Chapter 13

Cleft Palate

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Major surgical textbooks describe cleft palate repair in great detail. In this text, an attempt will be made to simplify the technique so that general surgeons can carry out the repair if they have adequate general anesthesia, the required instruments and satisfactory postoperative care. Adequate anesthesia requires someone familiar with general endotracheal anesthesia, pulse oximeters and ideally the use of Rae tubes—short endotracheal tubes with a sharp angle so that it will curve around the lower lip. The most important instrument is the Dingman mouth retractor (gag). Since the surgery is carried out in a deep “hole” and not on the surface, forceps and scissors must be 7-8 inches long. A Freer elevator may be used for the entire operation but a sturdy elevator as a Woodson or an Obwegeser is best to perform the mucoperiosteal elevation of the palatal mucosa and right angle elevators are best to elevate the nasal mucosa from the nasal side of the hard palate. Fine toothed pickups 7-8 inches long are ideal for the procedure. Postoperative care is best carried out in a small ICU or in a ward where experienced nurses and adequate monitors and suction machines are available for the first 24 hours. Speech therapy is needed after all palate repairs; however, the earlier the repair the better will be the speech.

Though conceptually simpler than cleft lip repairs, cleft palate repairs are more technically challenging and require more sophisticated anesthesia, surgical expertise and nursing care as described above. Because of the relative ease in repairing a lip, at least in getting it together, often cleft lips are repaired and the cleft palate forgotten until the child cannot speak properly—maybe at school age. The cleft lip carries with it significant stigma for the family whereas the unnoticed cleft palate causes little concern and social shame for the parents other than the feeding difficulties and regurgitation of food through the nose. Also, a poorly done cleft lip repair usually still improves the patient’s condition compared to an unrepaired cleft lip. However, a poorly done cleft palate repair may leave the patient in a worse condition than having no repair at all. Simply put and important to remember: a bad lip repair is better than no lip repair, but a bad palate repair may be worse than no palate repair.

This chapter will deal with the practical aspects of cleft palate care and one method of repair for remote areas. One is referred to major textbooks for discussion of the history of cleft palate and alternate
methods of repair. A popular repair of the soft palate in the past 20 years has been the Furlow double opposing Z-plasty repair. This repair is not recommended in this chapter due to the complexity of the repair and the high fistula rate. Acellular Dermal Matrix has been used to replace nasal lining when it is difficult to approximate these Z-plasty flaps in the Furlow or other repairs.

**Initial treatment and pre-operative assessment**

Many children will have a cleft lip and a cleft palate together—see Cleft Lip chapter. If the patient is seen early the lip can be performed at 3-4 months and the palate at 9-12 months. If the child is seen at 1 year of age, the palate should be performed first or at least at the same time as the lip. As discussed below, the palate should be performed before the child is a year old to give the child the best chance for normal speech. After 2 years of age, cleft palate repair will decrease reflux of liquids and food into the nose but will have little effect on speech. The remainder of this chapter will deal with the cleft palate alone.

**Initial Problem:** A neonate with cleft palate in the developing world has a life-threatening problem due to the child’s inability to breast-feed. The primary intervention at this stage is to teach the caregiver how to feed the child. With a cleft palate the child cannot generate suction and what breast milk enters the mouth easily refluxes into the nose. Careful spoon-feeding is an option when baby bottles are not available. This should be done when the child is upright and not lying down. Once the milk reaches the back of the throat, the child will swallow normally. It is important the child is fed breast milk. Since the child cannot generate suction there will be inadequate stimulation to continue milk production. The mother should regularly massage her breasts and capture the milk in a clean container and then immediately feed her child with a spoon, syringe, or cup (Expressed Breast Milk—EBM).

Unfortunately, many of these children will die of dehydration or malnutrition since they will not have access to a medical facility. However, some do survive this neonatal period and will present later in life with their parents seeking treatment for their cleft palate. Since the cleft palate is not noticed by those outside the immediate family, the children with an isolated palate are often brought late to the hospital. Most of these patients present with some degree of malnutrition and may need a period of nutritional support before undergoing surgery.

As with any patient being evaluated for potential surgery, a thorough history and physical examination must be performed. Some important points of which to be wary (in addition to a standard, complete evaluation) are:
History
• Isolated cleft palates are associated with many syndromes so a thorough family history is important

Physical examination
• Cardiac murmur: An isolated cleft palate has a higher association with cardiac anomalies; also, valvular disorders are common due to rheumatic heart disease secondary to URIs.
• Neurologic: If the patient has a neurologic speech problem, then the palate should not be repaired as there will be no benefit from the operation.
• High palates with various syndromes as Pierre-Robin maybe very difficult to close unless the surgeon is experienced at CP repairs.

