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National University Hospital

Médico

JUL - SEP 2015

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EAR NOSE THROAT

IN THIS ISSUE

WHAT'S INSIDE+

Médico Jul - Sep 2015 Issue

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A Publication of NUH GP Liaison Centre (GPLC)

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UPCOMING EVENTS+

August - September 2015

19 September 2015

Primary Care Management of Endocrine Surgery Disease

University Surgical Cluster – Division of General Surgery (Thyroid & Endocrine Surgery)
NUHS Tower Block Auditorium
2.00pm – 3.45pm

26 September 2015

Doctors' Interactive Session on "Childhood Asthma – What's New?"

Khoo Teck Puat – National University Children's Medical Institute
NUH "I Can!" The Children's Asthma and Allergy network
Grand Copthorne Waterfront Hotel
12.15pm – 4.30pm
Please email **ICAN@nuhs.edu.sg** **or call** **6772 4420** for more information.

Event information listed is correct at time of print. While every attempt will be made to ensure that all events will take place as scheduled, the organisers reserve the rights to make appropriate changes should the need arises. Please refer to our events calendar at **www.nuh.com.sg/nuh_gplc** for more updates and information.

Chronic Ear Infections

A chronic discharging wet ear can be an irritating symptom for patients.
Its presence usually indicates a chronic ear disease that can worsen to cause complications like hearing loss, dizziness, facial weakness and even brain infections.

Outer Ear

Chronic ear infections of the outer ear are usually caused by inflammation of the outer ear canal skin or the ear drum. Most outer ear infections can be easily treated by a course of antibiotic ear drops. However, certain conditions can lead to a chronic discharging ear.

The outer ear canal can be affected by allergy or eczema. It leads to a chronic itchy discharging ear. Topical steroids can be used to control the symptoms, with anti-histamines prescribed to control the itch.

Another less common condition of outer ear inflammation is myringitis. This is inflammation of the eardrum from chronic infection. It is also seen in patients who have had repair of the tympanic perforations many years earlier. In this condition, the typical squamous lining of the outer eardrum has been de-epithelized to be replaced by a granular layer. Manipulation of the layer leads to easy bleeding and is difficult to cure. A wet granular layer with thick mucus overlying is seen on otoscopy. Patients need to apply topical treatment with steroids or antiseptic solutions to the affected area for symptom control.

Two serious diagnoses - Malignant otitis externa (skull base osteomyelitis) and Temporal bone squamous cell carcinoma, may mimic a chronic outer ear infection. The former is not malignant but has a significant mortality rate. It is a deep bony infection typically seen in poorly controlled elderly diabetics. Both present with a chronic discharging ear with bleeding and pain.
Malignant otitis externa is diagnosed on MRI scans, which will highlight the extensive soft tissue and bony infection of the skull base. External ear canal cancers are diagnosed based on tissue biopsies of the ear canal.
The diagnosis is often delayed as the clinician typically will treat these two conditions as otitis externa infections. If a patient does not respond to standard topical treatment, these two diagnoses need to be considered and excluded.

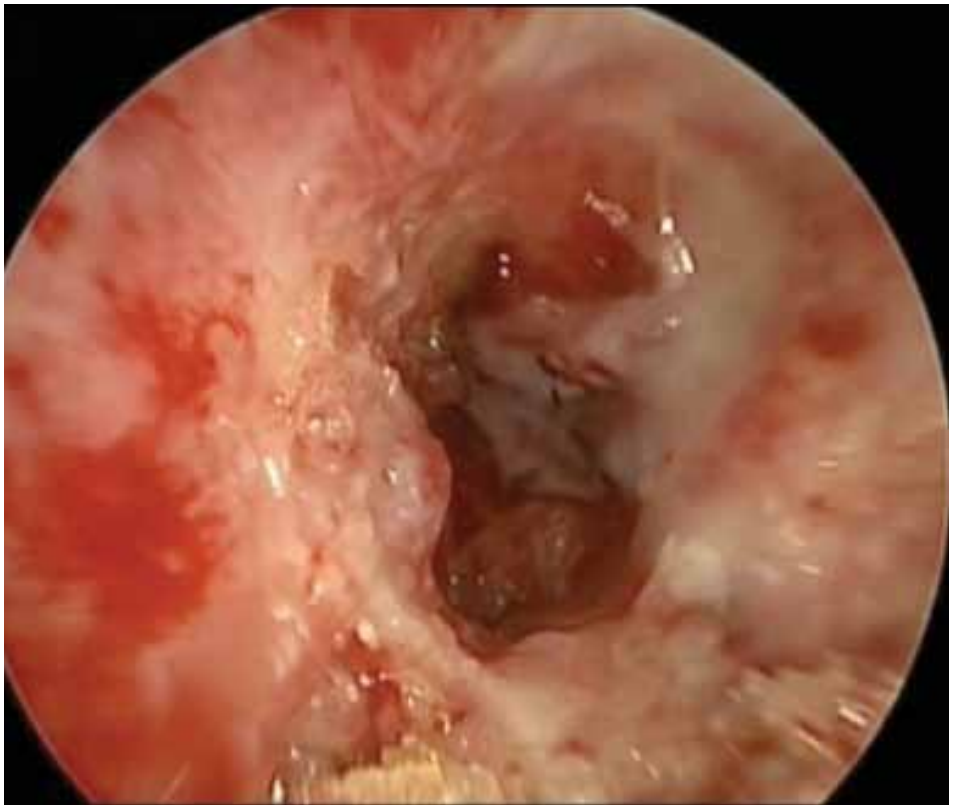

Figure 1: The left ear canal with granulation tissue and eroded exposed bone – External ear canal squamous cell carcinoma.

Middle Ear

Chronic ear infections of the middle ear are generally more serious.
The middle ear provides routes of infection into the inner ear, facial nerve and the brain. Some complications from infections are labyrinthitis, facial palsy, sigmoid sinus thrombosis and cerebral abscesses with meningitis. Although these complications are rare, they occur occasionally, especially in diabetics and immuno-compromised patients.

A persistent discharging ear should be cultured. The most common organism that infects the middle ear is pseudomonas aeruginosa.
The antibiotic of choice is ciprofloxacin or ceftazidine, and irrigation of the middle ear through the perforation can be done with topical antibiotics. However, aminoglycoside ear drops should be used with caution due to the dangers of ototoxicity, and these are not recommended in the presence of an eardrum perforation. If the mastoid air cells are infected, then an oral antibiotic is added for systemic coverage.

The most common chronic ear infection of the middle ear is a perforated eardrum with chronic discharge. This is termed chronic suppurative otitis media. The presence of a perforation does not equate to a discharging ear. Many patients with dry perforated ear drums do not have symptoms and surgery may not be required.
A discharging perforation, however, indicates an active infective process in the middle ear and mastoid. Hence, treatment may require exploration of the middle ear and mastoid air cells with a mastoidectomy.

