JAW/MANDIBULAR DISTRACTION OSTEOGENESIS MANAGEMENT IN NEONATES - GCNC - CHW

PRACTICE GUIDELINE ©

DOCUMENT SUMMARY/KEY POINTS

- Mandibular Distraction Osteogenesis is an operative technique that involves bilateral osteotomies of the mandible followed by daily distraction or lengthening of the mandible.
- This surgical procedure can be used in the management of neonates with Pierre Robin Sequence and severe obstructive airway disease to prevent a tracheostomy.
- The goals of MDO are to increase the size of the mandible and improve airway obstruction, relieving any breathing difficulties.
- Post-operatively extra care must be taken with the airway as the neonate is muscle relaxed/sedated.
- Wound care is essential to prevent a post-operative infection.
- Key Performance Indicators (KPI):
  - No post-operative infection
  - Adequate pain management during distraction of drive screw procedure
  - Improve airway obstruction by reducing level of respiratory support required

Approved by:	SCHN Policy, Procedure and Guideline Committee	
Date Effective:	1st April 2023	**Review Period**: 3 years
Team Leader:	Clinical Nurse Educator	**Area/Dept**: GCNC - CHW

CHANGE SUMMARY

- Document due for mandatory review.
- Minor change of pre-operative preparation, pressure area care and infection management.

READ ACKNOWLEDGEMENT

- To be read and acknowledged by all nursing and medical staff working in Grace Centre for Newborn Care.

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Introduction

Jaw/Mandibular Distraction Osteogenesis (MDO) is an operative technique used to improve upper airway obstruction in neonates with Pierre Robin Sequence (PRS). The procedure (Mandibular Distraction Osteogenesis) involves a bilateral osteotomy of the mandible followed by daily distraction or lengthening of the mandible in the NICU.[3,7] Lengthening of the mandible brings the tongue forward, preventing it from occluding the airway.[9] Jaw distraction is most commonly required in infants with Pierre Robin Sequence, which is identified as a combination of micrognathia and glossoptosis with evidence of mild to severe respiratory distress.[1,5] Most neonates with PRS will also have a cleft palate,[3] as a result of the tongue blocking the fusion of the palate and forming a U-shaped palate[2,5] as well as micrognathia and glossoptosis. Micrognathia is a very small or recessed mandible.[3,4,8] Glossoptosis is a retrograde positioning of the tongue which obstructs the upper airway.[3,8]

In the past neonates with severe airway obstruction have been treated with a tracheostomy[3,4,5] or a nasopharyngeal airway necessitating a prolonged hospital stay causing cosmetic deformity of the nose. A tracheostomy is associated with swallowing difficulties, speech and language problems,[3,7] a risk of decannulation and/or death. There is also significant financial and psychological impact on the family.[3] Mandibular Distraction Osteogenesis is used as an alternative to tracheostomy, thereby reducing long term complications for families caring for an infant with a tracheostomy[4,7] or a nasopharyngeal airway.

The goal of surgical intervention and mandible distraction osteogenesis is to lengthen the size of the mandible and prevent airway obstruction and relieve any breathing and feeding difficulties.[4,6,7]

Background

- Pierre Robin Sequence (PRS) can be isolated or associated with other disorders such as Treacher Collins syndrome, Stickler syndrome, velocardiofacial syndrome, fetal alcohol syndrome and Nager syndrome. Isolated PRS is caused by intrauterine forces on the mandible.
- The degree of respiratory obstruction depends on the severity of the micrognathia and glossoptosis.[4]
- Breathing difficulties caused by airway obstruction may lead to repeated periods of oxygen desaturations resulting in cyanotic episodes,[1] and obstructive sleep apnoea with requirement for home CPAP.
- Breathing and feeding difficulties are caused by the position of the tongue.[10] This often results in failure to thrive of the neonate.[8]
- Glossoptosis prevents a normal swallow and infants will require feeding through an intragastric tube.[8]

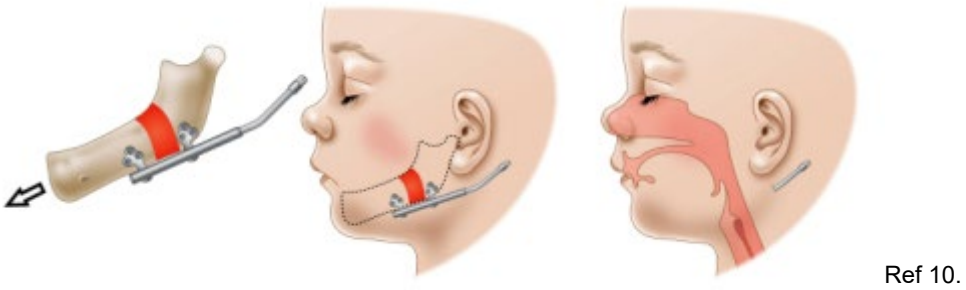
Investigations and Management after admission to the NICU