Laboratory
• All patients should have their hemoglobin levels measured. Most will have iron-deficient anemia. They should be treated with oral iron supplements as well as nutritional support and parental education (meats and vegetables high in iron). Cleft palate repair is contraindicated if the Hgb < 10 gm/dl as there can be substantial intra-operative blood loss.
• Malaria smear: If positive on an asymptomatic patient, delay surgery until after the treatment course is complete. If febrile/symptomatic, treat the malaria and delay surgery for a few months to allow recuperation and anemia resolution.
• Any patient who is old enough to crawl or is ingesting anything but breast milk is assumed to have intestinal worms and likely be malnourished. So, these patients (the vast majority) are treated with albendazole (for the worms) and multivitamins before surgery.

Goals of cleft palate repair
1. Reconstruct velopharyngeal competence. The primary goal is to allow the patient to speak intelligibly by restoring the palate to its normal mechanics. The palate functions to regulate the air and sounds projecting through the nose and mouth. The hard palate is a static, fixed barrier between the nose and mouth whereas the soft palate has muscles within it that close off airflow from the pharynx out through the nose. When the palate is cleft, the patient has no way to regulate the air/sound flow so has great difficulty generating intelligible speech. This mechanical disability
is called *velopharyngeal insufficiency* (VPI). Cleft palate is not the only cause of this disability but it always has this as a feature. The resulting speech disorder is called *hypernasal* speech. (If instead of too much sound coming out of the nose, a person had too little sound coming out the nose such as with an upper respiratory infection causing nasal occlusion, the speech would be called *hyponasality*.) Though patients with cleft palate typically have normal mental capacity, they are thought to be unintelligent. Being effectively mute is a substantial social disability which prevents the patient from going to school or gaining employment. This is not only a quality of life problem but, in the developing world where there are few welfare programs or social “safety nets”, it is potentially a quantity of life problem.

2. **Restore separation of oral and nasal cavities for improved feeding.** This is not a primary goal but a secondary benefit to the cleft palate repair. The patients with cleft palate are able to eat. However, having an intact hard palate will prevent passage of food and liquids that irritate the nasal mucosa and will improve social interaction by removing the stigma of food or liquid draining from the nose.

3. **Restore eustachian tube function:** Although a cleft palate causes dysfunction in eustachian tube drainage, the repair does not restore this function. There is active research in this area (reconstructing the tensor veli palatini muscle), but the current standard treatment for middle ear disease in children with cleft palate is placement of pressure equalizer (PE) tubes. A description of this operation is outside the scope of this text. It is a straightforward procedure but requires specialized equipment, operating microscope, and instrumentation. Learning this procedure from a visiting ENT surgeon (who would also need to bring the instrumentation) can make a substantial difference in these patients’ lives, particularly if the middle ear disease is treated early (before speech development). Children with cleft palates have very poor hearing which compounds the speaking difficulties as it is very difficult to learn to speak when the one cannot hear and thus cannot mimic sounds because they are not heard.

**Timing for cleft palate repair**
- Ideal age of patient to repair: 9 months to 18 months of age. The earlier the repair the better speech the child will have especially where speech therapists are few, but the earlier the repair the more likely there may be impairment of facial growth. The later the repair, as in 18-24 months, there will be less impairment of facial growth but greater speech impairment with less chance for good speech acquisition.
• In addition, there is a balance between anesthesia risks, speech acquisition and facial growth impairment.
  Early surgery, 9-12 months: better speech acquisition, more anesthetic risks and greater chance for midfacial growth impairment
  Later surgery, 18-24 months: poor speech acquisition, fewer anesthetic risks and less chance for mid-facial growth impairment
• Older children, > 18 months and adults: There is progressively less speech benefit with the repair, but there is still the secondary benefit of preventing nasal regurgitation. So, as long as the repair can be done safely and well, it is still indicated in older children.
• Adults. It must be clear to the patient that there will be very little probability of speech improvement with a primary cleft palate repair in adulthood. So, the main goal of surgery for adults is to prevent nasal regurgitation. The judgment for recommending surgery must be balanced with the patient’s medical fitness and other peri-operative risks, for instance, venous thromboembolism which is very rare in children.