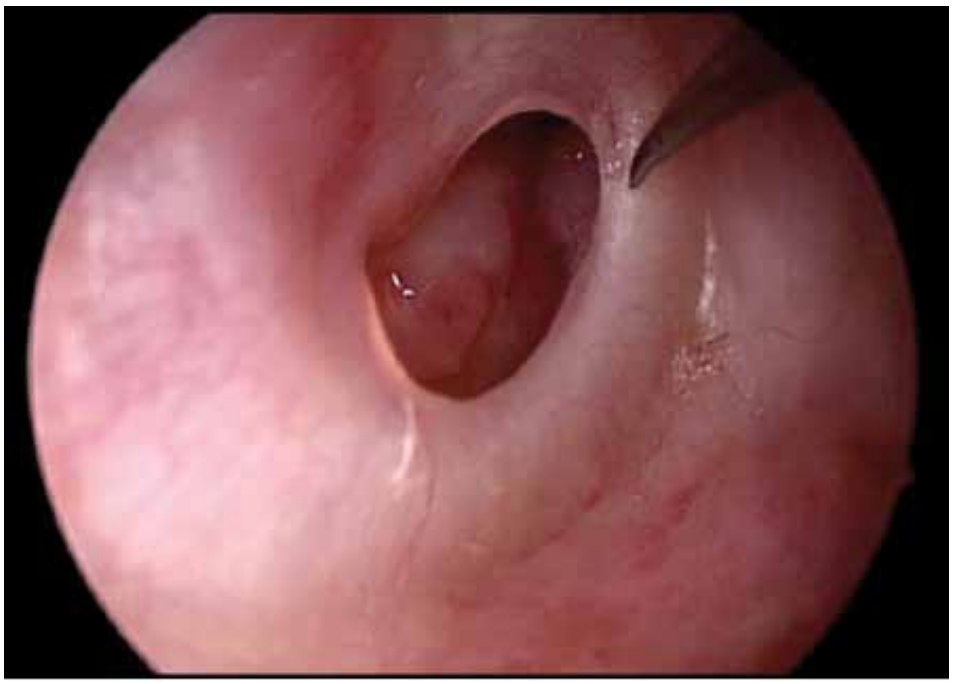

Figure 2: Right tympanic eardrum perforation

A more serious problem exists when there is a cholesteatoma. In adults, the cause is mostly due to a retracted eardrum. With poor ventilation of the middle ear, a vacuum progressively builds up in the middle ear. This causes the weakest part of the eardrum to pull in, typically at the pars flaccida. From a shallow retraction, a cholesteatoma sac gradually forms and expands into the middle ear and its surrounding structures. The condition presents with hearing loss or a discharging ear initially and may take years for the condition to progress. With time, bony erosion occurs into the surround structures like the inner ear and brain. It can then lead to a secondary infection, which causes mastoiditis. Some patients never realized that they have a cholesteatoma until they develop vertigo or a brain abscess. Once a cholesteatoma is diagnosed, surgery is recommended to remove the disease. The goals in order of priority for this condition are to make the ear safe, to create a dry ear and lastly to restore hearing.

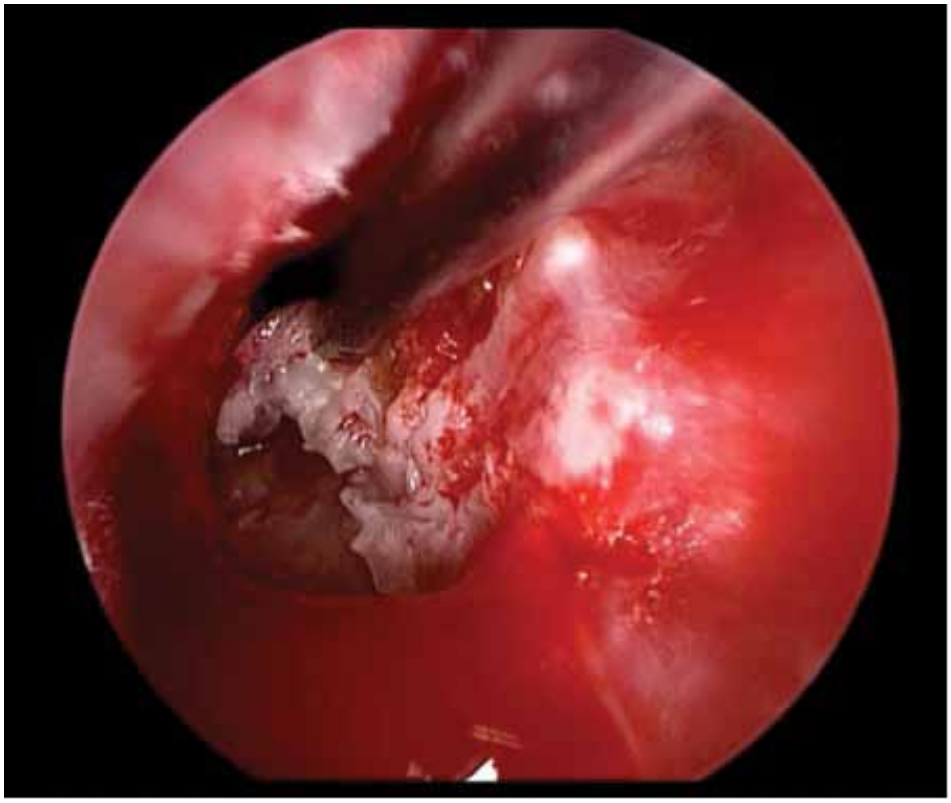

Figure 3: Cholesteatoma in the middle ear

Surgery for the middle ear may include an eardrum repair, ossicular chain repair and a mastoidectomy. Conventional approaches are typically done with the microscopic technique. Surgical approaches with the microscope can be transcanal or endaural (through the ear canal), and a post aural technique (behind the pinna).

In an eardrum repair (myringoplasty), a piece of fascia is harvested from the patient to cover the perforation, which can be done over the hole (onlay) or under the hole (underlay). If the ossicular chain needs to be repaired, cartilage or the patient's remnant ossicular chain can be fashioned to recreate the connection between the eardrum and the inner ear. In the absence of autologous tissue, titanium prosthesis can be used for ossiculoplasty.

Removal of cholesteatoma typically requires a mastoidectomy and is conventionally done by a post-aural microscopic approach. Bony drilling is required to reach the cholesteatoma for removal and the amount of drilling depends on the extent of the disease and the aeration of the mastoid cells. Extensive drilling may mean a large post-operative ear cavity that requires regular cleaning by the surgeon for life. Follow-up is recommended after a mastoidectomy for assessment of residual or recurrent cholesteatomas.

In recent years, the endoscopic approach can be used in myringoplasty and limited mastoidectomies. This involves a completely transcanal approach with instrumentation only through the ear canal. This results in the reduction of post-operative pain and discomfort

due to the limited soft tissue work required. Complications involving the post-auricular wound are also avoided. While suitable for eardrum repair surgery, the approach should only be used for limited cholesteatomas confined to the epitympanum of the middle ear.

Outcome

A recent endoscopic middle ear operation was done for a young man with known bilateral cholesteatoma. He had undergone a standard microscopic approach for removal of his cholesteatoma over the last two years. His right ear continued to have significant hearing loss despite an initial ossicular chain repair with a titanium prosthesis. A CT scan showed that the prosthesis was displaced. The endoscopic approach allowed the operation to be done entirely through the ear canal without any skin incisions. He underwent the procedure under general anaesthesia, which took less than an hour. His eardrum was elevated and a new ossicular prosthesis was inserted into the middle ear. A check of the middle ear showed no evidence of residual cholesteatoma. He was able to be discharged on the same day and gained good hearing outcomes after his revision ossiculoplasty.

Conclusion

Chronic ear infections can be controlled or eradicated. At times, surgical intervention is required to solve the problem. While rare, mastoiditis can still cause central infections, and the ear as the source of infection needs to be excluded. Persistent symptoms with no resolution should be referred for further investigations.

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Chronic Sinusitis

Chronic sinusitis or chronic rhinosinusitis (CRS) is a fairly common condition with estimated prevalence ranging from 6.9% to 27.1%. Though it usually does not lead to serious complications like spreading of infection to the nearby eye or brain (which are usually more a complication of acute sinusitis), patients still do suffer from significant loss of quality of life and impaired productivity.

Causes

The cause of CRS is multifactorial, varies from patient to patient, and frequently elusive. They include allergies like asthma and allergic rhinitis, environmental irritants like smoking, anatomical factors, bacterial infection, fungal disease, and immune disorders.

Nasal polyps

A subset of CRS patients also has bilateral nasal polyps (i.e. CRS with nasal polyps, or CRSwNP). It is important to differentiate this group from the "run-of-the-mill" CRS patients that do not have nasal polyps, because CRSwNP is more difficult to treat (Figures 1a, b, c). This group of patients usually requires oral steroids, and is at a higher risk of recurrence. However, not all nasal polyps are benign and inflammatory in nature. If a polyp is unilateral (instead of bilateral), it may be neoplastic and should be biopsied after review by a specialist.

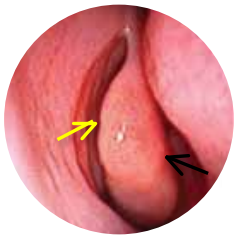

Figure 1a: Endoscopic view of a normal right middle meatus (a vertical cleft-like space through which many sinuses drain- yellow arrow). Middle turbinate (black arrow).

