly intervals till 2 years age.
Obstruction improved
Persistent obstruction/Ongoing feeding concerns.
Continue follow up in RSC @ 3-6 monthly intervals till 2 years age.
Consideration for home non-invasive support/ tracheostomy
Daytime PSG in NICU
Overnight PSG in sleep lab

Discharge Planning

Aim to discharge by 3-6 weeks of age. Safe discharge criteria:

Infant:

- No clinically significant bedside desaturations.
- Sleep study showed no or minimal upper airway obstruction
- Commenced on suck feeds and deemed safe on feeding assessment or by the feeding team when NPA required.
- Adequate weight gain; 150-200 grams/week.
- Reviewed by ENT CNS, Feeding Team, Plastic Surgeons, and Respiratory Team prior to discharge.

Parent / Caregiver:

- Confident in feeding the infant.
- Confident with the basic care/positioning of their infant.
- Completion of the Gastric Tube Feeding Learning Package if gastric tube feeds are required.
- Meet with the ENT CNS (ext: 65507) if NPA in situ for NPA management and training.
- Education for Safe Infant Sleeping
- Attendance at Infant Resuscitation training.
- Home monitoring supplied and parent/s competent with the use of the monitor.
- Car Seat Challenge; 30-60 minutes: no desaturation
- Referral to Cleft Pals Association of Western Australia by the Cleft Palate coordinator/nurse (ext: 64380). Cleft Pals provide Haberman Feeders to purchase and offer support groups.
- Rural/regional families – travel advice: adult to travel in the back seat with the infant during long car trips. Ensure suitable breaks if journey is a significant distance.
- Provide information on resources
    - Pierre Robin Australia website: Pierre Robin Australia
    - CleftPALS WA: https://www.cleftpalswa.org.au/

Follow up and Outpatient Referrals

Referral Service	Additional Information
Home Monitoring Clinic	**e-referral:** 1 week prior to discharge to arrange home monitor
Feeding Team	**e-referral:** all PRS/RS infants are referred regardless of feeding method. Advise of plans to discharge home with expected feeding methods
PCH Sleep Service	**e-referral:** Please state “Newborn infant with PRS/RS. Follow–up in respiratory support clinic at 3 weeks post discharge with a sleep study at 6 weeks of age/post discharge, whichever is a later”
ENT CNS	Fortnightly phone consult with parents/caregiver post discharge until ENT clinic appointment
ENT Clinic	**e-referral:** Please state “PRS/RS infant for review with ENT Consultant Dr Hayley Herbert, 6 weeks post discharge”
Hospital in the Home	**e-referral and phone call handover:** for infants going home with gastric tube feeds
PCH Cleft Palate Clinic	**e-referral:** PRS/RS with cleft
Genetic Services	**e-referral or Central Referral Service**
Hearing Assessment	Refer to PCH Audiology/ENT if failed newborn hearing screen. All PRS/RS infants will be referred in the first year of life
Ophthalmology	**e-referral:** High risk, PRS/RS infant to be reviewed in the first year of life
Neonatal Follow-up Clinic	4 month and 8 months for monitoring of growth and development

Related CAHS internal policies, procedures and guidelines
Neonatology Guidelines • Car Seat Challenge • Cleft Lip and Palate • Gastric Tube Feeding – Going Home • Genetics Referral Pathway • Intubation

- Difficult Airway (Neonatal)

References and related external legislation, policies, and guidelines

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3. Evans KN, Sie KC, Hopper RA, Glass RP, Hing AV, Cunningham ML. Robin sequence: from diagnosis to development of an effective management plan. Pediatrics. 2011;127(5):936-48.
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Useful resources (including related forms)

Nasopharyngeal Airway – Parent Education Record
https://www.cleftpalswa.org.au/
Infant Monitoring Clinic – Home Use Guide
Kids Health Information: Pierre Robin sequence (PRS) (rch.org.au)
Pierre Robin Australia
Safe Infant Sleeping

This document can be made available in alternative formats on request.