**Contraindications for cleft palate repair: patient qualities**

• Hemoglobin < 10 gm/dl
• Asymptomatic, untreated malaria. Refer to “laboratory” section above.
• Malnutrition. This is all too prevalent in developing countries, but children with cleft palates are at particular increased risk.
• Central neurologic disorder that prevents speech. Since the primary goal for the repair is speech, the operation should not be done if the patient has a CNS origin of aphasia.
• Upper respiratory infections. Peri-operative airway edema may make a URI a life-threatening complication in this elective operation.
• Pierre Robin is a relative contraindication. The palate is often arched and difficult to repair by the occasional cleft palate surgeon.
• Advanced age. If the patient is physiologically advanced in age (nearing the end of his life), the risks of cleft palate are increased and the benefits are reduced (years of nasal regurgitation-free life). Life expectancies vary in different regions and chronologic age does not always correlate with physiologic age. Also, it has been observed in Ethiopia that the older the patient and the more rural of an area the patient resided in, the more likely he/she was unsure of his age. So, with older adults, chronologic or stated age is probably not all that useful. For that reason, there is no strict age cut-off for cleft palate repair.
• Other medical problems conferring prohibitive risk as in valvular heart disease

**Contraindications for cleft palate repair: institutional qualities**

• Inexperienced surgeon—cleft palate surgery is significantly more difficult than cleft lip surgery and as mentioned above, a poor cleft palate repair may leave a final result worse than the original defect.

• Inexperienced or ill-equipped anaesthesia providers—if cleft palate repair is going to be performed in the ideal age group (9 – 18 months/old).

• Lack of anaesthesia and surgical equipment as mentioned earlier. Once again, an honest, thoughtful, critical appraisal of skills, training, and equipment must be done by the anaesthesia provider in consultation with the surgeon to discuss particular airway issues with cleft palate surgery before deciding the absolute or relative contraindications to surgery from an anesthesia perspective.

• **Ideally the anaesthesia provider will be able to monitor “end tidal CO₂”**. This will not be possible in many district hospitals. If this is not available, the surgeon must be certain the O₂ saturation is near 100% before beginning surgery. An O₂ concentration of 90% is not adequate and may indicate there is esophageal intubation and not oral intubation. Any unstable O₂ saturation indicates the same—possible esophageal intubation. Surgery must not be started unless the O₂ saturation is near 100% and stable. Never use the excuse that the O₂ saturation is low because of a high altitude.

• Inadequate post-operative nursing care or equipment. Similar to anesthesia infrastructure, the appropriate level of expertise is tiered based on the age of the patient. Pulse oximetry, monitors and suction machines that work are always necessary.

**Operative technique and peri-operative care:**

Anatomy

Figure 1 shows the surgically relevant anatomy of the hard and soft palate. The hard palate mucoperiosteal flaps are axial flaps based on the greater palatine vessels on either side of the posterior aspect of the hard palate (the only blood vessels depicted in the illustrations). In figure 1 B, the levator veli palatini (LVP) muscles do not form a sling but insert into the hard palate in a cleft palate. The levator veli palatini (LVP) muscle must be reconstructed to restore the sling effect that regulates air and
sound flow to the nose from the larynx. The normal sling mechanics are depicted in Figure 2.

Pre-operative care

All patients are admitted to the hospital ward the day before their scheduled operation to obtain blood work, to be bathed (at least once on the day before surgery and for a face wash on the day of surgery), and, most importantly, to ensure fasting status to reduce the risk of aspiration during anesthesia induction. Figure 3 is the standard pre-operative orders form developed for the CURE Ethiopia Children’s Hospital (CECH). Pre-printed order sets are very helpful in reducing
communication errors compared to relying on hand-written orders that may be illegible to the nursing staff. Also, it acts as a reminder checklist to reduce risks of forgetting important orders. The order sets should be tailored to the resources and infrastructure available locally.
Classification of Cleft Palate deformities:

- Unilateral CP—vomer attached to palate on the non-cleft side
- Bilateral CP—vomer is not attached to the palate
- Soft palate cleft—vomer is normal and not involved
- Submucous cleft palate—includes a bifid uvula, notching of hard palate, diastasis of soft palate musculature, possible speech impairment

Routine preparation for all palate cases:

- Prophylactic antibiotics: 3rd generation cephalosporin IV or amoxicillin/clavulanic acid IV.
- Local anesthesia for both anesthesia and vasoconstriction with control of bleeding. Use 0.5 % Lidocaine with epinephrine (1:200,000). **Maximum dosage is 1cc/kg of body weight.** Ideally wait 7 minutes before starting surgery to allow maximum vasoconstriction. **(1 cc of ½ % Lidocaine with epinephrine = 5 mg., so this is well-within safe dosage)**
- Tube myringotomies can be performed if expertise is available
- Throat pack

Repair of Unilateral Complete Cleft Palate: Bardach two-flap palatoplasty

- This is the **one best** repair to know for cleft palate repair

1) Incision in the palate as in Figure A: Along the alveolus the incisions can be made with a needle tip cautery using low power coagulation

2) Elevate the oral mucoperiosteum with a sturdy periosteal elevator. Care must be taken posteriorly and laterally to preserve the greater palatine vessels. These vessels must be completely freed up and if necessary they can be skeletonized up into the flap. A Freer elevator can be used along the medial and posterior edges of the palate and a fine right angle elevator may be used to dissect off the nasal mucosa and around the pedicle. **(All the instruments used are shown at the end of this chapter.)**

3) Elevate the soft palate mucosal flap with fine dissection off the palatal muscles. Err on the side of leaving some muscle on the flap rather than perforating the mucosal flap. However, if too much muscle is taken, then it will be inadequate to reconstruct the levator sling.
4) Complete the dissection and elevation of the Levator (LVP) muscle with fine dissection scissors. This includes dissection off the abnormal attachments to the posterior aspect of the hard palate and the attachments to the nasal soft palate mucosa.
5) Nasal hard palate mucosal elevation is with fine right angle elevator. The dissection off the hard palate shelf is particularly difficult since it’s a partially blind dissection and must be done by feel. The elevator head must stay right on the contour of the bone or the mucosa will perforate.  
6) If a vertical vomer is present, then a mucosa flap can be raised off the vomer to reach the opposite side for nasal closure.

7) Nasal mucosal closure: use 3-0 or 4-0 Chromic or Vicryl™ on a small round needle (RB-1 or smaller) placing inverted, simple interrupted sutures, hand tied knots starting anteriorly and progressing posteriorly, finishing the nasal side row at the uvula with a horizontal mattress suture (to reconstruct the uvula).  

(Editor’s note:  Not everyone will have the exact sutures as described, so you will have to use the needle and suture closest to what is given.)

8) Levator (LVP) reconstruction: use 3-0 Chromic or Vicryl™ on a small round needle (SH-1) placing a single figure of 8 suture to approximate the muscle in the midline (typically, >2 cm posterior to the hard palate).

9) Closure of the mucoperiosteal flaps will be with 3-0 Chromic or Vicryl™ with RB-1 or PS-4C needles placing interrupted horizontal mattress or simple sutures. For the soft palate mucosal closure, a round needle (RB-1 or SH-1) is used, similarly placing simple or horizontal mattress sutures. It is important that before closure of the mucoperiosteal flaps, any bleeding is controlled. Cauterization along the edges of the flaps is important.

10) Start anteriorly, aligning the tips to position the flaps in the most favorable position to maximize cleft closure. The non-cleft side flap is typically longer than the cleft side, so the tips will be approximated with some offset. Tighten the mucoperiosteal retracting sutures after the first anterior suture is placed to facilitate suture placement. Complete the rest of the midline closure.

11) Then several simple or mattress sutures can be placed on either side to loosely approximate the mucoperiosteal flaps to the alveolar mucosa. These suspension sutures should be loosely placed as to not cause tension at the midline. See Figure 4 D above.

12) Remove throat pack. Suction the naso- and oro-pharynx and pass soft catheter in to stomach to suction out stomach.

**Bilateral Complete Cleft Palate Repair**: Bardach two-flap palatoplasty with vomer flaps.
The technique is similar to the unilateral repair except for the addition of vomer flaps, an additional row of sutures to place, and a few modifications.

Fig 5
Bilateral complete cleft palate repair
(Cleft Palate-Craniofacial Journal, May 2011, Vol. 48, No. 3, Losken, H. Wolfgang Used by permission)

1) Lidocaine with epinephrine should be injected into mucosa of the vomer in the subperiosteal layer as much as possible.

