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In this issue of ‘The Otorhinolaryngologist’ we have a great mix of articles that I am sure you will enjoy reading. We continue to strive to deliver educationally relevant articles that all of us, as members of ENTK would like to read and refresh ourselves about. We aim to offer articles that cover a breadth of seniority from trainee to consultant and feel that all the articles in this issue achieve this.

Of special mention in this month, I wish to say an enormous ‘Thank you’ to Pat Bradley, who many of us know. Pat has been one of the driving forces behind rejuvenating ‘The Otorhinolaryngologist’. He has over the last 2 years tirelessly worked to keep us all moving in the correct direction and has been invaluable. Sanjai and I are extremely grateful for his assistance and wish him well on his next project during retirement.

As ever I encourage people to discuss the articles in their departments and to appeal to their teams to submit to the journal. We have streamlined this process within our excellent Editorial board whose help in making the journal run smoothly is essential. I reemphasise the CPD that can be obtained online and welcome any comments or suggestions regarding the journal.

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Pharyngeal Pouch (Zenker’s diverticulum) – a review

Abstract
Pharyngeal pouches affect 2/100 000 of the population, usually occurring in the sixth and seventh decade. Typical symptoms include dysphagia, regurgitation, chronic cough, aspiration and weight loss. Despite several theories the aetiology remains unclear. The gold standard investigation is barium swallow. Treatment is surgical via either an open or endoscopic approach with endoscopic stapling being the most frequently employed procedure in the UK.

Keywords
Zenker diverticulum, Surgery, Endoscopy.

Introduction
The first anatomical description of a pharyngeal pouch was made by Ludlow in 1769, who described a preternatural dilatation formed in the pharynx. It was made eponymous by Professor Friedrich Albert von Zenker in 1877. In 1907 Killian later described the dehiscence in the posterior wall of the pharynx between the cricopharyngeus and thyropharyngeus muscles.

The first reported successful resection of a pharyngeal pouch was by Wheeler in 1886. Since then, modification of the external resection technique has been described including diverticulectomy, diverticulopexy, diverticular inversion and cricopharyngeal myotomy.

Endoscopic diverticulotomy was first described by Mosher in 1917, who introduced the principle of dividing the septum between the oesophagus and pouch. However his initial success was complicated by mediastinitis and death of his seventh patient. Dohlman modified and repopularised the procedure in 1935 with the use of a specially designed double lipped hypopharyngoscope. He coagulated the septum between the oesophagus and pouch with insulated forceps and divided it using diathermy. Further modifications of the endoscopic method using the operating microscope and laser have been described by various authors.

In 1993, endoscopic stapling diverticulotomy was introduced by Martin-Hirsch and Newbegin in the UK and by Collard et al in Belgium. This is now a well established method of treating pharyngeal pouches.

Anatomy
Essential to the understanding of pharyngeal pouch formation is the anatomy of Killian’s triangle (Figure 1).

The oblique fibres of the inferior constrictor (thyropharyngeus) muscle arise from the midline raphe forming the upper 2 sides of the triangle. The horizontal fibres of the cricopharyngeal muscle, which arises from the cricoid cartilage forms the base of the triangle. At this junction there is a natural weakness through which pharyngeal mucosa can herniate.

Pathophysiology
The pathophysiology of this disorder remains unclear. It has been proposed that an anatomical predisposition to a large Killian’s dehiscence together with incoordination between the propulsive oblique fibres of the thyropharyngeus and the horizontal sphincteric fibres of the cricopharyngeus are the factors that contribute to the development of this posterior pulsion diverticulum (Figures 2 & 3).
Manometric studies have shown an abnormal sequence of premature oesophageal sphincter contractions prior to completion of the pharyngeal phase resulting in uncoordinated movement of the food bolus and hence a passage through the path of least resistance, which is Killian’s dehiscence. This is in contrast to a study by Cook et al who through controlled manometric and video radiographic studies, recorded marked increases in intra-bolus pressure and incomplete cricopharyngeus opening and concluded that this condition is due to a reduced opening rather than a lack of coordination. This theory has been refuted by van Overbeek in a study of 545 patients, he found no difference in intraluminal pressure between patients with a pouch and a control group. He postulated that the condition is not a result of differences in tonicity and contraction of muscles but rather a combination of anatomical predisposition and the loss of elasticity associated with age. There is also evidence that supports an association between cricopharyngeal spasm and gastro-oesophageal reflux.

However, one consistent finding in patients with a pouch is fibrosis in the cricopharyngeus muscle. This has been attributed to local ischaemia due to mechanical factors such as traction and compression of the upper oesophageal sphincter in its downward displacement in the presence of the pouch.

Clinical Features
It is an acquired condition with an incidence of 2/100,000. Most commonly patients are male and in their sixth and seventh decade. The common presenting symptoms are listed in Table 1.

Examination findings are few. Rarely a swelling may be palpated in the neck, which may gurgle on palpation (Boyce’s sign).

- Dysphagia
- Regurgitation of undigested food
- Weight loss
- Mucus in the throat
- Halitosis
- Gurgling noises in the neck
- Coughing
- Repeated chest infections due to aspiration

Table 1. Common presenting symptoms of pharyngeal pouches.
The majority of pharyngeal pouches are benign, but there is a small risk of malignancy within a long-standing pouch. This is thought to be caused by chronic inflammation and chemical irritation of the mucosa within the pouch. This should be suspected if there is a sudden recurrence following treatment or an increase in the severity of symptoms such as pain, haemoptysis or marked regurgitation of food.

Investigations
The gold standard is barium swallow (Figure 4). Other investigations to consider are endoscopy, oesophageal manometry and scintigraphy, but these are primarily used for research purposes.

Contrast study: A barium swallow will illustrate the location of the opening of the diverticulum in relation to the cricopharyngeus muscle, the size of the pouch and the relationship of the sac to the cervical oesophagus. It will also outline the lower oesophagus to exclude any distal pathology to the pouch.

There are several radiological staging systems based on the findings at barium swallow (Table 2):

<table>
<thead>
<tr>
<th>System</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lahey system (1930)</td>
<td>• Stage I: A small mucosal protrusion is present.</td>
</tr>
<tr>
<td></td>
<td>• Stage II: A definite sac is present, but the hypopharynx and the esophagus are in line.</td>
</tr>
<tr>
<td></td>
<td>• Stage III: The hypopharynx is in line with diverticulum, and the esophagus is indented and pushed anteriorly.</td>
</tr>
<tr>
<td>Van Overbeek system (1982)</td>
<td>• Small sacs are less than 1 vertebral body in length.</td>
</tr>
<tr>
<td></td>
<td>• Intermediate sacs are 1-3 vertebral bodies in length.</td>
</tr>
<tr>
<td></td>
<td>• Large sacs are greater than 3 vertebral bodies in length.</td>
</tr>
<tr>
<td>Ponette &amp; Coolen system (1992)</td>
<td>• Stage 1: 2 - 3 mm thorn-like diverticulum seen during the resting phase of deglutition.</td>
</tr>
<tr>
<td></td>
<td>• Stage 2: 7 - 8 mm clubshaped diverticulum, with horizontal or slightly caudal orientation, seen during the contraction phase of deglutition.</td>
</tr>
<tr>
<td></td>
<td>• Stage 3: bag-shaped diverticulum caudally oriented, without evidence of oesophageal compression.</td>
</tr>
<tr>
<td></td>
<td>• Stage 4: larger diverticulum with apparent compression and ventral displacement of the oesophagus</td>
</tr>
<tr>
<td>Morton &amp; Bartley system (1993)</td>
<td>• Small sacs are less than 2 cm in length.</td>
</tr>
<tr>
<td></td>
<td>• Intermediate sacs are 2-4 cm in length.</td>
</tr>
<tr>
<td></td>
<td>• Large sacs are greater than 4 cm in length.</td>
</tr>
</tbody>
</table>

Table 2. Radiological staging systems for pharyngeal pouch.

Oesophageal manometry (Figure 5): Oesophageal disorders may secondarily affect pharyngeal and swallowing function. In these cases, manometry may be performed in order to evaluate the tone of the oesophageal sphincters (upper oesophageal sphincter hypertonia and the lower oesophageal sphincter hypotonia) and to monitor disease evolution and symptom progression.

Treatment
There are two main surgical approaches to the pharyngeal pouch: endoscopic or open (Table 3).

Endoscopic vs open – patient selection
There are patient and technical factors which will determine the procedure used:

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The external approach has the advantage of complete removal of the pouch with a low chance of recurrence. Furthermore, it provides a histological specimen to exclude carcinoma within the pouch. It may be useful in treating small pouches, with cricopharyngeal myotomy alone, which cannot be treated endoscopically.

Disadvantages of the open procedure consist of a longer hospital stay and significant complications including recurrent laryngeal nerve injury and pharyngeal leak with mediastinitis. The literature quotes complication rates as being between 15 and 38%.30

**Endoscopic approach**

This is carried out trans-orally with the aim of dividing the muscular bar between the pouch and the oesophagus converting it into one cavity to allow transit of food. It is carried out using a double-bladed pharyngoscope (Figure 6). Various techniques have been described to divide the partition wall involving diathermy (Dohlman’s procedure), CO2 laser, KTP/532 laser or endoscopic stapling (Figures 8-11). A UK survey in 2004 found that endoscopic stapling was the most popular treatment method in the UK.30

Recently the Mayo clinic published their results of flexible endoscopic management using electrocautery...
under sedation as an outpatient. All patients had initial resolution of their symptoms, could commence feeding the next day and 82% of patients remained symptom free at one year post procedure.31 Al-Kadi et al suggest using a needle-knife papillotome for cricopharyngeal myotomy rather than stapling with good results.32

The advantages of the endoscopic approach are a shorter hospital as the patient returns to swallowing sooner, reduced perforation risk, lack of external scar and reduced risk of damaging the recurrent laryngeal nerve.33

Revision surgery is also easier. Stapling provides further advantages over diathermy and laser because the staples seal the divided edges reducing the risk of fistula formation, mediastinitis and thermal damage to the recurrent laryngeal nerve.33 There are, however, disadvantages with the endoscopic approach. Smaller pouches are difficult to treat as it is difficult to introduce the lower blade of the diverticuloscope into the pouch. A traumatic insertion of the pharyngoscope and excessive stapling are associated with a higher perforation risk.34 Some pouches cannot be treated endoscopically due to patient factors such as prominent teeth and stiff cervical spine and conversion rates to an open procedure range from 0-30%.35 Complication rates range from 0-15%,36,37 the main one being perforation. Recurrence rates are quoted as being between 0-32%.38,39

As no pathological specimen is provided, the pouch must be carefully examined with an oesophagoscope or 30° Hopkins rod prior to surgery to exclude the presence of carcinoma.30

Careful inspection of the divided bar after stapling is also mandatory to ensure that no perforation has been caused. If detected, there are two main ways to address it: open exploration and repair of the defect (depending on perforation size; fitness of the patient and experience of
Pharyngeal Pouch (Zenker’s diverticulum) – a review

the surgeon) or nasogastric feeding until the perforation heals. A water soluble contrast swallow study can be used to confirm this. Microlaryngoscopic repair has been described but only in a few patients.40

Patient satisfaction studies have been used to evaluate treatment methods. Wouters and Van Overbeek reported a 99% satisfaction rate after endoscopic diathermy or laser myotomy performed on 507 patients.16 Van Eeden et al. reported that 88% of endoscopically treated patients showed symptomatic improvement compared to 70% who underwent an open procedure.41 There are a number of published retrospective studies demonstrating patient benefit from the endoscopic approach.19,33,40,42

Roth et al. published their 10 year results of endoscopic stapling comparing single and multiple staple rows. They found a significantly increased rate of oesophageal perforation with multiple rows.43 However, as stated in their paper it is unclear to what extent the common wall has to be divided in order to achieve symptom resolution. Kooy and Bates suggested that this decision is based on experience, but recommend being conservative in order to avoid perforation44 as there is evidence to suggest that residual or recurrent pouches can be treated endoscopically without any increase in morbidity or mortality.45 Several series comparing the results of the endoscopic surgery versus external approach for treatment of pharyngeal pouches have been published. However, a Cochrane review stated that there is a lack of evidence from high quality randomised controlled trials to demonstrate the effectiveness of endoscopic procedures compared to open procedures for a pharyngeal pouch.46 The National Institute for Health and Clinical Excellence has stated that endoscopic stapling is associated with a shorter hospital stay and more prompt recovery to normal swallowing function and with few complications.46

Carcinoma within the Pouch

Carcinoma arising in the pouch is an uncommon but real risk. The most recent data stated that 45 cases of carcinoma had been reported up to 2001.27 A study of over 1000 patients from the Mayo clinic in 1992 revealed an incidence of 0.5%57 and van Overbeek quoted an incidence of 0.3% from a series of 646 patients from 1994 to 2000.20 A barium study of a carcinoma within a pouch will usually show a filling defect in the lower two-thirds, which can be diagnosed preoperatively in 29.8%.48

Despite examination of the pouch with a Hopkins rod, there is still a chance of missing a carcinoma in situ or a small carcinoma within the pouch. For this reason some authors advocate an open approach for patients under 65 as it provides a pathological specimen although this is somewhat controversial and may not be universally accepted practice. In patients whose symptoms persist or recur, an endoscopic examination of the whole oesophagus is advisable to exclude distal pathology.21

Postoperative follow-up

Studies by Jaramillo and Ong reported persistent pouch but easy flow of the contrast into oesophagus in all patients of their series. They found the postoperative radiological appearance has no correlation to clinical symptoms and concluded that the barium swallow has no routine role in postoperative evaluation of patients after endoscopic stapling.33,49 Follow-up should be clinical and recurrence of the pouch suspected if symptoms recur.

Summary

Pharyngeal pouch is a pulsion diverticulum caused by a combination of an anatomical predisposition to a large Killian’s dehiscence and incoordination of pharyngeal musculature mainly between the cricopharyngeus and thyropharyngeus. In the UK, the treatment of choice is endoscopic stapling as it conveys many advantages over the open procedure, but the open approach still has an important role in certain cases. Malignancy within the pouch, although rare, should always be considered and thorough examination of the pouch should be performed.

References

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Pharyngeal Pouch (Zenker’s diverticulum) – a review


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A Practical Approach to Facial Local Flap Surgery

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Abstract
This is a practical guide to facial flap surgery. We illustrate the key points we believe are necessary for a good outcome and indicate the salient features of the most reliable flaps. The challenges of each facial subunit is discussed. Almost all flap complications result from errors in judgement and we discuss how these situations may be avoided and resolved. An appendix of surgical tips is included.

Keywords
Skin flaps, Practical, Approach, Complications.

Introduction
This is a practical guide to skin surgery. We have not covered the more complex reconstruction of the mouth, eyelids, ears and nose in detail. We have tried to emphasise the principles, describe the use and planning of the most useful flaps and the key features and of others. We have included a list of books in the bibliography.

Defects of the head and neck may require advanced techniques for optimal closure. The approach depends on the characteristics of the wound, including the location and size, the functional outcome after closure, the medical co-morbidities of the patient and condition and proximity of neighbouring structures. The goals of facial reconstruction are optimal cosmesis with the preservation of function, and patient satisfaction.

Planning, , a meticulous technique, and an understanding of skin and its behaviour are essential for a successful outcome.

Principles
Some basic principals and tenets are fundamental to an optimal outcome. Basic surgical principals of tissue handling and respect of anatomy are especially relevant.

There are over 35 overlapping skin crease systems which are largely matching, but each may have particular relevance in specific areas. The 3 most widely use and described are

- Langer
- Borges
- Kraissl

It is important to exploit these when planning a flap to minimise scarring and distortion, to allow tension free transfer of tissue and to minimise secondary flap complications.

Langer’s lines are not visible, but largely coincide with the skin creases and are determined by the orientation of collagen and elastin in the skin. Langer determined these in post-mortem studies when stab wounds caused by a round awl were shown to produce linear clefts. Borges described a series of lines called Relaxed Skin Tension Lines (RSTL) which lie perpendicular to the action of the underlying mimetic muscles. These too largely coincide with Kraissl’s skin crease lines but as skin creases are often more evident in the older patient Borges lines become more significant in the younger person.
A Practical Approach to Facial Local Flap Surgery

Langer did not intend for his study to have any surgical application and it was Kocher who realised its possibilities. In contemporary use it is Borges’ lines that are accepted to be of most significance. Wrinkles tend to fall in or parallel the RSTLs, and scars can be hidden or camouflaged in natural skin creases (Figure 1).

The other concept that needs to be considered is that of the aesthetic facial units. The face is divided into areas which are demarcated by shadows, highlights and creases.

Facial units may be further described into subunits. The facial unit principle has several implications:

- It recognises facial shadows and reliefs that may be used during reconstruction
- Facial units may be concave and convex and this may have implications for tissue transfer
- Some subunit areas appear to heal better with by secondary intention - the concave NEET** areas appear to heal better in comparison to the convex NOCH** areas
- There is often tissue laxity between subunits, and this may be utilised
- Aesthetics are best preserved by keeping surgery within units or subunits as changes of skin colour, texture, thickness and contour are minimised (Figure 2).

For the optimal outcome final incision lines should fall into relaxed skin tension lines or along the borders of aesthetic units. This may require excision of normal tissue to move the incisions into more aesthetically favourable positions. It is difficult to design a flap that fulfils all these requirements concurrently. The best flap for any given defect is usually the best compromise of these tenets.

From the perspective of the surgeon, the facial nerve is probably the most critical structure in the face. It has a well documented pattern and distribution. The main trunk and branches are intra-parotid, and as it courses through the face it becomes more superficial but has to enter the mimetic muscle on their deep aspect. The nerve is therefore not usually vulnerable over the parotid or the muscles but is more vulnerable in the intervals between them (Figure 3).

The reconstruction ladder will help determine the best reconstructive options. Flaps have the advantage of a repair with reliable tissue with a good colour and quality match. When flaps are considered, the permutations are numerous and the choice is determined by site and size of the defect, facial subunits, proximity to adjacent structures, tissue laxity but also just as significantly by the experience of the surgeon.