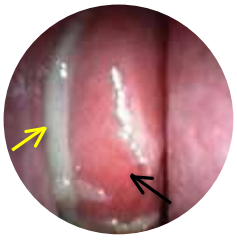

Figure 1b: CRS. Right middle meatus swollen shut with pus (yellow arrow). Middle turbinate (black arrow).

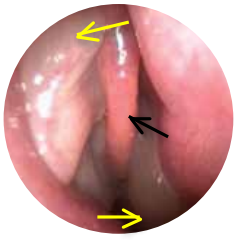

Figure 1c: CRS with nasal polyps (CRSwNP). Pale, grayish-white nasal polyps (yellow arrows). Middle turbinate (black arrow).

Diagnosis

The diagnosis of CRS can usually be made in the primary care setting based on the patient's history. This would be (a) a combination of any of the following **typical symptoms**: nasal congestion, nasal discharge (especially discoloured), facial pressure and/or loss of smell, and (b) **duration**: greater than three months. (If the symptoms have been present for less than three months, the diagnosis would be acute sinusitis)

Differential diagnoses

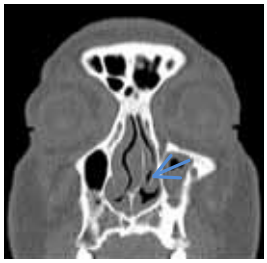

Figure 2: Deviated nasal septum (blue arrow) on CT scan.

It is sometimes difficult to differentiate CRS from other more common nose conditions like allergic rhinitis and deviated nasal septum (Figure 2), especially if the main complaint is just nasal congestion or if the nasal secretions are not discoloured. Less common conditions to also bear in mind include neoplasms. In such cases, a naso-endoscopy performed in the ENT clinic will help to confirm the diagnosis, as well as differentiate between CRS with, or without, nasal polyps.

Primary care management

The first-line management of CRS is medical therapy.[1,2] This mainly consists of intranasal steroid sprays and saline nasal irrigation (especially if there is nasal discharge) to treat the chronic inflammatory process (Figures 3a & b). In the primary care setting, it is recommended that antibiotics be reserved for acute exacerbations/ moderate-severe symptoms. The recommended duration is for 10-14 days and appropriate empirical antibiotics include amoxicillin with/without clavulanate, trimethoprim-sulfamethoxazole, macrolides and fluoroquinolones. The clinical response rates to such short-term antibiotics range from 56% to 95%. Anti-histamines may be used for those with a background of allergic rhinitis. The efficacy of mucolytics and decongestants is not well-established but they may be added for symptom relief.

Figure 3a: Commercially available squeeze bottle and saline salt packets for nasal irrigation.

Figure 3b: Patient squeezing saline up into his right nose, and out through his left nose.

The patient should be reviewed in about one month, and if the symptoms have not adequately improved, or he/she has frequent exacerbations (e.g. more than three times per year), then it would be prudent to refer the patient to an ENT specialist.

Specialist care management

The ENT specialist can help manage a CRS patient in the following ways:

(i) Naso-endoscopy – to rule out differentials, and confirm the presence or absence of nasal polyps

(ii) Targeted nasal aspirate of pus - for culture

(iii) Allergy and/or immunodeficiency testing

(iv) CT scan of sinuses – to establish the extent of the disease, and serve as a "road-map" during surgery

(v) Long-term pharmacotherapy - and monitoring of side effects

(vi) Serial endoscopic exam – for more accurate monitoring of patient's clinical response. This is important to justify longer courses of antibiotics.

(vii) Surgery

Long-term pharmacotherapy includes longer courses of antibiotics. There is no consensus regarding ideal length of antibiotic course and is thus usually tailored to the patient's clinical response. This may range from about six weeks of standard-dose antibiotics, to more than 12 weeks of low-dose mac rolides. Other medications that may be used include oral steroids, especially for those with nasal polyps.

If the patient fails the above medical therapy and has persistent or recurrent bothersome symptoms, then surgery would be recommended.

Sinus Surgery

The surgery to be performed is called endoscopic sinus surgery (ESS). During surgery, the patient's sinus outflow tracts are unblocked and widened with the judicious removal of swollen and diseased soft tissue (Figure 4). Trapped pus within the sinuses is also cleared. Nasal polyps, if present, are removed or debulked. All these will enable normal sinus ventilation and physiology to return (Figures 5a & b).

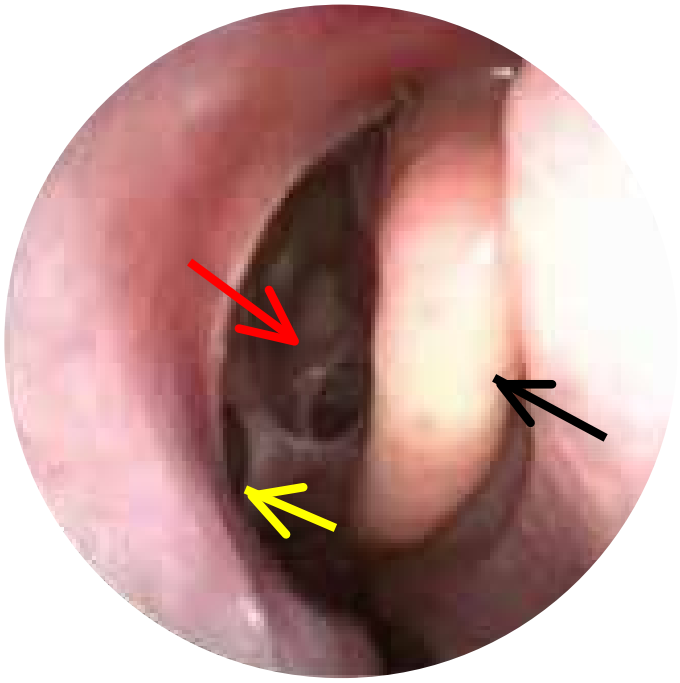

Figure 4: Endoscopic view of a wide-open and clean right middle meatus after successful sinus surgery. Enlarged opening to the maxillary sinus (yellow arrow). Opened ethmoid sinuses (red arrow). Middle turbinate (black arrow).

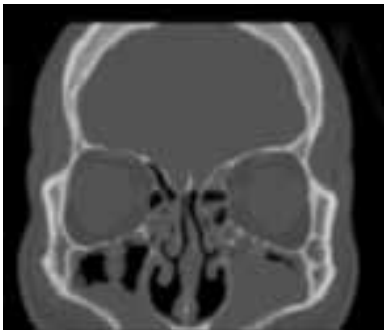

Figure 5a: Pre-op CT scan of the sinuses showing CRS with opacification/disease in the maxillary and ethmoid sinuses.

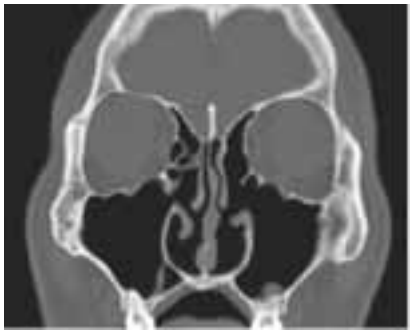

Figure 5b: Post-op CT scan of the same patient showing successful ventilation of the maxillary and ethmoid sinuses with resolution of disease/opacification.

This operation is performed under general anesthesia, and the patient is usually discharged either on the same day (i.e. day surgery), or after an overnight stay for routine observation. Patients can usually return to office in about one week, and resume normal activities in about two weeks.

Overall success rates with symptom improvement are generally between 75-95% of patients, with 10-15% requiring revision surgery.

However, the success rates of treatment can differ significantly depending on the cause(s) and extent of disease. An example of a very good surgical candidate would be one with CRS due to a fungus ball in the maxillary sinus (Figures 6a & b). Surgery would be strongly recommended to such a patient as cure rates are very high. A poorer surgical candidate would be a patient with Samter's triad (i.e. CRS with nasal polyps, asthma and aspirin-sensitivity). Such a patient is at a particularly high risk of recurrence of his nasal polyps, and will probably require repeated surgeries to episodically clear the polyps and relief nasal obstruction. He may even need to undergo an aspirin desensitisation program.