2) Vomer flaps: a No.15 blade scalpel is used to incise the vomer mucosa in the midline starting from just posterior to the level of the hard/soft palate junction and extending anteriorly to the pre-maxilla where a “Y” type extension is made avoiding the alveolus (see Fig. 5 A). The Freer elevator is used to elevate vomer flaps on each side so that they will reach the lateral nasal mucosa flaps.

3) After dissection from the palate, the nasal mucosal flaps should be advanced to determine if the flaps edges will reach the corresponding vomer flaps at the level of the hard-soft palate junction. (See small arrows in Fig. 5 B) If not, then relaxing incisions should be made at one or both sides to achieve a tension-free repair. These longitudinal (parasagittal plane) incisions
through the nasal mucosa are made laterally posterior to the greater palatine vessels.³ (Editor's Note: One must get a tension free closure of the mucosa and especially at the junction of the hard and soft palate. This is an excellent suggestion. These incisions are made as far laterally as possible in the nasal mucosa.)

4) Nasal mucosal closure: use 3-0 or 4-0 Chromic or Vicryl™ on a small round needle (RB-1 or smaller) placing inverted, simple interrupted sutures, hand tied knots starting anteriorly on each side approximating the nasal mucosal flap to the vomer flap and progressing posteriorly to the level of the hard/soft palate junction. The nasal mucosal flaps are then approximated in the midline starting where the vomer flaps end, finishing the nasal side row at the uvula with a horizontal mattress suture (to reconstruct the uvula).

(Editor’s Note: Since some hospitals have a limited amount of suture material, some will have to instrument tie some of these sutures but it is important to hand tie the first 2-3. Also some surgeons carefully run these sutures in order to conserve suture material.)

5) Levator (LVP) reconstruction: use 3-0 or 4-0 Chromic or Vicryl™ on a small round needle (SH-1) placing a single figure of 8 suture to approximate the muscle in the midline (typically, >2 cm posterior to the hard palate)

6) Oral side closure: detach the mucoperiosteal retracting sutures from the Dingman suture holders (springs) on the maxillary side, and re-attach toward the midline to bring the mucoperiosteal flaps in closer approximation but with some slack in the sutures.

7) Closure of the mucoperiosteal flaps will be with 3-0 or 4-0 Chromic or Vicryl™ with RB-1 or PS-4C needles placing interrupted simple or horizontal mattress sutures. For the soft palate mucosal closure, a round needle (RB-1 or SH-1) is used, similarly placing horizontal mattress sutures.

8) Start anteriorly and align the tips to position the flaps in the most favorable position to maximize cleft closure.

9) Sutures can be used to tack the flaps anteriorly to the alveolar mucosa of the pre-maxilla (a single horizontal mattress suture incorporating the tips of both flaps). Several other simple or mattress
sutures can be placed on either side to loosely approximate the mucoperiosteal flaps to the alveolar mucosa. These suspension sutures should be loosely placed as to not cause tension at the midline.

10) It is very important to ensure that there is no bleeding at the end of the case.
11) Suction naso- and oro-pharynx and pass soft catheter in to stomach to suction out stomach.

**Repair of Incomplete Cleft Palate: Veau-Wardill-Kilner VY Pushback procedure with intravelar veloplasty**

This technique can be used to repair all types of incomplete cleft palates including clefts of the soft palate. This VY procedure is recommended in this chapter because of its versatility and because of its similarity to the other repairs already described. This technique allows for good visualization for reconstruction of the LVP muscles and allows for full mobilization of the mucoperiosteal flaps for tension free closure of the hard palate component of the cleft. The “pushback” component is questionable as to whether it improves speech more than without it, “pushing” the flaps as far back as in the illustration (Fig. 6) is not recommend as this leaves very large raw areas that scar down and cause facial growth restriction without any clear speech benefit.

1) This technique is similar to that of the Bardach procedure but with the different incisions on the hard palate.
2) The tips of the mucoperiosteal flaps should not be opposed at the very distal tips as in the figure above.
Repair of post-operative oral-nasal fistula

Small anterior oral-nasal fistulas after cleft palate repair typically do not need to be repaired as they do not affect speech to a significant degree. The further posterior and the larger the fistula, the greater the impact on speech dysfunction and oral-nasal emission such that proper operative repair can salvage the goals of the original cleft palate repair. Operations to repair the fistula may include local mucosal flaps, staged tongue flaps, pharyngeal flaps, local axial flaps (facial artery muscular mucosal flap), distant axial flaps (submental flap), and even microsurgical free tissue transfers (radial forearm flap) for large fistulas. These are difficult, complex operations with variable results even in ideal situations (specialized instrumentation, expert surgeon, etc...), so a description of repairing fistulas is beyond the scope of this text.

I recommend only attempting a fistula repair if sufficient expertise is available (for instance, a visiting plastic surgeon with extensive cleft palate surgery experience). For most small to moderate size fistulas, it is best to redo the cleft palate repair.

(Editor’s Note: The author’s admonition at the beginning of this chapter is important: “a poor repair which may result in a large fistula is worse than no repair.” So experience and the right instruments are important before performing a cleft palate repair. If a fistula still results, it is probably best to delay attempted closure until a cleft lip/palate team comes to your area as secondary surgery is very difficult. As also mentioned, a small fistula that a parent observes is often not important to close and the parent can be reassured. This may result in a small nasal leak of fluid but this is often intermittent and not a significant problem. Even small fistulae are difficult to close!)

Post-operative Care

After leaving the recovery room, the patient should be admitted to a nursing unit where frequent monitoring of vital signs with respiratory assessments and operative site assessments (checking for blood in the mouth by inspection only—no instrumentation in the mouth) frequently
and at least every 1–2 hours in children less than 2 years of age. Pulse oximetry is a must during the first hours postop.

Diet is clear liquids for the first post-operative evening using a cup or syringe followed by a soft diet the following day (and subsequently for two weeks). No hard eating utensils (spoon or fork) should be placed in the mouth for six weeks.

A maintenance rate of intravenous fluids may be necessary for the first night if the patient is not interested in drinking fluids.

No labs are necessary unless there are concerns from the intra-operative blood loss.

Regarding medications: parenteral antibiotics are given for a total of 24 hours (including the pre-op dose). A narcotic is given IV or IM as needed for pain for the first 24 hours. Typically, no more than 1–2 doses are needed since the local anesthesia is injected prior to the incision and the epinephrine prolongs the anesthetic effects for several hours. Then paracetamol elixir is given orally as a scheduled dose every 6 hours for 24 hours then as needed for pain. Anti-emetics are given as needed (if available). Ear drops are ordered if PE tubes are placed. Invariably, cleft palate patients will run a fever postop.

The check lists below ensure that nothing is overlooked or forgotten in the postoperative period.

**Complications**

- **Hemorrhage.** Slight oozing from the raw surfaces of the flaps is expected; however it is very important that the patient does not leave the operating room until the bleeding is controlled. A fine tip cautery is used to once again cauterize the edges of the flaps. Pressure for several minutes helps control the bleeding. The Dingman retractor should be left in place until bleeding is controlled. If available, Surgicel or Gelfoam or other hemostatic agents can be used but one should not rely on these to control active bleeding, just any slight oozing.

- **Infection.** Operative site infection causing fever is very rare with cleft palate operations. Immediate postoperative fever should be considered malaria or some other infection overlooked pre-operatively. Otitis media, sinusitis, peri-orbital cellulitis may manifest a few days post-operatively, but the pre-operative prophylactic antibiotics typically prevent these infections. As mentioned above a slight fever is common with any palate repair.
Fig 8
CECH Medication Orders
Complications (continued from above)

- Oral-nasal fistula. See section on “Repair of post-operative oral-nasal fistula”
- Alloderm—Acellular Dermal Matrix has been used to replace nasal lining when it is difficult to approximate. It has also been used with good results in fistulae. It is expensive and difficult to obtain. When available, the use of Alloderm is a significant advance in CP surgery.
- Velopharyngeal insufficiency (VPI). Although the primary goal of cleft palate repair is intelligible speech, even the assessment of speech requires a speech-language pathologist (masters and even doctorate level of training). Since this level of expertise is not available in most of the developing world, this complication is only mentioned as something of which to be aware. There are secondary operations (palatal flaps and pharyngoplasty) to treat VPI after cleft palate repair, but those are beyond the scope of this text and the average general surgeon.

Patient draped and ready for surgery
Instruments used in Cleft Palate Repair
(One can use other instruments for cleft palate repair. These are the ones the author uses.)

Blair periosteal elevator

No.1 Woodson periosteal elevator

Cushing forceps

Reynolds scissors, 16cm length

Kilner scissors, 13 cm length
Jeter-Woodson hard palate elevator, left

Jeter-Woodson hard palate elevator, right side