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Reviewer / Team:	Neonatal Coordinating Group / ENT / Speech Pathology / Respiratory Medicine / Genetics / Plastics / Medical Photography		
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Endorsed by:	Neonatal Coordinating Group		
Standards Applicable:	NSQHS Standards:  Child Safe Standards: 1,10		

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Appendix 1: Nasopharyngeal Airway Insertion and Management

Indications for Use

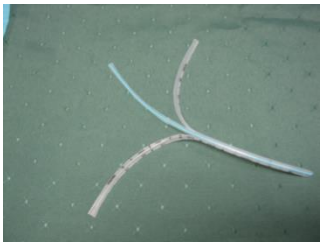
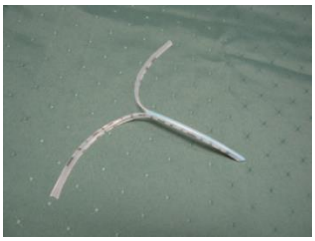
- Obstructive episodes.
- Respiratory distress.
- Episodes of desaturation.
- Sleep study indicating obstructive episodes.
- Poor feeding and weight gain.

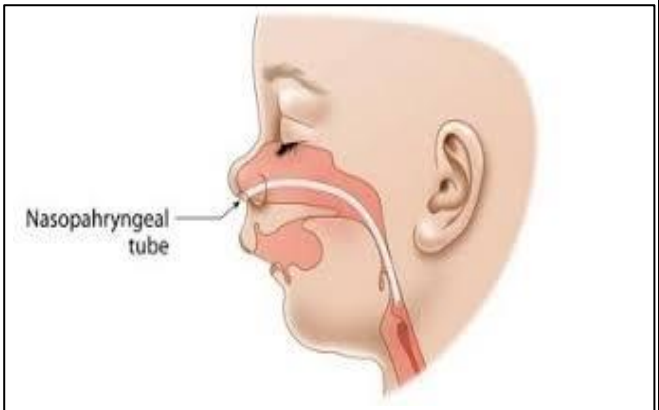
Equipment

- Ivory endotracheal tube.
    - Measure the length of the tube by measuring from the tip of the nose to the tragus of the ear and add 0.5cm. Cut the tube at the measured distance

Weight	ETT Size
< 1500 g	2.5 mm
1500-2500 g	3.0 mm
2500-3500 g	3.5 mm
> 3500 g	4.0 mm

- Saline.
- Fixomull tape.
- Skin preparation wipes.
- Sterile scissors.
- Sucrose.

Procedure	Additional Information
1. Medical staff (preferably ENT) to insert initial NPA under direct vision after FNE.	Nursing staff deemed competent in the procedure can insert subsequent NPA.
2. Select appropriate size tube and measure as per the above table.	
3. Cut ETT as described	Cut ETT into 3 strands Cut a 5cm length along either side of the blue line, then down the middle of the remainder of the tube  Trim off strand with the blue line, leaving 2 strands. 
4. Place infant in the supine position.	
5. Consider the use of oral sucrose.	
6. Moisten the tip of the tube with saline if required.	
7. Insert the tube into the nare and gently advance to the measured length.	The tip of the tube should end 1cm from the epiglottis
8. Secure cut lengths of the tube to either side of the nose along cheeks with fixomull	 Tape the NPA strands on either side of the nose along the cheeks

Procedure	Additional Information
9. Documentation	• ETT size and length at nare • Date for next tube change. • Condition of the infant during the procedure.
10. Lateral neck X-ray to be performed in neutral head position after initial insertion for confirmation of tube position.	 (picture adapted from RCH Melbourne website) The tip of the tube should end 1cm above the epiglottis

Note:

- NPA to be changed every 48 hours for the first 10 days and then weekly. Alternate nares when changing NPA
- A pre-cut ETT is to be kept at the bedside in case of accidental/unplanned removal of the tube.
- Review tube size and measurement, with every tube change.

Nursing Care of NPT

- Suction tube 2-3 hourly for the first 48-96 hours, then PRN.
- Observe and document at least each shift, condition of the skin around nares, and under taping.
- Change tape if soiled with milk or secretions. Remove the tape with adhesive remover.

Nasopharyngeal Airway – Parent Education Record

Appendix 2: Feeding Assessment

Initial suck feeds should be introduced with the Feeding Team, experienced nursing staff and caregiver. Infants with PRS/RS are a more complex patient group compared to infants with only a cleft palate concern. PRS/RS infants require swallow assessment in addition to multidisciplinary feeding input. Feeding and swallowing safely may be one of the most challenging tasks for these infants. Ensure laryngoscope and resuscitation equipment at the bedside.