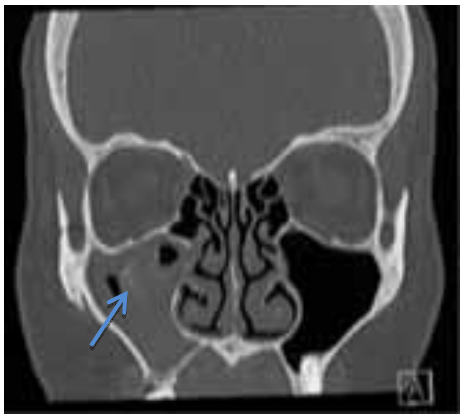

Figure 6a: CT scan showing CRS of the right maxillary sinus. Blue arrow points to an area of increased density which frequently indicates a fungus ball.

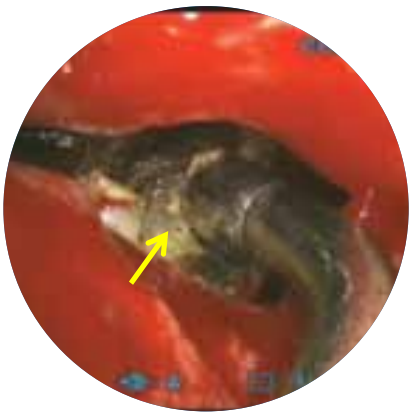

Figure 6b: Intraoperative picture of the same patient. A curved sucker is being used to suck out the fungus ball (yellow arrow) from within the maxillary sinus.

Balloon Sinuplasty – A Minimally Invasive Option

Balloon sinuplasty is a relatively new tool developed for sinus surgery. It essentially dilates sinus outflow tracts while preserving surrounding mucosa (Figure 7). Its main advantage over conventional rigid

instruments is its lower risk of stripping mucosa unintentionally, thereby avoiding scar formation which could lead to recurrent sinusitis.

Currently, the main indication for its use is surgery for mild-to-moderate chronic sinusitis (especially the frontal sinus). Data so far suggests that its clinical efficacy is at least comparable to traditional rigid instruments, but probably with a better safety profile.[3, 4] There is however additional cost that needs to be discussed with the patient.

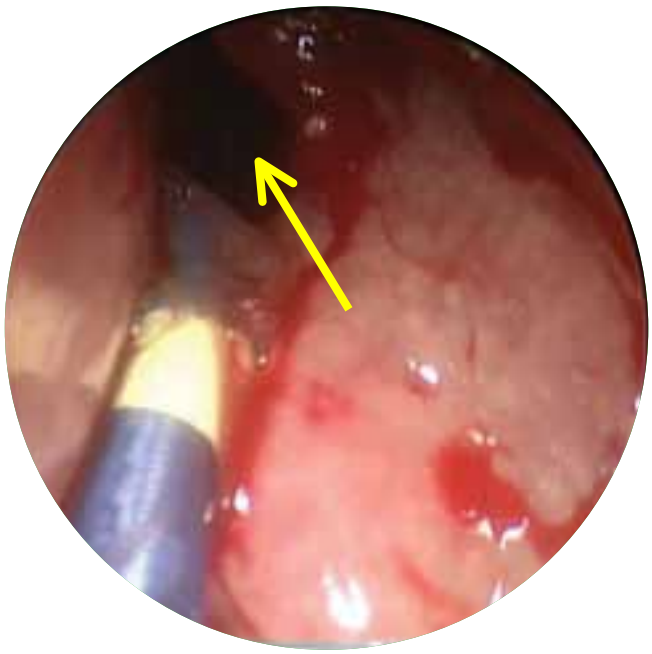

Figure 7: Balloon within dilated frontal sinus outflow tract (yellow arrow).

Paediatric CRS

Children share the same diagnostic criteria (i.e. typical symptoms and duration) as adults for CRS, with an additional predominant symptom of chronic cough due to post–nasal drip.[5] Once again, clinical diagnosis is more challenging as there is significant symptom overlap with other common childhood conditions, such as frequent viral upper respiratory tract infections, adenoid hypertrophy/adenoiditis and allergic rhinitis. The child may also not be compliant with a naso-endoscopy in the clinic. Thankfully, causes of refractory paediatric CRS like cystic fibrosis and primary ciliary dyskinesia are rare in our local population. Management by both the primary care and ENT specialist follows that of adults with age-appropriate medication. The child may also need to be evaluated for gastro-esophageal reflux which can be associated with paediatric CRS. Apart from ESS, alternative surgical options for a child with CRS would be an adenoidectomy, with or without antral washout.

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5. Fokkens et al. EPOS 2012: European position paper on rhinosinusitis and nasal polyps 2012. A summary for otorhinolaryn gologists. Rhinology. 2012 Mar;50(1): 1-12

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Dr Thong completed his fellowship in Rhinology and Sinus Surgery at the Lahey Clinic, Massachusetts, USA. His subspecialty practice encompasses chronic sinusitis and nasal polyposis, endoscopic and minimally invasive sinus surgery (ie “balloon sinuplasty”), open septorhinoplasty for nasal obstruction, and sinonasal allergy. Apart from general ENT, his other area of interest is in snoring and obstructive sleep apnea (OSA).He is also currently the Director of Undergraduate Education for Otolaryngology in the Yong Loo Lin School of Medicine, National University of Singapore.

Tonsillitis in Children

In my practice, I commonly encounter children who see me because of sore throat and a diagnosis of tonsillitis was made. Sometimes the problems may be related to snoring and obstructive sleep apnoea caused by tonsillar and adenoid hypertrophy. Recurrent, chronic tonsillitis and obstructive hyperplasia are no doubt the most common diseases of the tonsils and adenoids in children. Tonsillectomy and adenoidectomy remain the most commonly performed surgery in children in Singapore today.

To understand the diseases affecting the tonsils and adenoids better, we need to know a little bit about the anatomy and physiology.

The tonsils are paired oval-shaped masses located on the lateral walls of the oropharynx. They can be graded into Grade 0, 1, 2, 3, 4 based on the ratio of the tonsils to the oropharynx between the anterior pillars.

The tonsils and adenoids have always been known for their immune surveillance role in the body. The tonsils have 10-30 cryptlike invaginations that branch deep into the tonsil parenchyma and these invaginations are lined by specialised antigen-processing squamous epithelium. The epithelium serves as immune's system access route for both inhaled and ingested antigens.

Based on the literature reports, they have not found a significant specific adverse effect on overall immunologic integrity after adenotonsillectomy. In the cases where adenotonsillectomy was performed, the removal was clearly for well defined clinical disease such as recurrent/chronic tonsillitis. We have not had any patients with compromised immunity after surgery.

Clinical presentation

Acute tonsillitis

A child with acute tonsillitis commonly presents with fever, sore throat and tender cervical lymph nodes. Examination of the tonsils will reveal erythematous, enlarged tonsils with exudates. The most common organism that has been associated with acute tonsillitis is the Group A beta-hemolytic streptococcus (GABHS). Epstein – Barr virus (EBV) infection can also present as a serious acute pharyngotonsillitis and sometimes with airway obstruction.

In the acute period, the child experiences a lot of pain and may refuse oral intake. Antibiotics and analgesia are usually given. Occasionally, when the pain is severe and the child is not able to tolerate orally, they may be admitted for hydration and IV antibiotics.

Recurrent tonsillitis

is defined as four to seven episodes of acute tonsillitis in one year, five episodes for two consecutive years or three episodes per year for three consecutive years.

Chronic tonsillitis

is defined as chronic sore throat, malodorous breath, excessive tonsillar debris (tonsolliths), peritonsillar erythema, and persistent tender cervical lymphadenopathy when no other sources can be identified.

Tonsillectomy indications

The indications for tonsillectomy are obstructive or infective causes, or suspected neoplasia.

The most common indication is tonsillar hyperplasia with obstruction, resulting in obstructive sleep apnoea. Tonsillar hyperplasia can also result in failure to thrive due to marked swallowing impairment. Other problems related to tonsillar hyperplasia include orofacial abnormalities, corpulmonale and speech abnormalities.