Each defect and patient is unique but generally one design will result in the best cosmetic and functional outcome. Consideration must also be given to the patient’s medical history and co morbidities including social habits and previous treatment such as previous radiotherapy or surgery. Smokers should be warned that they are at greater risk for wound complications, and a more conservative reconstruction should be considered even if they are prepared to curb their smoking. We do not withhold aspirin but absolute haemostasis is essential and a light pressure dressing is placed for 48 hours. A flap should not be considered for the primary repair if the excised lesion is of unproven histology, such as the excisional biopsy of a suspected cancerous lesion, or if the margins of an excision are uncertain.

We find that a diagram or photograph of the lesion at consultation often helps with the flap planning, as does having a flap atlas based on defect site and size. This is an embodiment of what we have found works best (as well as what does not), together with selected solutions from text books. It maybe less useful to the experienced surgeon, but it nevertheless may serve as a useful teaching aid.

It is traditional to describe flaps as axial or random pattern flaps, and in the manner in which they are transferred – Advancement, Rotation or Transposition.

Skin Science (Figure 4)

The vascular supply to the skin is based on a dermal and a subdermal plexus fed by perforators. There are numerous collaterals so in practical terms almost any portion of skin in the face can be raised as a random pattern flap, and most flaps can be raised as subcutaneous flaps as long as their dimensions or reach is not excessive. The exceptions are flaps raised on the forehead, which are more reliable either full thickness or when the underlying fascia is included. Forehead flaps, of the Reiger type or Indian type need special respect, and need to be raised at least partly musculocutaneous, or on a vascular pedicle for reliability.

It is traditionally thought that the dimensions of a random pattern flaps should obey the 1:3 rule to protect the vascularity of the most distal end. In fact the perfusion to the distal end is not dependent on the width of the base
Figure 3. Course and relations of the Facial Nerve.

Figure 3. (Alternative) Course and relations of the Facial Nerve.
but on the quality of the vasculature and the closing pressure of the arterioles. In this context the reach of the flap and the tension within the flap is more critical. It is established that blood flow in a random flap will decrease in an inverse manner with increased tension. The 1:3 rule is however still considered the ideal (Figure 5).

Knowledge of the biomechanical qualities of skin is also important and can be exploited to assist in the closure of the difficult defect. 2 important characteristics are creep and stress relaxation.

Creep occurs when skin exhibits an additional lengthening beyond its initial stretch, when constant tension is placed for 5 to 15 minutes. This is explained by extrusion of fluid from the dermis and breakdown of the dermal framework. It can be applied with temporary horizontal sutures but must be applied judiciously so that the perfusion pressure within the flap is not overcome.

Stress relaxation occurs over a longer period of time and can be explained by increased cellularity in the skin and a permanent stretching of the skin architecture. Minor
discrepancies and distortions often relax by this mechanism.

The majority of skin defects can be closed with a small selection of flaps. These are the workhorse flaps and these will be described first.

**Elliptical excision**
This is the simplest form of closure and most lesions up to 1.5 cm in diameter can be excised and closed inconspicuously. Much larger defects can be closed where there is greater skin laxity or if some pull distortion is acceptable. Width to length should be 1:3 or greater to allow a tension and dog-ear free closure. In larger lesions a double ellipse, or **M-plasty** excision and closure, is useful.

The **A-T** closure is particularly useful when a lesion is adjacent to linear key areas such as a facial unit junction or the hairline, eyebrow or lid areas. It has the advantage of transferring tissue from 2 areas and of one limb of the reconstruction being concealed. The disadvantage is that the other limb often runs contrary to the RSTL (Figure 6).

**V-Y** closures depend on laxity of the adjacent tissues. The incorporation of a sliding island flap increases its versatility particularly allowing for repair of larger defects. The long axis should be oriented along RSTLs or natural skin creases. The area above the nasolabial fold reconstructs particularly well in this manner.

The **Banner flap** or single lobed flap is particularly versatile as the donor site can be brought in from any point on its circumference. There are variants depending on the pivot point. Closure of the donor site requires the removal of a triangle to eliminate a standing cone. Variants of a single lobed flap include 2 stage transfers when donation from an adjacent subunit is required. The flap is interpolated over adjacent tissue in the 1st stage, and is divided and with the completion of the inset in the 2nd (Figure 7).

Rhomboid flaps and their variants are the true workhorse flaps and are familiar to most surgeons. They are easy to plan and execute, but poorly oriented flaps may give rise to less ideal results such as pin-cushions deformities, or they may conceal poorly. Variants of the rhomboid flap are the classic **Limberg**, **Dufourmental** and **Note** flap.
The classic rhombus defect has sides of equal length, with 2 opposing 60° angles and 2 opposing 120° angles. This configuration creates a short diagonal (which bisects the 120° angles) of the same length as that of the sides of the rhombus.

There are variant’s and recommendations as to how rhomboids are best oriented.

The orientation of the rhombus depends on the RSTL and the donor site (Figure 8a). The RSTL are noted and the short diagonals are oriented along it. This orients the donor incision approximately along the RSTL. There is invariably some distortion and change in orientation but this can be minimised by wide undermining around the flap. 4 possible flaps are possible along the 2 short diagonals and the flap of choice is that which will transpose easiest and cause the least distortion. A pinch and push test will help determine this. We have found this method more predictable than orienting along the LMEs.

The 2 common variants of the this transposition principle are the Dufourmental and Note type flap (Figure 8b). Constructing a Dufourmental involves constructing a bisect of the angle EBF and then dropping a vertical limb parallel to the long diagonal CD.

When the flap is raised and ready for inset, the key suture is placed first. This transposes the flap, closes the donor site to give an estimation of ease and allows a tension free closure.

For most flaps the judicious use of Burow’s triangles increases the reach of flaps, minimises distortion and allows the transfer of a defect from one site to another. It can also convert a large defect to a smaller one.

Esser’s bilobed flap and and Zitelli’s modification.

The bilobed flap is a double transposition of 2 single lobe flaps that share a common base. The primary flap repairs the surgical defect and the secondary flap fills the donor site. The secondary flap defect is then closed primarily. The original description had each component rotate through an arc of 90 degrees but this had the disadvantage of a large reconstruction often crossing subunits, tension at the pivot point, as well as causing a standing cone at the point of the secondary defect (Figure 9).

Zitelli’s modification reduces the arc of rotation and with the addition of a Burow’s triangle at the tip reduces the standing cone. Because the 3 components of the flap are oriented at several angles it is difficult to adjust the flap to accommodate RSTLs or to follow skin creases. They are best used for reconstructions of the nose when the flaps are small or where RSTLs are less significant, or for very large cervicofacial reconstructions, when transfers of almost entire subunits occur. The orientation of the flap will be determined primarily by the donor site as RSTLs are not a primary concern. The donor flaps are typically 2/3 the size of each resultant defect and undermining is required for easy transposition and closure. On the nose the number of orientations are limited (Figure 10).

Forehead and temple

Small defects can be closed with an ellipse and forehead creases can be exploited to conceal the closure. Larger defects can be closed with bilateral advancement flaps or with an A-T closure. The RSTL and skin creases flow downwards at the temple and this needs to be considered in planning incisions.

Undermining should be done on the superior portion of the ellipse to prevent raising the eyebrows.

In the temple region excision in the region within 2 cms of the lateral brow should be done carefully as the temporal branch of the facial nerve is superficial. Branches
of the superficial temporal vessels may also be encountered. Defects in this region can be closed with good cosmetic results with a rhomboid flap. Flaps however need to be raised judiciously. The skin is thin, and if raised too thin vascularity may become compromised. If flaps are rotated from the lateral canthal region it may distort the canthal angle and alter the shape of the palpebral fissure. Minor distortions however do settle as skin relaxes. The area of the skin above the temple, the tight scalp region, is relatively unyielding and cannot be rotated easily.

**Cheek**

The cheek can be reconstructed relatively easily with ellipses, rhomboid or Banner flaps. The wide acreage of the cheek and the relative tissue laxity allows fairly simple reconstruction (Figure 11).

Medial defects of the cheek can be reconstructed with Banner flaps, nasolabial flaps or sliding subcutaneous island flaps. Nasolabial flaps may be raised either inferiorly or superiorly based on the dermal plexus or rotated as propeller flaps on its vascular pedicle. The nasolabial (melolabial) folds are useful for concealing the repair.

Larger defects require the distribution and transfer of tension over a wider area and a Mustarde type flap or similar is an elegant solution. It needs to be raised carefully to avoid injury to the facial nerve (Figure 12).

**Nose**

The nose is subdivided into 9 subunits on the basis of highlights and shadows, and better cosmetic results are obtained by containing the reconstruction within a subunit and sometimes excising and reconstructing an entire subunit. When an excision involves more than half a subunit it is often excised with the lesion, as long as reconstruction is not compromised.

**Characteristics of the nose** (Figure 13)

The nose is challenging because of:

- Quality of skin.
- It is tight and sebaceous. There is little subcutaneous tissue and excision to down to the cartilage is the norm.
Rostrally over the vestibule there is little separation between the 2 surfaces, and button holing through is easy. This can potentially complicate the reconstruction.

- Limited skin laxity within and between the subunits of the nose
- Reconstruction involving the alar rim is difficult. Composite constructs of graft and flap are bulky and have a higher risk of failure and bisedicted or folded flaps can be overly thick. Notching and retraction can complicate the repair and can be difficult to correct.
- Effacing the angle between the nose and cheek

Highlights and shadows which define the subunits are difficult to replicate

The majority skin defects of the nose can be dealt reconstructed with a limited number of flaps

- Banner flaps for the naso-facial groove and alae subunit
- Bilobed flaps for the lateral and dorsal subunit
- Rieger and modifications

This flap is a rotation-advancement flap based on a contralateral pivot near the medial canthus. It is based on the angular branch of the facial artery and like the forehead flap it has to be raised musculocutaneous near the pedicle. The rotation-advancement will rotate the glabellar apex of the flap which will require excision to allow inset. It is a useful for reconstruction for the middle and distal thirds of the dorsal nasal subunit (Figure 14).

**Forehead flaps** (Figure 15)
The flap is based on the supratrochlear artery and this can be identified with a pencil Doppler. Anatomically this lies within 3mm lateral or medial to the medial canthus, about 10-16 mm from the midline, and it pierces the frontalis muscle about 15mm above the supraorbital rim to then run in the subdermal-subcutaneous plane. The separation between artery and vein at the brow can be up to 15mm so the width of the pedicle should be no less. The flap can therefore be raised above the level musculo-aponeurotic galea as a skin only flap, but within 2 cm of the brow, the flap has to be deepened down to the pericranium to include the muscle. The flap is versatile but excels for the reconstruction of large, multi unit defects of the distal nose. It is raised on the ipsilateral pedicle to allow easy rotation and maximum reach. It is reliable when raised carefully and can provide a large amount of skin of good quality and colour match, but it is disadvantaged by the 2 stages required. At the initial inset the interpolated pedicle has to be tubed, and the poor appearance of the trunk can make it difficult for the patient in the 3-4 week interim. At the 2nd stage the trunk is divided, inset completed and the unused trunk can either be excised or returned.

A tunnelled island flap can be raised adjacent to the nasolabial fold to allow a neat closure of the donor site and is a good colour and texture match for the lateral nasal subunit. As a fallback we find that skin grafts can give a very acceptable result especially on the lateral aspect and the more sebaceous areas of the nose.

**Ear**
The reconstruction of the ear can be regarded according to the missing component parts, or considered superior to inferior in thirds.

In general helix and helix-antihelix defects extending to the pinna periphery may simply involve apposing the anterior and posterior skin over the exposed cartilage. This
may leave a defect or notch but this can be aesthetically acceptable. A helical advancement requires excision of a Burow’s triangle from the antihelix, or extending the excision into the conchal bowl and excising triangles. This allows a reduction of the inner circumference and allows advancement of the outer helix/antihelix without causing the ear to cup. The reduction of the pinna size is often unnoticed (Figure 16).

For other parts of the pinna, one consideration for the excision of a skin lesion is the depth. The perichondrium is a barrier to invasion and should always be excised with mobile skin lesions. Larger or fixed lesions must be excised with the underlying cartilage. Cartilage does not receive grafts well and should be covered with a flap if possible. The entire cartilage of the concha and scaphoid bowl can be excised without compromising the form of the ear.

The defect can be repaired simply with a graft, or a pull through flap or a revolving flip-flop flap. These flaps may require a second stage for pedicle division and inset completion.

**Lips**

The reconstruction of the lower lip is guided by a lip reconstruction ladder depending on site, size and involvement of the commissure. The reconstruction intent is to maintain cosmesis and preserve function. The reconstruction method for the of the lower lip is determined by the proportion of the defect.
**A Practical Approach to Facial Local Flap Surgery**

**Eyelids and canthal region**

The eyelids unit is a laminated structure and reconstruction can potentially be complicated by

- Distortion of the palpebral fissure
- Entropion
- Lid ptosis and sag
- Obstruction of naso-lacrimal duct
- Lid notching

The skin of the eyelid is thin and is not supported by the characteristic vascular plexus. There is little subcutaneous tissue, and over the tarsus and canthal areas it is almost absent. The skin here is only supported by areolar tissue. The skin can be elevated safely for access to deeper structures but for reconstruction skin only flaps should be avoided, and if required should ideally be bipedicled. Eyelid flaps such as the Tripper are raised as a musculocutaneous flap (Figure 18).

Simple skin only excisions confined to the eyelids are best reconstructed with a skin graft. Excision of the anterior lamellar (skin and underlying orbicularis) can be reconstructed with local flaps. Excisions and reconstructions need to be oriented to minimize the risk of ectropion. The RSTLs largely correspond to the skin creases and flow with the eyelid then fall away laterally. However contrary to other sites, excisions should be oriented perpendicular to the creases and the lid margin unless there are significant rhytids that allow for a tension free closure. This minimizes the risk of lid retraction that might occur with scar contraction and allows for an easier correction should this occur.

Full thickness excision of small lid lesions, that is excision of both anterior and posterior lamellar (tarsal plate and conjunctiva), should be excised as a wedge and closed meticulously in layers to avoid unsightly notching. A Burow’s triangle excised laterally with acantholysis will aid advancement.

Wider excisions require a reconstruction with composite construct of a chondromucosal graft for the posterior lamellar and a flap for the anterior lamellar.

Reconstruction of the medial canthal area requires special consideration for the difficulty is increased by the contour change and the paucity of tissue. The reconstruction of the canthal area may be complicated by displacement and distortion of the canthal angle. Some of this distortion eases after a few weeks as the skin relaxes. Reconstruction of the medial canthus can result in...
The effacement of the nose cheek groove, and insetting requires the placement of bedding sutures on the deep aspect of the flap to recreate this contour.

Management of difficulties and complications

Common problems with flaps may manifest as poor aesthetics or poor healing. Many difficulties can be anticipated by careful consideration and conception and technique. This may be due to

- Bleeding and haematoma formation.
  NSAIDs do invariably increase the risk so careful tissue handling and meticulous haemostasis is essential. The wound should also be supported with a pressure dressing for 48 hours.
- Nerve injuries
- Poor orientation

Insufficient reach and excessive tension causing distortion and compromising flap viability and healing. This can be overcome by

- Altering the pivot point
- Use of Burow’s triangles
- Undermining
- Raising a second flap

If either of these measures are unlikely to address the difficulties, or if the viability of the flap is doubtful, it maybe best to reset the flap back and to reconstruct the defect with a skin graft. The defect can then be contemplated at leisure, a reconstruction formulated and excision of the skin graft and eventual definitive flap reconstruction performed later. Secondary contraction of the defect may also make a delayed flap reconstruction easier.

An arterial or arteriolar concern is usually evident at the time of inset. If flap perfusion is uncertain it is sensible to keep the patient back for a few hours for a flap-wound inspection. If the flap is compromised then a decision must be made if resetting the flap is appropriate. At a later stage venous congestion, stasis and thrombosis is more likely because as swelling and tissue tension increases, the susceptible venous system is more likely to be compressed. In the early stages of microcirculation failure a flap may be rescued by the application of leeches

- Standing cones and dog ears

These are best dealt with at the time of inset. They do not as routine settle even with compression and bedding sutures. It is our practice to excise this towards the completion of inset so that an adequate amount from the

Figure 19. On the right suggested orientation of a rhomboid flap, and on the left a Trippier flap.

Figure 20. Elevation and defatting of a pin-cushioned flap.
The correct area is excised without compromising the viability or reach of the flap.

- **Trapdoor deformity**
  This is due to a mismatch of apposition of the wound edges and is exacerbated by a variance of angulation or height of the opposing margins. This can be avoided by ensuring that the wound margins are not bevelled and if they are, they should be corrected by excision or careful positioning of sutures.

- **Pincushion deformity**
  This is caused by a combination of defect-flap size mismatch, and excessive stress and tension at the flap edge. This should be corrected at inset if possible but may require further correction. Correction when delayed involves elevation of the flap, defatting and addressing the mismatch by excision of excess tissue or insertion of Z-plasties into the edge (Figure 20).

**Conclusion**

The permutations for reconstruction are innumerable. The majority of reconstructions however can be achieved satisfactorily with a limited number of flaps by respecting basic tenets of meticulous tissue handling and obeying the principles of facial units and RSTLs. When in doubt over the feasibility and suitability for a flap, a skin graft can provide a very satisfactory reconstruction with the option for a later secondary flap reconstruction.

**Bibliography**


**Papers**


**APPENDIX 1**

**Instruments**

- Dental syringe with a 23G needle
- Marking pen and ruler
- Calipers
- Swann-Morton or BP 3, or Barons 3B Scalpel holder
- SM blade 15, 10
- Pair skin hooks
- Adson tooth and non-tooth tissue forceps 125 mm
- Gillies-Foster needle holders 130mm
- Colle-Murray/Wood needle holders 230mm
- Nieverts needle holders 130mm
- McIndoe’s dissecting scissors 150 or 180mm
- Kline or strabismus scissors 115mm
- Stevens tenotomy scissors 140mm
- Pair of Mosquito forceps curved on flat 130mm
- Allis tissue forceps 3/4 teeth 150mm
- Silver skin graft knife
- 3/0 Silk suture
- 4/0, 5/0 Vicryl
- 5/0, 6/0 Vicryl Rapide
- 4/0, 5/0, 6/0 Nylon
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APPENDIX 2

Basic concepts and tips

Use of loupes
Appropriate local anaesthetic block before infiltration to minimise discomfort

Asepsis
Gentle, atraumatic tissue handling

Observe for skin laxity, secondary skin lesions, colour and texture match
Exploit tissue characteristics subunits, RSTL, creases
Use of templates to measure and judge movements, and for transferring the defect to skin graft donor site
Orientate to conceal scars
Respect skin tension lines and skin creases
Respect the facial units subunits

When incising
Precision is key, and it is easier to deal with bleeding before or as it occurs
Cut with the tip of a 15 blade
Cut under traction and counter-traction
Incise at right angles to minimise vascular compromise and to avoid trap door deformities
But respect the hair follicles
Incise the lower inferior edges first so that blood flowing dependently away does not obscure the incision as you progress

Planning the flap
Excise the lesion first before committing to the flap. The flap is never incised at the same time as the excision and the defect is assessed and considered a final time before the flap or the alternative flap is incised. Be flexible as an alternative may become obvious when the defect is reinspected. When planning the flap we find the use of a templates to measure and judge movements, or when transferring defect to skin graft donor site invaluable. A sterile piece of paper or the transparent side of the sterile packaging instruments come in, make useful templates. Several flap options are often drawn out, and the drapes make a useful jotter pad.

When closing
Generous undermining at correct level
Place key sutures first. This apposes the donor site and transfers the flap into the defect. Examine flap for tension, vascular compromise, and distortion. Undermine further if required. Plan and mark tissue for excision of dog ears and Burow’s triangles
Meticulous tension free closure with appropriate layered closure
Appropriate wound support and pressure

Adjuncts and dressings
At the end of the procedure we prefer to occlude the wound whilst it is still sterile with a barrier spray such as OPSITE, and to support the wound with adhesive strips. A pressure dressing may be applied over the flap if pos-operative bleeding is a concern.

If the wound is left exposed a bland ointment or an antibiotic one is used 3-4 times daily along the suture line to act as a barrier. It should be gently cleaned off each day.

Antibiotics are prescribed when skin grafts are employed, for surgery of the ear or nose, or when graft-flap constructs are used.
Abstract

Inverted papilloma (IP) is histologically a benign disease, but it has long been recognised as warranting aggressive surgical management. It has a propensity to be locally destructive, has high rates of recurrence, and a strong association with malignant transformation. Aetiology of IP is still uncertain, but Human Papilloma Virus (HPV) is implicated and, in a similar manner to cervical HPV infection, is proposed to have a role in malignant change occurring within IP. A review of recent literature on the aetiology of IP and possible predictors of recurrence and malignant potential is presented. Krouse’s staging of IP is discussed, with a recently published modification, adjusted for prognostic factors. Results of endoscopic and open surgery, with long-term follow-up are reviewed.

Keywords

Sinonasal inverted papilloma, schneiderian papilloma, inverting papilloma, sinonasal neoplasm, human papilloma virus, HPV, squamous cell carcinoma.

Introduction

Liampertico coined the term “inverted papilloma” in 1963, although Kramer had described the clinical entity more than 100 years earlier, in 1847. These irregular polypoid nasal neoplasms were named “Schniederian papillomas” in 1854 by Ward (in honour of C Victor Schnieder who had recognised that nasal mucosa originates from ectoderm). It was not until the development of microscopy that Ringerz, in 1935, was able to describe inversion of the epithelial cells into the underlying stroma.

A plethora of terms and descriptive names have been used to describe the clinical entity of IP, confounded perhaps by a poor understanding of the pathology. With the first large case study of papillomas published in 1971, Hyams sub-classified sinonasal papillomas into: fungiform, cylindrical and inverted. Exophytic (fungiform) papillomas have a similar prevalence to IPs (50%), but in contrast have an exophytic growth pattern and usually arise from the nasal septum. They have an extremely low rate of recurrence and are not considered to have malignant potential. Columnar papillomas (also known as cylindrical or oncocytic schniederian papillomas) are very rare (3%). They have a similar natural history to IP’s and should be managed in a similar manner.

IP’s make up the remaining 47% of sinonasal papillomas. Clinically they are uncommon, with an incidence of less than 1 per 100,000 population per year. IP’s occur more commonly in males (3:1) and in patients in their fifth to seventh decades, though they can present at any age. Symptoms are often nonspecific and innocuous, with unilateral nasal obstruction, being the most common presenting symptom. Epistaxis, rhinorrhea and bilateral obstruction are each reported in less than 20% of patients. Pain associated with IP is rare, and should raise suspicion of associated malignancy.

IP’s usually present as a unilateral mass, and are pink to grey in colour, usually appearing more vascular than inflammatory polyps. However, their physical features cannot reliably distinguish them from other pathologies. Histologically...
IP are characterized by hyperplastic squamous epithelium with invasion into the underlying stroma. A focus of IP has been reported as an unexpected histological finding in 0.26 – 0.37% of patients undergoing surgery for bilateral nasal polyps. Consequently, much debate has ensued about the need to send all nasal polyp tissue (including all micro-debrided specimens) to the laboratory for histological analysis.

IP arise predominantly on the lateral nasal wall (82%), often with extension into maxillary (53.9%) and/or ethmoid sinuses (31.6%). However, IP’s can arise in any part of the sinonasal mucosa, usually from a discrete pedicle, and slowly expand to involve contiguous regions. Cases have been described of IP’s arising in extranasal sites. Bilateral IP’s have been described in 4% of patients.

Although histologically benign, IP’s often behave in an aggressive fashion, and need to be managed accordingly. There are three factors that contribute to the clinical concerns regarding IP: their propensity to be locally destructive, their high rates of recurrence, and a strong association with malignant transformation.

**Localised Effects of IP**

Localised growth and expansion of IP can cause bony remodeling and erosion. Pressure from the mass effect of IP expansion tends to cause bowing of the facial bones (especially the septum and lamina papyracea). The bones of the base of skull are less "plastic", and regions such as the cribiform plate are more likely to become eroded from pressure. Unilateral bony remodeling has been reported on imaging in 43% of patients with IP. Radiological evidence of erosion is not thought to be prognostic of malignancy.

**Recurrence**

Following surgery for IP, rates of recurrence as high as 75% have been reported. With meticulous surgery attempting wide local excision of IP, recurrence rates improve, but still remain between 12.8% and 34%. This is generally agreed to be because of inadequate removal and subsequent recurrence of residual disease, possibly combined with inherent biological characteristics of the tumour (such as multicentricity). CT and histological studies show osteitis and mucosa embedded in irregular bone at the site of the IP pedicle. Unless the bone underlying the attachment of the IP is removed (en bloc dissection or diamond burr drilling), these embedded tumour fragments are thought to explain the mechanism of recurrence.

The location and extent of IP affects the rate of recurrence, with the frontal sinus recognized as a particular area associated with a higher risk of recurrence. Another frequent site of recurrence is at the buttress between the maxillary antrostomy and the lamina papyracea, however this region is amenable to close endoscopic inspection post-operatively.

Although there is no consensus on histological factors that predict a higher rate of recurrence, hyperkeratosis, squamous epithelial hyperplasia, an increased mitotic index (>2 mitoses per high powered field), and the absence of inflammatory polyps are suggested as possible factors. The relative risk of recurrence increases to 58% with revision surgery.

**Association with Malignancy**

Although early studies reported malignant transformation associated with IP in up to 53% of patients, more recent, larger studies with long-term follow-up, identified malignancy in 5% – 15%. The exact association between IP and malignancy remains controversial. Squamous cell carcinoma (SCC) is by far the most common malignancy associated with IP. However, a variety of other malignancies, including adenocarcinoma and mucoepidermoid carcinoma have been reported. In a medical review of 2279 cases, 7.1% of IP’s were found to have synchronous carcinoma, present as a focus of malignancy within the histological specimen. Another 3.6% went on to develop metachronous carcinoma, identified during follow-up at the site where IP had previously been identified and/or removed.

Genetic analysis suggests that IP’s are monoclonal proliferations, arising from a single progenitor cell. Other studies have found more than one population of monoclonal cells within an IP, which supports theories of multicentricity. Although the monoclonality of IP fits nicely with the concept of IP being a prototypic precursor lesion for SCC, monoclonal expansions do not necessarily progress to malignant neoplasms (eg polycystic kidney disease), and IP does not have the key genetic alterations that are seen in other recognised precursors for head and neck SCC’s.

Neither the frequency of recurrence nor the length of interval to recurrence is correlated with development of carcinoma. Histological features that are associated with an increased risk of malignant transformation include: the presence of bilateral lesions, a predominance of mature squamous epithelium, severe hyperkeratosis, an increased mitotic index (>2 mitoses per high powered field) and an absence of inflammatory polyps, low numbers of neutrophils, and the presence of plasma cells. These histological findings could be useful as negative prognostic indicators for malignancy in long term follow-up of patients with IP. SCC antigen is overexpressed in IP tissues, and as levels drop significantly following surgery, it has been proposed as a possible biological marker in the follow-up of IP patients.

**Aetiology of IP**

Two important questions that remain unanswered are: what initiates the formation of IP, and which factors trigger malignant transformation. There has been no proven association of IP with smoking or increased alcohol intake, and no causative environmental factors have been identified. Smoking is, however, higher in patients who have IP associated with malignancy, so this may be a factor in metaplasia and malignant transformation of IP, rather than initiating IP development.

**Allergy**

Allergy and chronic inflammation have both been implicated in the formation of IP. Most epidemiological
A Review of the Aetiology and Management of Sinonasal Inverted Papilloma

data does not indicate a higher incidence of allergic rhinitis among patients with IP, and the stroma of IP's has very low numbers of eosinophils.

Inflammation

Some evidence suggests that inflammation may have a role in IP formation. IP's and inflammatory polyps both originate most commonly in the region of the middle meatus – a key location of sinonasal inflammation. IPs appear to occur frequently in patients with co-existing inflammatory polyps (Figure 1). Many patients present with symptoms of associated rhinosinusitis, and 34-39% of patients have been reported as having pus evident at the time of resection. This could however be explained as a secondary obstruction from the mass effect of the tumour, rather than an initiating event. In support of the inflammation theory, CT scanning has shown bilateral mucosal thickening in patients with unilateral IP, but not in patients with unilateral sinonasal malignancy.

Histologically, IP's may have columnar, transitional, squamous epithelium, or a mixture of all three types. In 2004, Roh proposed a histological staging system based on a theory of stepwise progression of IP from columnar (respiratory-type) epithelium, gradually replaced by inverting squamous metaplasia, and then by squamous epithelium (Figure 2). Roh proposes that the initiating events for IP are similar to those for inflammatory polyps. His study showed that the stages I and II showed high numbers of inflammatory cell infiltration, consistent with an active inflammatory process in the early stages of IP development. These inflammatory cells, and the associated up-regulated cascade of inflammatory cytokines were absent in the later stages III and IV, suggesting that the progressive changes in IP are driven by factors other than inflammation. Increasing levels of p53 have been shown in parallel with increasing metaplastic changes in IP epithelium.

HPV

As with papillomas in other regions, there is growing evidence that HPV has a role, in the pathophysiology of at least a significant subset of patients with IP, although information regarding the importance and timing of HPV infection in IP is still unfolding. HPV is a heterogenous group of 90 or more viral types, each of which induce epithelial proliferation. They are small, double stranded DNA viruses, consisting of a circular genome of approx 8kb.

HPV is only capable of infecting squamous epithelial cells, therefore HPV infection cannot occur in normal respiratory (columnar) epithelium, and is therefore not a factor in the initiation of IP. It is more likely to be an event that occurs in some IP's, after the local nasal respiratory epithelium has already undergone the squamous metaplasia typical in the early histological changes in IP.

In 1987, HPV DNA was first detected in an IP specimen. Subsequently, in situ hybridization, polymerase chain reaction (PCR) using southern blot techniques, and laser capture microscopy have all been used to assess the prevalence of HPV in IP. Using different techniques, often with small numbers and from archival tissue, studies have reported detecting HPV DNA or RNA in as few as 0%, but up to 100% of specimens, making it difficult to conclude a true prevalence. Review papers, with larger numbers of specimens, suggest HPV is present in 32% of IP, but at much higher levels (58%) in IP associated with SCC. The presence of HPV has also been shown to be a strongly positive predictive factor for recurrence.

HPV capsid antigen has not been detected in IP, suggesting that there is no active HPV virus replication. Some recent research has focused on the virus’s ability to integrate it’s DNA into the host genome. The HPV genome consists of early phase infection genes (located “upstream” on the viral genome) and late phase infection genes (located “downstream”). In a natural infection, viral DNA acts as an episome, with equal numbers of “upstream” and “downstream” gene products. “Upstream” oncoproteins E6 and E7 interact with p53 and pRB respectively, and are regulated by other viral “downstream” genes (eg E5). Integration of the viral DNA into the host genome usually disrupts “downstream” reading frames, leading to loss of expression of the “upstream” genes. Overexpression of E6 & E7 gives a growth advantage for infected cells. HPV infection of “normal” nasal mucosa shows no integration of the viral DNA into the host genome (E7 transcripts are equal to E5). In IP with dysplasia, E7 levels are 12 times greater than E5, and in IP with SCC the E7 levels have been detected at 776 times the levels of E5.

IP & Malignant Transformation

IP's show increasing cell proliferation with increasing levels of dysplasia, but the driving mechanism towards malignancy is still uncertain. While the exact pathway of HPV disruption of the host cell cycle is not yet fully understood, it is thought to be a major player in at least a subgroup of IP's that undergo malignant transformation. As mentioned earlier, HPV E6 & E7 oncoproteins are thought to be capable of inactivating cell cycle regulators such as p16, p21, p27, p53 and retinoblastoma gene products.

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Increasing interest in typing the HPV present in IP tissue has come about from the stratification of HPV cervical infection into “high risk” and “low risk” subtypes. HPV type has been shown to be a prognostic indicator of developing cervical cancer. Several studies with long-term follow-up have shown similar “low risk” subtypes (6 & 11) associated with benign IP, and “high risk” subtypes (16 & 18) being implicated in the progression from IP to SCC. In SCC of the cervix, 85% have viral DNA that has changed from episomal to integrated.

Integrated HPV subtypes 16 & 18 are thought to produce a different form of E6 protein, that can form a complex with wild-type p53, and target it for early degradation.

P53 is an oncosuppressor gene that helps regulate DNA production, cell proliferation and apoptosis. Mutations of p53 are the most commonly found genetic mutation in all human neoplasia, and are thought to have a strong link with tobacco use. Reduced levels of “wild-type” p53 can lead to replication of cells with DNA damage. Mutated p53 has a longer half-life and tends to accumulate in tissues. Studies looking specifically at levels of p53 in IP have had conflicting results. Levels of p53 have been shown to be elevated in IP, when compared with inflammatory nasal polyps, whereas another study suggests p53 expression is not altered in IP. Another study shows that IP specimens were generally positive for HPV or p53 alteration, but not both simultaneously. Decreasing p27 expression has been shown to follow the trend of dedifferentiation of dysplastic IP’s into SCC.

**Imaging**

There are no pathognomonic radiological changes that can diagnose IP, or differentiate a malignant focus within IP, nevertheless, imaging has an important role in the staging and planning of surgical management in patients with IP. High resolution CT scan is thought to be the most useful form of imaging in non-recurrent IP. As discussed earlier, CT scans can delineate the affected sinuses, as well as any evidence of remodeling or erosion, and may show osteitis associated with the IP pedicle. It can be difficult to differentiate between tumour and inflamed mucosa or inspissated mucous on CT scan, often causing an overestimation of disease extent. An MRI scan can better distinguish inspissated mucous from IP, as well as delineating the extent of intracranial extension in IP with skull base erosion. A study assessing accuracy of imaging preoperatively, using histopathological analysis as gold standard, agrees that CT tends to overestimate the extent...
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of IP (69% sensitivity, 20% specificity), whereas intraoperative endoscopy has the same sensitivity as CT, but improved specificity (68%).

Neither CT or MRI are able to differentiate a possible foci of a concomitant malignant neoplasm within IP. However, high Fluorine-18 fluorodeoxyglucose positron emission tomography (FDG PET) has shown increased uptake in IP tissues, with a further increase in maximal uptake in tissue with associated SCC. In long-term follow-up, both CT and MRI have difficulty in distinguishing recurrent IP from scar tissue or inflammation. Most clinicians believe that endoscopy is far more sensitive than any form of imaging for early detection of recurrence.

Staging

A universal staging system for IP has not yet been adopted. The historical use of the “T” component of the AJCC TNM system for staging benign IP has been discarded by many, in favour of the staging system developed by Krouse in 2000 (Table 1). Krouse’s staging is based on 30 years of experience with IP and a review of 1426 cases in the literature. His staging combines the extent of the disease, 2) the extent of the disease, 3) and the presence of malignancy. Krouse recognized the difficulty in removing IP from the lateral wall of the maxilla, or spread into the frontal or sphenoid sinuses. His staging system comprises 4 stages (T1 – 4) and includes malignancy and/or extrasinus involvement noted on endoscopic examination of the nasal cavity and CT scan evaluation. Krouse proposes three primary factors in assessing the stage of the disease as: 1) the location of the disease, 2) the extent of the disease, 3) and the presence of malignancy. Krouse recognized the increased difficulty in removing disease from beyond the medial wall of the maxilla, or spread into the frontal or sphenoid sinuses. His staging system comprises 4 stages (T1 – 4) and includes malignancy and/or extrasinus extension in T4.

A modification of Krouse’s staging has been recently proposed. Cannady categorizes patients into three groups (A, B or C) based on disease location and extent (Table 2). The groupings are prognostically driven from data on long-term follow-up of 445 patients. Cannady argued that prognostic difference between Krouse T1 and T2 was questionable, and grouped them together as Group A, shown to have a low relative risk of only 4% for recurrence. He also recognised the increased technical difficulty in removing IP from the lateral wall of the maxilla, and the frontal or sphenoid sinuses, and called this Group B (equivalent to Krouse T3), with a corresponding increased relative risk of recurrence of 19.8%. Group C includes any IP with extrasinus extension, but removes Krouse’s inclusion of malignant tumours. The relative risk of recurrence in this group is 35.3%. This new grading is designed for treatment planning, with the intention for endoscopic surgery being used as the primary mode of surgery.

Management

The aim of surgical management of IP is complete removal, whilst minimizing the morbidity of the procedure for the patient, and ideally allowing an unobstructed view for postoperative surveillance for recurrence. Accurate identification of the specific site of origin and extent of disease, based on imaging and endoscopic evaluation is essential for surgical planning. Removal of all involved mucosa, with a rim of adjacent normal mucosa, and a portion of underlying bone is recommended to minimise the risk of recurrence. Medical treatment of IP involves management of any concurrent sinusitis. Based on the premise that HPV has a role in IP metaplasia, the possible use of interferon is being researched in treatment of advanced IP not amenable for resection. Radiotherapy has a very limited role, used occasionally in patients who are medically unsuitable for surgery, or in post-operative treatment of patients who have extensive SCC involvement.

Historically, surgical removal of IP involved a transnasal approach with poor illumination, achieving little more than an intranasal polypectomy, and unsurprisingly was associated with recurrence rates of up to 78%. In 1986 a review of 35 years of IP treatment showed that recurrence rates for external procedures (Cauldwell Luc or external ethmoidectomy) was 56%, which was reduced to 29% for open procedures. Consequently, the “gold standard” became a lateral rhinotomy approach for an enbloc resection, usually involving a medial maxillectomy. The recurrence rates improved, but with these open approaches, patients could develop significant postoperative morbidity including: epiphora, dacryocystitis, epistaxis, mucocoeles, ozena, cerebral spinal fluid leak and facial neuralgia. Modifications in placement of the incision can improve the cosmesis of the facial scar, and immediate dacryocystorhinostomy can reduce the rate of epiphora and dacryocystitis. To avoid the facial scar, a midface degloving approach was sometimes advocated, which still allowed en-bloc removal of the IP, but postoperative problems with vestibular stenosis and facial hypoesthesia were more common, and access was inferior to a lateral rhinotomy approach.

In the 1980’s, with the increasing expertise in treating inflammatory sinus disease, endoscopic approaches were used for removing small or limited IP, aimed at reducing

Table 1: Staging of Inverted Papilloma.

<table>
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<tbody>
<tr>
<td>T1</td>
<td>IP confined to the nasal cavity</td>
</tr>
<tr>
<td>T2</td>
<td>Osteomeatal complex, ethmoid, medial maxilla +/- nasal involvement</td>
</tr>
<tr>
<td>T3</td>
<td>Any wall of maxilla (exc medial), frontal, sphenoid +/- T2 criteria</td>
</tr>
<tr>
<td>T4</td>
<td>extrasinus involvement or malignancy</td>
</tr>
<tr>
<td>Group A</td>
<td>IP confined to the nasal cavity, ethmoids and/or medial wall of the maxilla.</td>
</tr>
<tr>
<td>(relative risk of recurrence 3%)</td>
<td></td>
</tr>
<tr>
<td>Group B</td>
<td>IP associated with the lateral wall of the maxilla, the sphenoid and/or frontal sinuses</td>
</tr>
<tr>
<td>(relative risk of recurrence 19.8%)</td>
<td></td>
</tr>
<tr>
<td>Group C</td>
<td>IP with any extrasinus extension</td>
</tr>
<tr>
<td>(relative risk of recurrence 35.3%)</td>
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Table 2: Staging of Inverted Papilloma.
A Review of the Aetiology and Management of Sinonasal Inverted Papilloma

postoperative complications. Recurrence rates for endoscopic approaches were reported on-par with open techniques (17% vs 19%). However, with no commonly accepted staging system, results from different centers were difficult to compare, and validity was questioned due to presumed patient selection bias for endoscopic approaches.

Over the last decade many reports have emerged using endoscopic techniques with rates of recurrence averaging out at 13.4%. A trend towards utilizing the improved endoscopic technology, including navigational systems, has slowly emerged. This approach avoids the problems of facial scarring and complications such as wound infection which has been reported in as many as 10% of lateral rhinotomy incisions.

Appropriate patient selection is the key to the use of endoscopic approaches in the treatment of IP. Assessment of endoscopic resectability is based on accurate preoperative staging, as well as considering the level of institutional expertise. Endoscopic removal of IP may entail either piecemeal removal of the tumour or en-bloc removal. In cases of piecemeal removal tissue collected from a microdebrider is thought to be still adequate for accurate diagnosis IP and/or malignancy. Microdebrider samples can be collected in a segmental systematic manner, which allows post-operative “mapping” of pathology specimens from different regions. All removed tissue should be sent for histological analysis, because of concern that a small focus of SCC within the IP could be missed if all excised tissue is not examined.

Bulky tumours that fill the nasal cavity can be readily addressed endoscopically, whilst retaining the site of mucosal attachment. Many studies using open techniques have advocated that as part of the resection, the entire mucosa should be stripped from the involved sinus and any adjacent sinus/es. It is now proposed that it is sufficient that the mucosal attachment of the IP be removed, with just a cuff of normal surrounding mucosa. Frozen section analysis of mucosal margins is utilized when there is any doubt about clear margins. Any microscopic tumour fragments embedded in the underlying bone can be removed with the use of endoscopic diamond burr drill, if the bone itself cannot be removed entirely. An endoscopic medial maxillectomy can be safely performed with minimal post-operative morbidity, and recurrence rates that are equal or better than those using a lateral rhinotomy approach.

Specific locations are notoriously more difficult to access endoscopically, such as the frontal sinus, as well as the anteromedial and anterior walls of the maxillary sinus. Improved access to the maxillary sinus can be achieved by endoscopic removal of the medial wall of the maxilla (including the inferior turbinate) and the use of a canine fossa puncture. Using angled telescopes through the antrostomy and instruments via the canine fossa, then alternating the position of the scope and instruments, allows direct vision of the entire maxillary antrum, whilst retaining the medial buttress of the maxilla.

Frontal sinus IP is rare, but has a very high rate of recurrence associated with the technical difficulties in accessing disease in this area. Disease in the frontal sinus has traditionally been treated with an osteoplastic flap and removal of all of the frontal sinus mucosa. Obliteration is not recommended for patients with IP.

Endoscopic surgery alone is not suitable for all cases. In one series of 104 cases when used in isolation the rate of recurrence was 22.4% which dropped to 16.2% when combined with open procedures for more extensive disease. It has been proposed that endoscopic surgery alone is suitable for those lesions confined to the lateral nasal wall with or without extension into the ethmoid, maxillary and sphenoid sinuses while tumours extending into the nasofrontal duct, orbit and frontal sinus may be better off with a combined procedure. Outcome studies have suggested that endoscopic and combined endoscopic/external approaches are at least equal in their effectiveness as more traditional techniques but are associated with a reduced hospital stay and decreased morbidity.

Post-operative surveillance

Most recurrences at the original IP site occur within two years, but late recurrences of up to 10 years or more have been reported. Surveillance of patients using clinic-based endoscopy is recommended for at least five years.

Management of malignant IP

For cases of SCC in-situ change, the approach is the same as for IP without in-situ development. Sufficient to say there is more vigilant post-operative surveillance. In situations of SCC development associated with IP, the surgical approach is once again the same with complete endoscopic resection. All cases are referred to the radio-oncologists for consideration of post-operative radiotherapy. In situations of extension of SCC outside the confines of the paranasal sinuses, surgical management is tailored to the specific location and managed in conjunction with the Head and Neck surgeons in our facility.

Conclusion

Sinonasal IP is a benign tumour originating predominantly on the lateral nasal wall, with a propensity to be locally destructive, allowing invasion into contiguous regions. It has a high rate of recurrence associated with incomplete removal, secondary to mucosal invagination into osteitic bone underlying the tumour pedicle.

The initiating factor/s in developing IP are unknown, but inflammation may have a role. IP’s consist of a monoclonal population, but it may be multi-focal.

IP has a strong association with malignant transformation, which is thought to be a multi-step process involving numerous DNA mutations, in which
HPV may well have a role. The presence of squamous metaplasia in IP allows HPV infection as a secondary event. HPV, when present, is associated with a higher risk of malignant transformation. High-risk subtypes 16 & 18 identified in cervical SCC, seem to have a stronger association with malignancy than low-risk subtypes 6 & 11. The difference between these subtypes is thought to be associated with the oncogenic potential of the E6 & E7 viral proteins once integrated into the host genome.

The key to successful management of IP includes accurate preoperative staging of the disease to determine the origin and extent of the tumour; using endoscopy, high resolution CT, and in appropriate cases, MRJ scanning. Surgery involves removing all diseased mucosa, a margin of normal mucosa, as well as addressing the localized underlying bone. In many patients with IP this can be achieved by endoscopic approaches. The high level of recurrence and association with malignancy warrants close surveillance of patients with IP for a minimum of 5 years.

References
A Review of the Aetiology and Management of Sinonasal Inverted Papilloma


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Branchial Anomalies in Children

Abstract
Branchial anomalies comprise a spectrum of disorders, the majority of which present in childhood. The normal embryological development of the branchial apparatus is discussed together with the developmental anomalies of each arch. The options for safe and effective surgical management are influenced by knowledge of the embryogenesis of the arch involved and relevant associated anatomy. Surgical management is aimed at complete excision of the sinus, cyst of fistula, except for fourth pouch sinuses where endoscopic cauterization is emerging as an alternative to ‘open’ surgery.

Keywords
Branchial, embryology, congenital, sinus, fistula, cyst.

Introduction – Embryological development of the branchial apparatus
Branchial anomalies comprise a spectrum of congenital defects that occur in the head and neck, the majority of which present in childhood. These anomalies result from abnormal development of the branchial arches, and account for up to 17% of all pediatric cervical masses.1,2
Six paired branchial arches are separated externally by the branchial clefts and on their internal surface by the branchial pouches.3 Phylogenetically the branchial apparatus is related to the gills of a fish and hence the origin of the word from the Greek “branchia”. Each cleft corresponds with the ipsilateral pouch of the same number. Each branchial arches contains a central cartilage core, supplied by a corresponding named artery and nerve.

The mesodermal concentrations of the arches develop in the fourth to sixth week of development and grow ventrally to fuse in the midline with that of the contralateral arch of the corresponding number. During the 5th week of gestation the 2nd arch grows caudally to overlap the 3rd and 4th arches, with the resultant cervical sinus disappearing by the 7th week of gestation (Figure 1). The first arch develops into the mandible and maxilla, the second and third into the hyoid and the fourth, fifth and sixth into the cartilages of the larynx (Table 1). The internal endodermal lining of the pouches gives rise to a number of important organs (Table 1). As the second arch extends ventrally, forming the cervical sinus, the ectodermal clefts obliterate except for the first, which forms the external auditory canal, with the outer layer of tympanic membrane in its most medial aspect. Failure of a pouch or cleft to obliterate during embryonic development may result in a fistula, a sinus, or a cyst (Table 2).

First Branchial Cleft Anomalies
First cleft anomalies are rare duplication anomalies of the external auditory canal, that present with periauricular swelling, inflammation or a sinus.4–7 Work suggested a classification based on the embryological origins of the tissue and the presence or absence of mesodermal elements (Table 3).4 A Type 1 anomaly is lined by ectodermal squamous epithelium and contains no cartilage or adnexal tissue. Type 2 anomalies also contain mesodermal elements in their wall, such as hair follicles or cartilage and lie in close proximity to the facial nerve. The
opening of a Type 2 anomaly is usually below the angle of the mandible, but above the hyoid.

Anomalous development of the 1st branchial cleft can result in either a sinus or fistula, dependant upon the extent of the abnormal tract. A first arch fistula (collaural / cervico-aural fistula) has an external opening anywhere on the line from the tragus down to the hyoid. Superiorly the fistula may open into the external auditory canal at the junction of the cartilaginous and bony portions or onto the skin around the tragus. The resultant tract is often intimately associated with the facial nerve. Rarely, duplication of the cartilaginous external auditory meatus
may occur (Figure 2). In some cases, otoscopy reveals a skin-covered band that runs from the floor of the external auditory canal to the umbo of the malleus and this is pathognomonic of a first arch fistula.

As a result of desquamation, epithelial debris may discharge from the sinus, or fistula, opening and may progress to inflammation or abscess formation. Treatment in symptomatic cases is complete surgical excision and this is most safely performed via a formal superficial parotidectomy approach and involves complete dissection of the epithelialized tract. Facial nerve identification and monitoring during the procedure is mandatory as the relationship to the nerve is unpredictable. Surgical excision may be complicated by scarring resulting from previous procedures for presumed suppurative lymphadenitis, such as incision and drainage. Rarely the tract may run into the middle ear cleft.

A first arch sinus is not the same as a pre-auricular sinus, with the latter resulting from failure of fusion of the Hillocks of His, which are the embryological precursors of the pinna and lobule.

**Second Cleft Anomalies**

Anomalies of the 2nd branchial cleft usually present with a fistula/sinus tract or cyst, located along the anterior border of the tympanic cavity. The embryological basis for these anomalies is shown in Table 1.
Fistulas and sinuses arising from the 2nd branchial cleft have a tract that passes between the internal and external carotid arteries, over the hypoglossal nerve, and open internally into the posterior pillar of the tonsillar fossa. The treatment is surgical and requires complete excision of the tract via an elliptical incision around the external sinus opening (Figures 3 and 4). Methylene blue or a lacrimal probe may be a useful aid to identifying the sinus tract.

Table 2. Definitions of Branchial Anomalies.

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<th>Type</th>
<th>Embryological tissue composition</th>
<th>Site of the external opening</th>
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<tr>
<td>1</td>
<td>Ectoderm only</td>
<td>Posterior, inferior or medial to conchal cartilage and pinna</td>
</tr>
<tr>
<td>2</td>
<td>Ectoderm and mesoderm</td>
<td>Lies more anterior, usually below the angle of mandible, but always lies superior to the hyoid.</td>
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Table 3. Work’s Classification of first branchial cleft anomalies.

Figure 2. First cleft anomaly showing duplication of the external auditory canal. The anomalous canal is seen to be lined by hair-bearing skin.

Figure 3. Bilateral 2nd cleft sinuses with the left sinus tract demonstrated using a lacrimal probe.
tract, which may branch. As the tract is dissected step ladder incisions may be needed to facilitate access superiorly, especially in older children and adults, with the tract being ligated or diathermised at its upper end.

Branchial cysts have traditionally been regarded as originating from the 2nd branchial arch and may present at any age, but tend to present in early adolescence and early adulthood. Rarely, they occur bilaterally (2% of cases). Patients present with a solitary painless mass in the neck, usually located anterior to the junction of upper and middle third of the sternocleidomastoid muscle, or with local inflammation or abscess formation.

The treatment of a branchial arch cyst is surgical excision and early intervention is advisable, before infections result in local inflammation and adhesion formation, which may complicate surgery. Acute infections of the cyst should be treated with antibiotics and possibly needle aspiration. Incisional drainage should be avoided if possible to limit additionally scarring around the anomaly. Theories postulated for the origin of branchial cysts are described in Table 4. Of the various theories of origin for branchial cysts, ‘lymph node inclusions’ is the most widely accepted theory, in which it is suggested that cystic transformation of a lymph node occurs, stimulated by trapped epithelium. The treatment of ‘branchial cysts’ differs in adults, where the possibility of cystic change in a metastatic cervical node must be considered.

It is important to remember that second arch anomalies may form part of branchio-oto-renal syndrome (autosomal dominant inheritance with variable penetrance) characterized by branchial anomalies in association with pre-auricular sinuses, sensorineural hearing loss and renal abnormalities. Therefore, a family history of branchial anomalies should be sought, and where indicated consideration given to audiological as well renal assessment, including renal ultrasound.

Third and Fourth Arch Anomalies

Inconsistency exists regarding the nomenclature used to describe anomalies of the 3rd and 4th branchial arches. However, if the definitions included in Table 4 are used then the anomalous tracts originating from the piriform fossae are branchial pouch sinuses rather than ‘fistulae’ as sometimes described.

Third branchial pouch sinuses are thought to result from persistence of the thyropharyngeal canal and open into the superior end of the piriform fossa. By comparison 4th branchial pouch sinuses are thought to be derived from the pharyngobranchial canal connecting the pharynx to the ultimobranchial body and superior parathyroid gland, and open into the apex of the piriform fossa. Such a distinction will only be possible at endoscopic pharyngolaryngoscopy, or possibly contrast swallow examination. The tract of a third pouch sinus runs through the thyrohyoid membrane above the superior

Table 4. Theories of origin of branchial cysts.
laryngeal nerve, and in the case of a 4th pouch sinus through the cricothyroid membrane and below the nerve. 16-18

Fourth pouch sinuses are rare and are located on the left side in 94% of cases. 18,19 The vascular derivatives of the 4th branchial arch are not symmetrical (aortic arch on left and subclavian artery on right) and it is thought that this asymmetrical development is responsible for the left side predominance. 16,17,20 The commonest presentations of 4th branchial pouch sinuses are recurrent lateral neck abscesses and acute suppurative thyroiditis. 16-21 Therefore, children presenting in this manner should undergo rigid airway endoscopy and possibly barium swallow. 22 A 4th pouch sinus leaves the apex of the piriform fossa, near the cricothyroid joint, and runs towards the deep surface of the ipsilateral thyroid lobe. 16

Treatment has traditionally comprised complete surgical excision of the sinus tract with possible partial thyroidectomy in order to protect the recurrent laryngeal nerve. 15-19 Partial resection of the thyroid cartilage may be necessary to gain adequate exposure as the tract enters the piriform fossa. However, despite thyroid lobectomy vocal cord palsies are well documented after ‘open’ surgery 18 and this has lead to the emergence of endoscopic obliteration as an alternative technique. The opening of the pouch sinus is identified using suspension laryngoscopy with closure of the sinus tract using electrocautery, laser or chemical-cauterisation (silver nitrate or trichloroacetic acid) 20,23-25 (Figure 5,6). The endoscopic technique avoids dissection and negates the risk of damage to the recurrent laryngeal nerve. Endoscopic and open approaches have similar recurrence rates (15%). 18 With the introduction of endoscopic obliteration, the role of complete surgical excision may be to treat recurrent disease. 22

A fistula involving the 4th arch would have a tortuous course within the neck and mediastinum and, although possible, none have been described. 20

Conclusion
Branchial arch anomalies represent a diverse range of congenital pathologies within the neck, usually presenting in children. A thorough knowledge of their embryological origin and resultant associated anatomy aids safe surgical planning and successful management. Surgical management is aimed at complete excision of the sinus, cyst of fistula, except for fourth pouch sinuses where endoscopic cauterization is emerging as an alternative to ‘open’ surgery.

Key Learning Points
- An in-depth knowledge of branchial embryology is necessary for safe surgery.
- First arch anomalies are closely related to the facial nerve.
- The tract of a second arch anomaly passes between the internal and external carotid arteries and, if an internal opening is present, opens into the tonsillar fossa.
- Suspect a fourth cleft fistula in any child with recurrent acute thyroiditis or lateral neck abscesses.
References


A huge paediatric sphenoidal mucopyocele mimicking a tumour: Case report and literature review

Abstract

**Objective:** The authors present a rare case of paediatric sphenoidal mucopyocele mimicking a tumour.

**Methods:** A case report and literature review of sphenoid mucoceles in the paediatric population.

**Results:** The authors present a case of sphenoidal mucopyocele in childhood initially thought to be a rhabdomyosarcoma. We discuss the presentation, investigation and surgical management of this rare entity. We also provide radiological evidence of this pathology.

**Conclusion:** Paranasal sinus mucoceles are uncommon in the paediatric population; with sphenoidal mucoceles being extremely rare. Endoscopic endonasal surgery is nowadays the gold standard for treating sphenoid mucoceles.

**Keywords**

Cystic fibrosis, Endoscopic surgery, Mucocele, Paranasal sinus, Sphenoid sinus.

Introduction

Paranasal sinus mucoceles are rare in children. A mucocele is an epithelial-lined sac completely filling a paranasal sinus and capable of expansion by bone resorption and new bone formation. It is the dynamic process at the interface of the epithelium and bone that distinguishes a mucocele from a blocked sinus filled with trapped mucus. The first clinical description of a mucocele of the frontal sinus was described by Langenbeck in 1818. Rollet introduced the term “mucocele” in 1896, and in 1901 Onodi formulated the histological evidence. Most reported cases of paediatric paranasal sinus mucoceles are associated with cystic fibrosis. Other predisposing factors include impaired secretion flow, pathological pneumatization processes and trauma. Literature describes the frontal and ethmoidal sinuses as the most common sites of mucoceles (98%) with maxillary and sphenoid sinuses an extreme rarity (1%). Here we report a rare case of paediatric sphenoid mucopyocele initially thought to be a rhabdomyosarcoma.

Case report

An 8 year old girl presented to the otolaryngology department in a district general hospital with a 4 month history of right nostril obstruction and right hearing loss. The family noted asymmetric right sided facial swelling and a protruding right eye. The child was otherwise well with no significant past medical history. Examination revealed right proptosis and right cheek swelling. Intraorally, the right upper buccal sulcus was swollen and the soft palate displaced. A right ottis media with effusion was present. Cranial nerve examination was normal. Fibreoptic nasendoscopy revealed a right nasopharyngeal smooth mass. A non-enhanced CT scan, due to lack of venous access, was carried out. This showed a large expansile mass in the right infratemporal fossa extending to the right parapharyngeal region. The right lateral pterygoid plate was displaced with destruction of the medial pterygoid plate. The tumour obliterated the nasopharynx and extended into the right orbit leading to proptosis (Figure 1). The girl was then referred to a tertiary hospital for further management.
The child started to complain of headache, toothache and blurred right eye vision by the time she was seen at the ENT outpatients’ department. An audiogram confirmed right glue ear with mild to moderate conductive hearing loss. An ophthalmology review was sought which indicated restriction of upward gaze of the right eye with diplopia. A diagnosis of rhabdomyosarcoma was suspected. The child underwent an urgent examination of the nose under anaesthesia and biopsy. Examination revealed a very large smooth expansile lesion completely filling the right nostril and extending to the postnasal space. Following the biopsy, 40 ml of pus was drained. A middle meatal antrostomy was not possible due to grossly abnormal anatomy. The posterior antral wall was displaced anteriorly to such an extent that the normal ostium was not identified. A further biopsy was taken from a hypertrophied adenoidal pad. The child was started on antibiotics. Post-operative MR imaging revealed a large expansile lesion posterior to the right maxillary antrum extending into the sphenoid sinus. The lesion caused considerable displacement of bony structures and was filled with air. No intracranial extension was seen (Figures 2 and 3). Both biopsies revealed benign inflammatory disease and in retrospect, a diagnosis of sphenoidal mucopyocele was confirmed.

The patient was seen in the outpatients’ department six days after the operation. A considerable improvement in diplopia and nasal obstruction was noted. However, she was still complaining of headaches and right sided toothache. Flexible nasendoscopy revealed patent nasal airway with no masses. A repeat CT scan illustrated good aeration of the sinuses and the large cavity of the mucopyocele arising from the sphenoid sinus. The greater wing of the sphenoid was breeched with no intracranial extension. Orbital proptosis was improving.

The child’s symptoms improved and she is still being followed up by the otolaryngology and ophthalmology teams at the tertiary hospital.

Discussion
Paranasal sinus mucocoele usually affects adults. It is considered to be very rare in infants and children.1 It has been suggested that pediatric mucocoeles occur predominantly in patients with cystic fibrosis. In a series of 10 paediatric cases managed over 10 years, 6 children had cystic fibrosis.1 Other causes include chronic sinusitis, sino-nasal polyposis and cranio-facial trauma. A benign fibroossous tumour has also been reported in association with an ethmoid mucocoele in an infant.6

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The differential diagnoses of this condition include congenital, benign, and malignant formations. Congenital conditions include dermoid and epidermoid cysts, meningoceles, meningoencephaloceles and gliomas. Tumours that develop in the nose and nasopharynx of children are usually benign and include juvenile angiofibromas, osteomas, lymphangiomas and haemangiomas. Malignant tumours include Ewing’s sarcoma and the commoner rhabdomyosarcomas. Our patient had right proptosis, cheek swelling and nasal obstruction with imaging findings of a mass lesion in the right infratemporal fossa extending to the nasopharyngeal region and right orbital cavity. This was initially suspected to be a rhabdomyosarcoma. Other rare malignant tumours include squamous cell carcinoma, adenocarcinoma, teratocarcinoma, and metastases of primary tumours.

Mucoceles in children are unilateral in 90% of cases reported in literature. It is extremely rare for the mucocele to arise from the sphenoid sinus. Hartley and Lund published a series of seven paediatric mucoceles. One child only had a sphenoid mucocele. Nicollas et al described the management of 10 cases of paediatric paranasal sinus mucoceles. Only one child had a right sphenoid mucocele. Olze et al presented three children with sinus mucoceles; two had involvement of the sphenoid sinus. Our patient had a mucocele extending from the right sphenoid sinus. Mucoceles progress slowly causing symptoms as they expand. However, they can present acutely if they become infected. Symptoms can vary from mild nasal obstruction to severe diplopia and impaired vision. Mucoceles can also invade the skull base with subsequent relevant symptoms and signs. Symptoms of sphenoidal mucoceles can be extremely subtle. The location of headaches and the nature of pain vary tremendously and can be associated with diplopia, visual field disturbance and globe displacement. Headaches are reported as one of the main symptoms of isolated sphenoid sinus disease with 70–90% of patients presenting with them. Olze et al reported the main symptom in both children with sphenoid mucocele as moderate to severe shifting headache which was refractory to medical therapy. There was no aetiological factor identified in both cases. Nicollas et al did not describe the presenting symptom of the child with the sphenoidal mucocele but has identified facial trauma as a predisposing factor. Our patient had right frontal headaches, blurry vision, diplopia and proptosis which correlate with the rare involvement of the sphenoid sinus. We could not identify any predisposing factors in our patient. Other rare symptoms and signs can be due to the mucocele affecting adjacent structures like cranial nerves and the pituitary gland.

CT and MR imaging are extremely helpful in ruling out tumours as the cause. CT scanning can delineate the mucocele as a homogenous, oval or round mass in the paranasal sinus. It provides essential information about anatomy of the bones which is useful in pre-operative planning. MRI differentiates between certain soft tissues and can help identify the anatomy of the sphenoid sinus and its relationship to base of the skull, optic nerve and internal carotid artery. Interestingly, our patient’s initial CT scan suspected a tumour as the primary cause. It was not until the mucocele has been drained that the subsequent MRI confirmed the diagnosis.

Endoscopic endonasal surgery is the choice of treatment for mucoceles. Results are excellent with minimal morbidity and absence of facial scarring. Hartley and Lund successfully treated all their cases with endoscopic intranasal surgical drainage. A sickle knife was used to open the mucocele and the opening was then enlarged using endoscopic sinus surgery forceps to obtain wide marsupialisation. All patients were followed up for one year without recurrence. Similarly, Nicollas et al treated all their cases with endoscopic endonasal marsupialisation. Interestingly, the patient with sphenoidal mucocele had to be operated on eight months later using the same procedure. There was no recurrence but synchia of the sphenoid ostium with sub-acute sphenoiditis were observed. Olze et al treated both patients with sphenoidal mucocele via the endoscopic endonasal approach. A transethmoid access was selected in the first case and direct access via the sphenoid sinus ostium in the second, with wide marsupialisation obtained in both cases. Follow up was arranged for 2 years with no evidence of recurrence. The traditional external approach for surgical drainage is exceptionally performed nowadays. Combined external and endoscopic approach is performed in complex cases including those with transcutaneous fistulae, intracranial infections and large mucoceles affecting the orbits. Our patient had marsupialisation of the right sphenoidal mucocele through the endoscopic endonasal approach.

References

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Extranasopharyngeal Angiofibroma of the Nasal Cavity in a 33 year old male

Case presentation

A thirty three year old male presented to the ENT clinic with a 1 year history of nasal obstruction. On two occasions, in that year, he had presented to the emergency department with a severe right sided epistaxis where he was treated with nasal packing and cautery. He also complained of poor sense of smell but there was no history of discharge, headache or facial pains. Clinical examination revealed adhesions in the right nasal cavity; a polypoidal lesion arising from the right middle meatus and a clear post nasal space.

A CT scan demonstrated a large right sided mass extending through the medial wall of the right maxillary antrum into the right nasal cavity (Figures 1,2). The mass was noted to be pushing the septum to the left. The patient was scheduled for endoscopic excision of this lesion.

At surgery, a mass was found extending from the lateral wall of the maxillary sinus cavity into the middle meatus and nasal cavity. An endoscopic medial maxillectomy was performed to ensure full excision and the tissue was sent for histology. The maxillary sinus mucosa itself appeared normal. This was an uncomplicated procedure.

The initial histology commented on densely hyalinised areas with both thick and thin walled blood vessels present. Aggregation of “plump” fibroblasts and myofibroblasts were also seen. The overall conclusion was of an angiofibroma with associated haemorrhage. Given the age of the patient, clinical findings of a maxillary sinus lesion with no nasopharyngeal involvement, together with the fact that the resection was relatively “avascular” the histology was sent for further panel review. The final report concurred with the initial histology (Figure 3).
At outpatient follow up, 6 months on, the patient remains free of disease.

**Case discussion**

Classical Nasopharyngeal angiofibromas are rare, histologically benign and vascular tumours occurring in the nasal cavity. The tumour occurs almost exclusively in adolescent males, hence the term Juvenile Nasopharyngeal Angiofibroma (JNA). The average age of presentation is 15 years of age with large series reviews reporting a cumulative range between 9-28 years old at diagnosis.\(^1,2\)

They account for just 0.05% of all reported head and neck tumours.\(^3\)

This case of angiofibroma has two striking features which make it an exceptional case: 1) the late age at presentation and 2) the atypical anatomical site of the tumour.

The exact aetiology of JNA, at present, remains unclear. The role of Epstein Barr Virus and Herpes Simplex Virus has been investigated and disproved.\(^4\) However given the predilection for JNA’s in adolescent males a hormonal pathogenesis has been postulated. The influences of oestrogen and testosterone have all been discussed with conflicting results. Male predominance, consistent tumour expression of androgen receptors\(^5\) and clinical reports of JNA recurrence after institution of exogenous testosterone therapy support the cause of androgen driven growth.\(^6\) However immunohistochemical analysis has also more recently found expression of newly discovered oestrogen receptors (ER-\(x\)) in all tested tumours, thus posing the question whether anti-oestrogen therapies would be possible.\(^7\) Given the vascularity of JNA’s evidence has been sought for the expression of vascular endothelial growth factor (VEGF) with partial correlation of vascular density. Any synergistic action with sex steroids is yet to be investigated.\(^8\)

Whether the anatomical site hormonal stimulation is on residual fetal erectile tissue or hamartomatous tissue is also open to question. There does not appear to be evidence for inheritance in JNA.\(^9\)

That this patient, at the age of thirty three, lies well outside the considered boundary of “adolescent” male necessitates consideration of other causative factors. Cases of JNA in the adult age group have been reported but are rare,\(^10\) indeed histologically confirmed nasopharyngeal angiofibroma occurring in elderly females has also been reported as an exceptional rarity.\(^11\)

Delayed diagnosis is unlikely to be an explanation as the natural history of JNA dictates continued expansion with extensive spread of the disease since onset in adolescence. Therefore one may have expected more severe disease in this patient.

Typically JNA’s originates adjacent to the superior border of the sphenopalatine foramen growing medially to initially involve the nasopharynx and paranasal sinuses. In our case the tumour involved the maxillary sinus and lateral nasal wall but did not appear to originate from the sphenopalatine foramen, nor did it extend into the nasopharynx, hence it’s recognition as an Extranasopharyngeal angiofibroma. These have been reported most commonly originating in the maxillary sinuses\(^12\) and comprising an incidence of 1.8% of all angiofibromas.\(^13\)

Extranasopharyngeal fibroma has been considered by some authorities to be separate diagnostic entities. The reported incidence in women, older age group and lack of hypervascularity\(^14\) are all suggestive of this. Indeed given that biopsies of suspected JNA’s are generally contraindicated for risk of uncontrollable haemorrhage, that the resection proved to be extremely avascular lead to questioning of the histological diagnosis.

Diagnosis, as for JNA, is initially a clinical one. In this case the patient’s age has appeared to allay clinical susc
Extranasopharyngeal Angiofibroma of the Nasal Cavity in a 33 year old male

of angiofibroma, however on consideration the incidence of vigorous epistaxis should keep it as a differential diagnosis. Nasal obstruction and hyposmia as in this case is common.

Characteristics on CT / MRI scanning include bowing of the posterior wall of the maxillary antrum anteriorly, however, in contrast to JNA’s, enlargement of the sphenopalatine foramen is lacking and vascular enhancement of the mass on post contrast studies is not as great.\textsuperscript{15}

Treatment is surgical excision. Whether pre-operative embolisation of the tumour in an attempt to minimise intra-operative blood loss is necessary is debatable in view of the relative hypovascularity of these tumours. Surgical approaches are dependent on the extent of the tumour growth. Small to moderate tumours may be excised by endoscopic endonasal approach as in this case. Larger tumours may require more extensive resection via lateral rhinotomy, transpalatal approach or midfacial degloving techniques. This patient is currently reviewed on a 3 monthly basis with nasendoscopy. Recurrence in extranasopharyngeal fibroma has been reported to be rare (albeit in small series)\textsuperscript{16} compared to the up to a 40% recurrence rate in JNA’s after surgery.\textsuperscript{17,18}

This case further supports the theory that hormonal action may not be the sole factor in angiofibroma pathogenesis, and emphasises the need to maintain angiofibroma in the differential diagnosis when managing adult patients presenting with nasal obstruction and epistaxis.

References
Antibiotic Prophylaxis in ENT Surgery

Abstract
Peri-operative antibiotics have a significant role to play in the prevention of hospital acquired infections. Poor prescribing practice can lead to the emergence of resistant organisms and antibiotic associated infections. An audit was undertaken in which the first audit cycle identified current antibiotic prescribing practice for 139 patients. 5 patients had received antibiotics when not indicated. Following this, evidence based guidelines were issued to improve and standardise prescribing throughout the department. The second audit cycle included 128 patients and identified only 1 patient receiving inappropriate antibiotics and 1 not receiving antibiotics when they were indicated. No adverse events were identified.

Keywords
Audit, antibiotics, prophylaxis, hospital acquired infection

Introduction
The complications associated with peri-operative infection account for significant morbidity and mortality in surgical patients leading to an increase in the length of hospital admission. Surgical site infections (SSIs) compose up to 20% of all healthcare-associated infections and at least 5% of patients undergoing surgery develop an SSI. There are also significant cost implications. Healthcare costs for a patient with an SSI are, on average, approximately twice the cost for a patient without an SSI.

Peri-operative prophylactic antibiotics are commonly used to help reduce the frequency of post-operative infections. However, the over-use of broad spectrum antibiotics is becoming well recognised and there is now a drive towards a more rational approach to antibiotic prescribing to help to reduce the production of resistant organisms. The inappropriate prescribing of antibiotics has also been recognised as a major cause of antibiotic associated infections such as C. difficile colitis. On average this increases a patient’s hospital stay by 3 weeks and costs £4000 -10000 per case. Over the last ten years the Department of Health and the Health Protection Agency have developed specific measures to tackle the incidence of MRSA and C. difficile. This has lead to a 50% reduction of the reported cases of MRSA bacteraemia and C. difficile infection over the last 10 years and this is due to a number of factors including improved standards of prescribing.

The evidence behind the efficacy of antibiotic prophylaxis in surgery has been lacking up until recently and a great variation in prescribing practice has been observed. The Scottish Intercollegiate Guidelines Network (SIGN) produced guidelines regarding surgical antibiotic prophylaxis in 2008 containing advice regarding specific surgical scenarios suggesting whether antibiotics are indicated and which to consider based on the best available evidence.

With this in mind, we sought to establish what the prescribing practice for our ENT department was for all subspecialties. This formed the basis of the first cycle of an audit. The results of this were then used to highlight areas where prophylaxis was not in keeping with recognised guidelines. A specific departmental guideline for antibiotic prophylaxis was agreed and distributed throughout the unit. The second cycle of the audit was then undertaken to
establish if the protocol had been taken into consideration and how the change in prescribing practice had affected operative complication rates.

Materials and Methods
The first cycle of the audit involved assessing all patients undergoing elective surgery at the Queen Elizabeth Hospital, Birmingham during a 3 week period in July 2009. Prospective data was collected regarding the patients’ medical problems, the operation findings and procedure, whether antibiotics were prescribed during admission (including intra-operatively) and any indications or contra-indications for prophylactic antibiotics. Information was gathered by reviewing the patient records, the electronic prescribing system and the anaesthetic charts each day. The ‘Guidelines for Antibiotic Prophylaxis in ENT’ were then designed by using information given in the SIGN guidelines (see attached protocol) and distributed to ENT prescribers. Data gathering for the second cycle of the audit was performed 4 weeks after the guidelines were agreed for a further 3 week period in September and October 2009.

Results
First cycle
139 patients were included. After analysis it was found that 5 patients received antibiotics when none were indicated for that procedure. Inappropriate antibiotics were given for patients undergoing septorhinoplasty, trimming of turbinates, septoplasty and nasal polypectomy. These patients received 5 or 7 days of co-amoxiclav or erythromycin post-operatively. In addition, 2 patients undergoing cochlear implantation were not given doses of antibiotics when they were indicated.

Second cycle
This cycle included 128 patients. The majority of prescribing adhered to the guidelines that had been agreed. 1 patient who had undergone surgery for a bone anchored hearing aid, received antibiotics which were not recommended. 1 patient undergoing cochlear implantation did not receive a third dose of co-amoxiclav which was recommended.

Discussion
This completed audit has resulted in a streamlining of prescribing practice in our unit so that the balance between post-operative infection prevention and both long term and short term complications associated with poor antibiotic prescribing has been achieved. In the past, many patients have received doses of antibiotics inappropriately. There are a number of reasons for this. There is a lack of strong evidence that post-operative antibiotics reduce post-operative infection rates for many of the common ENT procedures. However, the paucity of evidence for the contrary has lead to antibiotics being prescribed as the consequences of wound infections are notoriously difficult to treat. As the evidence for their use and more importantly, their non-use is becoming more apparent, prophylactic prescribing must become more justified. This is particularly important in the current era of hospital-acquired infections. Hospital cleanliness is improving but knowledge of hospital acquired infections is varied. Aroori et al. have found a significant lack of knowledge concerning C. difficile infection amongst healthcare professions, in particular amongst consultants and nurses. Antibiotic restriction is the single most effective measure to reduce C. difficile infections.

The SIGN guidelines which were reviewed as part of this audit go some way in helping surgeons to know which situations antibiotic prophylaxis is indicated. There is a growing body of evidence that a full course of oral antibiotics post-operatively is commonly not indicated. The first cycle of this audit identified that a number of individuals were practicing this and after an explanation of the current evidence, this prescribing practice has now significantly reduced. An understanding that clean and clean-contaminated surgery in ENT rarely requires antibiotic prophylaxis has now been acknowledged in this unit. This is particularly true for common middle ear and nasal procedures.

A further reason for poor prescribing practice is not only lack of current knowledge but resistance to change itself. Cabana et al. have demonstrated that there is a poor long term adherence to new protocols that are implemented. We plan to re-audit again to assess the longer term adherence to the guidelines. Analysis of the departmental morbidity and mortality data for three months following introduction of the guideline did not reveal any increase in post operative wound infections, hospital acquired infections or antibiotic associated infections.

Reducing hospital acquired infections including SSIs would lead to reduced costs for treating these patients. In addition, rationalised prescribing should reduce the use of more expensive broad spectrum antibiotics. The cost advantages for more strict measures to limit the spread of MRSA have been established and we believe that the process of improving prophylactic antibiotic prescribing will go some way in benefiting the hospital financially as well as the patients undergoing surgery.

Conclusion
A clear, evidence based antibiotic guideline has been created to help to rationalise antibiotic prescribing. A reduction in antibiotic prescribing suggested by this guideline did not cause any increase in post-operative wound infections. By prescribing fewer antibiotics, the risk of antibiotic associated problems such as C. difficile and resistant bacteria (e.g. MRSA) can be reduced. This may also help to achieve cost savings.
Antibiotic Prophylaxis in ENT Surgery

Key Learning Points

- Poor antibiotic prescribing practice leads to the emergence of resistant organisms and antibiotic associated infections
- Evidence is now emerging regarding the use of antibiotics for prophylaxis in ENT and evidence based guidelines now exist
- A completed audit cycle has identified poor prescribing practice and improved outcomes are now being seen

Guidelines for Antibiotic Prophylaxis in ENT Surgery

- Otology
  - Grommet insertion – consider single dose of topical antibiotic drops upon insertion
  - Cochlear implantation - single dose of co-amoxiclav (1.2g IV) on anaesthetic induction, then 2 further doses within 24 hours
  - Intravascular prostheses - no antibiotics
  - Other middle ear surgery – single dose of co-amoxiclav (1.2g IV) only justified if considered as a contaminated/dirty procedure.
  - BIPP packing as appropriate.

- Skull Base Surgery
  - Repair of CSF leak - single dose of co-amoxiclav (1.2g IV) on anaesthetic induction

- Rhinology
  - Prophylaxis only justified if prosthesis is used in reconstructive surgery

- Head and neck surgery
  - Benign surgery - clean; no antibiotics
  - Benign surgery – contaminated (eg. by saliva); single dose of co-amoxiclav (1.2g IV)
  - Neck dissection (malignant) - single dose of co-amoxiclav (1.2g IV)
  - Open vescic surgery - single dose of co-amoxiclav (1.2g IV) on anaesthetic induction

Notes

- These guidelines are based on the Scottish Intercollegiate Guidelines Network national clinical guideline published July 2008 and are based on the best current evidence available.
- Intravenous antibiotics should be given ≤30 minutes before the skin is incised
- If the procedure lasts >4hrs and prophylaxis is indicated, a second dose should be considered intra-operatively
- Patients colonised with MRSA should have a course of intranasal mupirocin prior to high risk surgery
- Patients undergoing high risk surgery who are MRSA positive or penicillin allergic should receive teicoplanin 600mg IV if patient <70kg or 800mg if >70kg plus gentamycin 120mg IV

References


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FRCS viva: Deep neck space infection

A 3-year old child presents with a two-week history of a sore throat, and malaise. Over the last 3 days the child has become increasingly unwell, and for the last 24 hours has been drooling, with mild stridor. They are seen in A&E where an X-ray is performed, and on reviewing the film, the A&E team ask you to see the patient.

1. What does the x-ray show? (Figure 1)
This is a lateral soft tissue radiograph of the neck. It shows prevertebral soft tissue thickening, with loss of the normal lordosis of the cervical spine and significant anterior displacement of the larynx and trachea.

2. What is the most likely diagnosis?
This is most likely to represent a retropharyngeal abscess. Although similar appearances would be seen with a prevertebral abscess, retropharyngeal abscesses are more commonly encountered.

3. Who needs to be involved in the management of this child; who would you call?
This child has sepsis and airway compromise, and prompt, effective interaction between members of the medical team is essential. A senior, paediatric anaesthetist should be called as well as a senior ENT surgeon. In addition, input from the paediatric team will be required in managing the child’s sepsis. The theatre team should also be made aware that the child has a difficult airway and...
is likely to need intubation, and subsequent drainage of the retropharyngeal abscess.

You make a plan to transfer the child to theatre to secure the airway and drain the retropharyngeal abscess.

4. What equipment should you ask your theatre team to prepare?
The theatre team should be asked to prepare a paediatric laryngoscope and ventilating bronchoscopy set, a tonsillectomy set (with a Boyle-Davis gag) and a tracheostomy set. A range of paediatric endotracheal tubes and tracheostomy tubes should also be available. A good headlight and suction equipment will also be needed.

5. Outline the discussion you would have with the anaesthetist regarding the management of the child’s airway.
The first priority is to maintain and secure the child’s airway. Once the airway is secure, the retropharyngeal abscess can safely be drained. Every attempt should be made to avoid distressing the child, as it may precipitate further airway compromise.

The child should be transferred to the operating theatre. With the child awake and sitting in an upright position, an inhalational anaesthetic is usually used for induction of anaesthesia in 100% oxygen. This relies on a patent airway for gas exchange to occur, thus if the airway becomes occluded, delivery of anaesthetic would cease and reawakening would occur. (This is the reason that IV induction agents are not appropriate in this situation).

When an appropriate level of anaesthesia is achieved, a paediatric intubating laryngoscope is used to visualise the vocal cords, taking care not to rupture the abscess. Paralysing agents are usually withheld until it can be confirmed that the airway is patent and ventilation can be maintained. When a view of the cords is obtained, the child is given a muscle relaxant to facilitate intubation, and a size appropriate uncuffed endotracheal tube is inserted through the glottis. A bougie may be used if visualisation of the cords is difficult. (Awake fibreoptic intubation is not appropriate, since it would distress the child considerably and may lead to further airway compromise).

Should this method of intubation fail, it is important to have alternative means of securing the airway. A good view of the larynx is often obtained with a small paediatric ENT laryngoscope, and this may be used to visualise the cords, allowing a bougie, and then an endotracheal tube to be passed through the glottis. A bougie may be used if visualisation of the cords is difficult. (Awake fibreoptic intubation is not appropriate, since it would distress the child considerably and may lead to further airway compromise).

Should this method of intubation fail, it is important to have alternative means of securing the airway. A good view of the larynx is often obtained with a small paediatric ENT laryngoscope, and this may be used to visualise the cords, allowing a bougie, and then an endotracheal tube to be passed into the trachea.

If this fails, it is likely that the child will need a tracheostomy in order to secure the airway. Ventilation can be usually be maintained temporarily via a bag-valve mask under these circumstances.

The above sequence of events should be agreed prior to any initial attempt at intubation.

6. How would you drain a retropharyngeal abscess?
The patient should be positioned in the tonsillectomy position, with a shoulder bolster. A Boyle-Davis gag is inserted ensuring that the tongue is in the midline. A diffuse swelling will be seen on the posterior pharyngeal wall. A vertical incision is made in the posterior pharyngeal wall at the most prominent point of the abscess. This incision will extend through the mucosa, the superior constrictor and the pharyngo-basilar fascia, into the retropharyngeal space. Once pus is encountered, the opening is widened using Burkitts forceps. Pus should be sent for an urgent gram stain, and microscopy, culture and sensitivity. A washout of the abscess cavity should be performed with normal saline, and the incision left open.

7. 4 days after drainage of the child’s retropharyngeal abscess, they develop a swinging pyrexia. What investigation would you organise?
As the retropharyngeal space is continuous inferiorly with the mediastinum, a potential complication of a retropharyngeal abscess is mediastinitis. This can in turn give rise to purulent pericarditis, pericardial tamponade, bronchial erosion or a mediastinal abscess. Mediastinal infection can also spread to the adjacent pleura and cause pleuritis, pyopneumothorax, or empyema. A CT of the thorax would be the most appropriate investigation.

Infection can also spread posteriorly from the retropharyngeal space, giving rise to osteomyelitis of the cervical spine. Plain X-rays of the spine may show subtle signs of endplate erosion and destruction, but usually this is not evident in the first 1 to 3 weeks of a pyogenic infection. The most sensitive imaging test for spinal infection is an MRI of the spine with gadolinium.

8. Describe the other deep spaces of the neck. How may infection of each of these spaces present?
The neck is divided into a number of potential spaces by the deep cervical fascia. The deep fascia consists of four components: the investing layer of deep cervical fascia, the deep cervical fascia. The deep fascia consists of four components: the investing layer of deep cervical fascia, pretracheal fascia, prevertebral fascia and the carotid sheath.

The prevertebral fascia lies in front of the prevertebral muscles. Superiorly, it is attached to the base of the skull; it attaches inferiorly to the body of the fourth thoracic vertebra, blending with the anterior longitudinal ligament. It extends laterally to the trapezius, covering the muscles that form the floor of the posterior triangle of the neck and all the cervical nerve roots as well as the cervical and brachial plexuses. Behind this fascia is the closed prevertebral space.

A prevertebral abscess is rare today and primarily occurs in adults secondary to tuberculosis of the cervical spine. A progressively painful and tender neck with limitation of movement is the usual presentation. A lateral neck radiograph shows prevertebral soft tissue shadowing and an abnormal vertebral body which may be wedge-shaped through collapse.

Immediately in front of the prevertebral fascia is a potential space extending from the base of the skull to the diaphragm via the superior and posterior mediastinum. The upper portion behind the pharynx is the retropharyngeal space, and this is continuous laterally...
with the **parapharyngeal space**. This latter space is cone-shaped, with its base located at the skull base and its apex at the hyoid bone. The medial border is formed by the lateral pharyngeal wall, the anterior border is the medial pterygoid muscle and the lateral border is the ramus of the mandible and the deep lobe of the parotid gland. The parapharyngeal space is divided by the styloid process into an anterior (pre-styloid) and posterior (post-styloid) compartment. The anterior compartment is related to the tonsillar fossa medially and contains mostly fat; the posterior compartment contains the carotid sheath, the last four cranial nerves and the cervical sympathetic chain.

**Parapharyngeal abscess** formation may occur secondary to infections of the oropharynx, although local spread from odontogenic sources and lymph nodes is possible. Most patients have a fever, sore throat, odynophagia, and swelling in the neck. Anterior space abscesses cause trismus and induration along the angle of the mandible, with medial bulging of the tonsil and lateral pharyngeal wall. Posterior space abscesses cause medial displacement of the posterior pillar of the tonsil and posterior pharyngeal wall, usually with minimal trismus. Posterior abscesses may involve structures within and around the carotid sheath, potentially causing neurologic deficits, thrombosis of the internal jugular vein and rarely massive hemorrhage from carotid artery rupture.

The **submandibular space** is located below the mylohyoid muscle and above the investing layer of fascia between the hyoid and mandible. This space communicates around the posterior border of mylohyoid with a sublingual space under the mucous membrane of the floor of the mouth.

**Ludwig’s angina** describes a rapidly progressive cellulitis of the soft tissues of the neck and floor of the mouth. The submandibular space is the primary site of infection, with 90% of cases secondary to dental infection. The second and third lower molars are the most commonly involved teeth. The most frequent presenting symptoms are dental pain, or a history of recent dental procedures, accompanied by neck swelling. Less common complaints include neck pain, dysphonia, dysphagia, and dysarthria. Trismus and drooling may be present. Fewer than one third of adults will present in respiratory distress with dyspnoea, tachypnoea, or stridor. On examination, over 95% of patients have bilateral submandibular swelling and an elevated or protruding tongue. The submandibular swelling is typically brawny and tense, with overlying erythema.

9. **How would the surgical approach differ if the child had a parapharyngeal abscess?**

The conventional method of approaching a parapharyngeal abscess is through an external transverse skin incision about 3cm below the inferior border of the mandible at the level of the hyoid bone. The sternocleidomastoid muscle and great vessels are retracted posteriorly. The posterior belly of digastric is followed superiorly to reach the styloid process in the parapharyngeal space; alternatively the carotid sheath is traced superiorly to enter the post-styloid space. Loculations are broken down with finger dissection. A drain is left in the cavity, and the skin is closed loosely with interrupted sutures.

A trans-oral approach to the parapharyngeal space has also been described for the drainage of parapharyngeal abscesses. Although it is claimed that this approach requires less operative time and permits an earlier patient discharge compared to the external approach, it is still regarded as somewhat unorthodox. One method is described by Amar and Manoukian (Otolaryngol Head Neck Surg 2004; 130:676-80). A Boyle-Davis tonsillectomy gag is firstly placed in the oral cavity to expose the oropharynx. The lateral pharyngeal wall on the involved side is palpated intraorally, or sometimes bimanually, to localize the abscess. Once localized, an 18-gauge needle is inserted, transorally, through the lateral pharyngeal wall and into the abscess cavity, and pus is aspirated. An incision is then made in the overlying mucosa and subsequently dilated in a longitudinal manner. The wound is left open, the mouth gag is removed, and the patient is awakened. This wound remains open for several postoperative days, with the potential for continued drainage of the abscess into the oropharynx.
Intercollegiate Exam Viva

Intercollegiate Exam – Viva in Paediatric Otolaryngology – Paediatric Emergencies

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The Paediatric viva is an important part of the viva section and you should be able to score high in this viva. Each viva lasts 30 minutes, 15 minutes each for the two examiners. In these 30 minutes, 6 topics need to be covered. Essentially 5 minutes per topic from basics to management of the condition. There are no trick questions. The opening question is simple to get you started and feel comfortable. Competency questions are asked to check if you are safe in your approach and management. During the viva you need to move on reasonably quickly from the basic questions to management to get good scores.

Within the paediatric section, you will be asked at least two emergency scenarios and we hope these examples will demonstrate how the topic develops and how to approach it.

Scenario 1

Q: You have done a tonsillectomy on a 3 year old child this morning and on the post-op round at lunch time, the nurses have mentioned that this patient has been spitting out some blood. How will you assess the patient?

A: The key thing in this case is to make sure that the child is fluid resuscitated and that ongoing bleeding is stopped. I will take a brief history from the carers regarding the duration of active bleeding and assess the child straight away. I will ask about swallowing, parents may have observed as well as blood coming out of the mouth. I will feel for the pulse to check for rate and volume of the pulse. I will check the capillary refill time and see if it is prolonged more than 2 seconds. I will feel for the peripheries to check if they are warm or cold. I will look at the pulse and blood pressure chart to look for rising pulse rate. If the child is spitting blood in a bowl, that will also give me some idea of the amount of blood loss.

Q: What would be this child’s estimated weight and circulating blood volume.

A: This 3 year old child’s weight should be 14 kg [2(age+4)]. The circulating blood volume of this child would be 1200ml (80ml/kg).

Q: How will you manage this child?

A: This child needs fluid resuscitation immediately. I will make sure that the child has a patent intravenous access and will start him a bolus 20ml/kg of normal saline, and see the response. I will give him 280 ml of normal saline stat and look for the response followed by maintenance fluids. I will also send urgent samples for full blood count, clotting profile and group and save.

The definitive management of this child would be to take him back to theatre to stop the bleeding as soon as possible. I will inform the senior most paediatric anaesthetist about this patient and the urgent need to take him to theatre. I will also inform my consultant and the theatre staff. I will explain the situation to the parents and the management plan.

Q: What are the reasons for this bleeding?

A: The reason for bleeding within 4–6 hours post-op is usually if a ligature on a blood vessel slips off or a blood vessel opens up after a bout of coughing.

Q: How will you control this bleeding in theatre?

A: Because of the active bleeding, these cases are an anaesthetic challenge and should be anaesthetised by a senior anaesthetist. One key problem is blood in the
stomach. The anaesthetist may well use cricoid pressure during induction to prevent blood in the stomach passing to the pharynx leading to aspiration. After the airway has been secured with endotracheal intubation, the child is positioned (Rose’s position) and a mouth gag is placed. The clots are removed and the bleeding point is visualised by systematic and careful inspection of both the tonsillar fossae. After the bleeding point has been identified, the blood vessel can be dealt with a ligature or bipolar diathermy. At the end of the procedure the swallowed blood should be removed using a nasogastric tube. The child needs to be observed for 24 hours for any further bleeding. Bloods should be checked prior to discharge specifically looking at haemoglobin.

Scenario 2

Q: You are called to paediatric A&E to assess a 2 year old child with a history of sudden onset of coughing bout? How will you assess?

A: With this kind of history I am thinking in terms of an inhaled foreign body. I will first of all make sure that the child’s airway is secure and he is breathing comfortably. I will at the same time start taking history from the mother regarding the onset of coughing bout, if it was witnessed by some adult, was the child eating something or playing with some small toys. Did the child choke or turned blue or had any noisy breathing. Has he been drooling/managing to swallow since? How has he been since the episode? How is his general health otherwise and if he has a recent upper respiratory tract illness? After obtaining this history I would like to examine him. I will check his airway first, listening for any added sounds i.e. stridor. I will listen to the voice. I will check what his oxygen saturations are. I will complete a full ENT examination and auscultate his chest.

Q: This is a otherwise healthy child and has been having coughing bouts since the choking episode 6 hours ago. He is spontaneously breathing and maintaining his saturations on air. On auscultation, there is good air entry on both sides and an occasional wheeze on the right side. What is your next step?

A: With this history and clinical findings, I am strongly suspecting an inhaled foreign body. I will ask for a chest X ray

Q: Here is the X ray (Figure 1). Please comment?

A: This is a Chest X ray PA view, showing tracheal deviation to the left. There is hyperinflation of the right lung. These findings suggest that there might be a foreign body in the right main bronchus causing a ball valve effect.

Q: How will you manage this child now?

A: In view of all these findings suggesting a inhaled foreign body, I will arrange for this child to undergo rigid bronchoscopy and foreign body removal at a paediatric ENT unit.

Q: Assuming your unit is able to do the bronchoscopy, the child has had last meal at 9 pm. When would you want to do the procedure?

A: I will inform my consultant as well as keep the parents informed of the need for bronchoscopy. This child is otherwise well and stable, I would admit him to the paediatric ward for close observation. I will keep him starved and arrange for the bronchoscopy to be done first thing in the morning in the presence of trained ENT nursing staff and senior paediatric anaesthetist.

Q: Which foreign bodies need removing in the night?

A: Any batteries or sharp foreign bodies need removing as soon as possible. Also if the general condition of the child was not stable, I would consider doing the bronchoscopy in the middle of the night.

The clinical scenario given was of a distal foreign body i.e. in the bronchi. If however, the history had been of a change in voice with stridor from the outset of the choking episode, then I would have been thinking much more of a foreign body stuck at the level of the cords rather than a bronchial foreign body. Glottic foreign bodies should be removed straight away. Glottic foreign bodies are much more likely to cause rapidly progressive swelling and acute airway obstruction.

Scenario 3

Q: You are asked to see a 6 months otherwise healthy child in Paediatric A&E with history of acute onset ear ache and facial asymmetry? How will you approach this?

A: I will start with a detailed history from the parents regarding the onset and chronology of these symptoms of
acute earache and facial asymmetry. I will also ask if the child was otherwise well in himself or irritable with high temperatures. I will be interested to know any past history of similar or any other ear related problems. I will also check out any symptoms suggestive of immunodeficiency. I will assess the child in general to rule out any suggestion of intracranial complications and a full ENT examination including grading the facial weakness, and evaluating the mastoid tenderness.

Q: What grading system of facial palsy do you use?
A: I use the House Brackmann’s grading system. In this system, grade 1 is normal facial nerve function and grade 6 is complete facial paralysis. Grade 2 is normal facial contour at rest, but some degree of weakness on active movement. Grade 3 is obvious weakness even at rest but complete eye closure. Grade 4 is obvious facial weakness and incomplete eye closure. Grade 5 is barely perceptible movement with maximal effort.

Q: So, this child is irritable with a temperature of 38.5°C, has right side grade 3 facial palsy. He has no signs of meningitis or mastoid tenderness. There is no significant past medical history. This is how this child’s otoscopy looks like (Figure 2). Please describe this?
A: This is otoscopic view of right tympanic membrane showing a grossly congested and bulging tympanic membrane. With this clinical history, my clinical diagnosis would be acute otitis media with facial palsy.

Q: How will you manage this child?
A: Clearly this child has severe acute otitis media and an associated complication with it. Keeping the SIGN guideline for otitis media in mind, I will admit this child on a paediatric ward for observations (for intracranial complication). I will send bloods for CRP, full blood count and blood culture. I will start him on antibiotics and steroids as per hospital policy and microbiology advice. He will need an urgent grommet insertion under general anaesthetic to relieve the fluid from the middle ear. I will send the middle ear fluid for culture and sensitivity. I will observe this child for the next 24 hours to assess the response to the treatment.

Q: Slightly different scenario, another child instead of facial palsy presents with a swelling behind the ear and acute earache as shown in this photo (Figure 3). Please describe?
A: This clinical photograph shows swelling and inflamed left mastoid region. I will approach this in a similar fashion, starting with history and chronology of events and a detailed general and ENT examination.

Q: This is a 2 years old otherwise healthy child who has had an acute ear ache for past 24 hours and has developed this postauricular swelling over past 6 hours, has a temperature of 38.5°C and is irritable. This swelling is tender, but not fluctuant and tympanic membrane is red and bulging. How will you manage this child?
A: With this history and clinical findings, my clinical diagnosis would be acute mastoiditis or acute lymphadenitis. As this child has already developed a complication of acute otitis media, and is at risk of developing a mastoid abscess or an intracranial complication, I will admit this child for intravenous antibiotics and close observations. I will send bloods for CRP, Full blood count and blood cultures and start this child on high dose intravenous antibiotics in liaison with microbiology team. Given the history of post auricular swelling is so quick I will plan to observe this child for 24
hours and see the response, although if there is any deterioration at all I will go straight for CT.

Q: You review this child after 24 hours of intravenous antibiotics and the child is still spiking temperatures and symptomatically has not improved? What is your next step?
A: At this stage I will certainly arrange for an urgent high resolution CT scan of mastoid and brain with contrast, to evaluate this situation further i.e. whether this child has a mastoid abscess, sigmoid sinus thrombosis or any intracranial collections.

Q: This is the scan (Figure 4) for this child, please explain?
A: This is an axial CT scan showing a collection over the mastoid bone. I would evaluate all the sections with a radiologist to rule out sigmoid sinus thrombosis and any intracranial collections.

Q: The only positive finding is this subperiosteal collection? How will you manage this?
A: I will explain the scan findings with the parents and with their consent, will take this child to theatre as soon as possible for drainage of this mastoid abscess, cortical mastoidectomy and a grommet insertion. I will also leave a drain in for at least 48 hours. I will send the pus for culture and sensitivity and continue with appropriate intravenous antibiotics.

Q: Inspite of all that you have done, this child has been getting swinging pyrexia for 4 days now. What are you thinking in terms of?
A: I will investigate this child for sigmoid sinus thrombosis with an urgent MRI scan.

Q: What is Grissenger’s sign?
A: This postauricular bruising in the absence of an injury is because of thrombosis of the emissary vein.

Scenario 4
Q: You have been asked to see a child on the neonatal intensive care unit. This child was born 4 hours ago and is struggling to maintain his oxygen saturations. He intermittently becomes pink and then drops the saturations. How will you assess this child?
A: I will start assessing this child first of all making sure that he has an airway and is maintaining oxygen saturations. I will at the same time take a history including antenatal, perinatal and birth history and since when the child has been having these episodes. I will also specifically ask about any added airway sounds or apnoic/blue episodes. In conjunction with the neonatologist, I will do a detailed general examination of this neonate and detailed ENT examination. In view of the given history, I will specifically assess for nasal airflow and patency, using either a nasogastric tube or a small flexible endoscope. I will observe the pattern of breathing looking for episodes of attempted breathing through the nose (with the mouth shut), followed by crying and gasping breaths via the mouth, followed by attempted breaths via the nose again, then gasping breaths through the mouth in a cyclical fashion.

Q: This is an endoscopic view through the mouth with a 120° telescope (Figure 5). What do you see?
A: This is an endoscopic view showing bilateral choanal atresia.
confirm the diagnosis and for further evaluation. This child then needs to be transferred to a tertiary paediatric ENT unit urgently for repair of choanal atresia.

**Q: What is CHARGE syndrome?**

A: CHARGE stands for Coloboma in eyes, Heart problems, Atresia choanae, Retardation of growth/development, Genitourinary problems and Ear anomalies. Any child with choanal atresia can have these associated anomalies. The associated heart problems can be particularly serious for example tetrology of fallot where arterial and venous blood are mixed in the heart.

**Q: What are the minimum investigations required before the surgery?**

A: CT scan to evaluate further the choanae and an ECHO for anaesthetic reasons is recommended before the surgical procedure.

**Q: Is the atresia usually bony or membranous?**

A: In majority of the cases, the atresia is mixed- partly membranous and partly bony.

**Q: Explain the surgery for choanal atresia?**

A: Choanal atresia surgery is done under general anaesthetic, through the anterior nares, under endoscopic guidance using a 120° telescope through the mouth. The first step, is to palpate the atresia using a small urethral dilator through the nose and then puncture the membranous atresia on each side. With the 120 degree scope via the mouth, looking upward and backward into the nasopharynx, it is possible to see the membranous area the dilator is being pushed against bulge before it is pushed through, so adding to the safety of the procedure by having the area under vision. The area that has been opened is serially dilated with urethral dilators. If there is bony component of the atresia, this can be drilled open using a shielded diamond burr through the nose, always under the vision given by the 120 degree scope. The back of the bony septum can also be removed using backbiters placed via the nose and again observed by the 120 degree scope via the mouth. Both nostrils may stented using custom made stents from endotracheal tubes and secured using prolene that runs through the middle of the stents. If stents are used one must make sure that they are not causing any pressure on the ala or columella. These stents are left in for 6 weeks.

**Scenario 5**

**Q: What do you see in this photo (Figure 6)?**

A: This is a clinical photograph of a child showing swollen eyelids on the right side. This is clinically periorbital cellulitis.

**Q: How will you manage this?**

A: The essential thing here is to make sure this child does not lose their sight. I would start my assessment with a detailed history from the parents, regarding the onset and duration of the symptoms and chronology of events, including any preceeding upper respiratory tract infection and the past medical history. Examination will be of the eye itself especially of eye opening, movements, proptosis and visual function. ENT examination will focus on the nose. The child's alertness will be assessed and cranial nerves will also be examined including facial sensation. I will admit this child for close observation and treatment. I will send bloods for full blood counts, CRP and blood culture and start this child on intravenous antibiotics as per microbiology advice. I will also get an urgent ophthalmology consultation. If the child had the erythema seen here but virtually no other eye signs, then I may wait rather than going straight to CT. I do however have a very low threshold to moving onto urgent CT in such a case.

**Q: What will you look for in your assessment of the eye and why is it important?**

A: In the eye I will assess eye opening, conjunctival oedema, proptosis, eye movement range and pain, visual acuity, colour vision and pupillary reflex. These are important as all indicate severity. Any change in vision in particular indicates immediate need for surgery to prevent irreversible visual loss. The absolute focus of my management is to prevent getting into such a situation.

**Q: Are you aware of any classifications?**

A: James Chandler in 1970, published an article describing pathogenesis and management of orbital complications and his classification is still used.
Intercollegiate Exam – Viva in Paediatric Otolaryngology – Paediatric Emergencies

Stage 1: Preseptal cellulitis
Stage 2: Orbital cellulitis
Stage 3: Subperiosteal abscess
Stage 4: Orbital abscess
Stage 5: Cavernous sinus thrombosis

Q: Assuming this child has preseptal cellulitis, how will you manage this?
A: I will explain to the parents that this is a very serious condition. I will start this child on high dose intravenous antibiotics as per microbiology advise and hospital policy. I will also start topical decongestents. If the only sign is erythema and the eye itself looks relatively healthy then I will take a conservative approach closely monitoring this child’s eye as well as neurology, temperature, CRP and white cell count. I will request for a formal ophthalmology examination on at the very least a daily basis and assess the response to medical management after 24 hours. If the child is responding, if the child is not responding i.e. if there is no improvement, or if there is any worsening at all, I will request for an immediate CT scan of the orbits and sinuses with contrast.

Q: What are the indications of requesting a CT scan in the middle of the night?
A: Marked reduced eye opening, reduced eye movements, marked chemosis, proptosis all make immediate CT indicated. The same is true of any central neurological signs.
Overall if there is no improvement in general condition or orbital signs after 24 hours of appropriate medical management I will also carry out a CT.

Q: Please describe this CT scan of your patient (Figure 7) who did not respond to 24 hours of medical management?
A: This is CT scan of the orbits and paranasal sinuses axial section. I would ideally likely to see other cuts including coronal sections. The obvious abnormality in this scan is a subperiosteal collection on the right side pushing the medial rectus muscle. Also the ethmoid sinuses on the same side are opacified.

Q: How will you manage this child?
A: After taking an informed consent from the parents, I will take this child to theatre urgently for drainage of the abscess. I will approach this externally using a Lynch Howarth incision and wash the maxillary sinuses at the same time and send the pus for culture. I am aware that in experienced hands this can be done endoscopically, but is technically challenging. I will leave a drain in situ until the eye is returning to normal and continue with intravenous antibiotics as per culture & sensitivity results, only changing to oral antibiotics when swelling has completely resolved and the acute erythema completely gone.
The term “fellowship” can be used to describe the context of additional training, beyond that available within a Higher Surgical Training (HST) programme. Fellowships have long been undertaken by those in the final stages of training or those who have just completed training. At that stage in their careers, trainees are often looking for additional subspecialty exposure and surgical experience, to ensure that they are as competitive as possible and will be able to provide the best possible care for patients within their chosen field. Whilst obviously not required for ENT consultant practice, many of the more subspecialist consultant posts will see a fellowship as a “desirable” attribute, if not “essential”. With the introduction of the European Working Time Regulations (EWTR), we are reaching our Certificate of Completion of Training (CCT) having worked fewer hours than our predecessors, although our training is now more structured and “quality-assured”. This means that while our specialty is still producing a high-quality consultant product, there are advantages to be gained from spending an additional year honing one’s surgical skills and being trained in the more “super-specialist” technical aspects of certain jobs, be that Head & Neck, Skull Base, Neuro-otology and Cochlear Implantation, Paediatrics, Rhinology – the list goes on.

Previously, most fellowship posts have been abroad, when they also allow an insight into different models of healthcare provision; this is perhaps increasingly important given the current economic climate and NHS reforms. Different areas of the world also have different population groups and unique medical conditions, such as those relating to tropical medicine. Certain countries have a higher incidence of skin cancers, chronic ear disease or nasopharyngeal carcinoma, to name a few examples, and there may be less access to certain technologies and treatments. The chance to live in another country for a time also attracts people, be that the sunshine of Australia, the snow of Canada, or elsewhere in the world! Many trainees are still looking to undertake fellowships abroad, but there are now also posts available in the UK which offer excellent opportunities.

Whilst there are many jobs badged as “fellow” posts around the country, not all of them have official recognition as such, so trainees should choose carefully. There are certainly some approved fellowship posts in existence, which are advertised as for any other job. Fellowships may be counted towards training, but this must be prospectively agreed by the deanery; there is no retrospective recognition.

There are a number of pre-CCT “interface” fellowships available. These approved posts are known as Training Interface Group (TIG) fellowships, and are centrally funded. They are designed to provide multidisciplinary training in appropriate subspecialist areas, for example Head & Neck, Reconstructive Surgery and Cleft Palate. They are advertised and recruited for nationally, and are open to trainees from all the relevant specialties. The exposure to those allied specialties make these fellowships an exciting addition to our own specialty training.

A few years ago, the Department of Health agreed to fund a number of “post-CCT Fellowships” in England only. These were accredited and fully funded, but not without controversy; only English trainees were eligible to apply, and there
were concerns that they were only introduced to “free up” NTNs to ease the bottleneck at entry to HST. Sadly the central funding was withdrawn after that first year, before such issues could be resolved. Whilst some hospitals have managed to maintain the fellowship through local funding, in other cases they simply disappeared.

Many surgeons, and surgeons in training, are concerned that the persistent unregulated proliferation of “fellowship” posts is primarily to support EWTR-compliant rotas. Hopefully such measures will not be needed once the EWTR has been reviewed in Europe. Interestingly, in Scotland there have been some recent changes; some HST posts have been withdrawn, to address workforce issues, and converted to fellow posts. Whilst this does give cause for concern that trainees may lose opportunities, it will perhaps provide some much-needed elasticity in the workforce. Ultimately though, the number and types of fellowships need to be planned in conjunction with future workforce needs. In some cases this may even require proleptic appointments to super-specialist fellowship posts.

There may also be changes ahead elsewhere in the UK, as the Royal College of Surgeons of England have recently proposed a National Fellowship Scheme. Whilst this scheme is a work in progress, the idea is that the College will provide quality assurance for approved fellowship posts, whilst ensuring that trainees in associated HST posts are not disadvantaged. Where the funding for such posts would come from is as yet undecided, but one would hope that trusts might see a Fellow as a cost-effective member of the team.

Whether a trainee chooses to do a fellowship or not, and where or when, the most important thing is that a CCT-holder is a fully trained ENT Consultant, and should be employed as such. CCT is the standard for independent practice, and fellowships cannot become mandatory for consultant appointments; this position is supported by the Association of Surgeons in Training (ASiT).

The AOT will continue to support this position, as well as the broader interests of trainees. For further information or to join the AOT Forum, please visit our website www.aotent.com
PHARYNGEAL POUCH

Carr et al

1. The gold standard for investigation of pharyngeal pouch is which one of the following:
   a. Scintigraphy
   b. Barium swallow
   c. Oesophageal manometry
   d. Video fluoroscopy

2. Which ONE of the following is not true of endoscopic stapling?
   a. Lack of pathological specimen
   b. Lower chance of oesophageal perforation
   c. Long hospital stay
   d. Reduced risk to recurrent laryngeal nerve

3. Carcinoma arising within the pouch is present in which percentage of patients?
   a. 1.1-1.5%
   b. 2.5-3.1%
   c. 3.1-4.1%
   d. 5.2-6.1%

4. Which one of the following statements is true about the endoscopic approach for managing a pharyngeal pouch?
   a. It is easier with a smaller pouch
   b. It is easier with a thinner partition wall
   c. More difficult in patients with multiple co-morbidities
   d. The conversion rate to open is 50%

5. What is the incidence of pharyngeal pouch?
   a. 2/1000
   b. 2/10,000
   c. 2/100,000
   d. 2/1,000,000

6. In the Ponette and Coolen staging system, a 2 - 3 mm thorn-like diverticulum seen during the resting phase of deglutition is classified as which stage?
   a. Stage 1
   b. Stage 2
   c. Stage 3
   d. Stage 4

7. In the Morton and Bartley system the length of an intermediate sac pharyngeal pouch is:
   a. 1-2cm
   b. 2-4cm
   c. 5-7cm
   d. 8-10cm

8. Which one of the following is a symptom of pharyngeal pouch
   a. Globus
   b. Hoarseness
   c. Otalgia
   d. Weight loss

9. What is the rate of recurrence of pharyngeal pouch with endoscopic stapling? between
   a. 0-16%
   b. 0-32%
   c. 0-48%
   d. 20-30%

10. The risk of perforation with endoscopic approaches is increased with which one of the following?
    a. Multiple staple rows
    b. Single staple rows
    c. Larger pouches
    d. Prominent teeth

EMQ:
Theme: Diagnosis
Options:
   a. Pharyngeal pouch
   b. Oesophageal stricture
   c. Oesophageal carcinoma
   d. Patterson-Kelly-Brown Syndrome
   e. Olsz-Werber-Endo Syndrome
   f. Achalasia
   g. Pseudohilbular Palsy
   h. Bulbar Palsy
   i. Gastro-oesophageal Reflux Disease

For each clinical scenario please select the most appropriate investigation from the list of options given. Each option may be used once, more than once or not at all.

a. Pharyngeal pouch
   a. CT angiography
   b. Contrast swallow
   c. CT Neck
   d. MRI Neck
   e. Chest X-ray
   f. CT chest
   g. Abdominal X-ray
   h. None of the above
   i. Rigid oesophagoscopy

For each clinical scenario please select the most appropriate investigation from the list of options given. Each option may be used once, more than once or not at all.

a. A 75 yr old woman with hoarseness complaining of coughing on lying flat and retrosternal discomfort.
   a. Pharyngeal pouch
   b. Oesophageal stricture
   c. Oesophageal carcinoma
   d. Patterson-Kelly-Brown Syndrome
   e. Olsz-Werber-Endo Syndrome
   f. Achalasia
   g. Pseudohilbular Palsy
   h. Bulbar Palsy
   i. Gastro-oesophageal Reflux Disease

Pharyngeal pouch

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For each clinical scenario please select the most appropriate complication from the list of options given. Each option may be used once, more than once or not at all.

a. A 73 yr old man complains of hoarseness and coughing on swallowing after undergoing external excision of a pharyngeal pouch.

b. A 56 yr old woman presents to A + E 48 hr post endoscopic stapling of a pharyngeal pouch, complaining of SOB and chest pain. She is tachycardic, pyrexial and hypotensive with oxygen saturations of 85% on room air.

c. A 70 yr old man presents to outpatients complaining of an 8 week history of dysphagia, sore throat and left sided otalgia. He underwent endoscopic stapling of a pharyngeal pouch 2 yr previously.

d. A 65 yr old woman presents to outpatients 2 months after having external excision of a pharyngeal pouch. Though her dysphagia initially improved it recurred and is progressively getting worse.

EMQ
Theme: Diagnosis
Options:
- Achalasia
- Barrett’s oesophagus
- Recurrent laryngeal nerve palsy
- Superior laryngeal nerve palsy
- Systemic sclerosis
- Pharyngeal Pouch
- Patterson-Brown-Kelly syndrome
- Pseudolubular Palsy

For each clinical finding/association please select the most appropriate diagnosis from the list of options given. Each option may be used once, more than once or not at all.

a. Chagas disease
b. Glossitis
c. Uncontrollable laughing or crying
d. Columnar epithelium

A REVIEW OF THE AETIOLOGY AND MANAGEMENT OF SINONASAL.....

Robinson et al

1. Which ONE of the following is a type of nasal papilloma according to the World Health Organisation 1991 classification?
   a. Exophytic
   b. Sessile
   c. Pedunculated
   d. Fusiform

2. What percentage of specimens taken from patients, undergoing bilateral nasal polypectomy, unexpectedly contain a focus of inverted papilloma?
   a. < 15%
   b. < 4%
   c. 0.4%
   d. <0.15%
   e. <0.01%

3. Inverted papillomas most commonly arise from which ONE of the following sites?
   a. Nasal septum
   b. Choana
   c. Sphenoid sinus
   d. Lateral nasal wall
   e. Skull base

4. Despite meticulous surgery to remove all inverted papilloma recurrence rates range between which two percentages?
   a. 7-12%
   b. 12-34%
   c. 38-45%
   d. 52-75%
   e. 63-80%

5. Which ONE location is particularly associated with recurrence?
   a. Bulla ethmoidalis
   b. Frontal sinus
   c. Septum
   d. Inferior turbinate
   e. Anterior ethmoids

6. Which range BEST describes the rate of malignancy associated with inverted papilloma?
   a. 0-5%
   b. 5-15%
   c. 15-30%
   d. 30-45%
   e. 45-60%

7. Which ONE of the following is NOT a feature associated with an increased potential for malignancy?
   a. frequency of recurrence
   b. bilateral lesions
   c. absence of inflammatory polyps
   d. an increased mitotic index
   e. severe hyperkeratosis

8. Human Papilloma Virus has many characteristics. Which ONE of the following statements is INCORRECT?
   a. there are over 90 different types
   b. it is a DNA virus
   c. it is found in inverted papilloma specimens
   d. HPV is only capable of infecting squamous epithelial cells
   e. it is known to be a factor in the initiation of inverted papilloma

9. The best method for detecting recurrent inverted papilloma is which one of the following?
   a. A CT scan
   b. A PET scan
   c. An MRI scan
   d. A bone scan
   e. Nasal endoscopy

10. Which ONE of the following is NOT part of the Krouse (2000) staging system?
    a. extrasinus involvement or malignancy
    b. confined to nasal cavity
    c. medial wall of maxilla affected
    d. osteoneal complex, ethmoid, medial maxilla +/- nasal involvement
    e. any wall of maxilla affected (exc medial), frontal, sphenoid

EMQ
Theme: Anatomy of the sinonasal area
Options:
- Onodi cell
- Haller cell
- Agger nasi cell
- Bulla ethmoidalis
- Concha bullosa
- Ethmoid infundibulum
- Glottis semilunaris
- Axilla of middle turbinate

For each anatomical description please select the SINGLE most likely answer from the list of options given. Each option may be used once, more than once or not at all.

1. A 14 yr old boy presents with a history of nasal obstruction, rhinella clausa and recurrent epistaxis. On examination he is found to have a unilateral smooth lobulated mass obstructing the right nasal cavity and bilateral glue ear.

2. A 32 yr old woman comes to see you in clinic with a one year history of progressive bilateral nasal obstruction, decreased sense of smell and clear nasal discharge. She is allergic to aspirin and suffers with brittle asthma.

3. You are asked to see a six year old child on the haematology ward with acute lymphocytic leukaemia currently undergoing chemotherapy. They are complaining of purulent rhinorrhea and have had a pyrexia of unknown cause for the past three days.

4. A 27 year old woman attends clinic complaining of bilateral nasal obstruction, clear rhinorrhea and a decreased sense of smell. She has recently been diagnosed with asthma and a full blood count has revealed a raised eosinophil count.
**EMQ**

**Theme: Investigations in patients with nasal pathology:**

Options:
- a. CT scan
- b. MRI scan
- c. Bone scan
- d. Gallium scan
- e. PET scan
- f. Ultrasound scan
- g. Nasal endoscopy
- h. Rhinometry
- i. Sweat test

For each scenario please select the SINGLE most appropriate investigation from the list of options given. Each option may be used once, more than once or not at all.

1. A 40 year old male patient has previously undergone an endoscopic lateral rhinotomy for inverted papilloma. He represents to the clinic with increasing nasal symptoms. The most reliable investigation for detecting recurrent inverted papilloma in this situation is?

2. A 56 year old male patient was found to have right sided inverted papilloma from specimens taken at routine endoscopic polypectomy. On his return to clinic it is obvious some polypoidal tissue remains in the middle meatus. A CT scan performed prior to the endoscopic polypectomy showed an opaque frontal sinus on the same side. What investigation would you perform to help determine the extent of frontal sinus involvement?

3. A 68 year old male patient is known to have had inverted papilloma resected 5 years ago. He was lost to follow-up and represented to another department with nasal symptoms and obvious polypoidal disease filling the right nasal cavity. Which single investigation is thought to be the most useful to determine the any bone involvement?

4. Which investigation has been shown to have increased uptake in inverted papillomas and further increased uptake in SCC associated with inverted papilloma?

**PICTURE QUIZ**

1. This is a right sided nasendoscopic appearance of a 35 year old female patient who has bilateral hilar lymphadenopathy on a chest X ray. What is this appearance?

2. This is a picture of the bony anatomy of the lateral nasal wall. The letter "x" has been placed on which anatomical structure?

3. The below picture shows the extent of involvement with inverted papilloma of a 62 year old female patient. What is the most likely grade according to Krouse (2000)?

4. The below CT scan of the paranasal sinuses has an air cell marked with an “X”. What type of cell is this?
3. Which ONE of these muscles is NOT derived from the 4th branchial arch?
   a. Palatoglossus
   b. Stylopharyngeus
   c. Palatopharyngeus
   d. Levator veli palatine
   e. Cricothyroid

4. Derivatives of the 2nd branchial arch include which ONE of the following:
   a. Inferior parathyroid gland
   b. Superior parathyroid gland
   c. Cricopharyngeus
   d. Stylopharyngeus
   e. Muscles of facial expression

5. The tract of a 2nd branchial cleft fistula has which ONE of the following pathways:
   a. Between the internal and external carotid arteries and over the glossopharyngeal nerve
   b. Through the thyrohyroid membrane and above the superior laryngeal nerve
   c. Between the internal and external carotid arteries and over the hypoglossal nerve
   d. Behind the common carotid artery and deep to the hypoglossal nerve
   e. Between the internal and external carotid arteries and opens into the lateral wall of the piriform fossa

6. Which ONE of the following is not true of 1st branchial cleft anomalies:
   a. Duplication anomaly of the external auditory canal
   b. Work Type 1 anomalies contain cartilage or adnexal tissue
   c. The external opening of a Work Type 2 anomaly is usually found below the angle of the mandible, above the hyoid
   d. A 1st cleft fistula may open into the external auditory canal
   e. Such anomalies are related to the facial nerve

ANTIBIOTIC PROPHYLAXIS IN ENT SURGERY
James Barralough et al

1. In which ONE of the following situations, according to the SIGN 2008 guidelines, are antibiotics NOT indicated?
   a. Malignant neck dissection
   b. Prosthetic nasal reconstruction
   c. Cochlear implantation
   d. Grommet insertion
   e. Intra-aural prosthesis
   f. Open pharyngeal pouch repair

2. Which ONE of the following is a gram positive bacillus
   a. Escherichia coli
   b. Clostridium difficile
   c. Pseudomonas aeruginosa
   d. Haemophilus influenzae
   e. Helicobacter pylori
   f. Neisseria meningitidis

3. Which ONE of the following is NOT currently effective against MRSA?
   a. teicoplanin
   b. vancomycin
   c. mupirocin
   d. chlorhexidine
   e. linezolid
   f. cephalaxin

4. Which ONE of these antibiotics is NOT associated with Clostridium Difficile colitis
   a. augmentin
   b. linezolid
   c. clindamycin
   d. ciprofloxacin
   e. cefotaxime

5. Which ONE of the following is NOT one of the recognised pillars of clinical governance
   a. Research and development
   b. Openness
   c. Risk management
   d. Clinical audit
   e. Education and training
   f. Remuneration

6. Which ONE of the following is TRUE regarding gentamycin
   a. active against streptococcus
   b. acts on the bacterial cell wall
   c. should not be used in patients with renal failure
   d. damages the cochlear nerve
   e. can be used against anaerobes

For each scenario please select the BEST treatment option from the list of options given. Each option may be used once, more than once or not at all.

1. patient undergoing insertion of T-tube
   a. Rodent-bite fever
   b. Neisseria meningitidis
   c. Pseudomonas aeruginosa
   d. Leptospirosis
   e. Lyme disease
   f. Mumps
   g. MRSA
   h. Hepatitis B
   i. Haemophilus influenzae

For each scenario please select the MOST likely organism from the list of options given. Each option may be used once, more than once or not at all.

1. A swab taken from green discharge associated with a grommet in the ear drum
   a. Neisseria meningitidis
   b. Pseudomonas aeruginosa
   c. Helicobacter pylori
   d. Clostridium difficile

2. A swab taken from a tick
   a. Borrelia burgdorferi
   b. Neisseria meningitidis
   c. Pseudomonas aeruginosa
   d. Clostridium difficile

3. A patient undergoing insertion of T-tube
   a. Neisseria meningitidis
   b. Pseudomonas aeruginosa
   c. Clostridium difficile
   d. That is usually sensitive to vancomycin

4. A patient undergoing repair of CSF leak who is MRSA positive on pre-operative screening
   a. Rodent-bite fever
   b. Neisseria meningitidis
   c. Pseudomonas aeruginosa
   d. Leptospirosis

5. A patient undergoing repair of otosclerosis
   a. Rodent-bite fever
   b. Neisseria meningitidis
   c. Pseudomonas aeruginosa
   d. Leptospirosis

6. A patient undergoing surgery for otosclerosis
   a. Rodent-bite fever
   b. Neisseria meningitidis
   c. Pseudomonas aeruginosa
   d. Leptospirosis

7. An allergic to penicillin
   a. Rodent-bite fever
   b. Neisseria meningitidis
   c. Pseudomonas aeruginosa
   d. Leptospirosis

8. A patient undergoing surgery for otosclerosis
   a. Rodent-bite fever
   b. Neisseria meningitidis
   c. Pseudomonas aeruginosa
   d. Leptospirosis

9. A patient undergoing surgery for otosclerosis
   a. Rodent-bite fever
   b. Neisseria meningitidis
   c. Pseudomonas aeruginosa
   d. Leptospirosis

10. A patient undergoing surgery for otosclerosis
    a. Rodent-bite fever
    b. Neisseria meningitidis
    c. Pseudomonas aeruginosa
    d. Leptospirosis

For each scenario please select the MOST likely organism from the list of options given. Each option may be used once, more than once or not at all.

11. A patient undergoing surgery for otosclerosis
    a. Rodent-bite fever
    b. Neisseria meningitidis
    c. Pseudomonas aeruginosa
    d. Leptospirosis

12. A patient undergoing surgery for otosclerosis
    a. Rodent-bite fever
    b. Neisseria meningitidis
    c. Pseudomonas aeruginosa
    d. Leptospirosis

13. A patient undergoing surgery for otosclerosis
    a. Rodent-bite fever
    b. Neisseria meningitidis
    c. Pseudomonas aeruginosa
    d. Leptospirosis

14. A patient undergoing surgery for otosclerosis
    a. Rodent-bite fever
    b. Neisseria meningitidis
    c. Pseudomonas aeruginosa
    d. Leptospirosis

15. A patient undergoing surgery for otosclerosis
    a. Rodent-bite fever
    b. Neisseria meningitidis
    c. Pseudomonas aeruginosa
    d. Leptospirosis

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Notes for MCQs

- Questions with a short stem and short items or a longer stem and short items are preferable.
- The use of can or may invariably demands a true response.
- Recognised means an accepted feature of the disease.
- Pathognomonic means a feature specific to the disease, and no other.
- Characteristic means a feature without which the diagnosis is in question.
- Typical is synonymous with characteristic.
- Percentages should be given as a range.
- Commonly, frequently and rarely are considered vague terms.

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