- On admission to the NICU the neonate is assessed for signs of obstruction and increased work of breathing. Further tests such as a sleep study and laryngoscopy, bronchoscopy & oesophagoscopy (LBO) will be undertaken to assess the airway and severity of obstructive sleep apnoea (OSA).
- Polysomnography (sleep study) is performed to determine if the breathing pattern has central (neurological) or obstructive (functional) episodes.[1,3,8,10]
- Facemask CPAP is trialled to overcome obstructive airway symptoms.[1,3,4] If the trial of CPAP is unsuccessful and /or symptoms of airway obstruction persist, then discussions are held with the speciality teams about proceeding to an MDO.
- An LBO is performed prior to making the final decision to undertake an MDO to rule out associated airway anomalies which can cause the MDO to be contraindicated.
- A CT scan or MRI may be performed to provide exact measurements of the mandible. This allows accurate planning for the osteotomies and placement of the screws. Tooth buds are also identified to avoid future complications.[8,10]
- Chromosomal testing is performed. Neonates may be referred for further genetics review..
- Further investigations and consultations are performed as required, to investigate other anomalies. These investigations include ophthalmology review, head, cardiac and renal ultrasounds and skeletal surveys.
- A multidisciplinary team, including Sleep, Ear, Nose and Throat Surgeons, Plastics, Cleft/Speech, Neonatology & Nursing, will assess whether the neonate requires the MDO procedure.[10] (See Appendix 1, Jaw distraction flow sheet).
- Results of the investigations are discussed in a multidisciplinary meeting with the parents, where the potential surgical options are discussed i.e. MDO or a tracheostomy.

Procedure

- Mandibular Distraction Osteogenesis is a surgical procedure where bilateral osteotomies are created on the mandible, followed by daily distraction (turning) of the implanted screws to lengthen the size of the mandible.[3,4,6,7,9,11]
- Usually resorbable plates and screws are used which reduce the need for further surgery and are resorbed within 12 months.[1] However there may be occasions where devices used are not resorbable and require removal in an operating theatre.

- Glossopexy (lip-tongue adhesion) may also be performed. During this procedure the tongue is secured to the lower lip to prevent the tongue from obstructing the palate and occluding the airway.[1,2]



Ref 10.

Picture 1 Picture 2 Picture 3

Picture1: Bilateral osteotomies are created. **Picture 2:** Resorbable plate and screws applied. **Picture 3:** Drive screws are brought through the skin superior or inferior to the ears.

Pre-Operative Preparation

- The neonate is prepared for surgery in accordance to the GCNIC CHW Transfer of a neonate to operating theatre and other hospital investigative departments
- Perform a single pre-operative wash on the day of surgery using a pH neutral soap e.g. QV or Johnsons & Johnsons if the patient is greater than 24 hours old. If a patient is colonised with a MRO perform 1 pre-operative wash on the day of surgery using Triclosan 1%
- Recommended preoperative bloods include FBC, EUC, CMP and cross-match

Post-Operative Management

- On return to the NICU a full head-to-toe assessment and examination of the neonate is conducted by both medical and nursing staff, including a pain assessment and temperature.
- A chest x-ray is undertaken to confirm the position of the ETT.
- Arterial blood gases and blood sugar level are taken within one hour and repeated as requested by the medical officer.
- Full set of bloods (FBC, EUC, CMP, CRP and blood gas) are taken on return from OT
- The head of the bed is elevated 30 degrees to minimise facial swelling.

Ventilation

- The neonate will remain intubated and ventilated for the first few days until an airway can be safely established and any swelling has decreased.[7]
- Neonates are given analgesia, sedated and/or muscle relaxed for 24-48 hours to establish adequate pain management and protect the surgical sites from excessive movement.
- Ventilation management is directed as per the GCNIC Respiratory Support in the NICU
- When post-operative swelling has reduced, ENT and neonatology team will discuss regarding the timing and place for trial of extubation.[3,7] In some case, the consensus of the trial extubation can be done on the ward with agreement with the multidisciplinary team.