Recurrent and chronic tonsillitis are other indications for tonsillectomy. Rarely, we have performed tonsillectomy for children with asymmetrically enlarged tonsils to exclude malignancy.

Surgery and complications

The surgery is performed under general anaesthesia and the actual surgery is about 30 minutes. In children with no significant co-morbid, they can be discharged on the same day after the day surgery. Very young children or children with other co-morbids, craniofacial abnormalities usually have to stay for one night for observation and discharge the following day. Children with moderate to severe obstructive sleep apnoea will require higher level of monitoring post-surgery and they will be monitored in the High Dependency Unit overnight.

The techniques and instruments used range from cold dissection, monopolar cautery, coblation and Peak plasma. Regardless of the technique chosen, meticulous hemostasis is required for all techniques.

The common complications after tonsillectomy are pain, emesis, dehydration and bleeding. Very rarely, there can be pulmonary edema after the relief of both acute and chronic airway obstruction. In my practice, most children tolerated the surgery very well and were able to eat soft cool diet on day 1. After one week, most have resumed their usual diet.

Complication of tonsillitis

Peritonsillar abscess (a.k.a. Quinsy) is due to infection of a peritonsillar minor salivary gland (Weber's gland) located between the tonsil capsule and the muscles of the tonsillar fossa. Peritonsillar abscess was once thought to be a complication of tonsillitis.

The child can present with severe sore throat, odynophagia with drooling, muffled voice and trismus. Clinical examination may reveal a peritonsillar bulge with medial and inferior displacement of the tonsil.

It is more common in older children, adolescents and adults. In an adolescent or an adult, needle aspiration or incision drainage can be performed successfully. In a younger child, the presence of peritonsillar abscess may sometimes necessitates a Computed Tomography (CT) scan, and possible drainage under general anaesthesia, or even hot tonsillectomy.

Diseases of the tonsils and adenoids remain to be the most common problem in children. Good communication with general practitioners, paediatricians and parents is very important in the management of the disease, and for surgical planning whenever necessary.

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Paediatric Cochlear Implantation

The ability to hear allow us to appreciate sounds and surroundings, communicate with each other, and develop language and speech. To many, this important ability comes naturally. However, in some children this ability is impaired, either congenitally or lost through post-natal mishaps. Such incidence of congenital hearing loss occurs in around 4 per 1000 live births, making it one of most common congenital defects.

The inability to hear or impaired hearing can severely impact a child's educational and psychosocial development. The significant negative consequences might persist despite adequate management, especially in those who received intervention late. It is with this understanding that a nation-wide newborn hearing screening was developed. All babies born in Singapore will have a Universal Newborn Hearing Screening at birth. Those who failed the screening require close follow-up. Most hearing loss can be adequately investigated or determined by six months to a year of age.

Majority of the congenital hearing loss is due to inner ear hair cell abnormalities, resulting in an inability to convert sound energy into neural impulses. Cochlear implant works by stimulating the auditory nerve endings, bypassing the hair cells. This invention has revolutionised the management of severe to profound hearing loss in children. Since 1990s, the use of such devices in children has been approved by FDA in children above 12 months of age, making it a standardized treatment for patients with hearing loss.

Cochlear implant has an external part which is worn much like a hearing aid, and an internal part, which has to be surgically implanted into the mastoid region. The surgical insertion is through a standard postauricularmastoidectomy, entering the middle ear via a posterior tympanotomy. Entry into the cochlear is usually done through a small drilled opening around the round window of the cochlear, or through the round window membrane. Device is left in-situ dormant and is usually turned on two to four weeks later, upon proper healing of the wound.

Pre-implantation work-up is important to select the candidate for implantation. Audiologically, cochlear implant is recommended for children with bilateral severe to profound sensorineural hearing loss (>70 dBHL), not amenable to hearing aids. Children usually go through a trial of hearing aids for three to six months, and those with poor response to hearing aids are counselled for cochlear implant.

Child's social set-up, especially parental/caregiver support, is evaluated as the child will need intensive rehabilitation post-implant to achieve good outcome. Child is also evaluated medically to ascertain he/she is fit for anaesthesia or the surgery. Pre-operative imaging is performed to determine if the inner ear is suitable for implant. In our centre, both a CT scan of the temporal bone and a MRI scan of the temporal bone and brain, are done as part of pre-surgical evaluation. Immunisation against Pneumococcal and Haemophilius is done to minimise post-operative meningitis risks.

Complications in cochlear implantation are low (around 10%). Majority are minor complications, e.g. wound infection, taste disturbance and device failure. Major complications, e.g. facial nerve palsy, perilymphatic gusher/cerebrospinal fluid leak and meningitis, are rare (less than 1%).

Despite it being established for rehabilitation for children with hearing loss, there are still some controversies in paediatric cochlear implantation:

1. Age of implantation

In pre-lingually deaf children, the best results are seen in children implanted under two years of age. This is likely related to neural plasticity at the early age. Beyond three years of age, the outcome tends to be poorer due to the auditory cortex in the brain gradually being taken over by other intact senses through cortical re-organisation. Early cochlear implantation aims to reduce the period of sensory deprivation and maintain the normal development of the auditory pathway in the early childhood period. Despite the obvious advantages, one has to balance the surgical and anaesthesiological risks in operating in young children.

Most cochlear implantation surgeries are done beyond one year old, but there have been reports of these surgeries being performed in children at six months of age. There are reports claiming better language outcome in such early implantation but there are also reports not seeing such advantage. Furthermore, the audiological evaluations might be difficult to interpret at such early age.

The exception to this controversy is children with hearing loss due to meningitis. With the rapid ensuing cochlear obliteration after meningitis, early implantation upon confirmation of hearing loss might make implantation easier.

2. Bilateral implantation

Bi-aural hearing is fundamental in sound localisation and better hearing in noisy situation. Children with unilateral cochlear implant and profound hearing in the contralateral ear do not perform well in these tasks, despite the implant. Bilateral cochlear implantation can potentially negate this problem. Although the concept appears advantageous, the doubling of the cost and operative time has to be taken into consideration. Furthermore, the cost of maintaining both implants can be significant as well.

3. Presence of inner ear malformations

About 20% of children with congenital sensorineural hearing loss have inner malformations. The outcome of implantation in these children is inversely related to the severity of deformities. Implant performance and outcome in cases with mild inner ear malformations is almost similar to those with no inner ear malformations. With advancements in implant technologies, the electrode can be designed to conform to the malformations, making many of such abnormalities not a contra-indication to cochlear implantation.

However, one still need to be aware of higher risks of CSF leakage, perilymph gusher, facial nerve damage due to anomalous facial nerve position etc. in these children.

4. Presence of associated medical or neurocognitive issues

Up to 30% of children with congenital hearing loss have some associated conditions, e.g. cerebral palsy, attention deficit hyperactive disorder, visual disorders and mental retardation. Language development, and eventually oral communication in these children can be difficult to achieve due to the associated medical issues.

Family members of these children do report improvement in quality of life, family interaction and sound awareness in these children after cochlear implant. Hence, implantation might not be contra-indicated as long as parental expectations are appropriate and realistic.

5. Single-sided deafness

Although children with single-sided deafness are still able to hear, they seemed to have more problems in noisy situations and a higher number of them do struggle in school compared to normal hearing children. While hearing aids can help, they might not be of much use in those with severe- profound single-sided hearing loss.

From adult studies, cochlear implant is able to restore bi-aural hearing in patients with single-sided deafness. However, data in children is still lacking. Preliminary data indicated improvement in sound awareness but spatial orientation did not improve in this group of children as compared to post-lingually affected children or adults. Studies need to be done to shed more light into this area.

Presently, cochlear implantation is considered a safe and highly effective technique to rehabilitate hearing impaired children worldwide. The significant improvement in cochlear implants over the years can be seen in the comparison methods. Previously, we used to compare results of implant candidates to children on high-power hearing aids. Now, we are comparing implant users to normal hearing children. The benefits of cochlear implants in these children include better abilities to hear and to develop speech and language skills, and also improved academic attainment, quality of life, and

better employment status. Our society also derives benefits from cochlear implantation. With such rehabilitation technique, there is cost-saving by cutting educational costs and restoring work productivity in these children.

With advanced technology, improvement of surgical techniques, as well as increased understanding of the auditory system, candidacy criteria for paediatric cochlear implantation will continue to be expanded, allowing more deaf children with various adverse conditions to benefit from this revolutionary technique.

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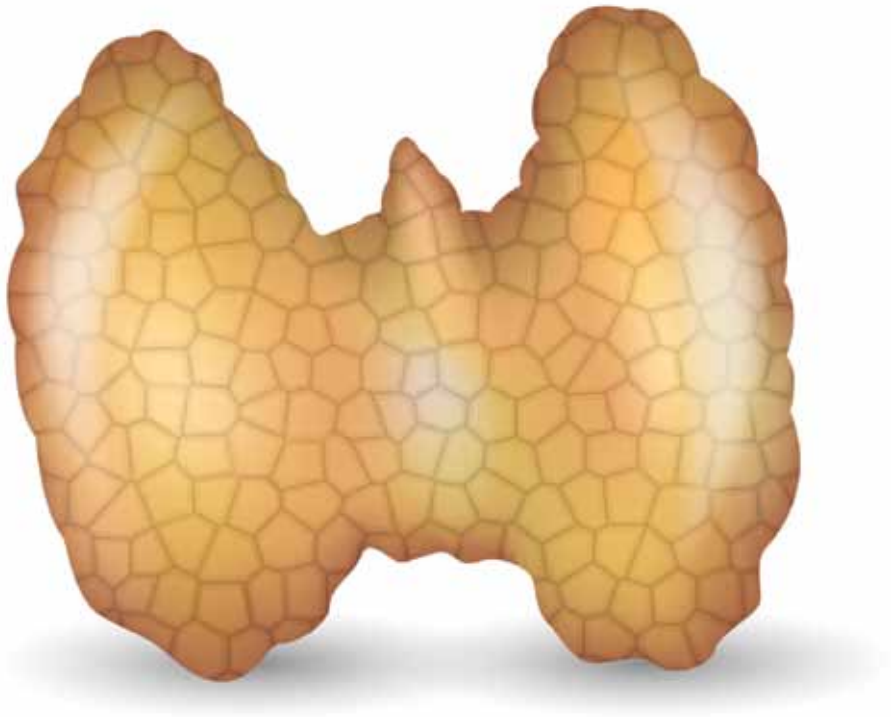
Robotic Assisted Thyroidectomy



Thyroidectomy is traditionally performed through a midline skin crease incision, which has become the "work-horse" approach for thyroid surgeons for many years. The expected clinical outcome following thyroidectomy performed using this midline approach is excellent, since the ability to identify key structures in the thyroid bed (recurrent laryngeal nerve and the parathyroids) is highly predictable.

With the increasing use of cross sectional imaging scans of the neck for other conditions, the diagnosis of incidental thyroid nodules is on the rise. This increase in diagnosis, coupled with ability to perform ultrasound guided fine needle aspiration cytology (FNAC) on small nodules, has seen an increase in the need for diagnostic thyroid lobectomy for nodules with indeterminate cytology. Conversely, remote access thyroidectomy has also found applications in some countries due to the ability to avoid a neck scar when performing thyroidectomy from either a trans-axillary or retroauricular incision. This is especially beneficial to patients who are prone to develop a keloid scar (Figure 1).

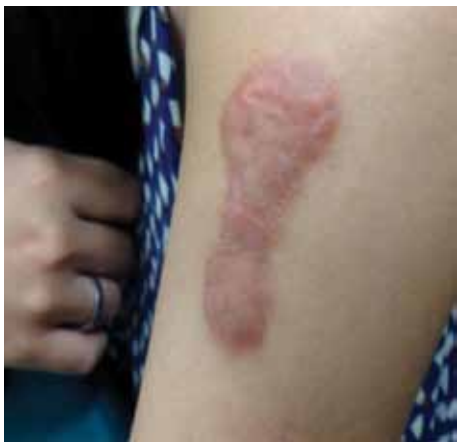


Figure 1: Patient with Keloid scar.

These remote access approaches can be performed either using the endoscope, or via robotic assisted technology which offers excellent three-dimensional, magnified visualisation of the thyroid bed. The latter also has the enhanced ability to operate in tight corners with increased maneuverability of some of the articulating instruments.

This quick review offers an overview of robotic assisted thyroidectomy compared to conventional thyroidectomy.

Techniques

1.Trans-axillary approach

Trans-axillary is the first remote access approach to the thyroid. Using either a 4-5 cm incision just caudal to the anterior axillary fold (or in some cases, two small mini 1-cm incision), a working space can be created over the chest wall to the anterior neck. The thyroid is approached from a lateral to medial fashion, after the anterior skin flap is suspended using specially designed "Chung" retractor. The robot is then brought into the surgical field and using three robotic arms (one Maryland retractor; one Harmonic shears and one prograsp instrument), thyroidectomy is performed in the standard fashion. Briefly, the superior thyroid pedicle is ligated between the harmonic shears and the thyroid retracted reflected medially, exposing the tracheo-esophageal groove where the recurrent laryngeal nerve is identified

and preserved. By providing counter-traction using cotton "peanut", the RLN is freed from the thyroid and the thyroidectomy completed after dividing the Berry's ligament. A closed suction drain is inserted and tunneled under the skin flap to be brought out in the axilla. Figure 2 shows the axillary scar in the patient who had undergone trans-axillary robotic assisted thyroidectomy.

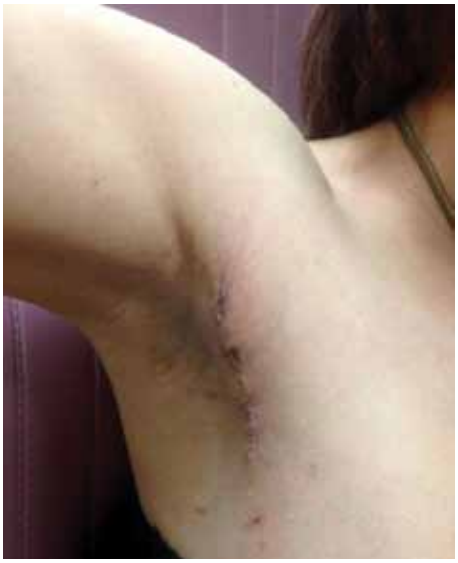


Figure 2: Trans-axillary incision of a patient following robotic assisted thyroidectomy.

2. Retro-auricular approach

This is a relatively newer technique whereby a hairline incision is made (Figure 3) and the skin flap raised inferiorly towards the clavicle. The skin flap is then suspended with specially designed "Koh" retractor. Following that, the robot is brought into the field with two working arms (one Maryland retractor and one Harmonic shears). Figure 4 shows the working space in a retroauricular assisted robotic thyroidectomy. The thyroid is approached from a superior-medial fashion after the strap muscle is lifted off the thyroid. Similarly, the superior thyroid pedicle is ligated between harmonic shears. Some surgeons prefer a medial to lateral approach where they divide the thyroid isthmus first and proceed to dissect the thyroid off the trachea until the recurrent laryngeal nerve is encountered in the tracheo-esophageal groove. On the other hand, some surgeons prefer the standard lateral to medial approach to identify the recurrent laryngeal nerve near to the entry point at the crico-thyroid joint. Regardless the technique, the primary aim is to identify and preserve the RLN. Following preservation of the RLN, the thyroid is freed from this loose lateral connections (from the deep cervical fascia) and the thyroidectomy specimen is delivered through the facelift incision.

Outcome

Published reports have demonstrated equivalent clinical outcomes (completion of resection and complication rates) between standard thyroidectomy versus robotic assisted thyroidectomy approach in high-volume thyroid centers. At our department where thyroidectomy is regularly performed, robotic assisted thyroidectomy is offered to patients who request for a "scarless" neck for their thyroidectomy. At present, our selection criteria for robotic assisted thyroidectomy technique are:

- Benign or indeterminate cytology on FNAC
- Nodules less than or equal to 4 cm
- No previous neck incision
- Favorable body and neck habitus (BMI < 30)

Conclusion

Robotic assisted thyroidectomy offers a feasible alternative of removing the thyroid gland through a remote access site. In high volume centres, it is a safe and technically sound approach in removing thyroid nodules in patients who prefer a "scarless" neck.

Figure 3: Marking of a planned incision for retro-auricular approach robotic assisted thyroidectomy.

Figure 4: View from a retro-auricular robotic assisted thyroidectomy Thyroid Gland

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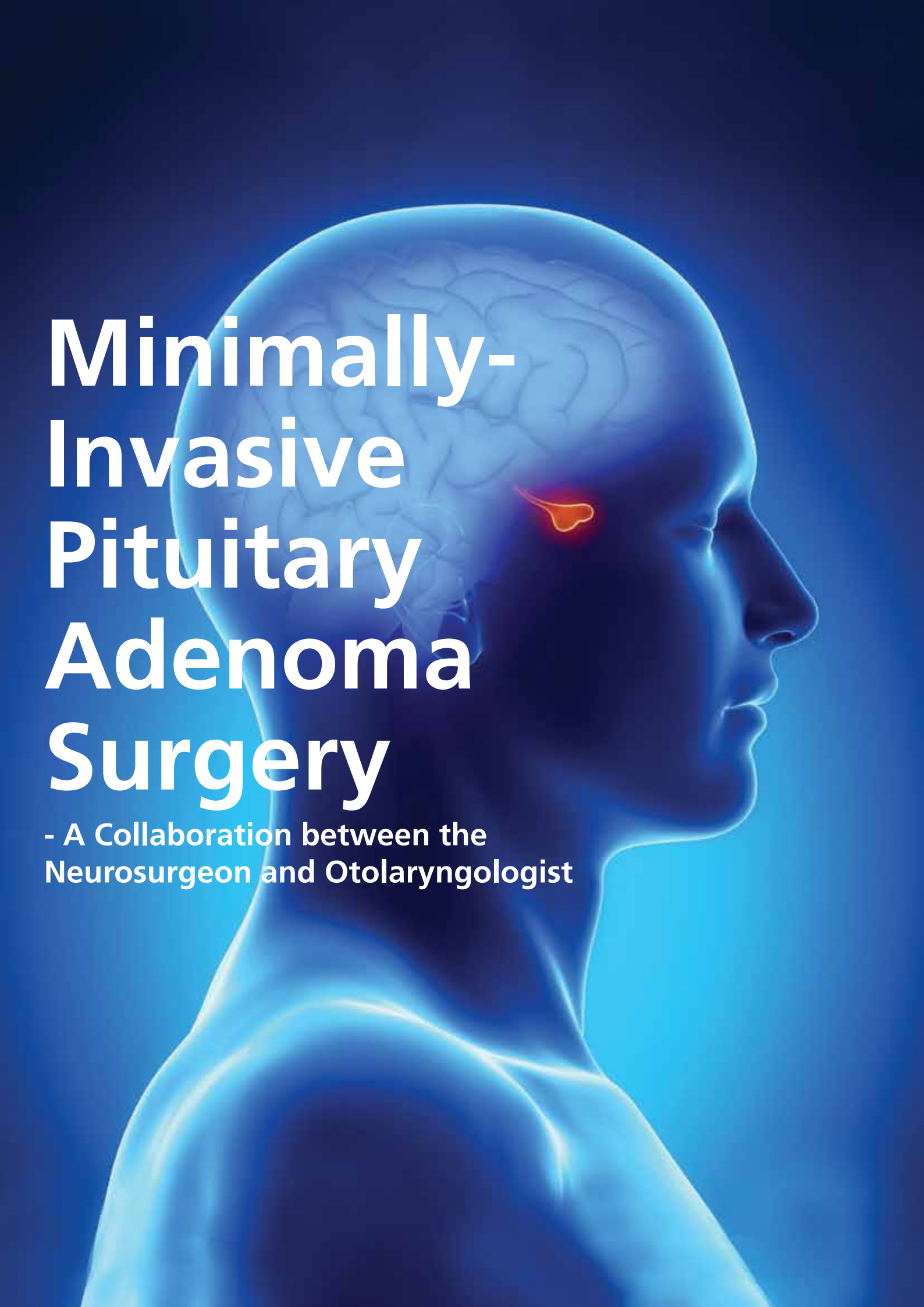

Minimally-Invasive Pituitary Adenoma Surgery

- A Collaboration between the Neurosurgeon and Otolaryngologist

Mr Ng, a 43-year old taxi driver, started noticing three months ago that he was having frequent headaches and nausea, which he attributed to long working hours and lack of sleep. He became concerned when he noticed his vision was becoming cloudy and was occasionally seeing double. A change of glasses did not improve his vision, and it was starting to affect his ability to drive and read.

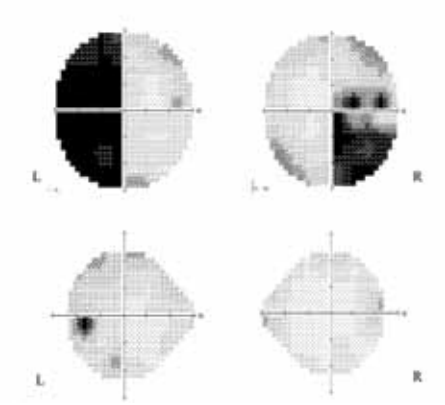

Figure 1: Humphrey visual analyser of Mr Ng. Top row is the pre-operative visual field test showing bitemporal hemianopia. The bottom row is the post-operative visual field test at eight weeks which shows resolution of the bitemporal hemianopia.

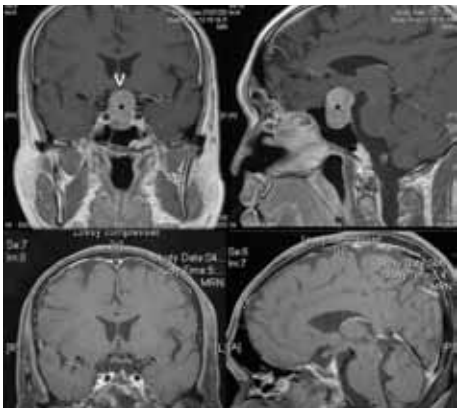

Figure 2: Top row shows the pre-operative MRI coronal and sagittal views of the pituitary tumour (*) compressing on the optic chiasm (V). Bottom row demonstrates complete resection of the tumour.

He finally saw his family doctor, who referred him to an ophthalmologist. Visual field testing showed that he had suffered from bilateral temporal hemianopia (Figure 1). MRI brain revealed a large pituitary tumour that was compressing on the optic chiasm (Figure 2). As he was at risk of permanently losing his vision, he was recommended surgery to remove the tumour.

Pituitary adenomas - symptoms and signs

While many lesions of the pituitary gland exist, this focus is on pituitary adenoma as it is the most common type of pituitary disorders. A pituitary adenoma, despite being a benign tumour, is anything but mild, given its seat in the brain. In fortunate cases, the tumour is small ("small" means less than 1cm in size - also known as a microadenoma), the patient is asymptomatic, and can be managed conservatively. However more often than not, like in Mr Ng's case, a pituitary adenoma grows beyond 1cm (also known as a macroadenoma) and becomes problematic because of compressive effects. The patient can experience headaches (stretching of the dural sheath), bitemporal hemianopia (impingement on the optic chiasm), palsies of the oculomotor, trochlear and abducens nerves (involvement of the cavernous sinus) and partial or complete hypopituitarism (secondary to compression of the pituitary stalk or pituitary gland).

In addition, two-thirds of pituitary adenomas are functional, meaning they secrete hormones in excess. The commonest of these are prolactinomas, which cause amenorrhoea, galactorrhoea and gynaecomastia. Growth-hormone secreting adenomas result in acromegaly, and adrenocorticotropic (ACTH)-secreting adenomas are responsible for Cushing's disease.

Pituitary adenoma can also present as an emergency. Pituitary apoplexy - an acute haemorrhage or infarction of the pituitary gland usually in the presence of a pituitary tumour, can present with sudden onset of severe headache, rapid deterioration in visual acuity and even altered mental state. This is considered a neurosurgical emergency and the patient will require immediate decompression to salvage the vision.

Except for prolactinomas, in which the treatment of choice is typically a dopamine agonist, the first line of management of virtually all symptomatic pituitary adenomas is surgery. Naturally, for most patients, the thought of having to undergo brain surgery can be daunting as it conjures the image of large head scars or having parts of the skull removed. However, with recent innovations in surgical techniques, patients can achieve complete resection of pituitary adenomas without facial incision or prolonged hospitalisation, and ultimately return to their normal, active life.

While the role of the neurosurgeon is obvious, where does the otolaryngologist come in?

Earlier method of approaching the skull base

In the past, pituitary adenomas were excised via the transcranial route - hence the need for craniotomy and brain retraction which can result in significant morbidity. A much more direct way of access to the pituitary tumour is via the sphenoid sinus. Thus the trans-septal trans-sphenoidal approach was conceptualised, whereby the neurosurgeon enters the sella via the nasal septum and sphenoid sinus using a speculum (a funnel-shaped device) and operating microscope. This method has been the workhorse for most neurosurgeons in the past few decades.

While this is significantly less invasive than the transcranial method, the amount of exposure it offered is often limited. The microscope and speculum gives a tunnel vision of the brain - much like looking through the keyhole of a door (Figure 3). In addition, the funnel shape of the speculum limits the range of movement of surgical instruments. Therefore large tumours, especially those with significant lateral or suprasellar extension, are unlikely to achieve complete resection. Patients often require adjuvant gamma-knife therapy for residual tumours.

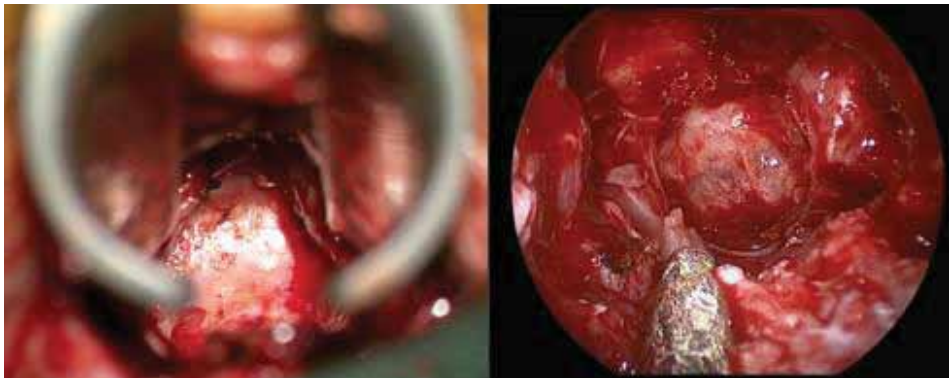

Figure 3: The picture on the left shows the 'keyhole' view via a microscope in the transeptal transsphenoidal approach. In contrast, the picture on the right is the panoramic view offered by the endoscope in the endoscopic transsphenoidal approach.

Endonasal endoscopic pituitary surgery - minimally-invasive surgery

Later on, it was the introduction of rigid endoscopes in sinus surgery performed by the otolaryngologists that hinted at its potential role in pituitary surgery. The endoscope provides distal illumination, enhanced magnification and panoramic (i.e. expanded) views of the sphenoid sinus. This means that while the microscope offers a telescopic view of the operative field, the endoscope brings the surgeon's eye right next to the area of interest instead (Figure 3).

The endonasal endoscopic approach to pituitary tumours was thus popularised and refined over the years with the help of highly-specialised equipment. Currently, each endoscopic pituitary surgery uses high-definition endoscopic cameras and video monitors for magnified, detailed views of the surgical field. Angled 30 degree and 45 degree endoscopes allow visualisation of hidden corners of the skull base. Computer-assisted navigation or image-guided surgery (akin to global positioning satellite (GPS)), provides intra-operative real-time feedback of the location of a surgical instrument based on a MRI scan performed preoperatively. From the days of "maximally invasive" transcranial surgery, complete resection of most pituitary adenomas, including those previously considered inoperable or hard to reach, can now be achieved in a truly minimally-invasive but yet maximal exposure method. In short, the endoscopic endonasal approach has revolutionised the field of skull base surgery.

How is endonasal endoscopic pituitary surgery performed?

The surgery is accomplished by a skull base team comprising a neurosurgeon and otolaryngologist specialised in endoscopic skull base surgery. The otolaryngologist starts the surgery by creating a wide intra-nasal surgical corridor which allows placement of the endoscope and up to three other instruments through both nostrils, thus eliminating the need for facial incisions. A free mucosal graft or vascularised flap (usually from the nasal septum, also known as the nasoseptal flap) is harvested, and the sphenoid sinuses open and widen to expose the sella floor. The

resection of the pituitary adenoma is then carried out by both surgeons working simultaneously using a "2-surgeon, 4-hand" technique, in which the neurosurgeon performs the dissection bi-manually, and the otolaryngologist provides dynamic visualisation (Figure 4). After the resection, the otolaryngologist repairs the resultant defect with the earlier harvested graft or flap.

Figure 4: A routine endoscopic transsphenoidal surgery of a pituitary tumour case involving both authors using a 2-surgeon 4-hand technique.

In Mr Ng's case, complete resection was achieved by this technique. By the first postoperative day, he had noticed some improvement in his vision. He was discharged well from hospital about one week after his operation. By the eighth week, he had recovered his vision fully (Figure 1) and was back at work. His surveillance MRI scan 12 months after surgery showed that he remains disease-free (Figure 2).

Limitations

Tumours that extend lateral to the internal carotid artery (within the lateral cavernous sinus) are not amenable to endoscopic, microscope transseptal or even transcranial resection, as there is a high risk of oculomotor, trochlear and abducens nerve injuries during manipulation of the tumour in this area. In such cases, gamma knife therapy may be the only suitable option to obtain control of the tumour.

While not a limitation per se, there is clearly a learning curve involved in this technique, as with any new surgical approach. Neurosurgeons, by virtue of their training, are more accustomed to using the microscope as well as the binocular vision it provides, in contrast to the endoscopic view and its lack of depth perception. The skull base otolaryngologist, while skilled with the endoscope, is less familiar with the intracranial anatomy. Thus a comfortable cooperation between both surgeons is crucial.

Complications

While pituitary surgery has its usual predictable risks, such as bleeding, cerebrospinal fluid leak, meningitis, hypopituitarism, diabetes insipidus, injury to the optic and other cranial nerves, a novel approach can lead to complications not normally encountered in the traditional transcranial or trans-septal approaches. The creation of the nasal surgical corridor can cause minor complications such as bleeding, crusting, sinusitis or synechae. Hyposmia may also occur as a result of crusting though this is usually temporary and is resolved by the second to third month after regular nasal douching and toilet. By virtue of the fact that a more complete resection can be achieved with the increased exposure and better visualisation, there is always a potential risk of internal carotid artery injury, although this can potentially be avoided by early recognition of the vessel during exposure of the sphenoid sinus.

Conclusion

There is a paradigm shift in the operative approach for pituitary adenomas. The endoscopic approach is a minimally-invasive approach that offers excellent visualisation of the operative field with the ease of bi-manual dissection. This is achieved by a close partnership between the neurosurgeon, which has the expertise to extirpate the tumour, and the otolaryngologist with intimate knowledge of the endoscopic skull base anatomy to adequately expose the sella whilst minimising injury to nasal structures. For the patient, this translates to potentially complete resection of large, hard-to-reach or previously considered "inoperable" pituitary adenomas without the need for extensive or disfiguring external scars.

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Dr Ong Yew Kwang completed his ENT specialist training in 2008 and in 2009 spent a year doing a clinical fellowship in skull base surgery at the University of Pittsburgh Medical Centre in Philadelphia. Following his return, he joined the rhinology service at National University Hospital and helmed the endoscopic skull base service with Dr Sein Lwin from the Division of Neurosurgery. To date, he remains the only endoscopic skull base-trained otolaryngologist in Singapore.

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