Procedure

1. Position the infant on your lap in either an extreme upright position or an elevated side lying position. Ensure the infant is comfortable and you are able to achieve a stable/supported position so airway patency is optimised (infants with low tone may not be supported enough in the upright position).

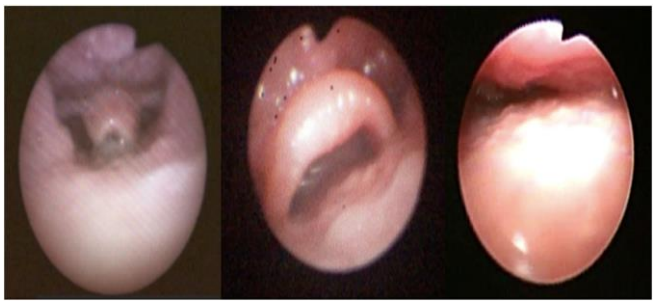
- Upright position: Place your hand between the infant's shoulders and the neck to support the baby during feeding. Place your feet on a foot stool. The baby should 'sit' on your thigh. Your body should be at a 90 degree angle. Take care that the baby's head/neck are not extended and their spine is straight (i.e. not flexed or twisted).
- Elevated side lying position: Position the baby on your lap or on a pillow on your lap in a side lying position. The infant's neck and spine should be in a natural straight alignment and hips should be flexed at 90 degrees. Place your feet on a foot stool so that the baby's head is above their bottom.

2. Use the MAM Squeezy Bottle with ward teat(s) or Pigeon squeezy bottle, place the nipple in the centre of the infants mouth and as the infant sucks gently squeeze the bottle (with your thumb and fore finger) to allow sufficient amount of milk to flow in the infant's mouth for them to swallow without choking. Co-ordinate squeeze, sucking and swallowing. Allow short breathing spells without removing teat from the mouth.
3. Ensure constant monitoring (cardiac, SaO_2 and direct vision) throughout the feed.
4. Babies with PRS/RS are at risk of becoming bottle aversive due to the difficulties they have with oral feeding and repeated negative touch to their face (e.g., due to NPAs, NGT insertion, tape changes, suctioning, etc.). Closely monitor the baby's cues throughout the feed and provide breaks or cease the feed if stress cues are demonstrated.
5. Excessive drooling/ frothing of milk are usually an indication of the teat sitting under the tongue. Remove the teat and place on top of the tongue.
6. Frequently burp the infant as they tend to swallow excessive amounts of air (Keep the infant in an upright forward leaning position to allow the infant's jaw to fall forward, thus preventing airway obstruction during the burping process).
7. If the feed is prolonged (30 minutes or more) consider finishing the feed via NGT to prevent the infant using excessive amounts of energy to feed.

Appendix 3: Flexible Nasopharyngeal Endoscopy (FNE)

Yellon classification of glossoptosis

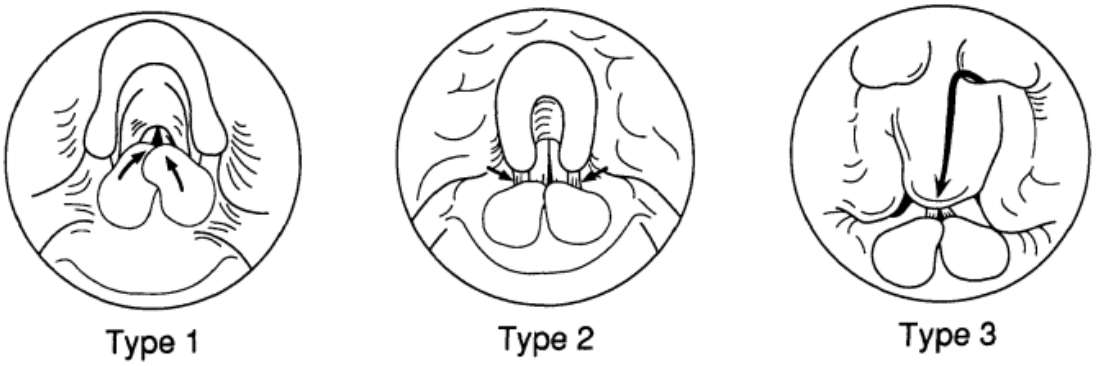
Grade 0	Normal airway
Grade 1	Posterior prolapse of epiglottis with obstruction of the airway but normal position of the base of tongue
Grade 2	Prolapse of the epiglottis and base of tongue with only the tip of the epiglottis visible and obliteration of the vallecula
Grade 3	Complete collapse of the tongue against the posterior pharyngeal wall with no portion of the epiglottis visible