Nasal and Oral Pharyngeal Suction

- Care is taken when attending oral suctioning if a lip-tongue adhesion has been attended. Suctioning under the tongue should be avoided to prevent damage to the sutures around the tongue and lip.
- Routine suctioning is not recommended, with suctioning instead provided based on a patient assessment. Additional information on procedural suctioning can be found in the GCNIC Respiratory Support in the NICU

Infection

- Is the most common complication of MDO [8] meticulous hand-washing is required when attending the neonate and during the distraction procedure.
- Topical antibiotic ointment i.e.: betadine ointment or chloramphenicol ointment, is prescribed by the surgeons and applied to the drive screw sites liberally twice daily to prevent infection.
- Topical antibiotic treatment will continue until the drive screws are removed approximately 6 weeks after distraction is complete.

Pressure Area Care

- Drive screws are to be stabilised and secured with dressings to prevent movement, leading to pressure areas or dislodgement. Care must be taken that the drive screws cannot be caught on linen or any other objects near the infant.
- Protective padding (gauze or mepilex lite) is to be placed behind the drive screws to prevent pressure areas on the scalp caused by the screws.
- Repositioning of the neonate is undertaken every 3-4 hours to avoid pressure areas with care being taken to avoid lying on distraction screws.
- The neonate should be nursed on a pressure reducing mattress.

- While the neonate is intubated and ventilated repositioning must be undertaken with the assistance of a second nurse.

Wound Care

- Steri-strips are applied to jaw incisions. These sites are regularly assessed for signs of bleeding or infection (swelling, redness, discharge, fever, discharge or pain).
- Drive screw sites are observed for redness, swelling or bleeding.[11]
- Drive screw sites are cleaned at least daily with normal saline and topical antibiotic ointment applied.
- Topical antibiotic cream is the first preference for site management, betadine is applied only when directed by the surgeon.
- Medical officers are to be informed of any signs of infection[11]

Pain Management

- Pain is assessed and managed as per the GCNIC Pain Management in Newborn Infants
- Pain assessment should be undertaken 2nd hourly in the immediate post-operative period for 24 hours, 2nd hourly within any changes to the dose of analgesia, otherwise, 4th hourly until after 48 hours after cessation of the pain relief.
- If the score is above 5, consideration is given to starting or increasing an opioid infusion. Results are recorded in the electronic medical record.
- Consider the use of non-pharmacological pain management and comfort strategies as part of routine caregiving.

Fluid and Nutrition

- Total Parenteral Nutrition is administered post operatively and continues until full feeds have been established.[11]
- Infants are weighed three times a week (once extubated) to enable their fluids to be calculated accurately to encourage optimal growth.

Feeds

- Neonates are not fed enterally in the immediate post-operative period.
- Mouth care with breast milk (if available) is recommended to support positive oral experiences.
- Feeds are slowly commenced through an intragastric tube and are graded up as tolerated.[7]

- When full intragastric tube feeds are tolerated sucking feeds may be introduced. Most neonates have not fed orally prior to MDO and so will require a formal feeding assessment by the speech pathologist before commencing oral feeds.

Developmentally Supportive Care

- Neonates who have undergone the MDO with regular distractions require a supportive environment and need to be positioned and wrapped so that they are able to calm themselves in response to the stressful interventions.
- From admission it is recommended to support the parents to undertake position changes and nappy cares, post operatively they may require additional support with caregiving as the infants needs have changed.
- When the infant is stable post-surgery skin to skin or a cuddle should be offered as soon as possible to offer parents the opportunity to engage with their baby.
- Scent pads are recommended to encourage recognition of maternal scent and to facilitate sleep and reduction of stress.
- Details of various strategies to support the infants developmental outcomes are found in GCNIC Developmentally Supportive Care for Newborn Infants

Distraction

- Distraction of the drive screws is performed daily by the plastics team. A distraction driver is used to perform the distraction and this device is left at the neonate's bedside and should remain with the neonate at all times.
- Distraction commences approximately two days after the initial procedure as directed by the operating surgeon.[3,6,7,10]
- Distraction will be between 0.5-1mm each side per day until desired lengthening has been achieved as per ENT/Plastics team.[3,6,10]
- A daily record of the distraction must be kept at the bedside. See Appendix 2.
- Parents may be educated by the plastics team to perform daily distractions.
- Sucrose or freshly expressed breast milk is administered prior to and during the distraction procedure as per the CHW Sucrose Management of short procedural pain in neonates
- Other non-pharmacological pain management strategies should be implemented particularly encouraging parents if present to support their baby by talking, singing and offering them comfort. Other strategies for health care professionals include swaddling, the use of maternal scent, hands on containment, and talking to the neonate.

