Surgical Manual of Procedures

All videos referenced in this document can be downloaded via this web link:

https://www.dropbox.com/s/5aethp5s783h4po/Surgical%20videos%20for%20manual.pptx

Summary of Trial Visits

		PROCEDURE	DURATION
Pre-Trial Screening	**Visit 1**	Appointment with research assistant	15 mins
	Visit 2	Appointment with sleep physician **TRIAL CONSENT TAKEN** **MBS-PBS CONSENT TAKEN** -> possible lateral skull x-ray -> PSG for eligibility (if patient has not had a lab-attended PSG within last 3 months)	30 mins 15 mins Overnight
	Visit 2A	Appointment with sleep physician (only if had PSG &/or lateral skull x-ray for eligibility)	15 mins
	Visit 3	Appointment with surgeon	15 mins
Randomisation	**Telephone**		
Baseline Measures and Intervention	**Visit 4**	Appointment with research assistant Blood pressure monitor Actigraphy with sleep diary (lead up to MSLT) Sleepiness assessment MSLT MRI (Surgical Intervention only)	60 mins Wear 24hrs 5 – 7 days 8 hours 1 hour
	Surgery	**Surgery** (Surgical Intervention only)	2-3 weeks off work
	Extra Visit	Post-op, only if required (Surgical Intervention only)	15 mins
1 Month Follow-up	**Visit 5**	Appointment with research assistant	15 mins
	Visit S1	Appointment with surgeon (Surgical Intervention only)	15 mins
	Visit 6	Appointment with sleep physician	15 mins
3 Month Follow-up	**Visit 7**	Appointment with research assistant	20 mins
	Visit S3	Appointment with surgeon (Surgical Intervention only)	15 mins
	Visit 8	Appointment with sleep physician	10 mins
6 Month Follow-up	**Visit 9**	Appointment with research assistant Blood pressure monitor Sleep study Sleepiness assessment MSLT (day after PSG) MRI (Surgical Intervention only)	60 mins Wear 24hrs overnight 8 hours 1 hour
	Visit 10	Appointment with sleep physician	15 mins
	Visit S6	Appointment with surgeon (Surgical Intervention only)	15 mins

Trial Eligibility Criteria

Inclusion Criteria

a. Diagnosis of OSA (defined as Apnoea Hypopnoea Index, AHI > 15 scored by AASM 2007 alternate criteria).
b. At least mild daytime sleepiness defined as ESS > 8.We used this cut point to target those with at least mild daytime sleepiness, but consider that the requirement for the ESS to be > 8 will not adversely affect recruitment.
c. Failed CPAP treatment despite persistent, supervised attempts to implement CPAP, or been treated in a tertiary centre sleep lab or by an Australasian Sleep Association accredited sleep service and have not taken up CPAP when prescribed, and failed MAS therapy due to patient refusal, patient found to be unsuitable on dental grounds, patient intolerance, or were never offered MAS as a treatment option.
    i. CPAP treatment reduces AHI to below 15 events per hour of sleep (N/A for outright refusers of CPAP).
d. Aged between 18 and 70 years inclusive.
e. Body mass index (BMI) ≤ 38kg/m^2.
    i. For patients with BMI 35-38: patient will be deemed appropriate provided they are of strong surgical/anatomical suitability, which consists of size 3-4 tonsil, with Friedman tongue 1-2, and dynamic assessment confirming predominant palatine tonsillar collapse

Exclusion criteria

1. Prior surgery on palate, tongue, mandible or maxilla. Previous tonsillectomy is allowed.
2. Nasal obstruction uncontrolled by medication or surgery.
3. Clinically significant retrognathia, confirmed by lateral skull x-ray (SNB angle < 72^o)
4. Moderate to severe COPD (FEV/FVC ratio < 70% and FEV 1 <50%).
5. Heart failure (New York Heart classes 2-4).
6. Recent history (last 3 months) of a major cardiovascular event i.e. MI, unstable angina, CVA; or major disorder of the pulmonary, renal or nervous systems.
7. Chronic narcotic use.
8. Major depression i.e. hospitalisation for depression, suicide attempt or symptoms necessitating antidepressant drug dose escalation in the previous 3 months.
9. Pregnant or breast feeding.
10. Unacceptable anaesthetic or surgical risk (e.g. anticoagulant or antiplatelet medication which cannot be withdrawn).
11. Contraindication to intraoperative dexamethasone e.g. mania, brittle diabetes, avascular necrosis of hip
12. History of dysphagia or aspiration.
13. Currently working as a commercial driver.

Surgical Eligibility

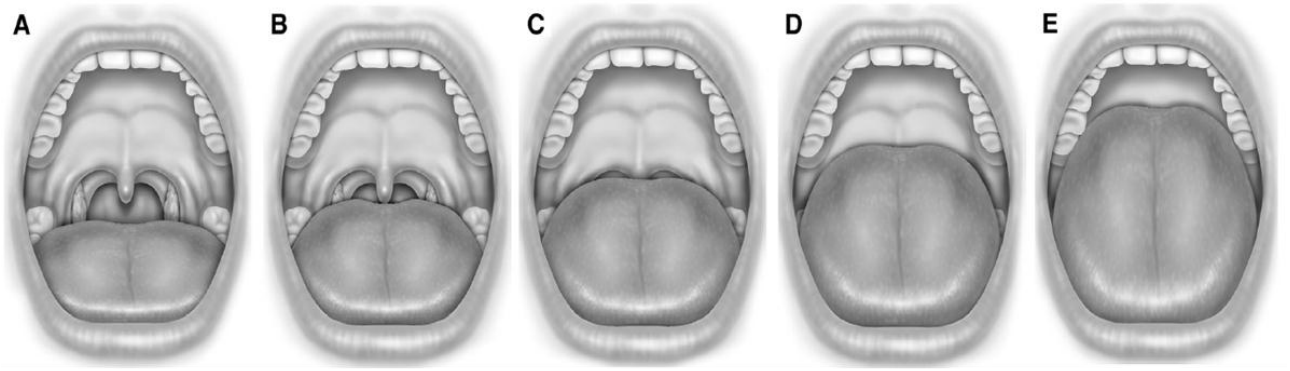
To be **eligible** for the trial, patients **must have**:

1. **Lack of significant obstructive nasal pathology by nasendoscopy**
2. **No significant palatal scarring from previous tonsil surgery**
   (surgeon feels scarring will compromise the ability to get a good outcome)
3. **No large obstructing lingual tonsils**
4. **Confirmed airway collapse on Mueller's Manoeuvre and/or Woodson's Hypotonic Method of airway assessment**
5. **No primary supraglottic collapse**
6. **No laryngeal or subglottic or tracheal stenosis**

Screening Measurements

Modified Friedman Staging System

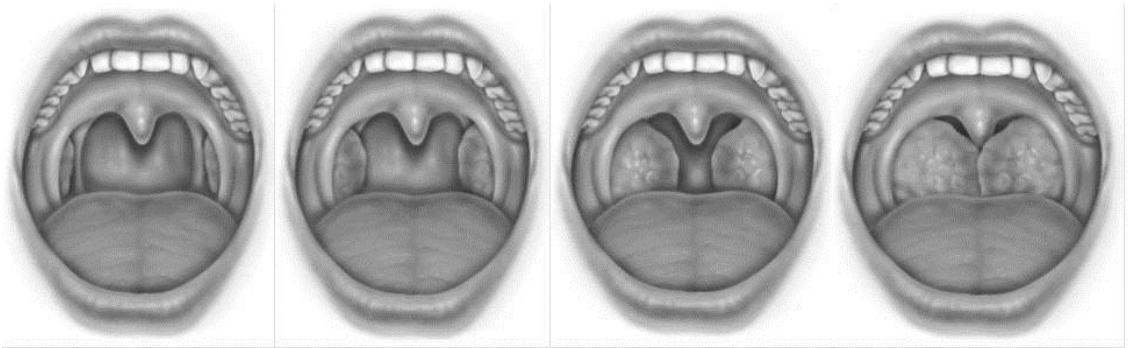
This measurement is taken pre-operatively during patient screening at Visit 3.



FTP I | FTP IIa | FTP IIb | FTP III | FTP IV

The Friedman Tongue Position is based on visualisation of structures in the mouth with the mouth open widely without protrusion of the tongue.

FTP	Anatomical structures visualized
I	Tonsils and pillars Entire uvula
II a	Uvula
II b	Most of the soft palate Base of the uvula
III	Some of soft palate
IV	Only the hard palate



Tonsil size 1 | Tonsil size 2 | Tonsil size 3 | Tonsil size 4

Tonsil size is graded from 0 to 4. Tonsil size 0 denotes surgically removed tonsils. Size 1 implies tonsils hidden within the pillars. Tonsil size 2 implies the tonsils extending to the pillars. Size 3 tonsils are beyond the pillars but not to the midline. Tonsil size 4 implies tonsils extend to the midline.

Table 4
Friedman staging system, based on anatomical findings

Stage	Friedman tongue position	Tonsil size	Body mass index
I	I	3, 4	<40 kg/m^2
	IIa or IIb	3, 4	<40 kg/m^2
II	I, IIa, IIb,	1, 2	<40 kg/m^2
	III, or IV	3, 4	<40 kg/m^2
III	III	0, 1, 2	<40 kg/m^2
	IV	0, 1, 2	<40 kg/m^2
IV	Any	Any	>40 kg/m^2

Reference: Friedman, M., Soans, R., Gurpinar, B., Lin, H.C., Joseph, N.J. Interexaminer agreement of Friedman tongue positions for staging of obstructive sleep apnea/hypopnea syndrome. *Otolaryngol Head Neck Surg*. 2008, 139(3):372-377.

Functional Nasal Assessment

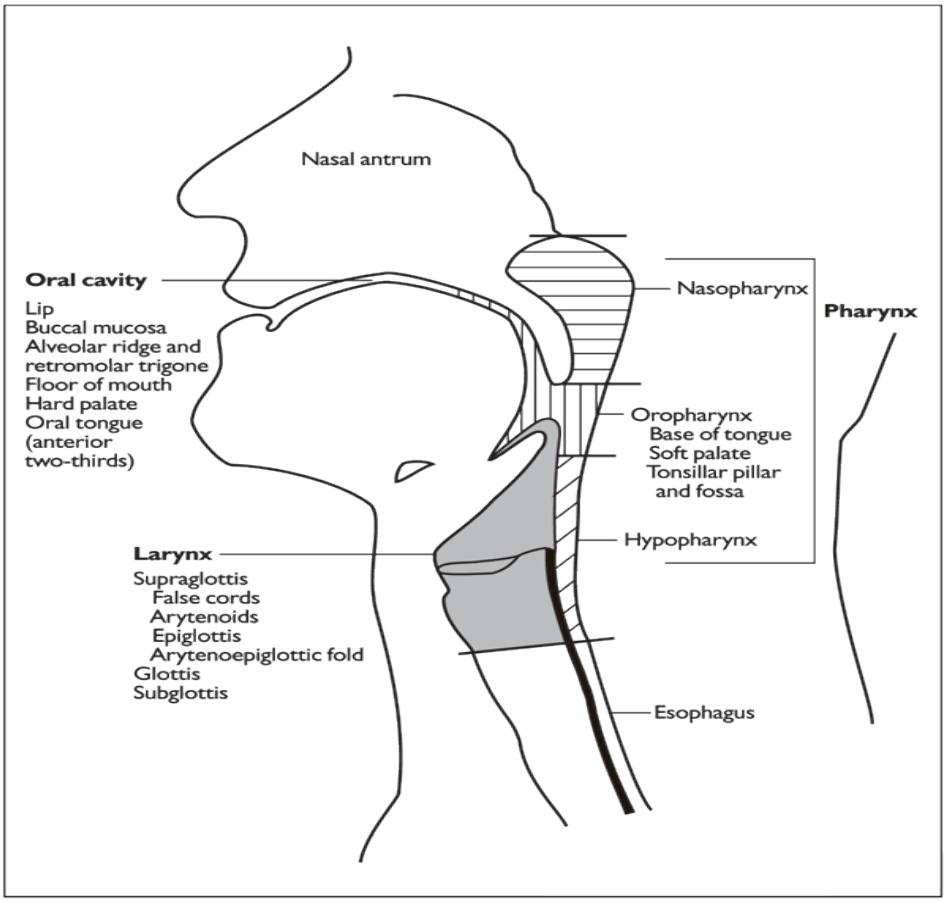
This measurement is taken at Baseline pre-operatively at Visit 3.

Refer to **Video 1** for comprehensive demonstration/methodology

- Nasal Misting Airflow (Left and Right Nostril)
- Thudichum Speculum (Left and Right Nostril)
- Dynamic Nasal Valve Collapse
- Tip of Nose

Fibreopticpharyngoscopy (Nasendoscopy) Manoeuvres

This measurement is taken at Baseline pre-operatively at Visit 3 and again at six months post-operatively at Visit S6.



Refer to **Videos 2 & 3** for comprehensive demonstration/methodology

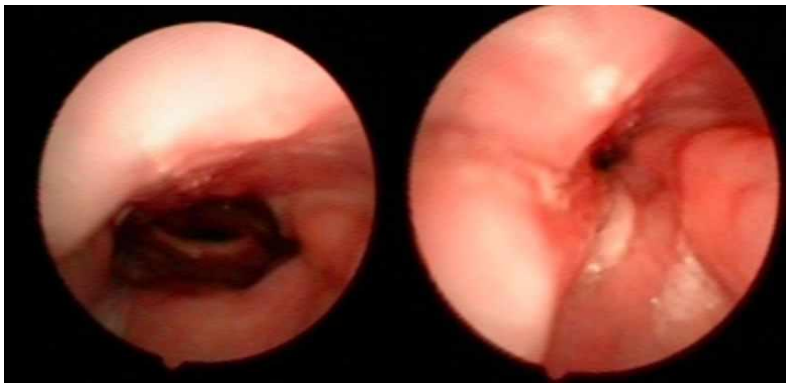
- Structural Assessment
- Modified Mueller's Manoeuvre (MMM)
- Woodson's Hypotonic Method (WHM)
- Erect and Supine Positions
- Retropalatal/Retrolingual levels
- Assess tonsillar generated collapse

- Collapse graded as:
  - **None (0-25%)**
  - **Moderate (25-75%)**
  - **Significant (75-100%)**

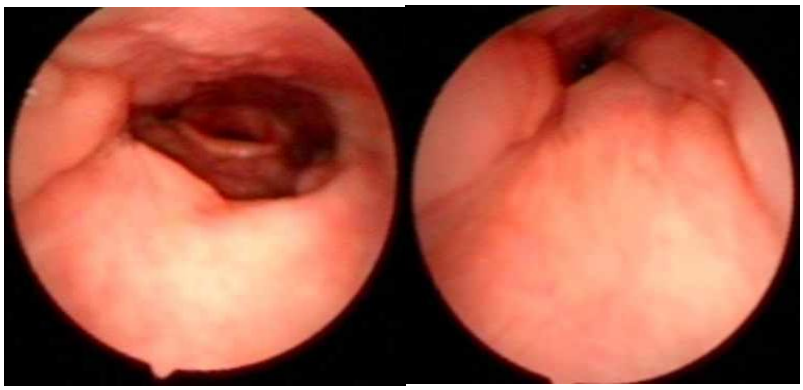
See **Video 3** for an example of 0-25%

Retropalatal Photos (copyright Dr. SG MacKay 2011)

Erect

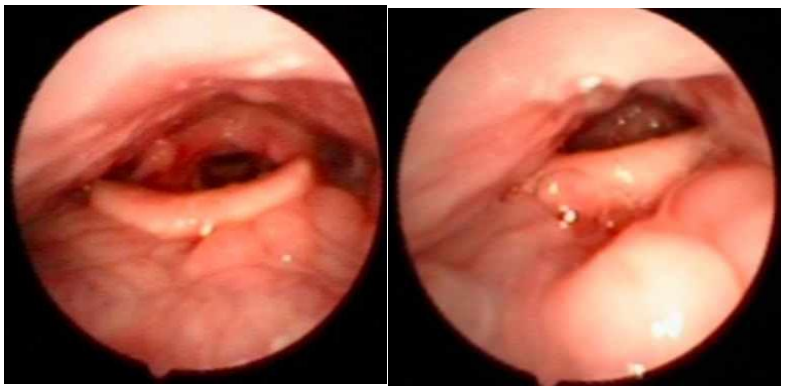


Supine

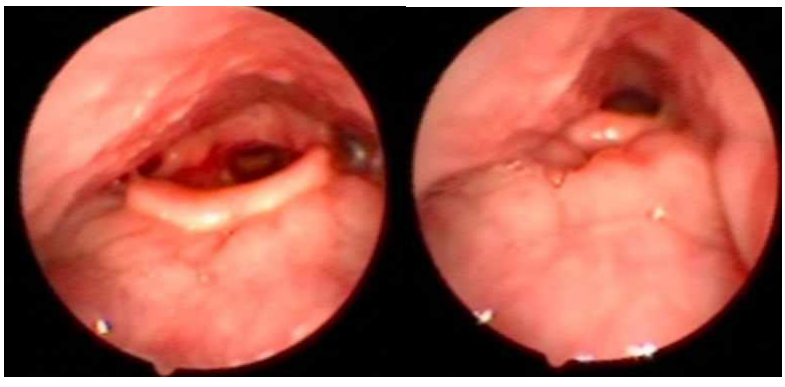


Retrolingual Photos (copyright Dr. SG MacKay 2011)

Erect



Supine



Surgical Procedures

Anaesthesia

As per Australian and New Zealand Collage of Anaesthetists standards.

Intraoperative dexamethasone and **intraoperative cephalosporin**, or other broad spectrum antibiotic if patient allergic.

Bilateral Tonsillectomy and Modified UPPP

Additional References

- MacKay *et al*. Modified uvulopalatopharyngoplasty and coblation channeling of the tongue for obstructive sleep apnea: a multi-centre Australian trial. *J Clin Sleep Med*. 2013. **9**(2):117-24.
- MacKay, S.G. and Crawford, J. Sleep Surgery Cadaver Dissection Manual. 2013

Refer to **Video 4** for demonstration/ methodology.

Tips:

- **DON'T** remove tissue apart from tonsils, supratonsillar fat, partial uvula (i.e. no mucosal resection) *RECONSTRUCTIVE NOT ABLATIVE*
- **DO** leave the palate *where you want it to be*
- **DO** use nasotracheal tube as a guide
- **DO** vary the extent of division of the posterior pillar musculature
- **DO** ensure good muscle to muscle suturing
- **DO NOT** get overly concerned with mucosal closure or lower pillar closure
- **DO** vary the extent of division of the posterior pillar musculature

Diagram of Robinson-type Modified Uvulopalatopharyngoplasty

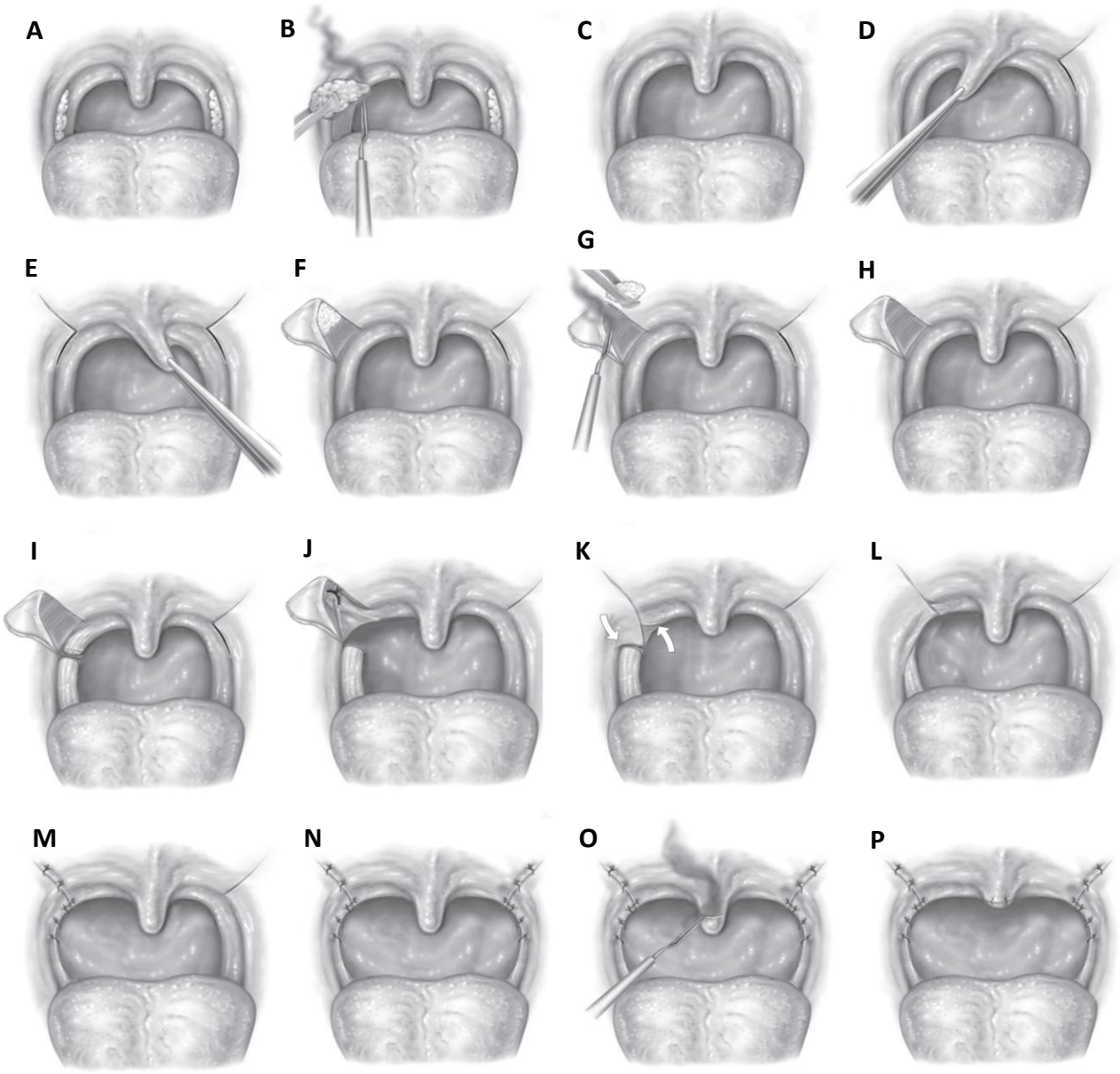
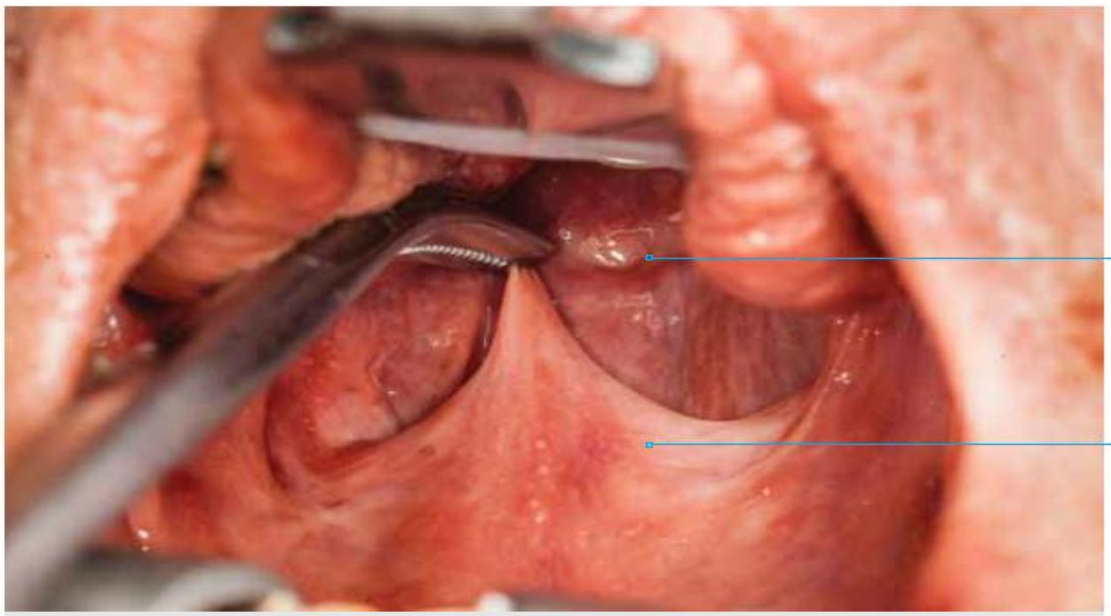


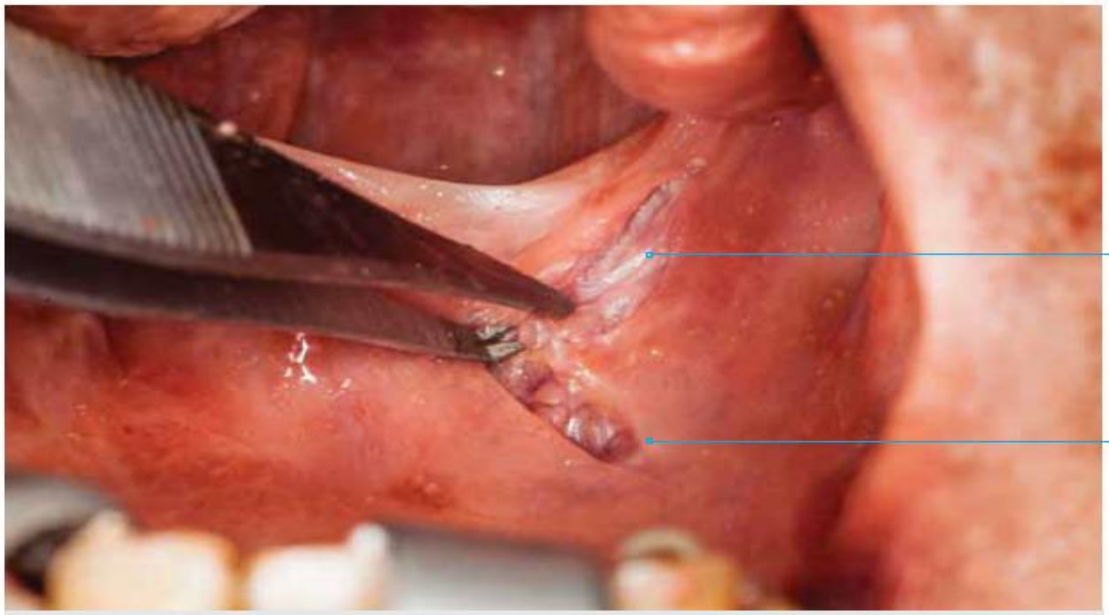
Image source: MacKay SG; Carney AS; Woods C; Antic N; McEvoy RD; Chia M; Sands T; Jones A; Hobson J; Robinson S. Modified uvulopalatopharyngoplasty and coblation channeling of the tongue for obstructive sleep apnea: a multi-centre Australian trial. *J Clin Sleep Med* 2013;9(2):117-124.

All of the following images sourced from the Sleep Surgery Cadaver Dissection Manual (MacKay and Crawford 2013)

BILATERAL TONSILLECTOMY & MODIFIED UPPP



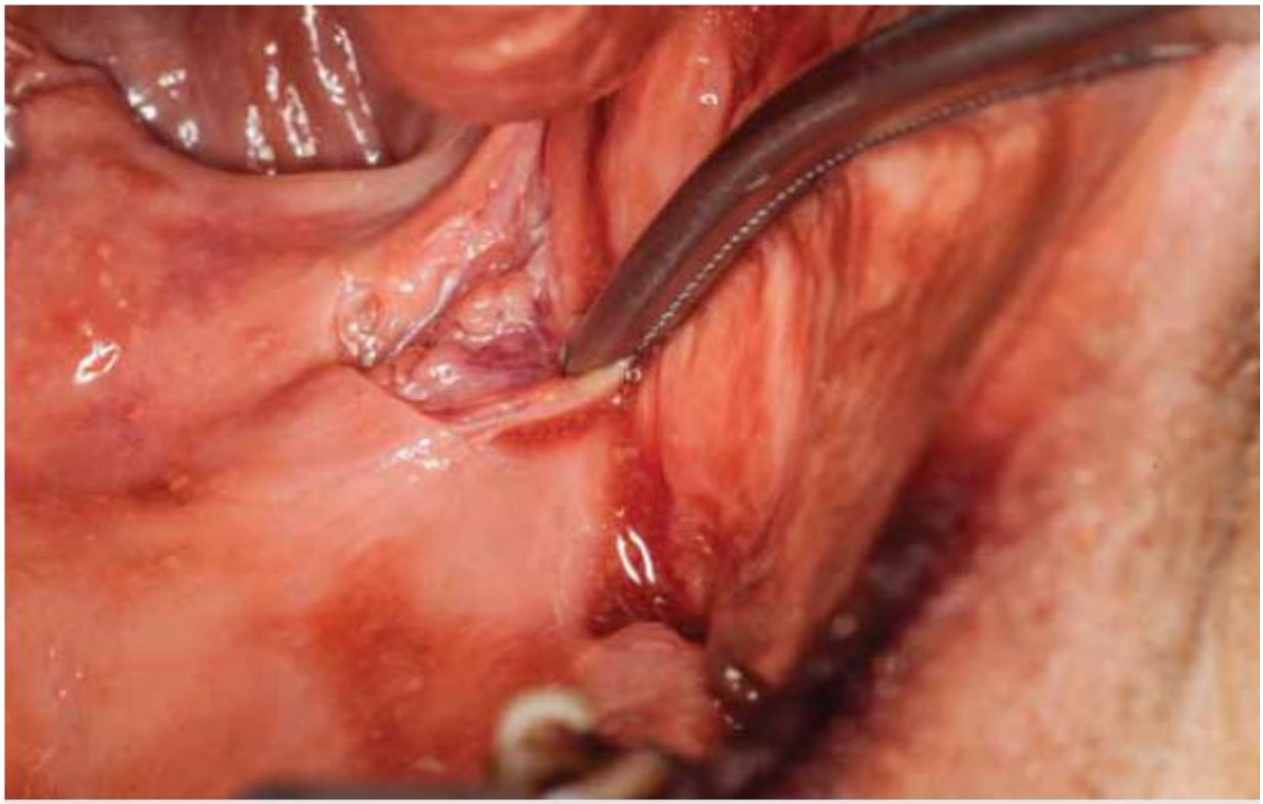
Caudal traction on the uvula towards the contralateral (left) foot



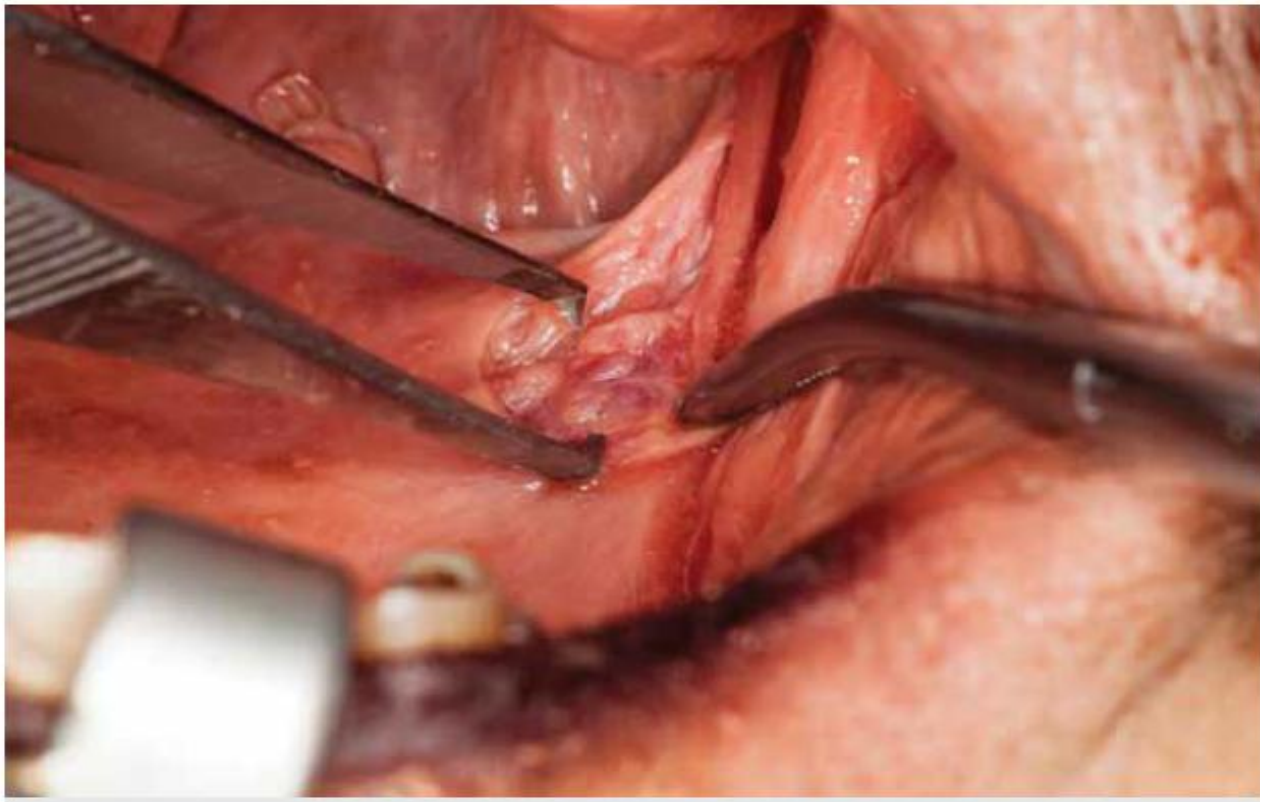
Whilst maintaining the caudal traction a triangular flap of mucosa is elevated

The upper limb of the triangle angles towards the maxillary tuberosity

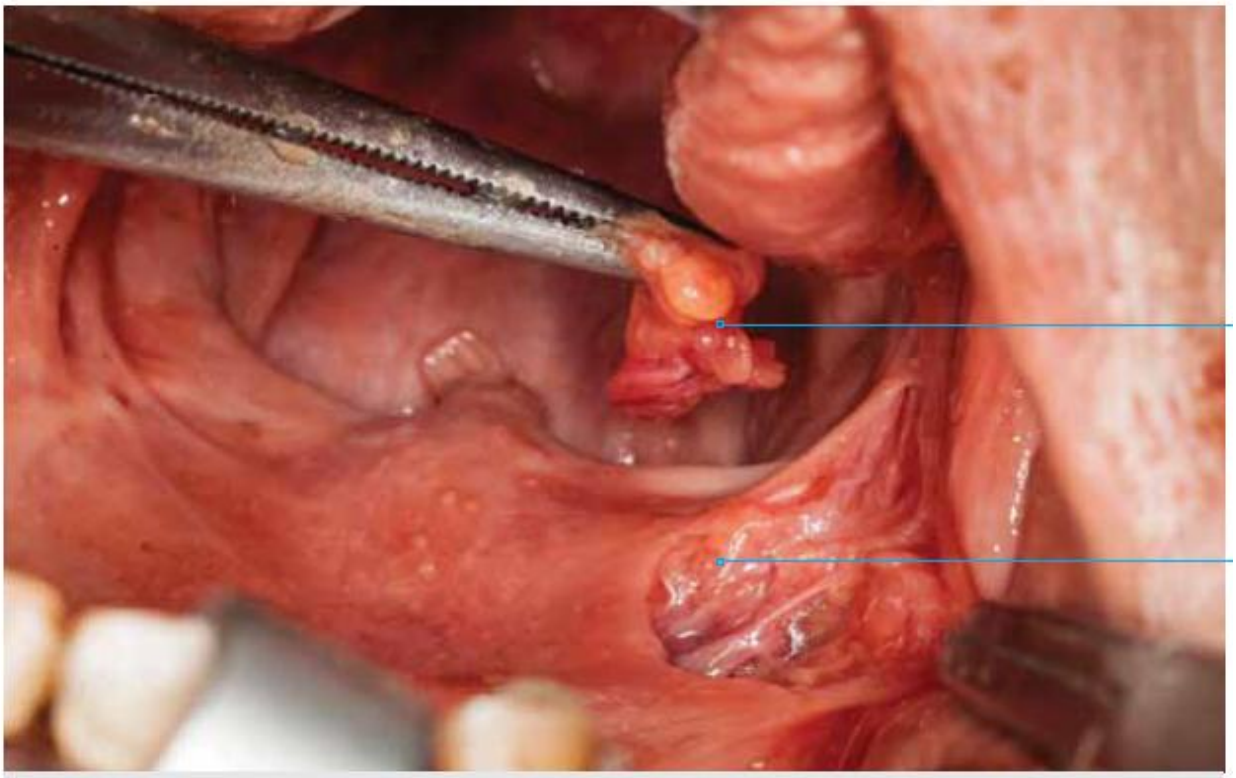
The lower limb follows the line of the anterior pillar



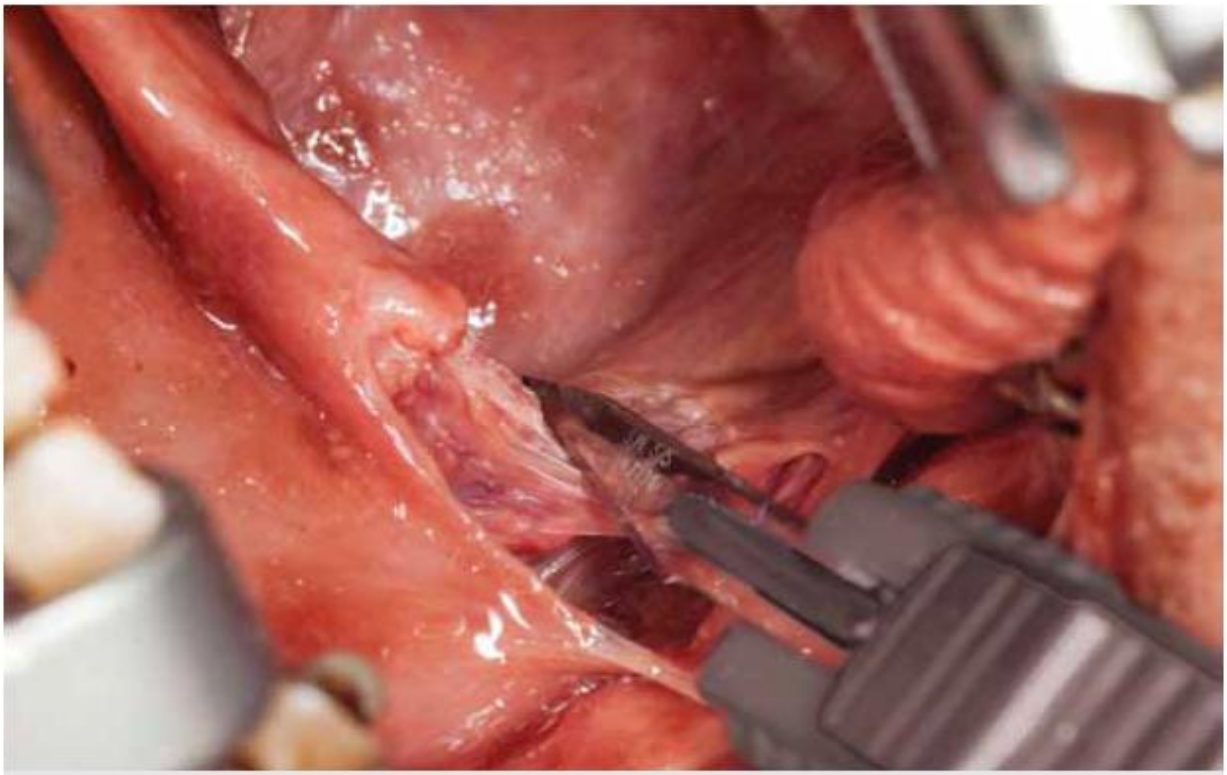
The triangular flap of mucosa is elevated to display the supratonsillar fat



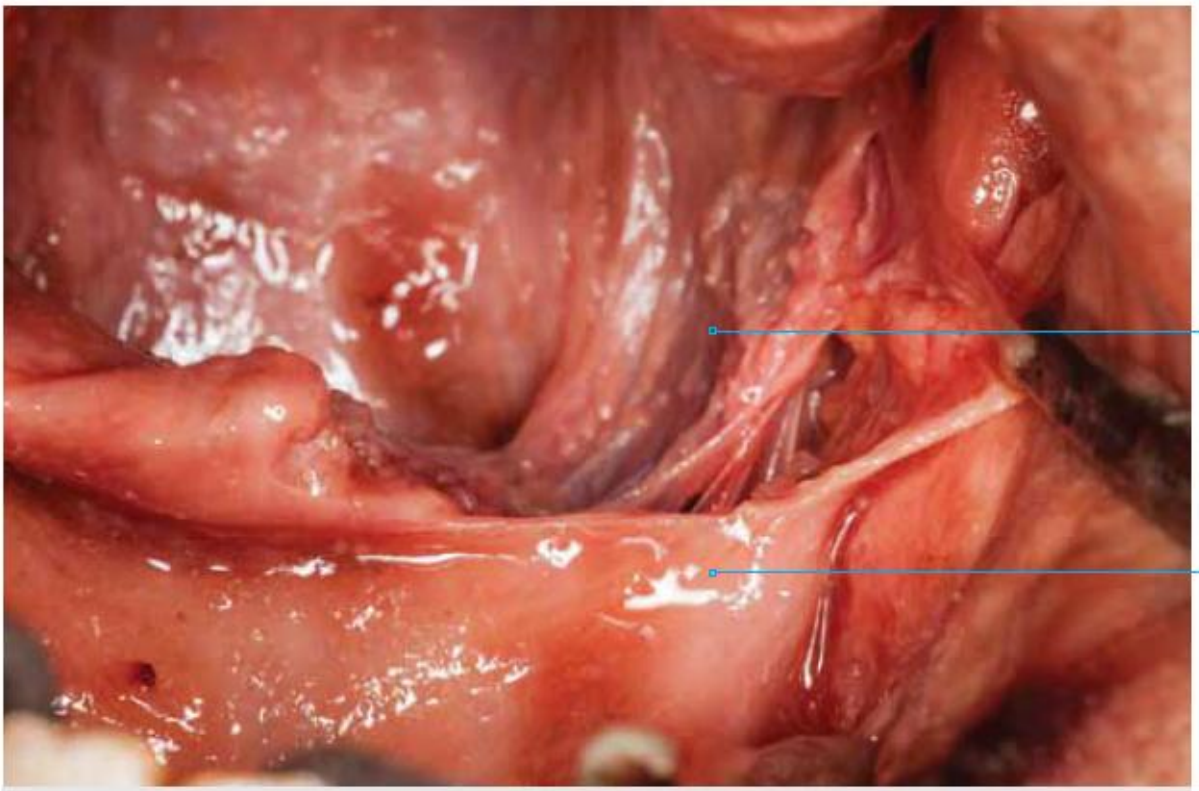
The supratonsillar fat is grasped with toothed forceps



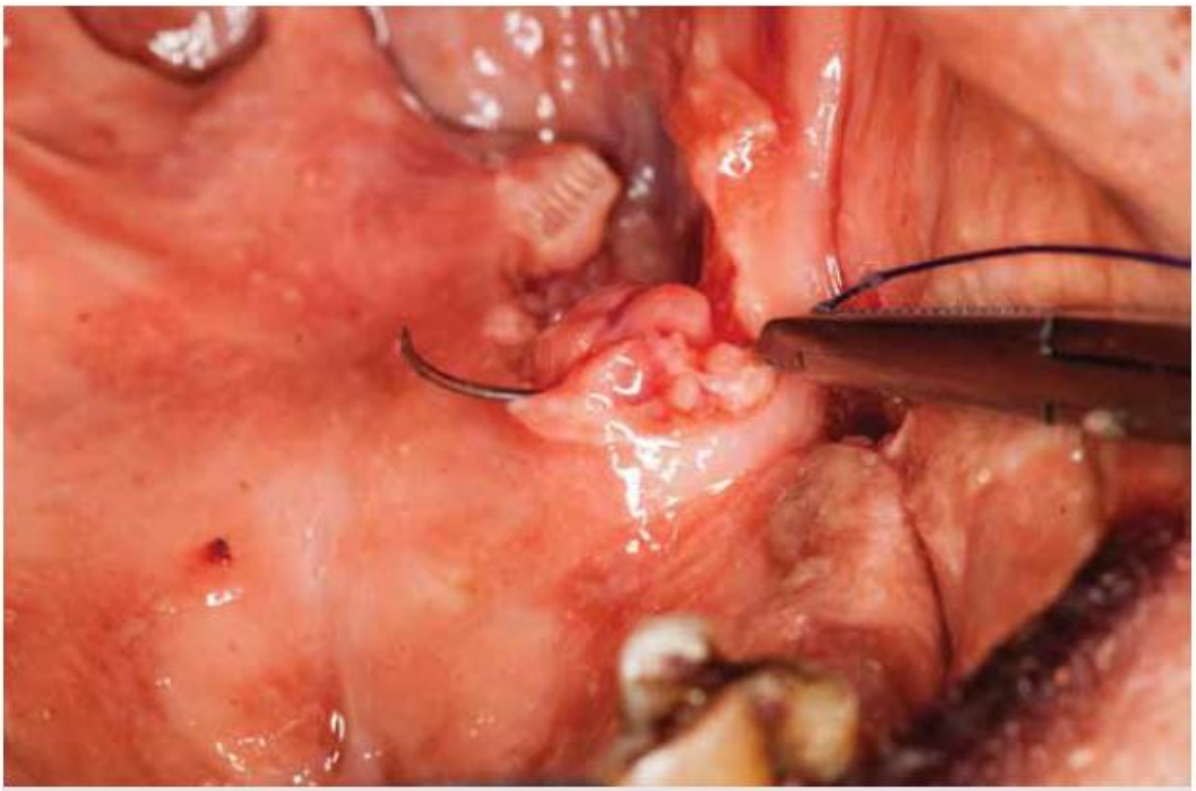
The supratonsillar fat is removed from the underlying arching muscular fibres



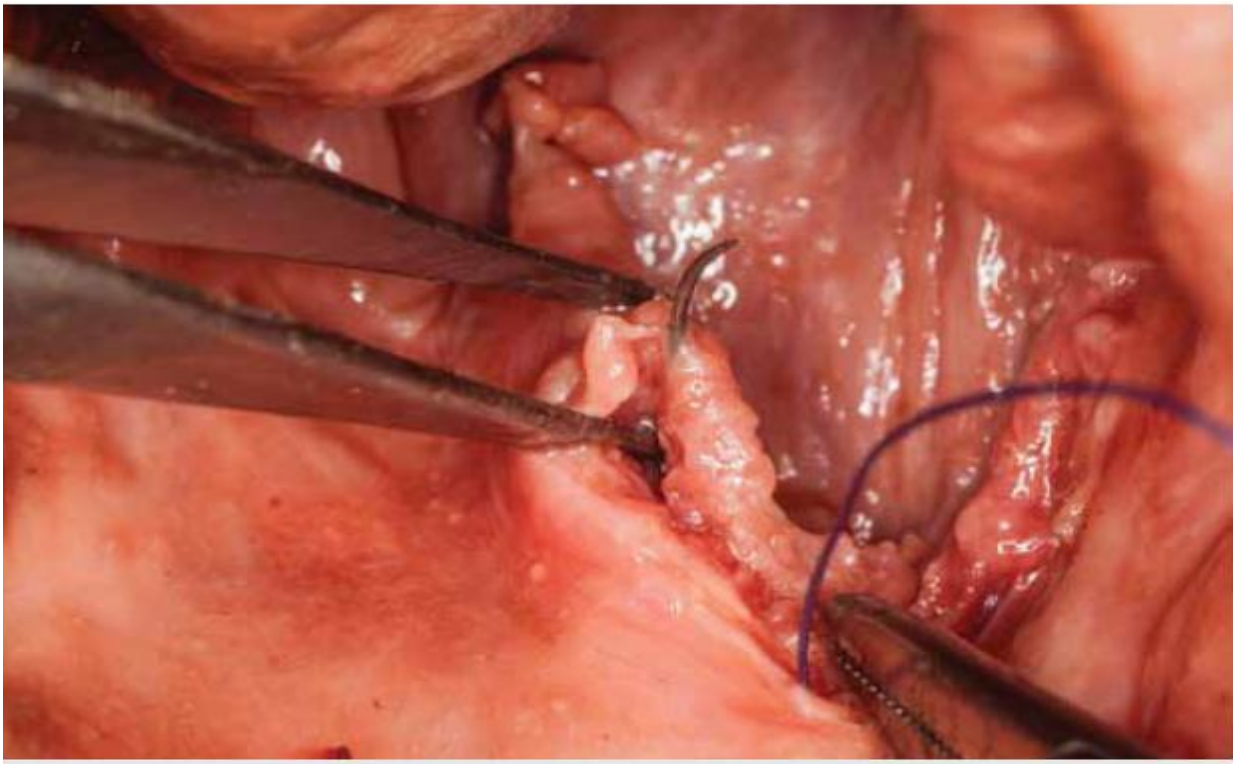
The posterior pillar mucosa and muscle is divided at the junction of the upper third and lower two thirds



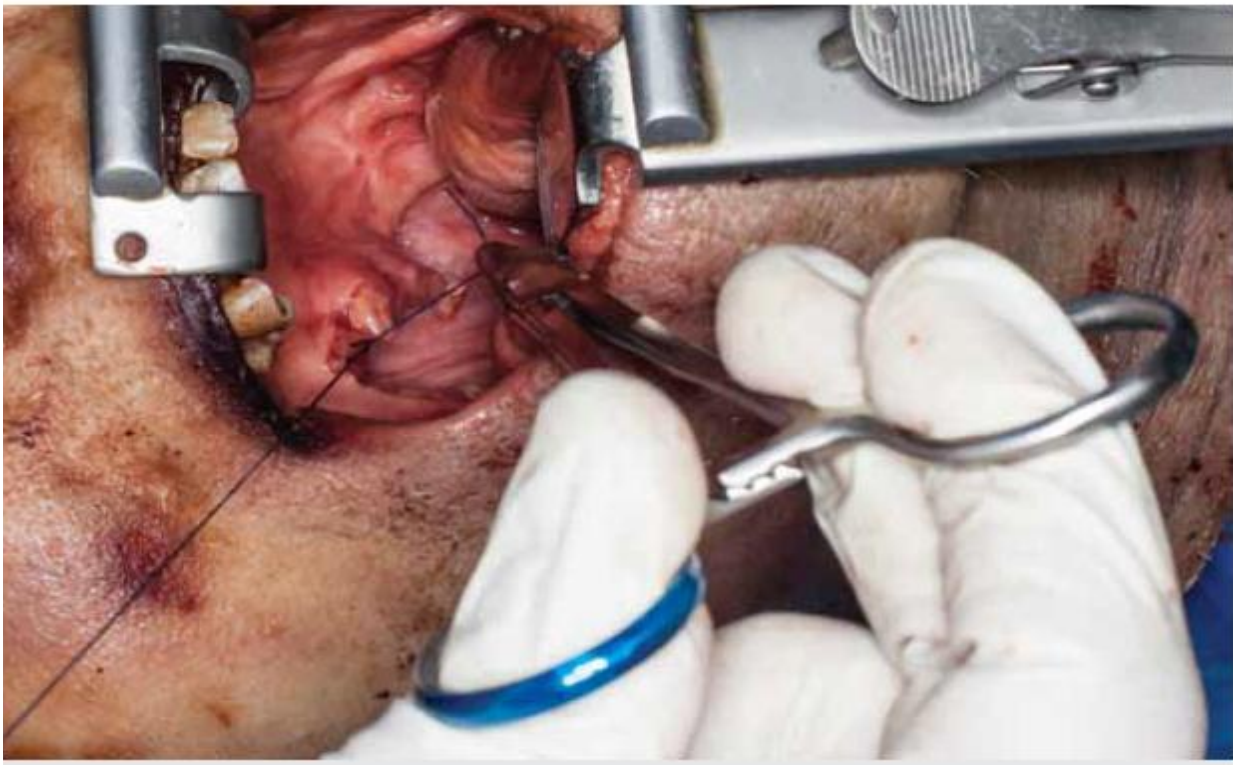
The completed division of the posterior tonsillar pillar is shown



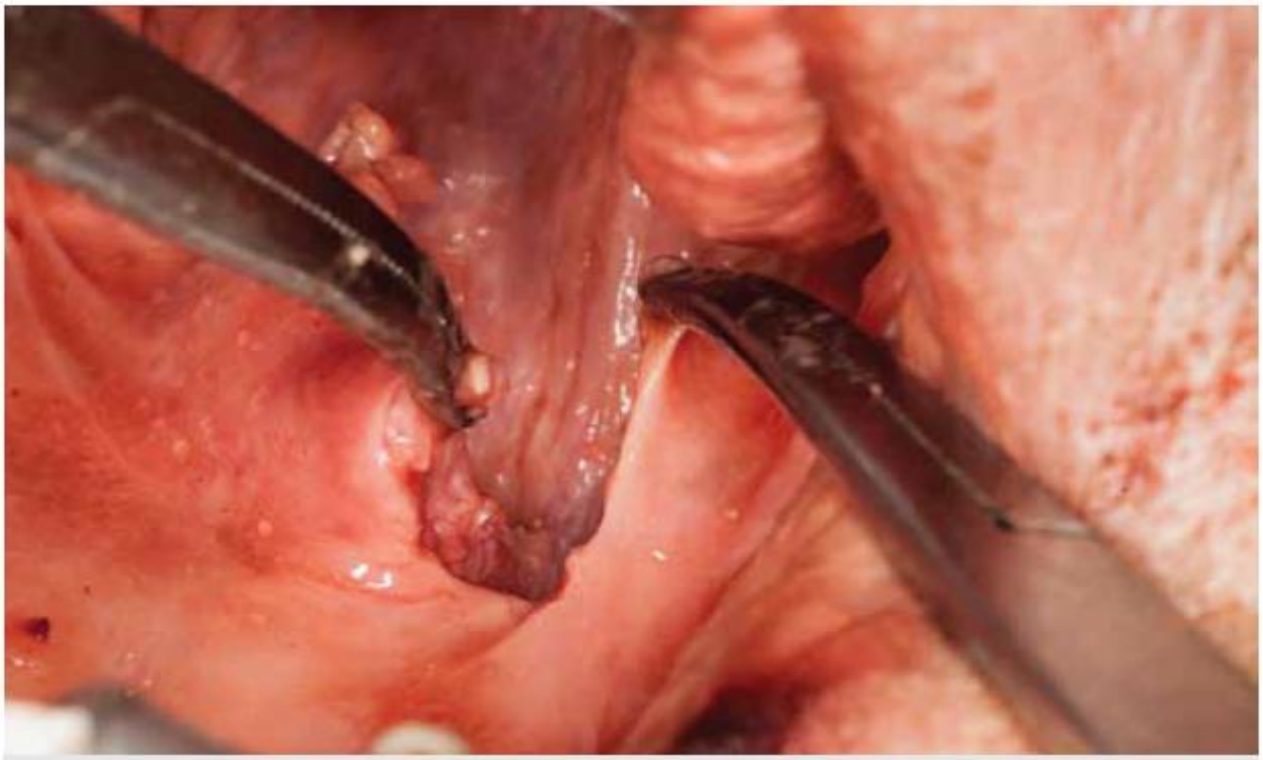
A 3-0 vicryl suture is passed with a large bite through the upper arching muscle fibres



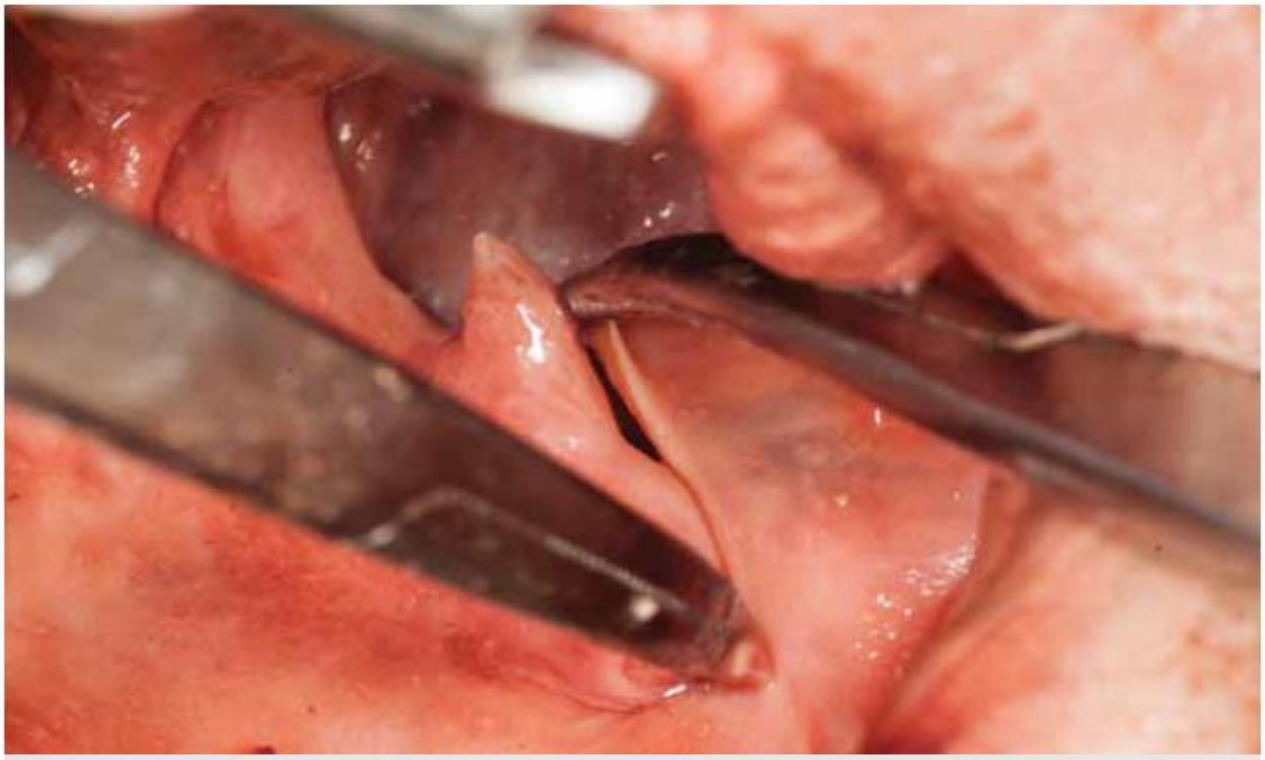
The suture is then passed through the muscle of the upper third of the divided posterior pillar tissue



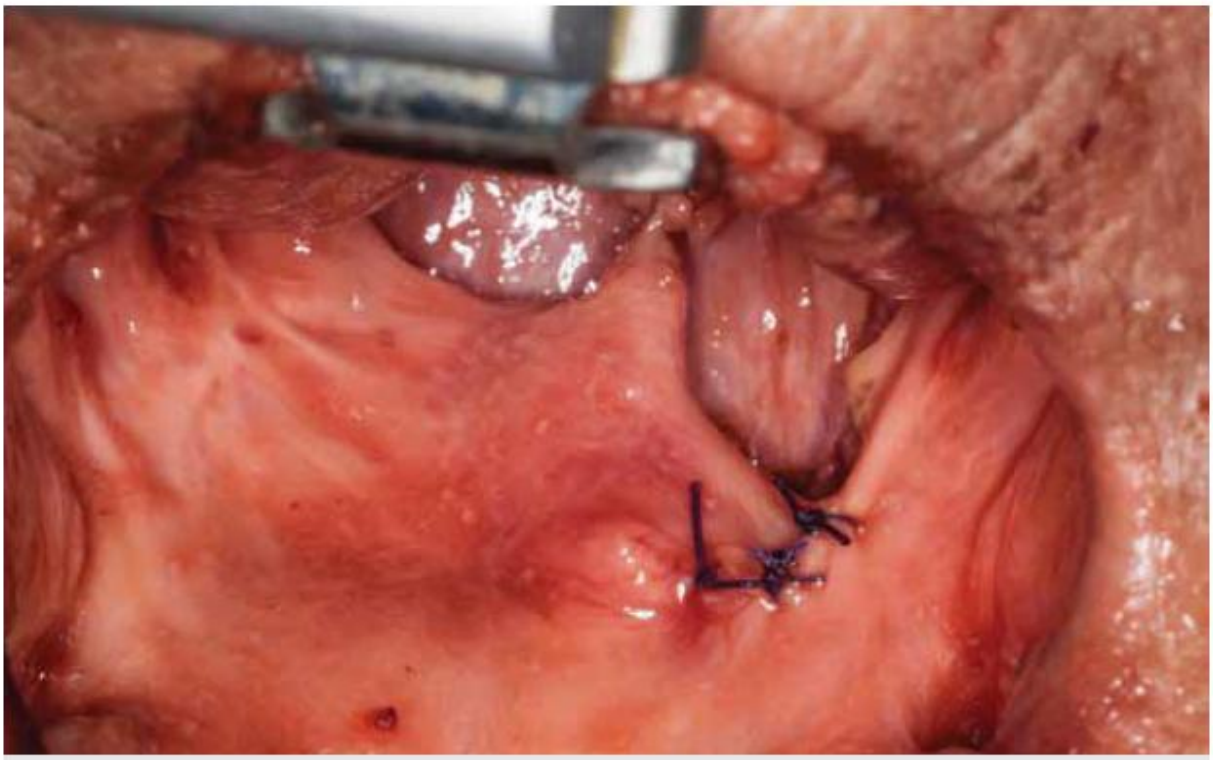
The needle holder is grasped in the orientation shown in order to secure the knot of the suture



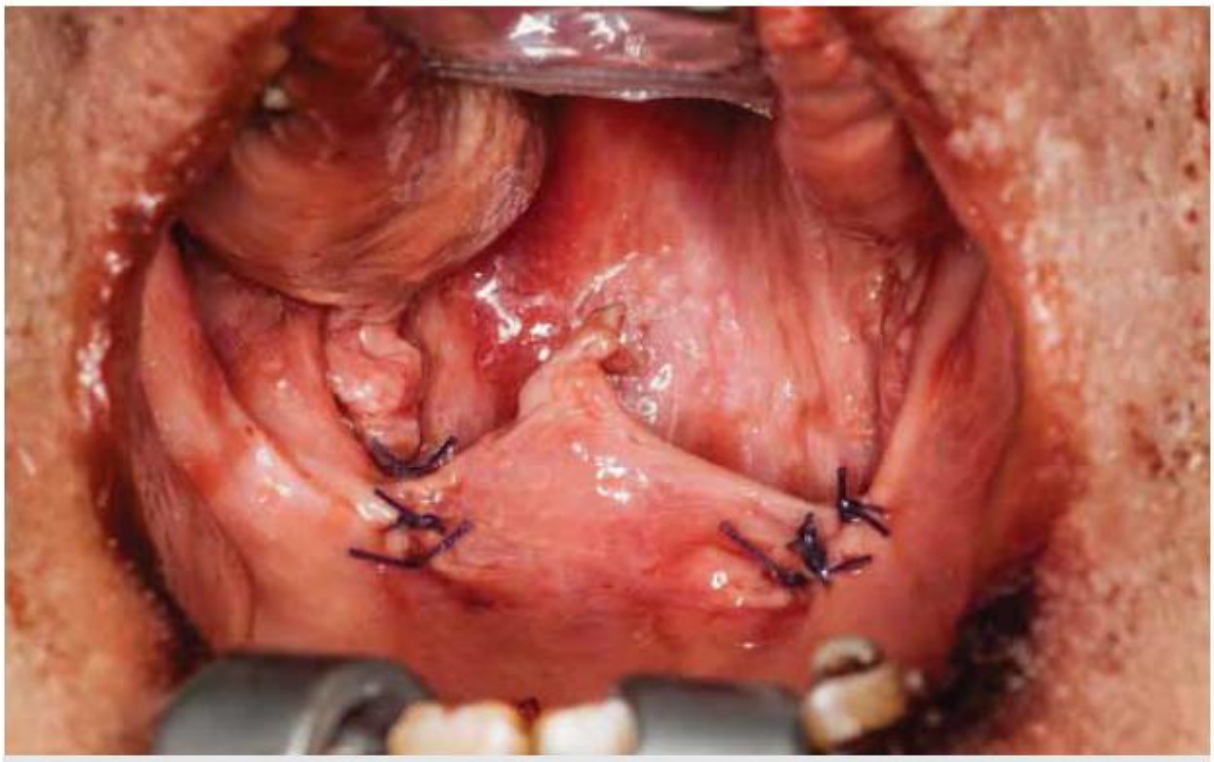
After muscle apposition is achieved the mucosal flaps are closed to reduce post operative pain



The mucosa may be closed in a pseudo z-plasty configuration

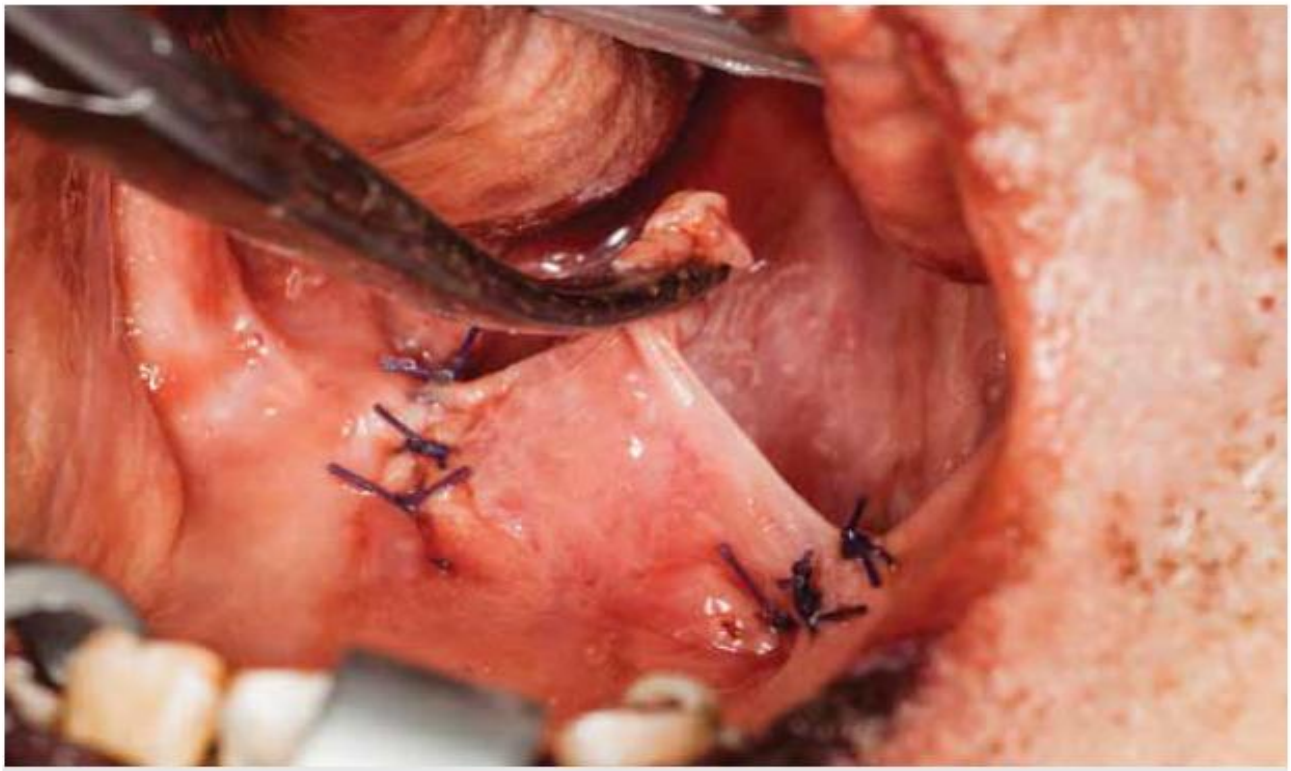


The right hemi-operation is complete

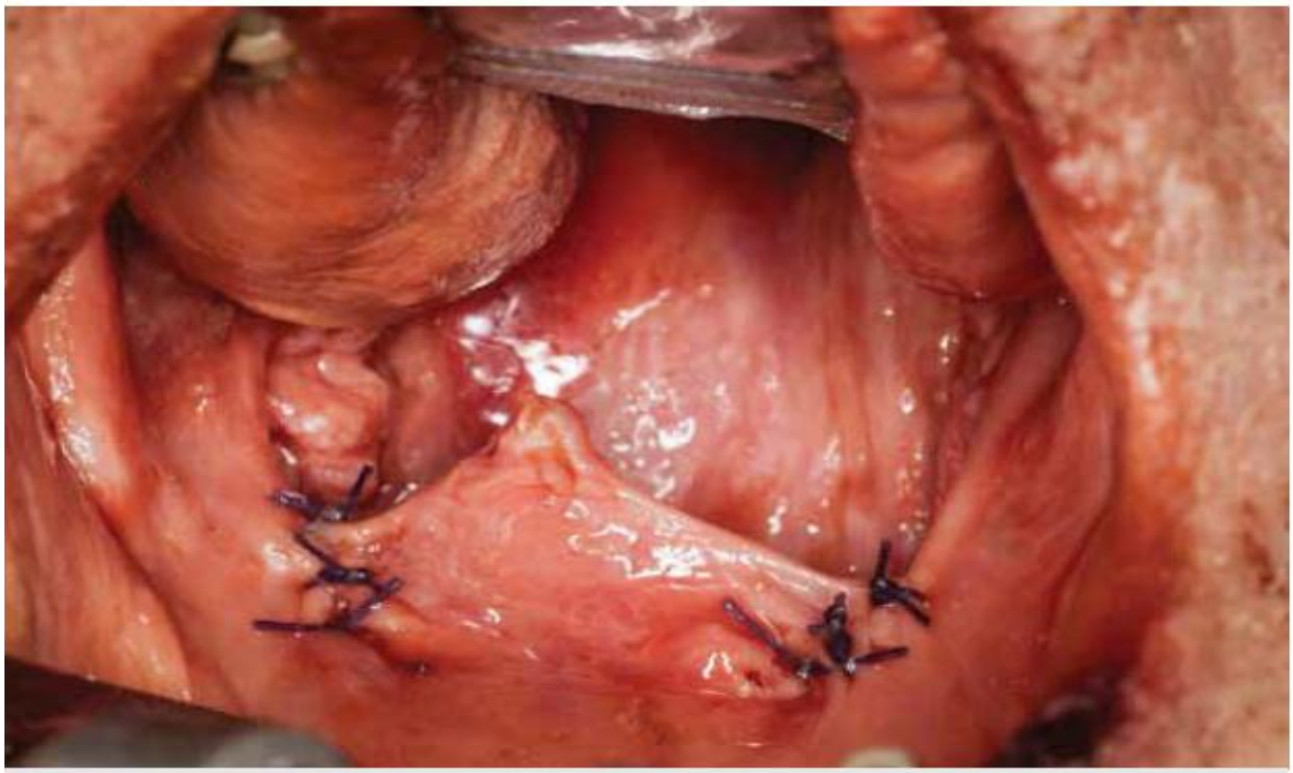


The same steps are repeated on the left

Superolateral velopharyngeal port openings, as well as increased anterior posterior dimension are achieved



A small neo-uvula is fashioned in a beveled plane, leaving a slightly greater amount of the posterior uvula mucosa

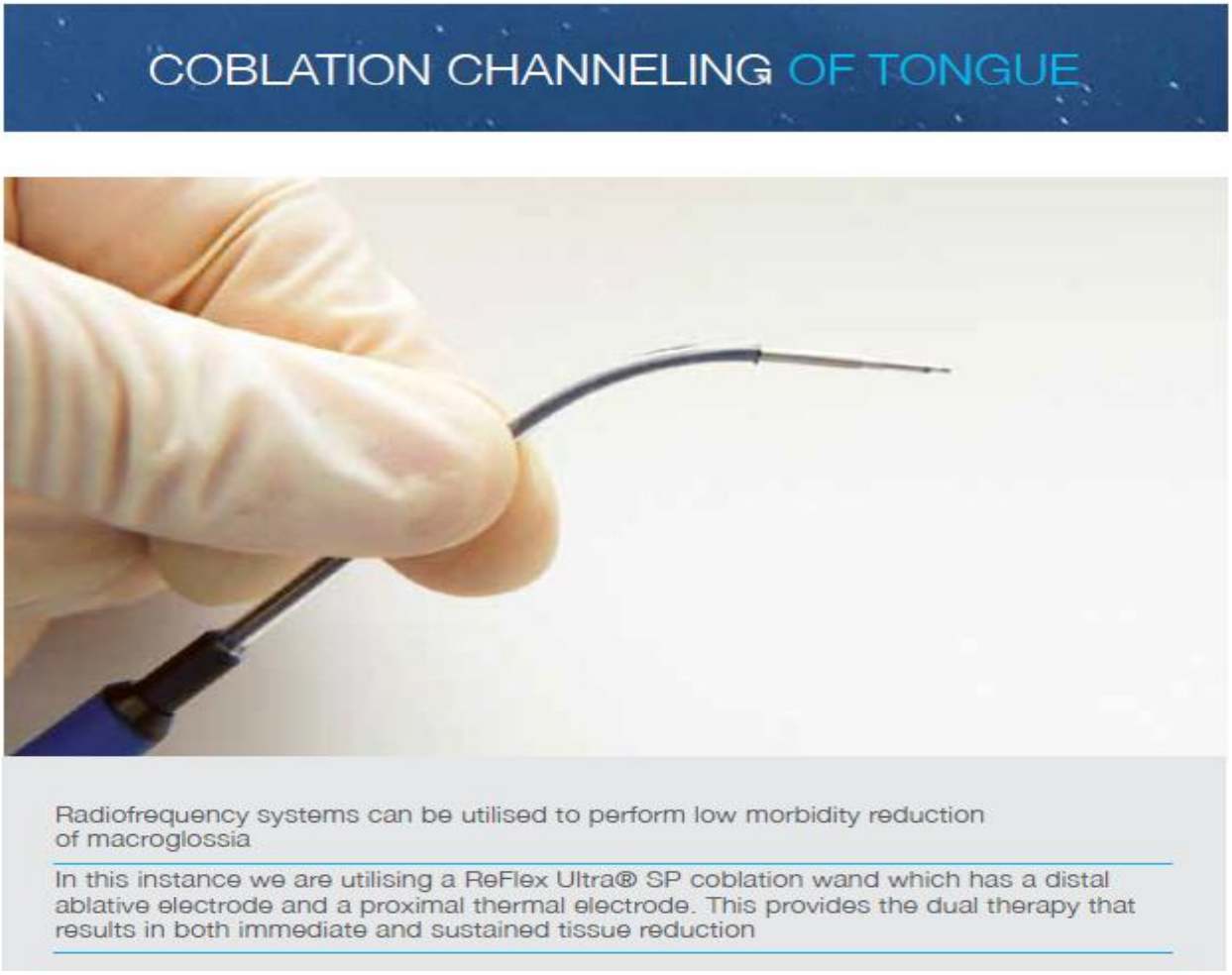


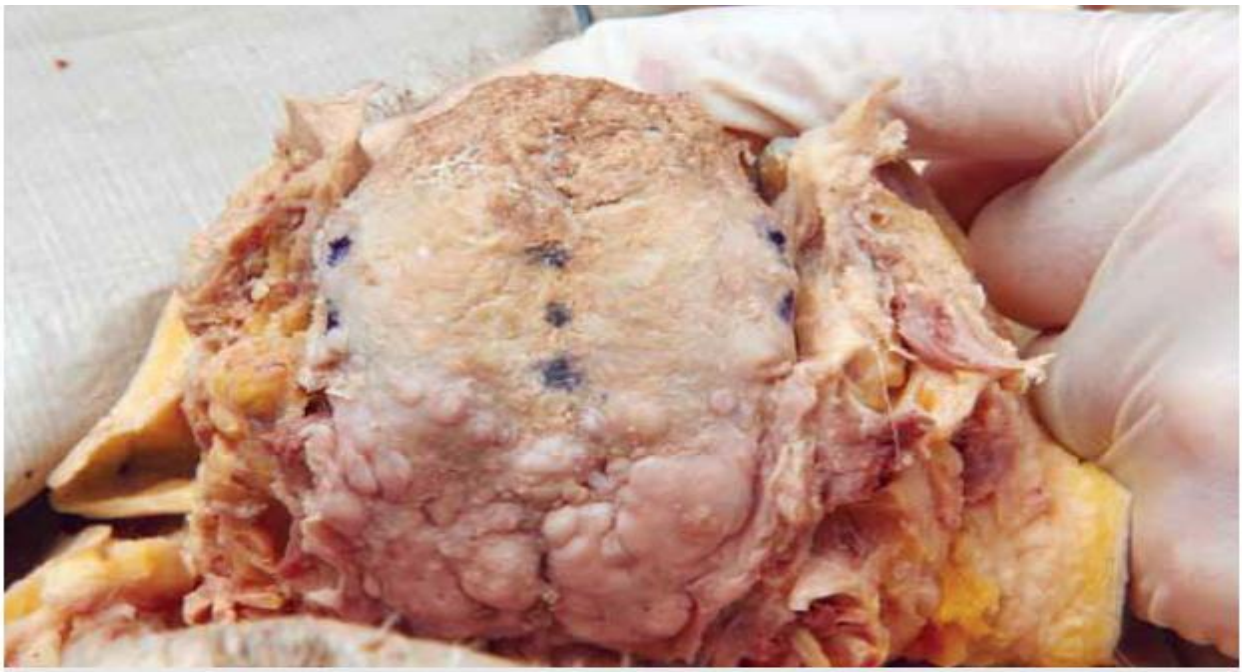
The completed operative view is shown

Coblation Channelling of the Tongue (CCT)

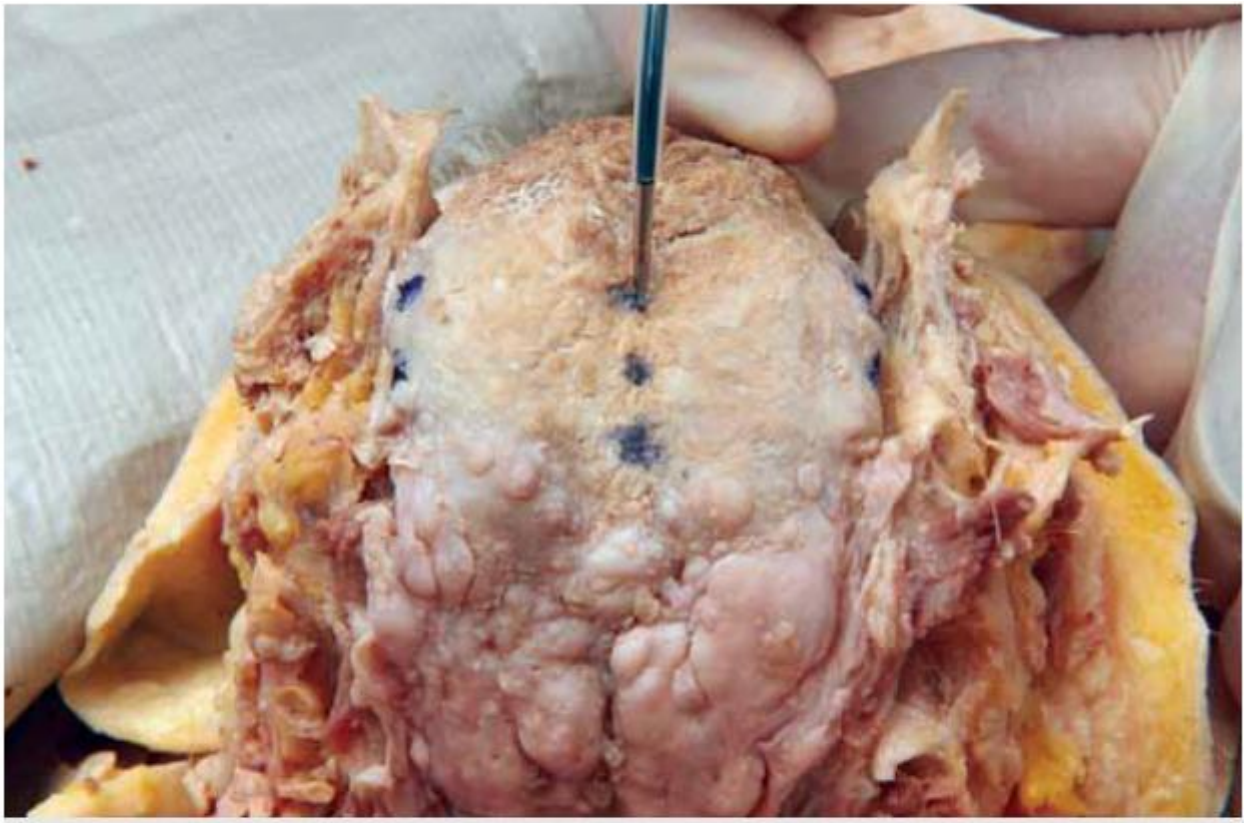
ReFlex XP wand, Power 6 **15 seconds per channel with chilled saline**		
Standard protocol:	**Total number of channels:**	**7**
	Midline coblation channels:	**3 standard**
	Lateral channels:	**4 (2 left, 2 right)**
Optional channels:	**Total number of channels:**	**9**
	Midline coblation channels:	**Up to 5, if no para-midline channels performed**
	Lateral channels:	**4 (2 left, 2 right)**
	Para-midline (optional):	**2 (1 left, 1 right), if only 3 midline channels performed**
	Lesions at **1 cm** intervals	
	Posterior limit:	**1 cm** anterior to circumvallate papillae
	Anterior limit:	**2.5 cm** from tip of tongue

All of the following images sourced from the Sleep Surgery Cadaver Dissection Manual (MacKay and Crawford 2013)

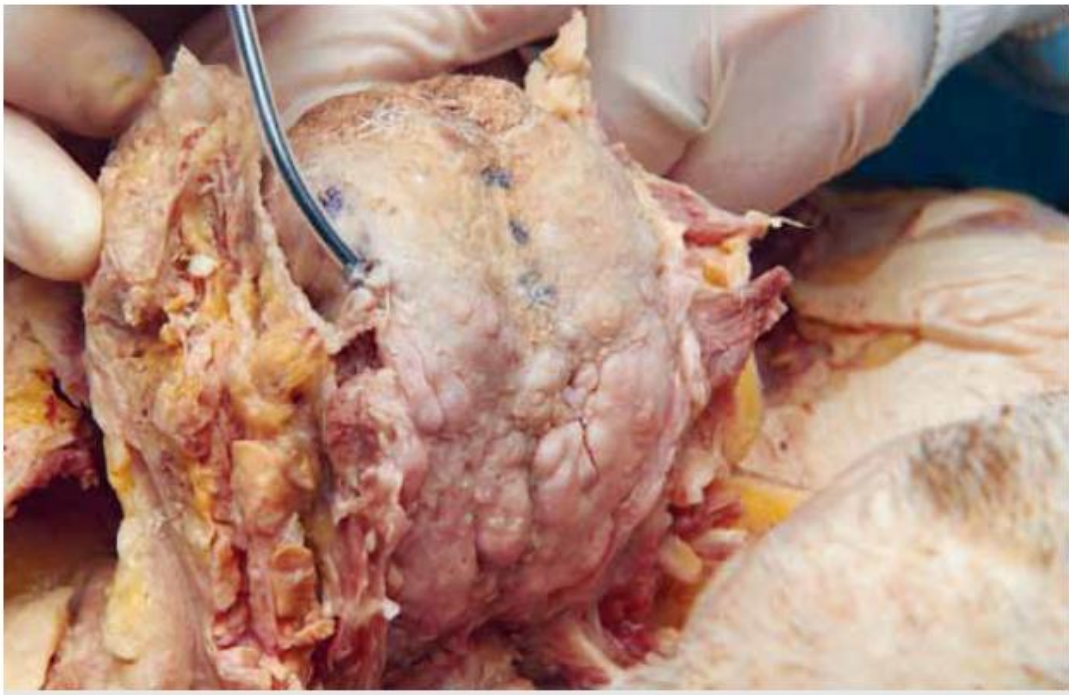




The probe can be passed into seven or nine anatomically safe channels preserving the integrity of the major neurovascular bundles

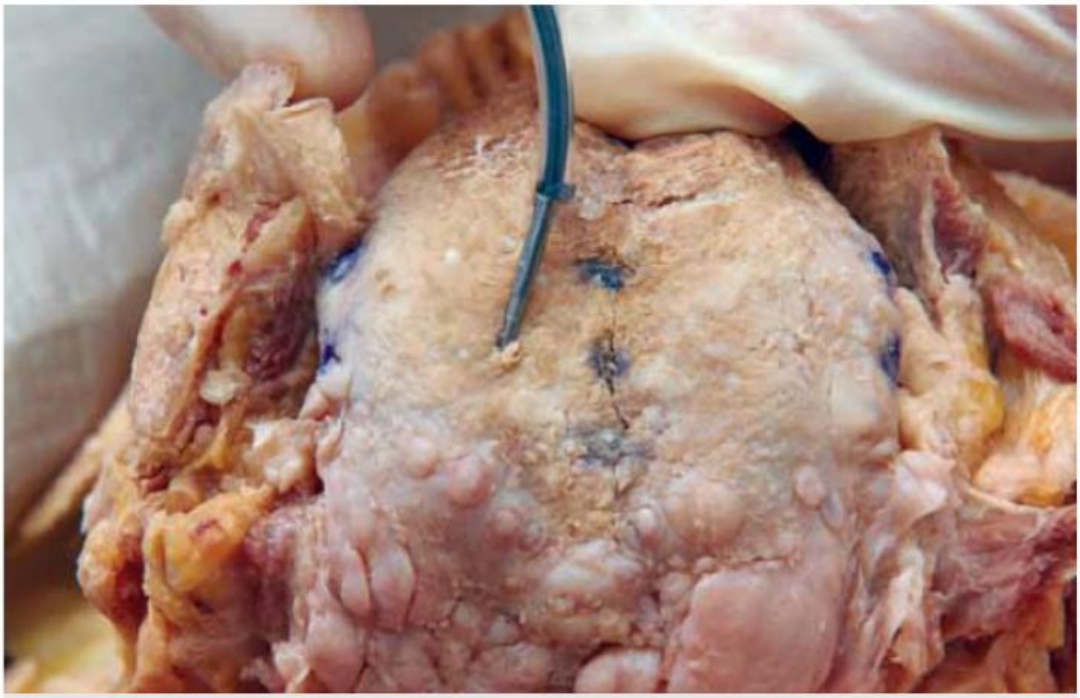


The first three channels should be in the midline, directing the probe posteriorly on an angle



Two lateral channels on each side are performed introducing the probe at the junction of the dorsal and lateral tongue mucosa

The probe is orientated towards the circumvallate papillae without angulation cranially or caudally



Two additional channels may be carried out by passing the probe midway between the midline and lateral tongue orientating the probe towards the postero-lateral tongue

Ensure delivery is performed superficially so as to preserve the integrity of the neurovascular bundle

Perioperative Care Protocols

Pre-Operative

Medications

All blood thinning mediations are to cease **2 – 10 days (as relevant) prior to surgery** and **10 days post-operatively.** These include (but are not restricted to) the following:

General	Aspirins	Anticoagulants	Anti-inflammatories
Echinacea	Aspirin	Asasantin	Brufen
Fish oils	Action cold and flu tabs	Brilinta (Ticagrelor)	Feldene
Flaxseed oil	Alka-seltzer	Clexane	Indocid
Garlic tablets	Aspalgin	Dindevan	Mobic (Meloxicam)
St John's Wort	Aspro/Aspro Clear	Heparin	Naprosyn
Gingko biloba	Astrix Bayer Aspirin	Eliquis (Apixaban)	Niapren
Tebonin	Bex powders/tabs	K-thrombin	Nurofen/Ibuprofen
Chamomile	Bufferin	Phenindione	Orudis
Vitamin C	Cardiprin	Plavix (Clopidogrel)	Surgam
	Cartia	Pradaxa (Dabigatran)	Tilcotil
ALL HERBAL SUPPLEMENTS	Codiphen	Warfarin (Coumadin Marevan)	Voltaren
	Codis	Xarelto (Rivaroxaban)	
	Codox		
	Codral Forte		
	Decrin powders		
	Disprin		
	Ecotrin		
	Morphalgin		
	Pedodan		
	Solcode		
	Solprin		
	Sra		
	Veganin		
	Vincent powders/tabs		
	Winsprin		

Post-Operative

- Assess tongue, ice to suck in recovery concurrent RFTA/CCT
- Intraoperative antibiotics, steroid
- ICU/ HDU monitoring
- Encourage post-op intake of fluids, soft foods
- Reduce incidence of gagging by sleeping upright at a 45^{o} angle for 10-14 days post-op

Medications

All patients initially offered *Standardised Tiered Analgesia:*

- Cephalexin x 500mg 4 daily 7-day course or alternative broad spectrum antibiotic
- 2 Panadol or 2 Panadeine Forte (or one of each) on every administration of antibiotic
- Post-operative telephone call regarding pain management/wound site
- Addition of 25 or 50 mg Prednisone as option for post-operative oedema or:
    i. On presence of persistent break-through pain
    ii. On presence of break-through pain
- Anti-reflux medications as indicated
- In the event of codeine instigated constipation, coloxyl and senna or lactulose

Additional Analgesia to the above for persistent break-through pain at surgeon's discretion:-

- Endone (5 - 10 mg 4 hourly PRN)
- Celebrex 100 – 200 mg BD PRN
- Tramadol 50 - 100 mg 48hrs PRN
- Endep 10 mg at night for up to 10 days

**** Caution: Use strong opioids with care with patients with significant obstructive sleep apnoea ****

Post-operative expectations

Presence of *Globus* in first month through to 3 months post-op is an expected manifestation of procedure. **Persistent *Globus* at 3 months and beyond is an <u>adverse event</u>**.

Other normal post-op occurrences include:

i) swollen uvula (or tongue because of the retractor)

ii) spitting out, swallowing stitches

iii) oedema

iv) minor bleeding at wound site

v) wound break-down

vi) halitosis

vii) whitish/greyish scab over suture line

Adverse Events

All adverse events occurring from the time the patient signs the consent form up to completion of the study, serious or not, should be recorded in the Adverse Event Form within 48 hours of study personnel becoming aware of the event. If the adverse event can be categorised as a Serious Adverse Event, a Serious Adverse Event Form must also be completed.

Post-op

Airway swelling - requiring medical or surgical intervention (other than steroids)

Bleeding – Stammberger grades B - E

Dehydration – requiring hospitalisation

Excessive pain – requires additional analgesia above protocol for persistent break-through pain.

Transient at 1 Month to 3 months

Velopharyngeal inadequacy (VPI) speech

VPI swallowing/ regurgitation

VPI hypernasality

Persistent at 3 Months and beyond 6 months

Globus pharyngeus

Taste loss

Tongue numbness

Tongue weakness

VPI speech

VPI swallowing/ regurgitation

VPI hypernasality

*An increase of **3 points** on the 0 - 10 scale from the Baseline scores (day of operation) is considered an adverse event and requires an Adverse Event Form to be completed.*

*If tongue function and taste responses at 3 month follow-up and beyond are **different from Baseline responses (worsening)**, this is considered an adverse event. Surgeon to investigate further and complete an Adverse Event Form.*

Bleeding Grades

Post-operative bleeding is measured using the grading system defined by Sarny *et al*., Laryngoscope 2011.

Severity of Bleeding Episode	
A	Anamnestically recorded blood-tinged sputum
A1	Wound is and stays dry, no coagulum upon inspection
A2	Coagulum upon inspection, dry wound after removal
B	Bleeding actively under examination, treatment necessary, dry wound afterwards, blood count in normal range, no shock
B1	Minimal haemorrhage, stops after non-invasive treatment (e.g. adrenalin sponge)
B2	Haemorrhage requiring treatment in local anaesthesia
C	Surgical treatment in general anaesthesia, blood count still in normal range, no shock
D	Dramatic haemorrhage, haemoglobin decreased, blood transfusion required, difficult surgical treatment, intensive care may be necessary
E	Exitus due to haemorrhage or haemorrhage-related complications

Sarny, S., Ossimitz, G., Habermann, W. and Stammberger, H. *Hemorrhage Following Tonsil Surgery: A Multicenter Prospective Study.* Laryngoscope, 2011. **121**(12): pp. 2553 - 2560.

*Post-operative bleeding of grades **B, C, D and E** are considered to be adverse events and require **an Adverse Event Form** to be completed.*

Serious Adverse Events

The mechanisms for reporting Serious Adverse Events are based on the guidelines adopted by the International Conference on Harmonisation Good Clinical Practice (ICH GCP). The definition of a SAE is any untoward medical occurrence that:

- Results in death
- Is life threatening (i.e. the patient was at risk of death at the time of the event; it does not refer to an event that might hypothetically have caused death had it been more severe)
- Requires in-patient hospitalisation or prolongation of existing hospitalisation
- Results in persistent or significant disability or incapacity
- Is a congenital anomaly or birth defect

Recording and Reporting Adverse Events

The minimum information required to be documented is diagnosis/adverse event term, details of any procedures performed, the date of onset and resolution and the investigator's opinion regarding the causal relationship of the event in relation to the study.

All Serious Adverse Events must be reported to the Southern Adelaide Clinical Research Ethics Committee. A Serious Adverse Event Report (template from SAC HREC) must be completed and submitted to the committee within 48 hours of study personnel becoming aware of the event, CC'd to the Wollongong, Sydney and RAH governances, if affecting that site. The committee must also be informed if the investigator believes that the SAE has implications for other study patients.

The study research assistants have all of the paperwork essential for reporting adverse events and serious adverse events. ***In the event of an AE or SAE, please contact your corresponding RA or trial project manager within 24 hours*** so the paperwork may be completed and sent to the relevant committees within 48 hours.

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