Duarte, D.W., Schweiger, C., Manica, D., Fagondes, S., Fleith, I.J, et al. (2021), Predictors of Respiratory Dysfunction at Diagnosis of Robin Sequence. The Laryngoscope. https://doi.org/10.1002/lary.29685

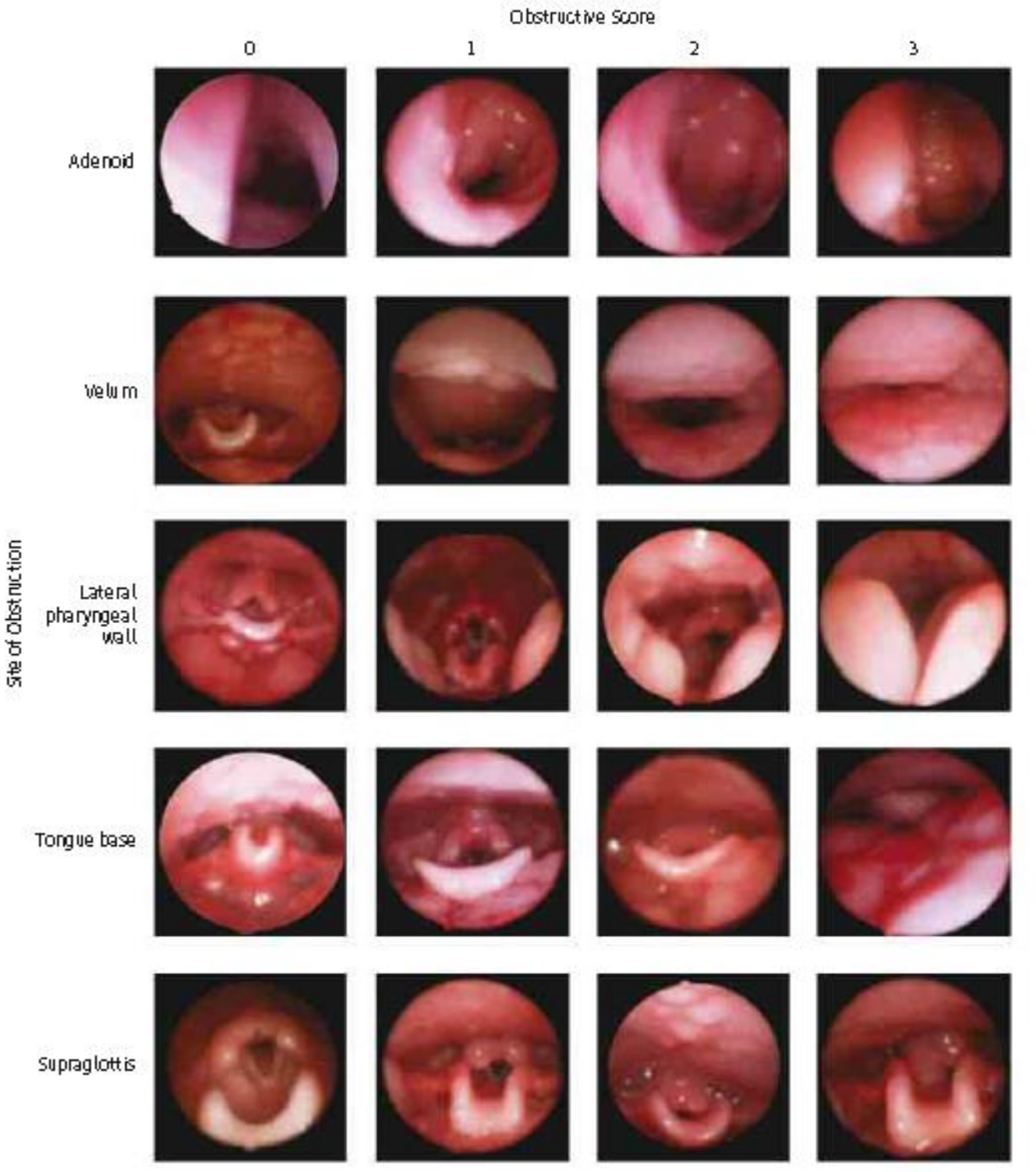
Laryngomalacia classification

Type 1	Prolapse of mucosa overlying the arytenoid cartilages
Type 2	foreshortened aryepiglottic folds
Type 3	posterior displacement of the epiglottis



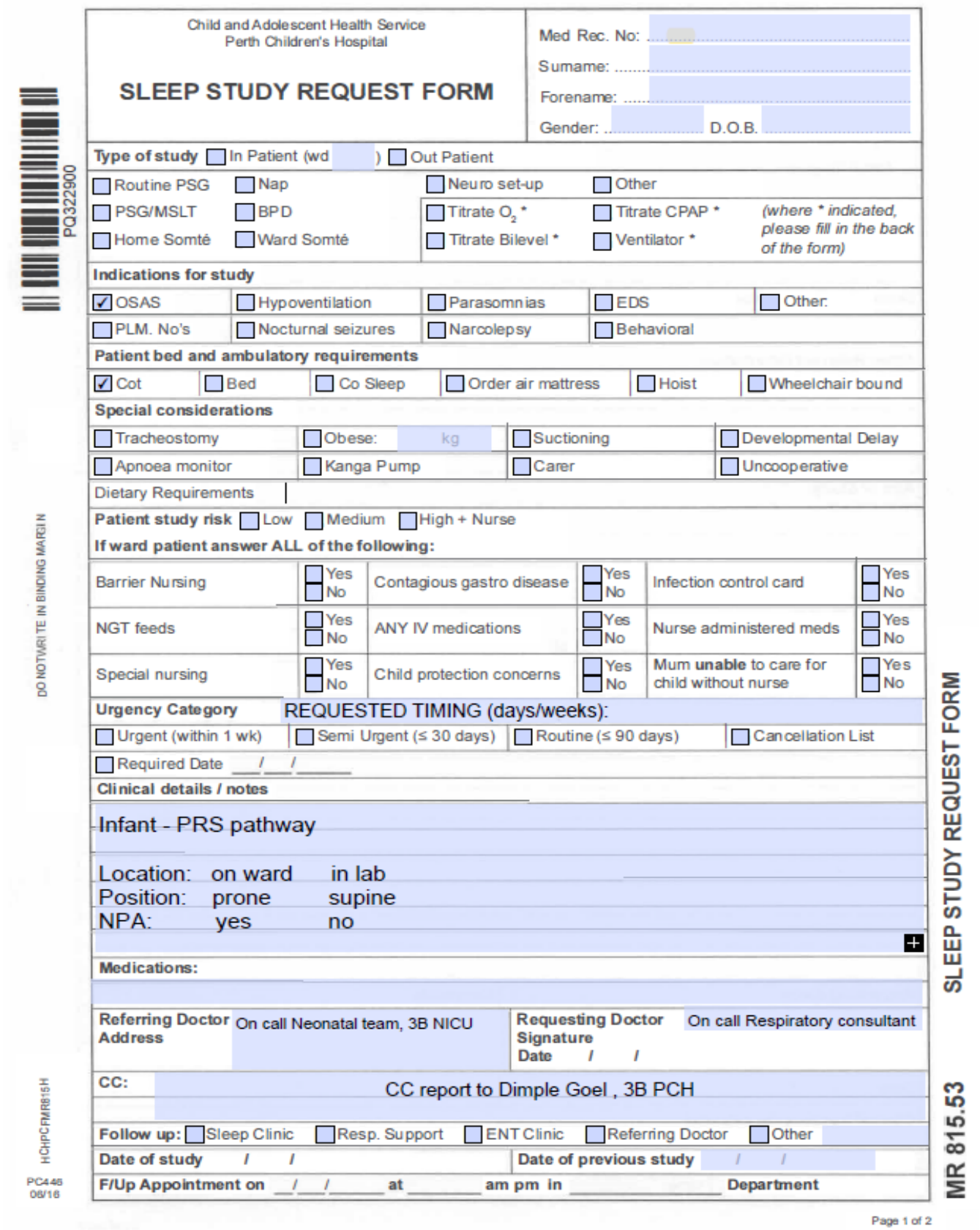
Olney DR, Greinwald JH Jr, Smith RJ, Bauman NM. Laryngomalacia and its treatment. Laryngoscope. 1999; 109: 1770-1775.

Upper Airway Paediatric Sleep Endoscopy scoring: Seattle DISE scoring



Chan DK, Liming BJ, Horn DL, Parikh SR. A New Scoring System for Upper Airway Pediatric Sleep Endoscopy. JAMA Otolaryngol Head Neck Surg. 2014;140(7):595–602. doi:10.1001/jamaoto.2014.612

Appendix 4: Sleep Study Request MR815.53



Child and Adolescent Health Service
Perth Children's Hospital

SLEEP STUDY REQUEST FORM

Med Rec. No: .....
Surname: .....
Forename: .....
Gender: ..... D.O.B. .....

PQ322900

Type of study ☐ In Patient (wd) ☐ Out Patient

☐ Routine PSG	☐ Nap	☐ Neuro set-up	☐ Other	
☐ PSG/MSLT	☐ BPD	☐ Titrate O_2 *	☐ Titrate CPAP *	*(where * indicated, please fill in the back of the form)*
☐ Home Somté	☐ Ward Somté	☐ Titrate Bilevel *	☐ Ventilator *	

Indications for study

☑ OSAS	☐ Hypoventilation	☐ Parasomnias	☐ EDS	☐ Other:
☐ PLM. No's	☐ Nocturnal seizures	☐ Narcolepsy	☐ Behavioral	

Patient bed and ambulatory requirements

☑ Cot	☐ Bed	☐ Co Sleep	☐ Order air mattress	☐ Hoist	☐ Wheelchair bound

Special considerations

☐ Tracheostomy	☐ Obese: kg	☐ Suctioning	☐ Developmental Delay
☐ Apnoea monitor	☐ Kanga Pump	☐ Carer	☐ Uncooperative

Dietary Requirements

Patient study risk ☐ Low ☐ Medium ☐ High + Nurse

If ward patient answer ALL of the following:

Barrier Nursing	☐ Yes ☐ No	Contagious gastro disease	☐ Yes ☐ No	Infection control card	☐ Yes ☐ No
NGT feeds	☐ Yes ☐ No	ANY IV medications	☐ Yes ☐ No	Nurse administered meds	☐ Yes ☐ No
Special nursing	☐ Yes ☐ No	Child protection concerns	☐ Yes ☐ No	Mum **unable** to care for child without nurse	☐ Yes ☐ No

Urgency Category REQUESTED TIMING (days/weeks):

☐ Urgent (within 1 wk) ☐ Semi Urgent (≤ 30 days) ☐ Routine (≤ 90 days) ☐ Cancellation List

☐ Required Date __/__/____

Clinical details / notes

Infant - PRS pathway

Location: on ward in lab
Position: prone supine
NPA: yes no

Medications:

Referring Doctor **Address**	On call Neonatal team, 3B NICU	**Requesting Doctor** **Signature** **Date** / /	On call Respiratory consultant

CC: CC report to Dimple Goel , 3B PCH

Follow up: ☐ Sleep Clinic ☐ Resp. Support ☐ ENT Clinic ☐ Referring Doctor ☐ Other

Date of study / /	**Date of previous study** / /

F/Up Appointment on __/__/____ **at** _____ **am pm in** _____ **Department**

DO NOT WRITE IN BINDING MARGIN

HCHPCPMR815H

PC446
08/16

SLEEP STUDY REQUEST FORM

MR 815.53

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Appendix 5: Polysomnography / Sleep Study (PSG)

Airway obstruction can be reported as mild, moderate or severe as per the American Academy of Sleep Medicine (ASSM, 2020) recommendation and the respiratory physician's discretion. The reference range for sleep study parameters of healthy term infants at 1 and 3month of age.

Descriptive statistics for cardiorespiratory events and indices during sleep at the age of 1 month.

	Median	Minimum	75th Centile	95th Centile	Maximum
Indices (n/h)					
Central apnea index	5.5	0.9	10.6	20.5	44.3
Obstructive apnea index	0.8	0.1	3.2	5.1	6.7
Mixed apnea index	0.3	0	0.4	1.1	1.2
Hypopnea index	0.2	0	1.2	3.5	5.4
Central apnea after sighs index	1.3	0	1.8	3.1	3.4
AHI	7.8	1.9	14.2	25.5	46.4
MOAHI	1.5	0.2	2.6	5.8	7.0
Index of desaturation events on ⩾3% points	8.2	2.2	16.2	24.9	36.8
Index of desaturation events below 90% SpO_2	1.6	0	6.9	19.4	21.7
Index of desaturation events below 85% SpO_2	0.2	0	0.8	5.2	6.4
Index of desaturation events below 80% SpO_2	0	0	0.2	0.7	0.9
Duration of episodes (s)					
Central apnea	5.2	3.3	6.1	7.9	20.1
Obstructive apnea	5.2	3.6	6.1	6.5	15.5
Mixed apnea	6.9	0	7.9	12.0	14.3
Hypopnea	6.0	0	8.9	9.9	10.2
Central apnea after sighs	8.2	5.3	9.4	11.7	13.3
Periodic breathing (% of estimated sleep time)	1.1	0	2.0	8.9	10.4

Abbreviations: AHI, apnea-hypopnea index; MOAHI, mixed obstructive apnea–hypopnea index; *n*/h, number per hour; SpO_2, oxygen saturation; s, second.

Descriptive statistics for cardiorespiratory events and indices during sleep at the age of 3 months.

	Median	Minimum	75th Centile	95th Centile	Maximum
Indices (n/h)					
Central apnea index	4.1	1.2	7.8	24.2	27.3
Obstructive apnea index	0.8	0	1.5	2.2	2.3
Mixed apnea index	0.1	0	0.3	0.7	0.8
Hypopnea index	0	0	0.2	0.7	3.1
Central apnea after sighs index	0.9	0	1.4	4.0	4.4
AHI	4.9	1.7	9.7	26.4	27.4
MOAHI	0.9	0.2	1.9	3.4	4.4
Index of desaturation events on ⩾3% points	7.5	2.2	12.5	24.0	27.3
Index of desaturation events below 90% SpO_2	2.6	0	3.8	13.3	14.8
Index of desaturation events below 85% SpO_2	0.2	0	1.3	3.8	5.5
Index of desaturation events below 80% SpO_2	0.9	0	0.3	1.0	1.6
Duration of episodes (s)					
Central apnea	5.1	3.1	6.0	9.1	9.5
Obstructive apnea	5.1	2.9	5.7	7.8	8.5
Mixed apnea	6.8	0	7.8	10.9	11.3
Hypopnea	6.6	0	8.7	9.4	9.4
Central apnea after sighs	7.5	5.3	8.9	10.7	11.0
Periodic breathing (% of estimated sleep time)	1.0	0	1.9	3.9	4.6

Abbreviations: AHI, apnea-hypopnea index; MOAHI, mixed obstructive apnea–hypopnea index; *n*/h, number per hour; SpO_2, oxygen saturation; s, second.

Brockmann PE, Poets A, Poets CF. Reference values for respiratory events in overnight polygraphy from infants aged 1 and 3months. Sleep Med. 2013 Dec;14(12):1323-7. doi: 10.1016/j.sleep.2013.07.016. Epub 2013 Oct 14. PMID: 24211071.

Oximetry*: McGill Criteria

McGill Interpretation	Number of desaturations		
Score	85-89%	80-84%	<80%
1 Inconclusive	1-2	0	0
2 Mild OSA	≥3	0-3	0
3 Moderate OSA	-	>3	1-3
4 Severe OSA	-	-	>3

- Desaturation ≥ 4% fall in saturation
- Cluster ≥ 5 desaturation within a 30 minute period

***Note** McGill criteria was developed for children more than 2 years of age with no literature in infants or neonates.