Removal of Drive Screws

- The drive screws are removed by the plastics team in the NICU/Outpatient department or in some cases the neonate will be taken to the operating theatre for removal.10 This occurs approximately 6-10 weeks after distraction is complete to allow for bone consolidation.[3,6,11]
- Steri-strips are applied when distraction screws are removed.
- If removed in the NICU Sucrose or freshly expressed breast milk is administered prior to and during the procedure as per the CHW Sucrose Management of short procedural pain in neonates

Discharge Planning

- Fiberoptic assessment of glossoptosis should be done in the ward before discharge.
- A repeat sleep study or oxycapnography is performed by the sleep team after the distraction is complete and prior to discharge to assess the success of the procedure. Some infants may still require home CPAP after having a MDO.
- Assessments are performed to progress oral feeding and growth . Studies have shown that successful distraction results in healthy growth and development [3,4] through improvement in feeding.[3,9]
- Parents will receive adequate education and training and be deemed competent in the care of distraction pins before patient is discharged.

Possible Complications Following a Mandibular Distraction[12,13,14]

Short Term	Long Term
Surgical site infection	Open bite deformity
Cellulitus	Tooth loss or malformation
Soft tissue dehiscence	Temporomandibular joint ankylosis
Facial nerve injury	Scarring
Device failure requiring replacement	Permanent facial nerve palsy
Pin loosening	
Incomplete osteotomy/premature ossification	

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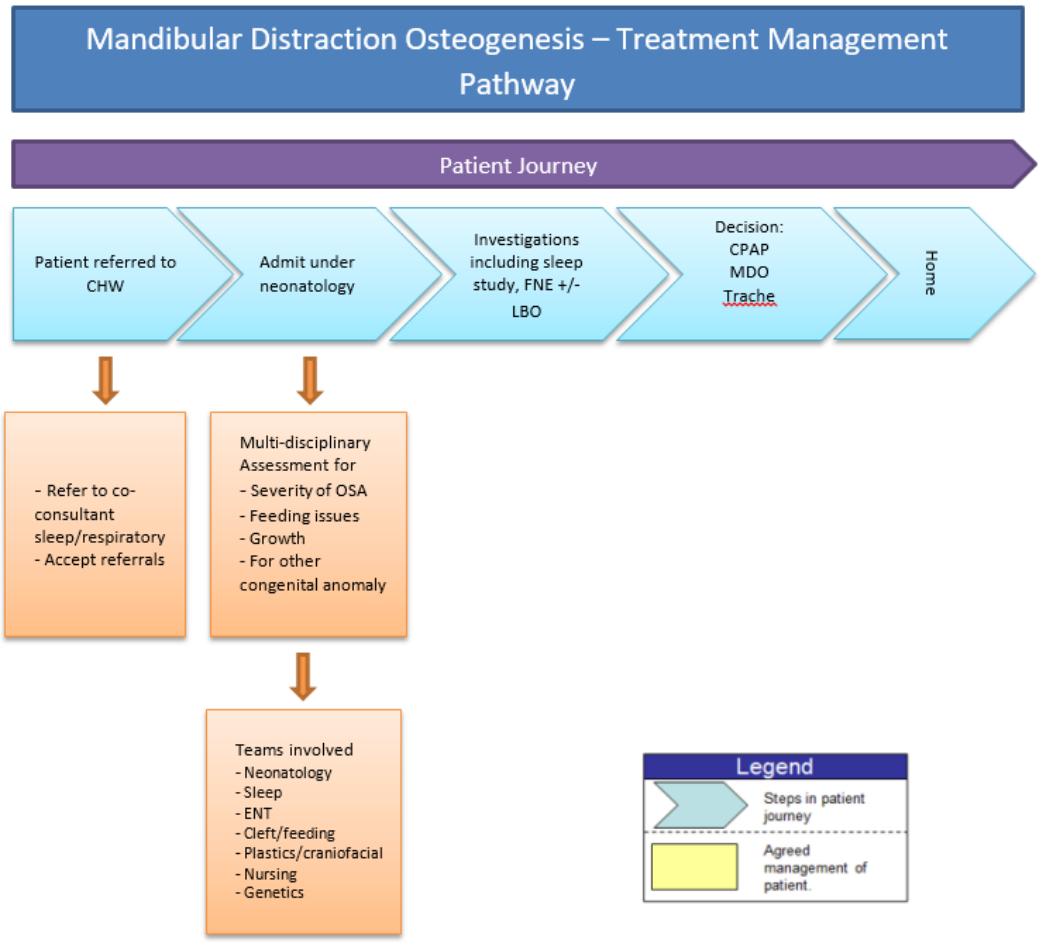
Appendix 1: Jaw Distraction Flow Sheet



Appendix 2: Record of Distraction

Practice recommendations:

- Clockwise turns.
- 0.5mm = 2 clicks

Left side				
Date	**Time**	**Turn**	**Total**	**Completed by**

Right Side				
Date	**Time**	**Turn**	**Total**	**Completed by**

Comments: