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Disclaimer: The individual authors have responsibility for the integrity of the content of the manuscripts.
Welcome to Volume 12 Issue 1 of Journal of ENT Masterclass® 2019

I would like to welcome all our readers to the 12th edition of the Journal of ENT Masterclass®. The journal continues the mission of the Masterclass platform in providing global free education. This will be the second year that the journal is instantly available for online access and we are pleased with last year’s success judged by the number of hits on the Masterclass website. We also plan to periodically add new material to the journal.

As for previous edition, our section editors have selected up to date comprehensive articles written by national and international authors. Previously uncovered areas have been incorporated to include image guided ablation of benign thyroid disease, infants with feeding and swallowing difficulties, paediatric reinnervation update and complications of dermal filler, amongst others. We are, as ever, immensely grateful for the hard work provided by the authors and section editors.

The Masterclass travelling club has extended even further than last year with trips to Manama, Lahore, Islamabad, Cape Town, Beijing, Chongqing, Bucharest, Tashkent and Lausanne. For 2020, there are equivalent travel plans with the highlight of the ENT Masterclass ‘World Congress’ that will be held in the grand avenue of the Palace of Parliament in Bucharest on the 21st and 22nd of August, 2020. The UK based ENT Masterclass courses in 2020 will continue as before with the flagship course at Doncaster in January, Emergencies’, Thyroid and Radiology Masterclasses in June, Nurses Masterclass in October, GP Masterclass in November and Consultants Masterclass in December.

I hope you will enjoy reading this 12th edition, and please send us any comments and suggestions that you may have.

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December 2019.
Image guided ablation of benign thyroid disease

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Abstract
Non-surgical management techniques have been described to manage thyroid nodules, ranging from high energy and chemical ablation to fine needle aspiration. We performed a review of recent literature of available non-surgical techniques, discussing and assessing acknowledged image guided ablation interventions by mechanism of action, indication, effectiveness, limitations, contraindications and the appropriate level of anesthesia or analgesia required. All interventions were deemed safe alternatives to surgery, and while not as absolute as surgery, can provide an appealing alternative to some patients. Interventions can further be tailored to the patient and nodule morphology.

J ENT Masterclass 2019; 12 (1); 4 - 12.

Key words
Ablation, benign, thyroid

Background
Thyroid nodules are common in the population with reported rates of up to 65% having significant nodules at autopsy. Nevertheless, the majority of these are not clinically relevant and most patients do not require any interventional treatment. Clearly patients with malignancy or toxic nodules require treatment in the form of surgery and / or Radioactive iodine. Currently patients with compressive symptoms (breathing or swallowing problems) from large or multiple nodules are treated surgically as previously there has been no good “Medical” treatment for this problem. The vast majority of patients with significant thyroid nodules are not malignant, so a treatment that symptomatically improves them whilst avoiding the inherent risks of surgical intervention at little risk in itself is the holy grail for managing these cases.

In recent years, non-surgical techniques have been described to manage thyroid nodules. From high energy and chemical ablation to regular aspiration, these have the potential benefit of providing symptomatic relief for patients without the risks of surgical intervention. Further, they can be cost-effective in comparison as many only require normal cohort of clinic staff compared to inpatient or day case staffing for surgery. A recent review by Nixon et al looked into the efficacy and complications associated with many image-guided ablation techniques, as well as its role in the current management of thyroid disease. The purpose of this article is to expand on this recent review and describe acknowledged image guided ablation interventions by mechanism of action, indication, effectiveness, limitations, contraindications and the appropriate level of anesthesia or analgesia required.

We will be focusing on benign thyroid disease as most reported data of these image guided techniques on malignant disease do not have longer term outcomes available, though much of that data is encouraging in low risk primary and recurrent disease.

High-energy techniques

High intensity focused ultrasound

High intensity focused ultrasound (HIFU) is a minimally invasive procedure that uses a focused US beam to a target area, inducing coagulative necrosis. The target area is very small thus allowing for precision but requires a significant amount of time to cover any large area. Particularly given that a cooling interval should be performed between each short sonication. Typical treatment times range from 45 to 60 minutes and in larger nodules may need to be repeated. It utilizes piezoelectricity via a high-frequency amplifier. Software uses areas marked by the user and develops a treatment unit with safety margins. The procedure can be performed under conscious sedation with the patient supine and neck hyperextended. Local anaesthetic can be used to alleviate pain during the procedure, this is infiltrated around the thyroid gland. Some users advocate general anaesthesia to avoid patient movement and the need for recalibration between treatment pulses, but the procedure has also been described without anaesthesia or sedation.

Reported studies largely focus on solid thyroid disease such as toxic nodules, benign thyroid nodules or multinodular goitres. Outcomes are reported as better with smaller volume thyroid nodules but Lang et al further demonstrates larger nodules can be treated with sequential sessions. It has also been used to treat persistent or relapsed Graves’ disease with variable levels of success.

Many studies recently have reported an overall effective volume reduction in benign nodular disease from reported between 48% to 57%. Further, 95% of patients reported reduced overall symptoms (measured by a visual analogue scale) at 24 months in a recent study by Lang et al. When patient outcomes were looked at in comparison to open thyroid lobectomy surgery, the symptom reduction rate was comparable.

There is reduced efficacy as the treated nodule volume increases. Using a single session technique, Lang et al reports a reduction of 78%, 68% and 48% in small (<10 mL), medium (10-30 mL), and large (>30 mL) nodules demonstrating decreasing effectiveness with size.

Further, nodules that are close to the skin, carotid sheath, trachea, oesophagus or recurrent laryngeal nerve are difficult to treat as they are near these critical structures which are outlined in the safety margins during treatment. It is advised to maintain safe distance of 1 cm from the tracheoesophageal groove to prevent recurrent laryngeal nerve injury.

HIFU is typically more expensive than other high energy ablative techniques. Additionally, only one machine is available on the market presently that is able to deliver this technique and as it utilizes real time ultrasound in the planning it requires some end user familiarity with ultrasound.

As HIFU requires no needle or injected substance, it can be said to be nearly non-invasive. Despite this, some patients suffer side-effects to the procedure such as temporary vocal cord palsy (1-4%), pain during session, transient skin erythaema, minor swelling, cough, skin blisters (12%), hypothyroidism, 14thner’s syndrome and haematoma.

Radiofrequency ablation

Radiofrequency ablation (RFA) involves the insertion of a needle into a thyroid nodule that conducts electrical energy from a generator to induce coagulative necrosis. This incurs a locally controlled temperature of up to 100 degrees Centigrade. This can be done as either a cranial-caudal or trans-ithmic approach. Hydrodissection with 5% dextrose beforehand has been shown to help protect critical structures. Pescatori et al advise using an 18-19 gauge needle as this allows for better maneuverability and thus better results and less complications, however Using a 14 gauge needle may be more effective in larger nodules. The cost of the generator is around $25,000 and an electrode is about $750 for each session.

RFA is recommended as a non-surgical, minimally invasive technique for large thyroid nodules that are cosmetically undesirable or causing compressive symptoms. It is effective in solid benign thyroid nodules, toxic thyroid nodules and cystic nodules. The latter has been evaluated as second line treatment in cystic nodules refractory to chemical ablation. There has been a further report by Hong et al of it being an effective non-surgical treatment in paediatric patients with compressive or cosmetically unsatisfactory thyroid nodules in Perithyroid lidocaine is the advised method of analgesia. This is preferred to GA or sedation as it allows for constant assessment of nerve function and will alert the clinician to any proximities to the trachea as the patient will begin to cough and ablation should be immediately ceased. Further, it allows the patient to swallow cold fluids to help prevent oesophageal injury during the procedure.

In benign nodule, a response rate of up to 91% has been reported with an effective (>50%) reduction of volume at 6 months. A recent UK study on 31 nodules demonstrating an average volume reduction of 67% at 6 months and recent prospective Austrian study on 277 patients demonstrating similar results at 6 months (68%) and a reduction of 82% at 12 months. Deandrea et al demonstrated that RFA is more effective on spongiform nodules when compared to mixed or solid patterns on Ultrasound findings (76% vs 67 and 66% respectively P =<0.01). Patient satisfaction scores are high, with Jung et al, demonstrating 98% therapeutic success rate and an 95% volume reduction at 60-months in a prospective multicenter study on 345 patients.

In Toxic Nodules results are variable with 24-82% normalization of thyroid function according to recently published Korean guidelines on RFA.

In Cystic Nodules Sung et al demonstrated no significant difference in effectiveness to percutaneous ethanol in cystic nodules compared with RFA, and thus the consensus to utilize RFA as a secondary technique as it is less economical than percutaneous ethanol.
Toxic nodules that are larger than 20ml can have a reduced response to RFA\textsuperscript{3,5}, and nodule volume appears a significant predictor in efficacy in these nodules\textsuperscript{4,5}. Similarly, in large volume benign lesions, a second session may be required to manage patient symptoms and achieve adequate reduction\textsuperscript{1,3}. Further, in nodules with heavy calcification, adequate ablation can be technically difficult\textsuperscript{2,3}. Caution is advised with pregnancy, serious heart conditions or patients with pre-existing contralateral vocal cord palsy\textsuperscript{2,3}.

In the hands of an expert service, RFA has a very low side effect profile (overall complication rate of 2.5%\textsuperscript{2,30,31,32}). Major complications including nerve injury (recurrent laryngeal (2%\textsuperscript{2}), cervical sympathetic ganglion, brachial plexus (<1%), and accessory nerve), nodule rupture (<1%), permanent hypothyroidism (<1%), abscess (<1%) thyroid storm\textsuperscript{19} and haemotoma (1%) have been reported\textsuperscript{2,3}.

Other minor complications include vomiting (<1%), skin burn (<1%), transient thyrotoxicosis, lidocaine toxicity, voice change (<1%), hypertension and pain (>2%). Sim et al has demonstrated in a long-term follow-up that this can occur in up to 24% of nodules at an average of 40 months post procedure\textsuperscript{34}.

From an economic standpoint, RFA is more expensive than radioactive iodine treatment (for toxic nodules) but comparable in expense to surgery\textsuperscript{2,39,40}.

Microwave ablation

Microwave ablation (MWA) is a non-invasive technique that operates by transferring up to 100W (typically 30-50W) of energy at a via frequency (2,450MHz) along a cable into an inserted needle (antenna). This results in rotation of molecules and an increase in temperature as a result of increased kinetic energy\textsuperscript{1,3}. Hydrodissection has been reported to be helpful in protecting critical structures – similar to other thermal techniques\textsuperscript{41,42}.

Local anaesthetic, usually in the form of lidocaine, is injected in the perithyroid space. Per-procedural cardiac and observation monitoring is recommended.

For benign disease, being a relatively new technique, there are less reported studies on the use of MWA. These predominantly focus on solid benign thyroid nodules.

In reported studies on benign solid nodules, the volume reduction ranges from 45-40%\textsuperscript{41,42}. A recent meta-analysis on MWA reports a 12-month reduction rate of 88.6%\textsuperscript{43}.

Vorlander et al demonstrated that results of MWA on benign solid nodules were comparable to RFA (54% and 51% respectively\textsuperscript{44}), this matched a further study that included a HIUF\textsuperscript{3} arm as well as all three being effective and without statistical significance in efficacy\textsuperscript{4}. Further, a prospective trial by Zhi et al demonstrates MWA to be an effective alternative surgery with a long-term effect profile and overall greater patient satisfaction\textsuperscript{4}.

At present, there is little research in the application of MWA to benign thyroid disease other than solid benign nodules. As it has been reported as effective as other thermal techniques in this regard, there is scope to assess its efficacy in other pathologies, such as toxic nodules.

Complication profile is similar to other thermal ablative techniques with reported overall complication rate of 6.6%\textsuperscript{4}. Reported complications include subcapsular haemorrhage (40%), pain (70%), fever (30%), voice change (3.9%), recurrent laryngeal nerve injury (9%), Horner’s syndrome\textsuperscript{15}, skin burn and thyroid dysfunction\textsuperscript{43}.

Nodule regrowth has been demonstrated by Wang et al with 16 of 110 patients experiencing this complication\textsuperscript{44}.

Laser ablation

Laser ablation (LA) is a thermal ablative minimally invasive technique that utilizes laser light to heat up local tissue to temperatures between 46C – 110C and, depending on the temperature used, induces a combination of carbonization, coagulative necrosis and subsequent fibrosis of thyroid tissue\textsuperscript{1,3}. This is achieved by inserting an optical fibre into the target tissue through a needle under US guidance and energy is delivered by Nd:YAG laser or laser diode\textsuperscript{45}. It can be operated with single needle or multiple but needles should be more than 1cm apart if the lesion is large enough to necessitate multiple needles\textsuperscript{46}.

The needle should be parallel to the long axis of the thyroid nodule\textsuperscript{47}.

Due pain associated with the procedure, it is typically performed with a combination of sedation and local anaesthesia. Local anaesthetic alone may be inadequate\textsuperscript{41,42}.

Despite this, some have suggested that no anaesthesia allows the operator to better monitor proximity to critical structures\textsuperscript{41}.

LA has been demonstrated as an effective treatment alternative of benign thyroid nodules\textsuperscript{2,3}. It has also been used in conjunction with aspiration in mixed or cystic nodules\textsuperscript{48}. While a systematic review demonstrated that RFA may be superior to LA in nodule reduction\textsuperscript{49}, LA appears to be more effective in large nodules\textsuperscript{50}. It has been reported used effectively in nodules that did not respond to other thermal ablative techniques\textsuperscript{51}.

Volume reduction is reported to range from 47.84% in solid benign disease\textsuperscript{5,3,33,39}. The effectiveness can vary based on the ultrasound appearances of the nodule. Negro et al report a 3-year nodule reduction of 59.7% with solid nodules versus a 78.6% reduction in spongiiform nodules\textsuperscript{52}.

In mixed and cystic nodules, aspiration combined with subsequent LA has been shown to result in an average nodule size reduction of 92% and a loss of the cystic component in 75% at an average of 45 months\textsuperscript{53}. Oddo et al further reported that there is a significantly positive procedural response in patients who have undergone it. 100% of patients stated their symptoms of discomfort had improved and there was a significant reduction of goiter symptoms using a validated thyroid patient reported outcome questionnaire (ThyPRO\textsuperscript{54}).

Toxic nodules can be treated with LA but results show only 50% of cases achieving normalization of TSH\textsuperscript{55}.

There appears to be a correlation to reduction of volume and normalization of thyroid function\textsuperscript{56}, this improves to 87% with multiple cycles of LA, though this value is still less than what is observed with RAI\textsuperscript{57}. Single session appears to be adequate in most cases for nodules under 5ml in volume, with Gambelghue et al reporting about 90% of these patients were able to come off their methimazole\textsuperscript{58}.

Similar to RFA, there is suggestion that LA can be used in combination with RAI for treatment of the thyroid.

For large nodules, a combined approach may have greater control of symptoms compared to only RAI (2, 66). Using this technique, Negro et al demonstrated in large volume nodules, both surgery and a combination of RAI and LA were comparable in efficacy of restoring normal thyroid function and both resulted an overall improvement in quality of life for patients (67).

From an economic standpoint, a solitary diode or Nd:YAG laser source costs between $15,000 – $20, 000 with the disposable components factoring in at $400 per session\textsuperscript{59,60}.

Aspiration requires there to be a completely cystic or a non-calcified nodule with a cystic component. Further, this method also allows for the operator to send off samples of fluids and tissue by means to FNA or core biopsy if there is still diagnostic uncertainty. Lastly, as previously described, it can be used as an adjunct with other non-invasive image guided therapies.

The range of reported effectiveness is highly variable. In 1966, Crile et al described clinical success in 94% (absent or significant reduction on clinical examination) of patients after up to two aspirations. With the advent of US assessment of thyroid, this number is more likely between 14% - 89%\textsuperscript{61,62}. The largest issue is the rate of complications, which is still diagnostic uncertainty.

TFNA should avoided in hot nodules on scintigraphy or patients with coagulopathy\textsuperscript{63}. Further, some reported studies required as many as 17 repeat aspirations, which can represent a significant burden both to patient and service\textsuperscript{64}.

The complication profile of TFNA is minimal, with infection, bleeding and haemotoma (0.01%)\textsuperscript{64} being the most commonly reported\textsuperscript{65}. The largest issue is the rate of complications, which is 20%\textsuperscript{66} and can result in a larger cyst\textsuperscript{67}.

Needle aspiration is well tolerated and cost effective\textsuperscript{68}. It can often be done in a clinical setting and rarely requires any analgesia.
Percutaneous chemical ablation

Percutaneous chemical ablation (PCA) involves the use of a sclerosing agent injected into the cyst or nodule to invoke a thrombotic, coagulative necrotic and fibrosing response to the target tissue or cyst. Most research describes the use of tetracycline or ethanol as the sclerosing agent. Other agents have been used including hydrochloric acid\(^\text{78}\), polidocanol\(^\text{84}\) and arginine hydrochloride\(^\text{85}\). Current guidance advises the used of percutaneous ethanol in cases of relapsing and symptomatic benign cystic nodules. While most studies used between 30 – 70% of the fluid extracted volume of ethanol\(^\text{83}\). Halenka et al demonstrated injecting 20% worth of initial cyst volume in 95% ethanol achieves adequate response\(^\text{86}\).

It is often performed in a similar manner to US guided FNA, with an added step of sclerotic agent injection. As such, it rarely requires formal anesthesia or more than simple analgesia. Lacrose or saline can be injected before final withdrawal of the needle\(^\text{8}\).

PCA has been predominantly described as a method to treat benign cystic thyroid diseases. Percutaneous ethanol injection (PEI) has been also used to treat solid and toxic nodules. PEI has also been described without US guidance in large cysts but the authors note this is more appropriate in the limited resource setting\(^\text{87}\).

Resolution of the cystic nodules through the use of ethanol has been reported to range between 72% - 100%\(\text{86,87,89,92-95}\). Comparatively, tetracycline, has a cure rate of 43% - 97%\(\text{75,79,89,92-95}\). This demonstrates how the former has become the standard agent used in practice today for PCA. Further, it has reported that there was no statistical significance in resolution of cysts when comparing tetracycline and injected isotonic saline (43% and 47% respectively)\(^\text{8}\) and in similar studies comparing ethanol and isotonic saline there was a significant difference of 77%-82% cure rate with ethanol and 36% - 48% with isotonic saline\(^\text{87}\).

Other sclerotic agents have been mentioned including: hydrochloric acid a 37.5% cure rate\(\text{78}\), polidocanol with a 98% reported cure rate\(\text{86}\). Other sclerotic agents have been described, including peri-glandular fibrosis, laryngeal and skin necrosis\(^\text{86}\), jugular vein thrombosis (3%\(\text{86}\)), graves’ disease and graves’ orbitopathy\(^\text{86}\). A Cochrane review has suggested that side effects were more likely in treatment of solid nodules as opposed to cystic\(^\text{8}\).

Table 1. Suggested Optimal Minimal Invasive Treatment Based on Efficacy

<table>
<thead>
<tr>
<th>Benign nodule type</th>
<th>Suggested Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solid nodule</td>
<td>RFA/MAA/HIFU</td>
</tr>
<tr>
<td>Large solid nodule</td>
<td>LA</td>
</tr>
<tr>
<td>Spongiform nodule</td>
<td>RFA</td>
</tr>
<tr>
<td>Mixed nodule</td>
<td>Aspiration + LA</td>
</tr>
<tr>
<td>Cystic nodule</td>
<td>Aspiration</td>
</tr>
<tr>
<td>Recurrent cystic nodule</td>
<td>1st line PEI, 2nd line RFA</td>
</tr>
<tr>
<td>Toxic nodule</td>
<td>RAI, RAI + RFA in large nodules (&gt;20mls)</td>
</tr>
</tbody>
</table>

PEI may make any future surgery more difficult due to periglandular fibrosis\(^\text{86}\) and this should be recognised should any future surgical planning take place. Economically it is very cost effective with the items required to perform PEI valued at between $50 – $100\(\text{8}\).

Reported complications with PEI include pain (21 - 73%\(\text{86,87,89,92-95}\)), ethanol toxicity (10% - 24%\(\text{86,87,89,92-95}\)), brusings (2.5%\(\text{86}\)), temporary dysphonia (3 - 5%\(\text{86}\)), vocal cord palsy (<1%\(\text{86}\)), and horners syndrome (2.5%\(\text{86}\)). Severe complications related to extravasation from the nodule have been described, including peri-glandular fibrosis, laryngeal and skin necrosis\(^\text{86}\), jugular vein thrombosis (3%\(\text{86}\)), graves’ disease and graves’ orbitopathy\(^\text{86}\).

A Cochrane review has suggested that side effects were more likely in treatment of solid nodules as opposed to cystic\(^\text{8}\).

Conclusion

Non-surgical management of benign thyroid nodules is feasible and there are a variety of options available that may be more appropriate given a certain nodule morphology or clinical picture (Table 1). It is important to recognise that these treatments aren’t as absolute as surgical intervention, which is well tested and regarded as safe, but may be more appealing to or more appropriate for certain patients. Surgery has the benefit of not requiring potential further intervention for the same nodule as it is definitive and removes the fear of misdiagnosis by giving definitive histology on the nature of the lesion. Complications comparing each intervention and those of surgery can be found in Table 2. Cost for non-surgical intervention should be considered before being adopted by a health board. Surgical treatment cost can vary between countries with a hemithyroidectomy being charged as much as $30,000\(^\text{87}\) in the USA but this includes pathology costs and definitive histology on the nature of the lesion.

There remains further scope for research in terms of further robust direct comparison of these minimal invasive interventions. Further, some complication data can appear skewed when not wholly reported in or in small number trials and as such, a meta-analysis of the available databases in reported studies would help sharpen these values.

By tailoring the intervention to the lesion and the patient, healthcare boards will be able to effectively offer non- surgical management options to patients with benign thyroid disease. While it may be unreasonable for each individual trust to be able to provide every intervention, utilizing a national framework would help address this issue.

References


Table 2. Complication Rates of Non-surgical Intervention Treatments of Benign Thyroid Nodules

<table>
<thead>
<tr>
<th>Complication</th>
<th>HFUS</th>
<th>RFA</th>
<th>MWA</th>
<th>LA</th>
<th>FNA</th>
<th>PEI</th>
<th>Surgical lobectomy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pain</td>
<td>73</td>
<td>2.6</td>
<td>6.5-70</td>
<td>10.6-</td>
<td>3.4</td>
<td>NR</td>
<td>21-73</td>
</tr>
<tr>
<td>Fever</td>
<td>NR</td>
<td>NR</td>
<td>30</td>
<td>6- 7.7</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
</tr>
<tr>
<td>Infection / abscess formation</td>
<td>NR</td>
<td>&lt;1</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>0.5</td>
<td></td>
</tr>
<tr>
<td>Skin blistering / erythema</td>
<td>1-12</td>
<td>2</td>
<td>&lt;1</td>
<td>NR</td>
<td>NR</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>Hypothyroidism</td>
<td>1-3**</td>
<td>2</td>
<td>&lt;1</td>
<td>NR</td>
<td>NR</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>Hamatomas / bleeding complication</td>
<td>1-1</td>
<td>3-40</td>
<td>&lt;1</td>
<td>0.1</td>
<td>0.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Voice change / dysphonia</td>
<td>NR</td>
<td>NR</td>
<td>3-10</td>
<td>&lt;1</td>
<td>NR</td>
<td>3-5</td>
<td>5.3</td>
</tr>
<tr>
<td>Recurrent laryngeal nerve injury / vocal cord palsy</td>
<td>1-4</td>
<td>2</td>
<td>1-9</td>
<td>1.6</td>
<td>NR</td>
<td>&lt;1</td>
<td>0.01</td>
</tr>
<tr>
<td>Nodule / cyst recurrence</td>
<td>NR</td>
<td>24</td>
<td>14</td>
<td>5</td>
<td>80</td>
<td>NR</td>
<td>NR</td>
</tr>
<tr>
<td>Estimated cost</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>$750**</td>
<td>NR</td>
<td>$800**</td>
<td>Minimal NR $5617</td>
</tr>
<tr>
<td>Overall complication rate</td>
<td>10.8</td>
<td>2.5</td>
<td>6.6</td>
<td>0.9 - 38.3</td>
<td>Minimal</td>
<td>NR</td>
<td>2.6</td>
</tr>
</tbody>
</table>

*reported but no values given
**for disposable items only
*reported as ‘thyroid dysfunction’
The use of percutaneous drains in head and neck surgery – An evidence-based approach

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Abstract

Introduction: Percutaneous insertion of neck drains in head and neck (H&N) surgery is a common practice. However, their benefits remain controversial.

Aims: i) To provide an evidence-based approach on the use of percutaneous neck drain and, ii) to review the latest technical advancement in facilitating a drain-less approach.

Outcome: The usage of neck drains and the timings of their removals can vary, dependent on the surgeons’ preference and experience. With the advancement of energy-based devices and the ease-of-use of haemostatic agents, these are increasingly used in various H&N procedures with good outcomes and allow the routine omission of neck drains in selected cases. Furthermore, a drain-less approach has been shown to facilitate same-day or day case surgery, with the additional benefits in resource utilisation and patients’ satisfaction.

Conclusion: Drain-less surgery is a safe and viable alternative for select H&N procedures. Instead of a routine practice, neck drains should be judiciously used in H&N surgery on an individual basis.


Key words

Head and neck surgery, neck drain, day case, outpatient surgery, drainless surgery

Introduction

Drains are commonly used in post-operative care in head and neck (H&N) surgery. The aim is to obliterate potential dead space, drain any blood or fluid collection and to potentially reduce the risk of local infection.

In recent years, the use of surgical drains has decreased in many specialties including in H&N surgery, as the evidence of their benefits has been questioned1,2. This trend has been reinforced by increasing evidence of the viability and safety of the drain-less approach. As the use of neck drains is often the determinant of the length of hospital stay, the drain-less technique is further lauded for opening up the possibility for same-day discharge. With the additional benefits in resource utilisation and cost-effectiveness, it is not surprising that the drain-free approach is more widespread in privatised healthcare systems such as in the USA, Canada and Singapore, compared to the UK.

Nevertheless, the use of neck drains remains largely dependent on surgeons’ preferences with practice variation seen dependent on the type of operation performed. In this article, we aim to provide an evidence-based approach on the use of percutaneous neck drains, as well as a review of the latest technical advancement in H&N surgery.

Use of drains in head and neck surgery

Traditionally, neck drains are inserted in major H&N procedures and necessitate at least an overnight hospital stay. Although in some units, patients are allowed to go home with neck drains in-situ and the aftercare to take place in an outpatient setting, this is yet to become a widespread practice3. The character and quantity of the drain output informs the healing process and facilitates early recognition of complications such as bleeding, Anastomosis dehiscence, chyle leak etc. Although it aims to reduce post-operative morbidity, the neck drain itself can result in complications. These include trauma during insertion, patients’ discomfort
Haemostatic agents in head and neck surgery

In addition to EBD in haemostasis control, the use of novel topical haemostatic agents has also gained momentum over the past few years. A number of studies have demonstrated that tissue sealants are not only safe to use in H&N surgery but also decrease the length of hospitalization and frequency of complications, consequently leading to sizeable cost savings.

A variety of the haemostatic agents have been developed, including fibrin sealants such as TISSEEL and ARTISS or, gelatine-thrombin matrix sealants such as FLOSEAL and SURGIFLO. These haemostatic agents can be directly applied, either therapeutically to an ‘oozing’ site or, prophylactically to a wound bed. They act through activation of the clotting cascade resulting in local haemostasis, an essential component in post-operative wound healing.

Encouraging evidence for the use of fibrin sealants in soft tissue H&N surgery was reported in a systematic review and meta-analysis by Bajwa et al. This showed that fibrin sealants reduced the mean total volume of wound drainage. However, due to the poor methodology of the included studies and statistical heterogeneity, a statistically significant earlier drain removal or hospital discharge, as a consequence from the application of fibrin sealants, could not be demonstrated. Although more evidence is needed to establish the direct effect of haemostatic agents with drain usage, it is possible to assume that these novel agents, in synergy with EBD, have the potential to replace the routine need for drain insertion in H&N surgery.

Thyroid surgery

Among all H&N procedures, evidence of drain usage is most concentrated in thyroid surgery, with a rationale to primarily minimise the risk of potentially life-threatening airway complication from bleeding, as well as to prevent seroma formation. The incidence of haematoma in thyroid surgery and the need for re-operation is reported up to 1.5%. While drains are often used for prevention of haematoma or airway compromise, it is worth noting that in a large bleeds, the drain can be blocked off and does not necessarily alleviate the situation. Notably, in a meta-analysis by Tian et al., in comparing drain placement and no drain in patients undergoing total or partial thyroidectomy, no significant difference was found in haematoma formation between the two study groups. Pertinans et al also reported in their study that no decrease in re-operation rates was found when drains were used in thyroid surgery.

Figure 1: (Original) The prophylactic intra-operative use of haemostats (applied as micro-dots) on parotid bed.
Conflict of Interest
None declared

Funding
None

Acknowledgement
We would like to thank Dr Simon Crawford, our consultant anaesthetist for allowing us to use his image for illustrative purposes.

References
A systematic multidisciplinary approach for assessing infants with feeding and swallowing difficulties: Understanding what the otolaryngologist brings to the team

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Assessment and management of feeding and swallowing difficulties in infants requires a multidisciplinary approach, tailored to the presenting problems and the specific needs of the infant and their family. Focusing on the potential contribution of the otolaryngologist to the multidisciplinary team, we present a four-stage assessment process that includes: (1) assessment of nutritional status; (2) assessment of anatomical and functional status; (3) assessment of general feeding function; and (4) assessment of airway protection during swallowing. We expand on each stage of the assessment process, and the potential contribution of the otolaryngologist to the multidisciplinary team in a modern multidisciplinary environment.

Keywords
Infant, breastfeeding, swallowing, aspiration

Introduction
Paediatric feeding disorders are commonly viewed from the perspective of a single professional discipline. However, due to the complexity and heterogeneity of infants presenting with feeding and swallowing difficulties, their management requires diverse skills and experience. This paper presents a structured and practical approach to the assessment, diagnosis and management of paediatric feeding disorders within a modern multidisciplinary environment.

We use the term paediatric feeding disorder to include any impaired oral intake that is not age-appropriate and is associated with medical, nutritional, feeding skills and/or psychosocial dysfunction, with the broader definition of this term now including dysphagia1.

Stage 1: Assessing nutritional status
Are they achieving sufficient nutrition to grow? What is the trend (in weight percentile) over time?

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Stage 3: Assessing general function: motor, sensory, cognitive
Are there concerns regarding how the infant achieves their feeding and swallowing? Is aspiration +/- penetration visualised on VFSS +/- FEES?

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Table 1: A 4-Stage Approach for ORL Assessment of Infant Feeding and/or Swallowing Difficulties: Overview and Key Questions

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Table 2: Stage 1: Assessing Nutritional Status

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<tbody>
<tr>
<td>What was baby’s birth weight?</td>
</tr>
<tr>
<td>What was the mode of delivery?</td>
</tr>
<tr>
<td>What is baby’s current weight percentile and trend over time?</td>
</tr>
<tr>
<td>(Plot on appropriate growth chart)</td>
</tr>
<tr>
<td>Do you think your baby eats/drinks enough?</td>
</tr>
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</table>

**Stage 1: Nutritional Status**

The first stage involves assessment of the infant’s nutritional status (Table 2). This involves taking a history of the child’s nutritional intake and assessing their growth. Standard growth charts can be found in a child’s health records book or electronic health record. These growth charts plot serial measurements of a child’s growth (weight, length and head circumference). The World Health Organisation (WHO) Growth Charts are more appropriate for tracking the weight of breastfed infants than the USA CDC Growth Charts, which are based on populations with a high percentage of formula fed infants.

A weight below the 9th percentile or that drops across percentile-lines is considered a “red flag”. However, having a healthy weight based on age does not exclude the presence of clinically significant feeding difficulties. Among newborn infants, concern should be raised if the infant loses more than 10% of their birth weight or does not regain their birth weight within fourteen days post-delivery. A premature infant, born before 37 weeks’ gestation, should have their weight plotted using their corrected age. Some specific populations, such as children with Trisomy 21, have modified growth charts that allow for altered expectations for growth associated with their condition.

With the transition from placental to enteral nutrition, it is expected that newborn infants will lose weight after delivery. Healthy breastfed babies will commonly lose more weight than formula fed babies (average 6.5% versus 3.5%) and will take slightly longer to regain their birth weight (8.3 days versus 6.5 days). Research has shown that over 20% of infants delivered by caesarean section (versus 5% of non-caesarean delivered infants) will lose greater than 10% of body-weight and it has been suggested that weight at 24 hours may be a more appropriate measure of “true” birth weight for these babies. Babies born via caesarean delivery also have a higher incidence of breastfeeding difficulties, so early lactation consultant support is recommended for this group.

Faltering growth, previously known as failure to thrive, is a descriptive term and not a diagnosis. Causes for suboptimal weight gain need to be considered. A referral to a dietician will ensure a thorough assessment of nutritional intake, with early involvement of a lactation consultant recommended for breastfed babies and referral for general paediatric review when appropriate.

**Stage 2: Anatomical Structure**

The second stage involves systematically assessing the infant for any anatomical anomalies or variants that may impact on feeding (Table 3), through history-taking, examination, and investigation as appropriate (Table 4). During this stage of assessment, an otolaryngologist’s clinical skills and use of awake flexible trans-nasal endoscopy can provide valuable information on oropharyngeal anatomy and swallow dynamics for the multidisciplinary team.

**Airway**

Feeding and breathing are closely integrated in infants. Therefore all infants with feeding difficulties should be assessed for potential airway compromise and all infants with airway compromise assessed for potential feeding difficulties. Any increase in respiratory rate or effort will compromise the timing and coordination of the swallow, increase the risk of aspiration and potentially negatively impact nutritional intake. Compromised breathing can cause early fatigue during feeding, resulting in short feeds of inadequate volume and calories and or the infant falling asleep during feeds. Increased effort of breathing may also increase calorie expenditure.

History taking should enquire about noisy breathing, with video recordings taken by parents helpful when the noise is not directly observable. Foggling of a cold metal tongue depressor (or mirror) held under the nares can assess nasal airflow. The infant’s thorax should always be exposed to observe for an altered breathing pattern or resultant changes in the chest wall contour/shape.

Stertor is typically created by obstructed airflow within the nose or by dynamic collapse of the soft palate and/or tongue base. The infant may tend to mouth breathe and symptoms may be worsened when supine and/or sleeping. A breastfeeding infant with impaired nasal airflow will need to come “on and off” the latch frequently to breathe orally, which may cause nipple trauma and pain for the

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**Table 3: Anatomical “Checklist” for infant/paediatric feeding difficulties**

<table>
<thead>
<tr>
<th>Airway</th>
</tr>
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<tbody>
<tr>
<td>Nasal patency (fogging of mirror/nail)</td>
</tr>
<tr>
<td>Septum alignment</td>
</tr>
<tr>
<td>Inferior turbinate appearance Rate, effort and noise of breathing</td>
</tr>
<tr>
<td>(expose chest)</td>
</tr>
</tbody>
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**Table 4: Stage 2: Assessing Anatomical Structure and Function**

<table>
<thead>
<tr>
<th>Key Questions</th>
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<tbody>
<tr>
<td>Does the baby have noisy breathing?</td>
</tr>
<tr>
<td>Is there any evidence of airway compromise?</td>
</tr>
<tr>
<td>If so, what levels of the airway is/are affected?</td>
</tr>
<tr>
<td>Has a thorough clinical examination been performed?</td>
</tr>
</tbody>
</table>

**Key Red Flags**

- Airway compromise: noisy breathing, nasal obstruction, increased work rate of breathing
- Parental concern
- Chest wall shape deformity (e.g., pectus excavatum)
- Velopharyngeal insufficiency: milk/liquid/food via nose during feeding
- Difficulty latching at breast (weak, sliding off, maternal pain and/or nipple trauma)
- Feeding interrupted by coughing +/- choking
- Unlatching for “breathing breaks”

Any structural anomalies: including tongue, lingual frenulum, hard & soft palate

**Investigations & Management Options/Suggestions**

- Ideally observe infant feeding – parent recorded video can be helpful
- Consider flexible endoscopy (+/- FEES: recommend always performed with SLT)
- If lingual frenulum appears restricted – ensure LC input, consider division if indications present
- Investigations and/or interventions regarding any anatomical anomalies should be considered in the context of functional impact rather than appearance alone
- Involvement of other specialties as appropriate
mother. Bottle-fed babies with nasal airway compromise can usually be managed by reducing the flow rate of the teat and using “paced” feeding, which gives frequent pauses for “breathing breaks” by removing the bottle teat briefly from the infant’s mouth.

Minimal or mild symptoms are often caused by nasal mucosal congestion and can usually be managed with saline drops, non-invasive manual evacuation of nasal secretions and consideration of nasopharyngeal aspirate testing for viral-induced rhinitis. When more significant symptoms are present; congenital structural anomalies such as septal deviation, choanal atresia, piriform aperture stenosis and intranasal/nasopharyngeal masses need to be excluded. If no surgical intervention is indicated, measures such as topical nasal steroids, humidification and/or a temporary nasopharyngeal airway could be considered.

Stridor is typically a higher pitched noise and is usually generated at the level of the larynx or supraglottis, and usually worsened by increased tidal volume and faster airflow, as occurs during feeding and crying. If there is a dynamic component to airway compromise, supine positioning will alter tongue base and epiglottic positioning, which will often worsen airway compromise. Positioning the infant semi-prone or “laid-back” position may improve their ability to breastfeed (as shown in Figure 1), with bottle-fed infants often improved in an upright or side-lying position. Remember that infants with complex airway problems, even those requiring tracheostomy, may be able to fully breastfeed once their airway is stabilised (see Figure 2).

Awake transnasal flexible endoscopy can be very helpful in determining the level/s of airway obstruction and can usually be performed in an outpatient clinic with appropriate personnel and monitoring. A vagal response can be stimulated, particularly in new-borns, so continuous oximetry is recommended, with immediate withdrawal of the endoscope if heart rate deceleration occurs to avoid causing an apnoeic event. Electronic recording with audio capture allows correlation of any noise generated during the endoscopy with the dynamic anatomy and the ability to analyse in slow motion. Laryngomalacia is the most common cause of neonatal stridor, but should only be diagnosed when endoscopically the supraglottic tissue collapse can be confirmed as generating the audible stridor. It is possible to proceed directly to Flexible Endoscopic Evaluation of Swallow (FEES) while the endoscope is in situ, but requires some pre-planning to ensure a speech-language therapist is present (see Stage 4).

Other investigations such as a chest x-ray, overnight oximetry and an early morning capillary blood gas may be appropriate, together with a formal rigid airway endoscopy if there are concerns regarding tracheal anomalies or aspiration (see Figure 3).

Craniofacial Midface hypoplasia is often associated with nasal airway compromise and micro/micrognathia with tongue base prolapse. Both can potentially create airway and feeding difficulties. These infants all warrant early multidisciplinary assessment of airway and feeding, with regular re-evaluation to assess for changes with growth and development.

Oral Cavity and Tongue The biomechanics of breastfeeding require the infant’s tongue to elevate the nipple to the hard palate, contouring the dorsal surface around the nipple and creating a base-line intraoral vacuum. Milk transfer then occurs by lowering of the mandible and tongue (en-bloc), increasing the strength of the intra-oral vacuum. A biomechanical disadvantage is likely to exist when there is; retro/micrognathia, a high arched hard palate, a short anterior free length of the anterior tongue and/or restriction of tongue elevation caused by the lingual frenulum. An infant with any of these anatomical variants is more likely to

Figure 1: Adapted breastfeeding latching positions.

Figure 2: Breastfeeding infant with tracheostomy.

Figure 3: Assessment of an infant or child with complex feeding/airway difficulties +/- concerns.
Figure 4: Tongue tie: before and after scissor division.

Figure 6: Large tonsils viewed via trans-nasal endoscopy.

Figure 5: Partial cleft of soft palate.

Soft palate and uvula

The diagnosis of a cleft of the soft palate (particularly when partial or submucous) can be missed in newborns (Figure 5). Visualisation of the free edge of the soft palate and uvula is essential and usually requires a tongue depressor and headlight. A cleft of the soft palate is likely to cause an “air-leak” from the intra-oral space, preventing establishment of the intraoral vacuum required for breastfeeding. Although some infants with cleft palate can transfer milk at the breast, presumably aided by the maternal milk ejection-reflex creating flow, most need to be bottle fed using a specialised teat.

Tonsils

Large tonsils are an uncommon cause of dysphagia in infants but can be an increasingly common cause of dysphagia as childhood progresses. Flexible endoscopy can identify pendulous enlargement of the inferior poles of the tonsils which is not apparent trans-orally (see Figure 6).

Stage 3: General Function: Motor, Sensory & Cognitive

The third stage involves assessment of motor, sensory, and cognitive function (Table 5). Successful feeding requires a symphony of precisely coordinated neuromuscular activity from the lips to the lower oesophagus, mediated by cranial nerves, brainstem and the cerebral cortex. Many factors can disrupt the reflexes which facilitate sucking, swallowing, and breathing in the early postnatal period. Feeding and swallowing skills usually follow a pattern of developmental progress. However, problems are reported in 15 to 45% of typically-developing children, 70% with chronic medical conditions, and 80% of children with developmental disabilities. An emphasis on feeding volumes and rigid timing schedules can create unrealistic expectations for parents and can override recognition of impaired feeding quality. Delay in identifying paediatric feeding disorders in children can result in impaired cognitive, physical, emotional and social development, can have an adverse effect on caregiver-child relationships and may lead to significant health and behavioural complications.

Dysphagia is defined as any disruption to the swallow sequence that compromises the safety, efficiency or adequacy of nutritional intake. It is a skill-based disorder and is distinct from behavioural feeding problems that may arise in children who have sufficient skills for normal eating and drinking. To help distinguish symptoms or behaviours which are more indicative of a significant underlying problem, Barkmeier-Kramer et al identified a set of questions which correlate with the presence of paediatric feeding disorders (included in Table 5).

A clinical feeding evaluation should be conducted in all infants with feeding and swallowing difficulties and will help guide when (and which) further investigations may be appropriate. It will include analysis of observable and audible oral phase skills and swallowing behaviours. Normal swallowing is divided into four main phases: (1) oral phase - sucking, chewing and propelling the bolus toward the pharynx; (2) oral-pharyngeal transit phase - triggering the swallowing reflex; (3) pharyngeal phase – bolus moving through the pharynx and (4) oesophageal phase – bolus moving through the oesophagus to the stomach. Ideally more than one full feed would be observed, assessing each phase of the swallow, any changes during the feed, feeding equipment being used, the infant’s position, arousal levels and their physiological state before, during and after the feed. An important part of evaluation includes understanding the parent’s perceptions and interpretation of their infant’s behaviours during feeding.

Stage 4: Airway Protection with Swallowing

The fourth stage involves assessment of airway protection with swallowing (Table 6). Protection of the airway during swallowing is one of the primary functions of the larynx. The infant larynx is positioned high in the pharynx, with the epiglottis often visible trans-orally (Figure 7). In this position, the epiglottis optimises airflow directly from the nasopharynx to the glottis and diverts milk directly into the piriform fossae. This adaptation optimises the airway feeding and swallowing skills usually follow a pattern of developmental progress. However, problems are reported in 15 to 45% of typically-developing children, 70% with chronic medical conditions, and 80% of children with developmental disabilities. An emphasis on feeding volumes and rigid timing schedules can create unrealistic expectations for parents and can override recognition of impaired feeding quality. Delay in identifying paediatric feeding disorders in children can result in impaired cognitive, physical, emotional and social development, can have an adverse effect on caregiver-child relationships and may lead to significant health and behavioural complications.

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Stage 4: Airway Protection with Swallowing

The fourth stage involves assessment of airway protection with swallowing (Table 6). Protection of the airway during swallowing is one of the primary functions of the larynx. The infant larynx is positioned high in the pharynx, with the epiglottis often visible trans-orally (Figure 7). In this position, the epiglottis optimises airflow directly from the nasopharynx to the glottis and diverts milk directly into the piriform fossae. This adaptation optimises the airway
from the aquatic foetal environment, as immature apnoeic and rapid swallowing behaviours develop into a mature cough response for airway protection in the aerobic postnatal environment. Immaturity of these reflexes at birth may explain why infants with no other neurological or medical comorbidities will usually “grow out” of their aspiration with normal development. Unfortunately, there is no normative data regarding the volume or frequency of aspiration that would be considered “within normal limits” for children. Potential for harm is probably related to a combination of: the volume aspirated; what substance was aspirated; and individual patient factors that modulate their response to aspiration. As some populations have a much higher risk of developing chronic lung disease such as bronchiectasis, it is likely that the volume of aspirate required to cause harm will differ between individuals. Although coughing or choking during feeds is suggestive of aspiration, there is a high prevalence of silent aspiration in infants, therefore the lack of overt signs does not exclude the diagnosis. The decision to proceed with further investigations should be guided by the presence of clinical signs or symptoms suggesting the lower respiratory tract is compromised. The history may include description of a constant “rattly chest”, “wet-sounding breathing”, a chronic cough, frequent courses of antibiotics or hospital admissions for pneumonia. A baseline chest x-ray is recommended. When no lower airway harm is evident, the infant can be kept under review without a need for immediate investigation. When lower airway harm is evident, further investigation can confirm if aspiration is present and guide any recommendations to modify intake. Aspiration can take several forms: (1) an anterograde event (during swallowing of a liquid or solid bolus); (2) a retrograde event (when material that has entered the stomach or stomach is refluxed back into the hypopharynx and then aspirated); or (3) aspiration of saliva (see Figure 7: Normal epiglottis: visible on transoral view).

Potential therapeutic interventions to reduce aspiration risk

When aspiration is present, both VFSS and FEES can be used to assess variability in airway protection by modifying bolus size, flow rates and/or consistency (by thickening).

Traditionally, if these therapeutic options failed to adequately improve airway protection, an infant would be made nil by mouth and a nasogastric tube inserted.
catching/feeding position, gravity can be used therapeutically to modify and improve airway protection during swallowing in some infants.

Laryngomalacia is the most common cause of airway compromise in infants and is often associated with dysphagia. Both VFSS and FEES show high rates of dysphagia during swallowing in some infants. With this adaptation, gravity ensures milk flow is diverted through the epiglottis, necessitating pauses in feeding to recover.

Infants with unilateral vocal cord palsy have a high incidence of silent aspiration. By positioning the infant side-lying for breastfeeding, with the affected vocal cord always positioned superiorly, we have shown using FEES that gravity ensures milk flow is diverted through the larynx.

References
Implications of childhood obesity for the otolaryngologist

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Abstract

The incidence of childhood obesity is increasing worldwide and has been described as an epidemic by the UK Royal Society of Public Health. This has implications for ear, nose and throat (ENT) surgeons both in terms of the increasing incidence of ENT pathologies secondary to childhood obesity and how obesity complicates their management. This article reviews the management of obese children from the perspective of an ENT surgeon.


Key words

Obesity, childhood, management, otolaryngologist

Introduction

Childhood obesity is rising in incidence worldwide and specifically in the United Kingdom (UK), which has one of the highest prevalence of obese children in Europe with almost 1 in 5 children leaving primary school obese1,2. This has significant public health implications as not only children who are obese, there are other considerations that need to be taken into account when listing an obese child for surgery9. Operating on an obese child

An observational study in a large teaching hospital found that the majority of operations for obese children are being performed by ENT surgeons11. Whilst surgical time for performing surgeries such as adenotonsillectomy in obese children is similar to when performed on children who are not obese, there are other considerations that need to be taken into account when listing an obese child for surgery9. The potential for developing anaesthetic complications has been covered in the previous section and this could lengthen the time spent in theatre, subsequently affecting theatre turnover. Postoperatively, obese children are also found to be 2.3 times more likely to suffer from a post tonsillectomy bleed and a longer hospital stay3,11. For obese children with sleep disordered breathing (SDB), they are also more prone to have persistent SDB post adenotonsillectomy as described in the next section12.
Obesity and SDB
Pedaedic SDB is a condition caused by increased upper airway resistance and collapse leading to hypoaxia and intermittent apnoea (ie. stopping and restarting breathing). The mainstay of treatment for children with SDB is adenotonsillectomy, which has been shown to be effective in reducing upper airway resistance and curing children of SDB. Obese children have adenotonsil hypertrophy, increased lymphoid tissue hyperplasia in the tongue base, and external compression of surrounding adipose tissue around the pharynx leading to a higher incidence of SDB in obese children. Furthermore, when comparing tonsil size in terms of height, width and weight, Wang et al. (2010) found obese children to have larger tonsils when compared with their leaner counterparts. The association between obese children and having more prominent lymphoid tissue is believed to be secondary to endocrine mediated somatic growth in these children. This may explain why a higher incidence of tonsillar and adenoidal hypertrophy is seen in obese children from SDB despite initially showing improvement in their symptoms following adenotonsillectomy.

A prospective study by Mitchell and Kelly (2004) of 30 children assessed the outcome of obese children with SDB following adenotonsillectomy by performing polysomnography (PSG) pre and post surgery and found 54% of children continued to have SDB. Interestingly, an imaging based study found lingual tissue hypertrophy is more marked in obese children following tonsillectomy which could also partly explain the persistence of SDB following tonsil surgery. However, there are additional factors that could cause persistence of SDB symptoms in obese children following adenotonsillectomy. Obese children are likely to have higher mechanical load on the chest and reduced chest compliance leading to ventilation/ perfusion mismatch and increased work of breathing. These are hypotheses that could lead to fatigue and further exacerbate SDB in obese children. The cause for persistent SDB in obese children post adenotonsillectomy is therefore most likely multi-factorial and secondary to multi-level obstruction.

In children who continue to be symptomatic post operatively, a repeat sleep study is indicated. Weight loss is encouraged and there may be a role for continuous positive airway pressure (CPAP) therapy for obese children who continue to have SDB following adenotonsillectomy. Obese children that are unable to draw a conclusion due to small sample size. A large cross sectional population based study in the United States found obese adolescents are more likely to suffer from high frequency sensorineural hearing loss and noise-induced hearing loss. The cause for this is not fully understood although it is known a independent risk factor for age-related hearing loss in adults. Adipose tissue secretes hormones and pro-inflammatory mediators and this is believed to cause end organ damage leading to hearing loss. There is also a reported association with adipose tissue hysteresis and otitis media in children with high BMI. In animal model, lower adiponectin levels were found to be associated with a slower blood flow to the cochlear.

Obesity and nasal obstruction
A large cross sectional study performed in France of over 6000 children aged 9-11 found a higher incidence of allergic rhinitis in children with a high BMI. A similar finding was reported by Cibella et al. (2011) who performed a cross sectional study of 10-16 year old children in Italy. The reasons for this are not well understood but one theory widely reported is that obese children are more likely to have asthma, suggesting a degree of atopy. Kim et al. (2016) studied the role of diet and association with allergic rhinitis and found in their study of obese children that allergic rhinitis was more significant associated with a high fat and high carbohydrate diet. The above cross-sectional studies performed have demonstrated possible associations, however, there were numerous confounding factors and it was difficult to draw a definitive conclusion. For instance, a large multi-national cross-sectional study of more than 10,000 children combining affluent and non-affluent countries did not find an independent association between allergic rhinitis and paediatic obesity.

Conclusion
Childhood obesity is rising in incidence worldwide and this group of children are increasingly presenting to otolaryngologists with multiple ear, nose and throat complaints. Greater understanding and awareness of this global issue will lead to a more effective, structured multi-disciplinary management of these children.

References
Paediatric reinnervation update

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Abstract
The management of unilateral or bilateral vocal fold palsy is challenging for otorhinolaryngologists. The ideal treatment should aim to restore the respiratory, phonatory, sphincteric and swallowing function without disruption of the laryngeal framework. After encouraging results for both unilateral and bilateral reinnervation in adults, these procedures have been performed in select paediatric patients, with the purpose of offering a long lasting treatment option in comparison with traditional procedures. With this review we hope to encourage further international collaborations and investigation in this field, since the benefits of the techniques appear to be particularly promising in paediatric patients.


Key words
Vocal fold palsy, laryngeal electromyography, laryngeal reinnervation

Introduction
The availability of the paediatric flexible nasolaryngoscopy has made it possible to perform vocal fold palsy (VFP) easier among children. Consequently an increased prevalence of paediatric unilateral VFP has been shown. This data is also reinforced by the higher survival rates among preterm, very low birth weight infants, who frequently require surgical treatments including patent ductus arteriosus (PDA) ligation with an associated high risk of recurrent laryngeal nerve injury resulting in a unilateral vocal fold paralysis.

In the past congenital or acquired infections represented a large share of the aetiologies, but the implementation of vaccination programs and antibiotic treatments has drastically decreased their incidence. Nowadays iatrogenic left VFP seems to be mainly related to cardiovascular disease with the estimated incidence of iatrogenic palsy following PDA ligation in babies under 1 kg ranging from 22.7 to 67%. Right VFP is usually neoplastic or subsequent to a central lesion.

Bilateral vocal fold palsy (BVFP) is mainly neurological or idiopathic. Arnold Chiari Malformations are the most frequently associated condition in children diagnosed with BVFP. Both unilateral VFP (UVFP) and BVFP are also complications following surgery for congenital tracheo-oesophageal malformations. The early diagnosis of VFP is vital to improve morbidity and mortality in children with long-term respiratory complications following tracheo-oesophageal fistula (TOF) repairs.

However, despite all the heterogeneous information about the aetiology available in literature, the real incidence of VFP in children remains unknown and is therefore probably underestimated.

The management of VFP is challenging for otorhinolaryngologists, since the larynx is one of the main tools for human social interaction and therefore its functional impairment during growth can have dramatic consequences. The ideal treatment should aim to restore the respiratory, phonatory, sphincteric and swallowing function without disruption of the laryngeal framework.

The concept of laryngeal reanimation was developed in the early 1900s, but only in recent decades has reinnervation been applied in humans. After encouraging results from both unilateral and bilateral reinnervation in adults, these procedures have been performed in selected paediatric patients, with the purpose of providing a more permanent treatment option in comparison with traditional procedures.

It must be recognised however that the most common causes of unilateral and bilateral VFP in children differ to...
those in adults; in adults usually the cause of laryngeal nerve injury is iatrogenic.

**Pre-operative work up**

In order to consider the option of laryngeal reinnervation, a comprehensive preoperative work up is crucial.

Direct dynamic and static evaluation of the larynx helps to define possible anatomical alterations or structural defects such as crioc arytenoid joint ankylosis, interarytenoid scars, interarytenoid webs or posterior glottic stenosis. A dynamic evaluation also helps to elucidate whether there is a breathing pattern coordinate with respiration and any paradoxical vocal fold movements. These conditions can be related to traumatic or prolonged endotracheal intubation, laryngeal trauma, inflammatory processes, radiation or caustic damage.\(^{1,2}\)

Magnetic Resonance Imaging, and in select cases Computed Tomography, may be necessary to investigate the aetiology and associated pathologies, particularly in cases of bilateral vocal fold paralysis. Assessment of cardiorespiratory function is fundamental to plan the treatment and includes specialist paediatric respiratory and cardiac opinion. Chest radiography is important to assess the extent of any pre-existing lung injury and also to determine if the condition is in cases suitable for bilateral selective reinnervation techniques.

Evaluation of swallowing together with the involvement of speech and language specialists and with videofluoroscopy is helpful to investigate feeding difficulties and aspiration. The assessment of voice is fundamental and should include a thorough assessment working together with paediatric speech and language therapists, to use the most appropriate, accurate tests for each child. Videos are obtained of voice, cough and maximum phonatory times. Paediatric voice research and quality of life scores and paediatric voice handicap index scores should also be documented for all children with VFP.

Genetic investigations help to characterise clinical features and diagnose mutations related to neuropathy that can affect possible donor nerves which is especially important and diagnose mutations related to neuropathy that can affect possible donor nerves which is especially important. Genetic investigations help to characterise clinical features and diagnose mutations related to neuropathy that can affect possible donor nerves which is especially important.

The examination of both thyroarytenoid muscles and posterior crioc arytenoid (PCA) is needed for a precise diagnosis, in particular in iatrogenic nerve damage, since it has been found that the recurrent laryngeal nerve (RLN) branch to the PCA is more frequently damaged during surgery.\(^\text{3}\)

Recent studies have shown that in iatrogenic VFP a waiting time of 6 to 9 months since the onset of the palsy may be more appropriate to establish the diagnosis, and confirm whether recovery is likely or unlikely.\(^\text{4}\)

The data obtained from these investigations is not only crucial in understanding the dramatic impact of vocal fold palsy in children but when considering treatment options. Therefore an early diagnosis of permanent nerve damage is key to plan an adequate management strategy or avoid unnecessary treatment if a possible recovery is expected.

A management algorithm for paediatric swallowing dysfunction and feeding difficulties is helpful to investigate feeding difficulties and aspiration. Efforts to talk may be compromised by a loss of air volume through the glottic gap. In children and teenagers UVFP can represent a risk for social and emotional disturbance and isolation as well as physical and functional impairment.\(^\text{5}\)

Aspiration pneumonia may result in possible life threatening consequences particularly in pre-term infants with UVFP.

Surgery should be considered when conservative management has not been successful or when there is significant aspiration and dysphonia.

Injection mediatisation\(^\text{6}\) should be carefully performed. In newborn infants and children, the vocal fold mucosa is thinner and the different layers are not developed. In addition the ligmament is not clearly detectable in children under 4 years. A correct choice of the material (ideally short lasting) and meticulous injection are essential to avoid scarring, granulation or disruption of a growing vocal fold.\(^\text{7}\)

Type I thyroplasty\(^\text{8}\) does not provide adequate permanent results. As the larynx grows, the implant may be displaced or the size may be inadequate. Moreover procedures under local anaesthesia and where patient cooperation is necessary are not possible in children. Thus cranial nerves and larynx are likely to prove exceptionally difficult in a child.

Currently the most widely used and well accepted reinnervation technique for UVFP is based on ansa cervicalis to RLN neurorrhaphy.

This procedure reinnervates the muscles of the hemi-larynx and can restore vocal fold tone, bulk and tension. There is no restoration of movement coordinate with respiration and phonation; hence it is defined as “non-selective”. The first satisfactory reports of this technique were published by Crumley in 1986.\(^\text{9}\) Positive outcomes have also been described by Olson et al. (1998), Miyayuchi et al. (1998), Lee et al. (2007), Lorenz et al. (2008), Marie et al. (2010) and Weng et al. (2011) in larger retrospective case series in adults.\(^\text{10,11}\)

All of these reports demonstrated that in adults over 17 years of age non-selective reinnervation could restore the physiological laryngeal phonatory function to near normal/normal voice quality.

The application of this unilateral non selective laryngeal reinnervation (NSR) technique has been extended to the paediatric population. The first report was by Smith in 2008,\(^\text{12}\) who in 2015 published the largest report, on a cohort of 35 paediatric patients who underwent this surgery. Although the study revealed no significant association between age at time of surgery and outcome, a slight negative correlation was found with the length of denervation (a longer period of denervation resulting in a poorer outcome), though voice improvement was observed in all patients.\(^\text{13,14}\)

Zur and her group described their first results in 2012, with promising outcomes in 10 children under 14 years of age.\(^\text{15}\) In 2015 Zur and Carroll published a comparison study between non selective reinnervation and injection laryngoplasty in 33 children with dysphonia. The study confirmed the hypothesis of long-term superior outcomes of NSR compared to injection laryngoplasty,\(^\text{16}\) and thus the group offer NSR as a standard treatment option in appropriately selected children. Furthermore in 2017 the same group reported on three paediatric patients affected by UVFP who underwent successful NSR for aspiration primarily with concomitant dysphonia.\(^\text{17}\)

Following comprehensive assessment, multidisciplinary discussion and encouraged by the results in the literature, the indications of dysphonia and aspiration causing significant medical and psychosocial issues resulted in the authors performing the first NSR in the UK in a 6 year old affected by UVFP, with successful outcome.\(^\text{18}\) In all of the documented cases in the literature good outcomes have been reported, with resolution of aspiration and improvement of voice. Our team has successfully embraced this procedure, only recently introduced into the UK, with good preliminary results.\(^\text{19}\) This technique has been offered in a fully evaluated structured way through the development of a management algorithm (Figure 1) with the aim to establish the prognosis and plan best treatment.\(^\text{20}\)

Figure 1: A management algorithm for paediatric unilateral VFP.
Our group has now performed NSR in 5 paediatric patients, 2 male and 3 females, age range 2 to 16 years old, affected by iatrogenic UVFP. The postoperative outcomes in 3 have revealed a significant improvement in both voice and swallowing parameters and quality of life scores. In one case there has been no improvement following NSR and on reflection it is likely that this was due to a modification of the ansa nerve selection, therefore a revision procedure may be considered. We await the results of NSR following the most recent surgery. Table 1 summarises the findings of the recent literature following NSR in children. The procedure is currently offered to carefully selected children at our institution following a thorough multidisciplinary panel assessment and review.

**BvFP**

BVFP usually presents with life threatening stridor in neonates and 50% of these children require a trachecostomy. Paediatric and laryngology specialists from our region have developed a prognostic and therapeutic algorithm for children with BVFP (Figure 2), to aid management in this often psychosocially complex group of children.

In addition to tracheostomy other surgical procedures may be considered for BVFP and include glottic widening procedures, such as lateralising sutures, cordotomy or arytenoidectomy. If BVFP is an option these techniques should be avoided as they result in permanent disruption of the laryngeal framework, with voice impairment and preclusion of a possible reinnervation.

Table 1. A summary of the available evidence for NSR performed in children for unilateral VFP.

<table>
<thead>
<tr>
<th>Author</th>
<th>Year</th>
<th>Number of patients</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ongkasuwan J et al.</td>
<td>2019</td>
<td>32</td>
<td>NSR performed at a younger age may have better voice outcomes compared to NSR performed 1 to 2 decades later.</td>
</tr>
<tr>
<td>Faoury M et al.</td>
<td>2019</td>
<td>1</td>
<td>The use of laryngeal EMG is crucial to predict outcomes and to choose the best treatment option. NSR may provide a permanent solution and should be considered in children as a management option.</td>
</tr>
<tr>
<td>Zur KB et al.</td>
<td>2017</td>
<td>3</td>
<td>NSR is a safe and effective option for the management of chronic aspiration pneumonia and dysphonia in patients with UVFP.</td>
</tr>
<tr>
<td>Farhood Z et al.</td>
<td>2015</td>
<td>3</td>
<td>There was statistically significant improvement in shimmer and Noize to Harmonic Ratio (NHR).</td>
</tr>
<tr>
<td>Smith ME et al.</td>
<td>2015</td>
<td>35</td>
<td>Denervation duration showed a slight negative correlation with postoperative outcomes. Voice improvement was seen in all patients.</td>
</tr>
<tr>
<td>Zur KB et al.</td>
<td>2015</td>
<td>33</td>
<td>The ANSA-RLN group showed better and longer-lasting perceptual and acoustic parameters in comparison with the injection and control groups.</td>
</tr>
<tr>
<td>Marcom KK et al.</td>
<td>2010</td>
<td>2</td>
<td>NSR previously described for older children and adults can be safely adapted for younger children (3 and 6 years old).</td>
</tr>
<tr>
<td>Crumley RE et al.</td>
<td>1991</td>
<td>1</td>
<td>Improvement of pitch control in an 8 years old patient treated with NSR.</td>
</tr>
</tbody>
</table>

Selective Laryngeal Reinnervation (SLR), as described by Professor Jean-Paul Marie, has the aim of restoring vocal fold movement coordinate with breathing and phonation. A root of the phrenic nerve acts as the donor for both posterior cricoarytenoid (PCA) muscles, with the goal of producing an inspiratory trigger on inspiration and consequent abduction of the vocal folds. The adductor muscles are reinnervated from a small branch of the hypoglossal nerve, active on phonation and swallowing. Both the recurrent laryngeal nerve and phrenic nerve are active on inspiration. This specific function can be mutually beneficial in nerve reanimation surgery. This has been supported by a recent report in which the RLN has been successfully employed as a donor nerve in a patient with a diaphragmatic palsy. This provides further validation to the theory on which the sophisticated steps of reinnervation are based. Marie has performed this technique in both paediatric and adult patients with promising results. Other authors have published good outcomes in the adult population.

Concerns may be expressed regarding possible permanent damage to the phrenic nerve in a child. As such a comprehensive respiratory assessment is essential prior to proceeding with the surgery. In adults the entire phrenic nerve is commonly used to restore shoulder abduction in brachial plexus injury without major problems. In children there are series that describe the safe use of a phrenic nerve root for the same purpose without significant respiratory impact.

Our case series (2018) described three selective laryngeal reinnervation procedures performed in children under 3 years of age. Two of the children had idiopathic congenital BVFP and one iatrogenic BVFP, secondary to the cervicothoracic removal of a lymphangioma. Postoperatively the first two children have been decannulated and one has greatly improved with only slight stridor on demanding exercise. Selective reinnervation has also been performed in a 17 year old boy. He recovered bilateral inspiratory abduction and is now able to exercise without dyspnoea.

This procedure forms the basis of laryngeal reanimation and hence rehabilitation. In particular the benefits among paediatric patients can be impressive if restoration of physiological respiration and phonation is achieved. Further data and research is required in order to establish the most suitable children and best methods for reinnervation.

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**Figure 2: A management algorithm for paediatric bilateral VFP.**

In his case series Marie (2018) described three selective laryngeal reinnervation procedures performed in children under 3 years of age. Two of the children had idiopathic congenital BVFP and one iatrogenic BVFP, secondary to the cervicothoracic removal of a lymphangioma. Postoperatively the first two children have been decannulated and one has greatly improved with only slight stridor on demanding exercise. Selective reinnervation has also been performed in a 17 year old boy. He recovered bilateral inspiratory abduction and is now able to exercise without dyspnoea.

This procedure forms the basis of laryngeal reanimation and hence rehabilitation. In particular the benefits among paediatric patients can be impressive if restoration of physiological respiration and phonation is achieved. Further data and research is required in order to establish the most suitable children and best methods for reinnervation.
reinnervation techniques in order to obtain optimum reproducible outcomes.

Conclusion

VFP when symptomatic is associated with a high morbidity rate and often has a significant negative impact on the lives of children and their families. Therefore the best treatment options are mandatory. Laryngeal reinnervation, unilateral or bilateral, is sophisticated surgery with potential beneficial effects likely to be especially effective in the paediatric population, in particular when taking into account the rate of nerve regeneration in children compared with adults. This technique can be taught and performed by laryngologists and head and neck surgeons with microsurgical skills. However, these techniques have not yet been extensively embraced, and have only recently been introduced into the UK in both adults and children. Further studies in this field are crucial and an increased worldwide interest and collaboration in this approach are desirable, in particular when reporting techniques, data and outcomes.

Acknowledgements

The team would like to thank Miss Eleanor Sproson for her vital help in constructing the algorithm and Jamie-Allen and Julia Robinson speech and language therapists for their help in developing the algorithm.

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Crico-arytenoid joint fixation in juvenile idiopathic arthritis

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ABSTRACT
JIA represents the commonest rheumatic disease in the paediatric age group and may involve the cricoarytenoid (CA) joints resulting in stridor and potentially life threatening airway compromise due to bilateral CA joint fixation. Conversely in the paediatric population stridor as a presenting feature of JIA is rare with only a few cases reported in the literature. Otolaryngologists need to be aware of this potential diagnosis as multidisciplinary care is required for optimum long term follow up.


Key words
Juvenile idiopathic arthritis, crico-arytenoid, fixation, stridor

Introduction
Juvenile idiopathic arthritis (JIA) (previously termed juvenile rheumatoid arthritis) is a term frequently given to juvenile idiopathic arthritis (JIA) (previously termed juvenile rheumatoid arthritis). Juvenile idiopathic arthritis, crico-arytenoid, fixation, stridor

The recently (2019) proposed classification for JIA identifies 6 subtypes including: systemic JIA, rheumatoid factor positive JIA, enthesitis/ankylosing-spondylitis-related JIA, early-onset ANA-positive JIA, other JIA and unclassified JIA. The first subtype (systemic JIA) affects approximately 5-15% of the general paediatric population in North America and Europe. Systemic JIA is the commonest subtype and is characterised by daily fevers of unknown origin that may reach 39°C or higher once daily then decrease to 37°C or less between fever spikes. Fevers should persist for at least 2 weeks and be associated with 2 major criteria or 1 major criterion and 2 minor criteria in systemic JIA. Arthritis and evanescent rash, are considered major criteria. Minor criteria include arthralgia for a duration of 2 weeks or longer (without associated arthritis), serositis, leucocytosis to 15,000/mm3 or more with neutrophilia and generalised lymphadenopathy and /or hepatomegaly.

JIA can involve any joint in the body, however there is a predilection for large joints. Hand and feet small joints and ossicular joints in the middle ear may also be involved in the disease process.

Although involvement of the cricoarytenoid joint in the disease process is unusual, it can be a manifestation of early JIA. In 50 cases of JIA, Abdel-Aziz et al. (2011) reported that cricoarytenoid arthritis was detected in 12% of the cases.

Aetiology
The cricoarytenoid joint is a synovial diarthrodial articulation between the cricoid and arytenoid cartilages. The inflammatory process may ensue in the synovial membrane, then proceed to the articulating surface with resultant fibrosis and subsequent fixation.

Clinical Features
Upper airway symptoms in children with JIA include sore throat, hoarseness, dysphonia and pharyngeal disturbances. Progressively worsening symptoms including dysphonia and inspiratory/expiratory stridor which may require intubation and mechanical ventilation may ensue. The disease process is usually more acute in children when compared with adults. While adults can tolerate cricoarytenoid joint inflammation, children tend to present in a more urgent fashion, often necessitating intubation. This is attributed to a narrower glottic opening with larger arytenoids and a higher amount of loose areolar tissue in children allowing inflammatory oedema to spread around the epiglottis and arytenoids. Adults have less severe disease which does not usually result in airway compromise.

Cricoarytenoid arthritis should be considered in every JIA patient with chronic stridor and laryngeal obstruction. Conversely cricoarytenoid arthritis may be the first sign of the disease, as reported in Case 1 preceding peripheral arthritis. JIA may also present with a maculopapular rash in addition to the joint pain, stridor and dyspnoea.

Diagnosis
Diagnosis of JIA is made mainly by eliminating other causes. History including familial history with emphasis on joint pain, morning joint stiffness, complete physical examination and documentation of any pathological features should be elucidated. The commonest manifestation of JIA is a unilateral swollen knee. Inflammation of the synovial membrane, that is not always identical, may additionally involve other small and/or large joints. Examination of the knee, wrist and ankle is essential in cases of rheumatoid factor positive JIA. Skin examination may show subcutaneous nodules. Hand examination may reveal boutonniere and swan neck deformities. Torticollis due to cervical spine involvement can also be seen. Asymmetric growth may ensue in advanced cases.

Examination of the oral cavity may show decreased oral opening, and micrognathia due to temporomandibular joint involvement. Paediatric hearing tests can detect conductive hearing losses due to ossicular joint involvement. Hoarseness due to cricoarytenoid joint involvement may also be heard. Systemic examination may reveal pericarditis or myocarditis, splenomegaly, and lymphadenopathy especially in children with systemic JIA. The diagnosis of JIA requires a thorough multidisciplinary assessment with attention to detail as the presentation may be subtle.

X-rays are the gold standard investigation for the detection of structural joint damage, growth and maturation disturbances of bones in JIA patients. However, sensitivity is low in detecting active synovitis and erosive changes in early stages of the disease. MRI is preferable to assess all features of synovial disease and is superior to conventional radiography in its ability directly visualise synovitis, cartilage, and early erosive lesions.

Laryngotracheobronchoscopy (LTB) with cricoarytenoid joint palpation and additionally laryngeal electromyography (LEMG) may be diagnostically helpful in cases of JIA. LTB with the expert use of a laryngeal probe allows the otolaryngologist to assess the extent of fixation. LEMG

Case 1:
A previously well 2½ years old girl developed progressive stridor over 6 weeks. Following critical airway compromise and unsuccessful medical management she was urgently intubated. On extubation she developed increased nocturnal work of breathing. Rigid laryngotracheobronchoscopy (LTB) revealed reduced mobility of the cricoarytenoid joints but action potentials from the posterior cricoarytenoid (PCA) muscles. A diagnosis of juvenile idiopathic arthritis was confirmed. Treatment of both the knee and cricoarytenoid joints with steroid injections was performed intraoperatively. Postoperatively she was commenced on oral steroids which were converted to etanercept and methotrexate. She remains relapse-free after 21 months.

LEMG undertaken during Laryngotracheobronchoscopy.
allows assessment of the action potentials generated by the thyroarytenoid (TA) muscles and posterior crico-arytenoid (PCA) muscles during respiration, hence demonstrating laryngeal nerve activity and aids diagnosis in terms of differentiating between CA joint fixation and a vocal fold palsy. Airway assessment under spontaneously breathing general anaesthesia also allows other pathologies both structural and dynamic to be excluded.

Management

Treatment of JIA includes a variety of drugs. The most commonly used are non-steroidal anti-inflammatory drugs (NSAIDs), including ibuprofen, indomethacin, tolmetin and naproxen sodium. Other anti-inflammatory drug options include methotrexate and corticosteroids. Several case reports comment on effective treatment with non-steroids1,5. Methotrexate 0.5-1mg/kg/week has improved the disease course significantly in JIA as well as in rheumatoid arthritis4. However, its effect may be delayed. The addition of 1mg/kg/day folic acid or folic acid is advised to lower the effects on the bone marrow and control the side effects5. Oral or parenteral administration of steroids results in significant improvement of pain, swelling, sensitivity in the joints, carditis, hepatitis and lung disease. Biological drugs are used more in adults, however, recently there are reports of their recommended administration in children with limited usage. Etanercept, Adalimumab, Kanakinumab, Rilonacept, Tositumumab and Rituximab are examples of these drugs which have been approved by the food and drug association (FDA) for JIA5. These drugs act mainly against Tumor necrosis factor-alpha (TNF-α). TNF-α is a cytokine which is directly involved in the pathogenesis of JIA and presents in high level in the serum and synovial fluid5. Etanercept is a dimeric fusion protein inhibiting human TNF receptor. It is the first treatment choice in patients with rheumatoid factor positive JIA. The main drawback is the local reaction at the injection site Consequently it is better to administer the drug in multiple sites. Adalimumab is a human monoclonal antibody which inhibits TNF-alpha. Use of this drug in conjunction with methotrexate markedly accentuates its efficiency5. Kanakinumab is a monoclonal IgG1 antibody that acts as isoform of interleukin-1β. It is main advantage is that it does not cause much reaction at the injection site compared to other drugs. In addition it has a longer half-life when compared with other medications. Side effects include abdominal pain, vomiting and diarrhoea. Biological drugs have proven safe and effective in the treatment of JIA. Their usage has resulted in the reduction of the use of steroids and surgical intervention for JIA. Their limited usage is due to the lack of information regarding their long-term safety profile and cost, though they are effective drugs5. JIA is a complex disorder that needs multiple medications to achieve symptomatic control. The combination of anti-inflammatory drugs, and biological drugs should be made according to the severity of the condition5.

Prognosis

Disease activity is rated based on a visual analogue scale (VAS), ranging from 0 (no activity) to 10 (maximum activity)5. The outcome for children with JIA is unpredictable. Pending no flare-ups during the first 5 years, the probability of permanently restricted joint mobility and cumulative joint damage is low. Aggressive medical management to achieve disease remission, is a key element to achieve a better outcome. A good preliminary response to medical treatment within the first 6 months, is an indicator for improved long term outcomes5. Early initial treatment is essential to prevent long lasting disability and complications of the disease5.

Conclusion

JIA should be managed in a multidisciplinary team setting including paediatric rheumatologists, paediatricians, physiotherapists, ophthalmologists, and orthopaedic surgeons. Cricothyroidal arthritis should be considered as a diagnosis in children presenting with chronic stridor, especially if JIA is present. Cricothyroidal arthritis can be steroid-responsive, mimicking croup. LTBI with cricothyroidal joint palpation and LEMG can be diagnostically helpful. The mainstay of treatment in JIA is to achieve inactive disease or disease suppression without continued anti-inflammatory medication.

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References

Paediatric dysphagia: The role of the speech and language therapist

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Abstract
We discuss the role of the Speech and Language therapist (SLT) in dealing with infants and children with swallowing disorders. This paper will outline the benefits of the holistic approach of the speech and language therapy swallow assessment and how it complements the ear, nose and throat (ENT) management in the multidisciplinary team (MDT) setting. This is highlighted in the ear, nose and throat (ENT) management in the MDT approach. The SLT’s role during FEES is to look at the pharyngo-laryngeal phase has become increasingly useful as part of the initial assessment. Videofluoroscopic swallow study (VFSS) provides further valuable information but has the risk of radiation exposure so is not generally used in neonates and is restricted to specific cases.

Key words
Speech and language therapy, dysphagia, MDT, FEES, FSS

Introduction
Paediatric dysphagia refers to babies and children with difficulties chewing, sucking and swallowing food, drink and saliva1. Dysphagia or feeding difficulties can present at birth or as a child progresses to larger volumes of liquids, during weaning and throughout their life following an event or change in medical status. Feeding concerns may be raised by parents or various healthcare professionals including midwives, health visitors, general practitioners (GPs), nurses and paediatricians. On going dysphagia can be associated with aspiration pneumonia, malnutrition, failure to thrive and potentially neurodevelopmental problems2.

The SLT plays an integral role in the assessment, diagnosis and management of infants and children with dysphagia. Often children with dysphagia are referred to Speech and Language therapists (SLTs) who provide a holistic approach to the swallowing assessment. In the UK, SLT services are generally arranged in two tiers, hospital based and community based SLTs. There are NHS hospital based specialist paediatric SLTs who manage the swallowing and communication needs of complex, acutely unwell or neurologically impaired inpatient and outpatient children. Close liaison between the services is essential to ensure continuity of care, particularly as feeding support may be required throughout childhood particularly as feeding skills and safety of swallow may change. The main focus of the initial assessment is to undertake a detailed case history and determine if there are any anatomical, physiological, neurodevelopmental or sensory and associated behavioural difficulties with eating and drinking at the pre-oral, oral and/or pharyngeal stage of swallowing.

The SLTs adopt a very holistic approach to feeding emphasising the need for an appropriate setting, neurodevelopmental skills as well as oro-pharyngeal motor skills. Observation of feeding is essential and the use of fibreoptic endoscopic evaluation of swallow (FEES) to look at the pharyngo-laryngeal phase has become increasingly useful as part of the initial assessment. Videofluoroscopic swallow study (VFSS) provides further valuable information but has the risk of radiation exposure so is not generally used in neonates and is restricted to specific cases.

SLT Assessment of swallow

General assessment
A child or an infant refusing or unable to feed is a very emotive situation and it is important to provide a supportive atmosphere and minimise stress for the child, carers and the child’s wider support network e.g. school, nursery and playgroups. Introducing fun into feeding may help children who have had negative feeding experiences e.g. related to medical conditions, force feeding, and lack of experience with oral feeding/ long term alternative methods of feeding) or are demonstrating oral aversive behaviours4,5,6. Optimising position through supportive seating and postures for children with poor core strength or reduced head control is essential when optimising feeding skills7,8. Observing a child’s self-feeding skills (where appropriate) and encouraging them will assist with successful feeding and further development of their pre-oral and oral skills. Children with specific pharyngeal dysphagia may benefit from manoeuvres such as chin tuck, head turn or other compensatory strategies which may reduce the risk of aspiration however these should be assessed during the instrumental assessment.

Oral Phase
SLT assessment of oral stage involves offering the child a range of appropriate textures and consistencies while observing lip closure, lip, tongue and jaw movement during mastication, oral transit time, sucking which includes suck type, rhythm of the suck, suck-swallow- breath pattern and suck burst length/ duration subsequently relating these skills to the developmental stages of feeding.

Assessment of swallow
The pharyngeal phase of swallow is initiated at the point where the swallow reflex is triggered. The SLT may comment on the byolaryngeal movement (elevation and excursion/ anterior tilt), timing of swallow trigger, number of swallows per bolus, wet sounding voice/ breathing post swallow and adverse signs of aspiration/ penetration which may include coughing, eye watering, gagging and colour change. Cervical auscultation may also be used when commenting on the phases of swallowing and swallow breath pattern. Cervical auscultation is part of the SLT’s bedside assessment which can include palpation of the larynx, observation of saturation levels, heart rate and respiratory rate during feeding9,10. Where a bedside assessment may not provide full information of the child’s dysphagia the SLT may recommend further instrumental assessment including FEES/ VFSS.

Fees
The Royal College of Speech and Language Therapists (RCSLT) position paper11 describes the use of FEES in the SLT’s assessment and management of dysphagia within paediatrics as well adults. The purpose of FEES can be to, diagnose dysphagia and assess the nature of the problem along with guiding dietary and behavioural management. Although in adults the SLTs often perform the FEES independently of ENT surgeons, the complex developmental nature of paediatric swallow benefits from an MDT approach. The SLT’s role during FEES is to assess the swallow function with a range of appropriate textures/ consistencies and provide recommendations regarding the swallow, whether oral feeding is advisable and whether any interventions are required to facilitate safe and efficient feeding. Observations can also be made on the child’s neurodevelopment and the skills seen at the pre-oral (self-feeding skills versus being fed), oral stage (developmental stages of mastication, oral transit time, sucking which includes suck type, rhythm of the suck, suck-swallow- breath pattern and suck burst length and duration) as well as the pharyngeal stage of the swallow (see below). SLT’s can also provide developmentally appropriate recommendations and goals for children, their family/ carers and for community SLTs including school teams. During the pharyngeal phase, the following observations are made:

• The appearance of the tissues, base of tongue, velum, nasopharynx at rest and during swallow.
• Potential nasal obstruction causing mouth breathing.
• Any asymmetry of main structures.
• Presence of copious secretions (studies have shown pooled secretions have high correlation with aspiration12). We may describe them (foamy, thick, capacious). Amount of standing secretions: normal, excessive. Pooling within the laryngeal vestibule.
• Observing the movement and sensation of critical structures within the hypopharynx and larynx at rest and on swallow, any vocal fold immobility or laryngomalacia.
• Secretions during swallowing. Is there any evidence of overspill into the subglottis? How does the child react to the secretions? Are there spontaneous swallowing to clear, ineffective attempts to clear or no attempt to clear these secretions?
• Is there evidence of airway protection during the swallow?
• Directly observed laryngeal penetration or aspiration.
• Can we improve the swallow by using a change of posture/position, flow rate of fluids, consistency of the diet and fluids, utensils and/or bolus volume?

Following the FEES, the MDT often reviews recorded images and a feeding strategy developed with the family. This is integral as the family/ carers can understand the reasoning behind the recommendations given and feel involved in the decision making. Along with discussions with the family/ carers the SLT in the clinic will often hand over the recommendations to the child’s community SLT who will be able to support the family/ child at home. Onward referrals may also be discussed and requested following the FEES clinic for example referrals to occupational therapy (OT), physiotherapy (PT), dietetics, gastroenterology and neurology. When determining if a

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very young children and neonates in a more natural setting. FEES can be used safely and reliably when assessing laryngeal and pharyngeal aspiration in NICU infants (38 weeks+ gestational age)⁴. FEES enables assessment of very young children and neonates in a more natural position such as the parents arms, whilst breastfeeding, with which there is no other instrumental assessment of swallowing that exists for this population⁴. Unlike with VFSS there is no “screening” time constraint with a FEES assessment that has proven helpful in determining issues that may be evident during the middle or end of a feed.

VFSS versus FEES

FEES is a very effective investigation that can be used in the inpatient and outpatient setting to provide useful advice regarding swallow. Its main limitations are that in our experience some children often age 2-7 find it difficult to tolerate and it does not examine the oesophageal phase of swallow⁴. VFSS examines all 4 phases of swallow and can be used to detect reflux and site of aspiration. VFSS however involves ionising radiation exposure therefore there are screening time constraints and repeated tests are restricted. In complex patients however, FEES and VFSS are complementary.

The following case is used to highlight the integral role the SLT has within the FEES assessment along with the repeatability and flexibility of the FEES assessment itself.

Case Study:

A 6-week old baby girl was referred from the local ENT team to the tertiary children’s hospital ENT clinic with a history of stridor post-bottle feeding, poor weight gain and nasogastric (NG) feeding. The differential diagnosis given was reflux, laryngomalacia, low tone or an underlying laryngeal cleft. There was no SLT involvement noted. Her past medical history involved; term birth, 22q duplication, hypotonic, stridor, poor feeding and failure to thrive.

Her initial examination was unremarkable however laryngeal cleft could not be excluded on fibroptic nasolaryngoscopy alone. She was commenced on anti-reflux medication, referred to a dietician with a plan for follow up by community SLT.

On review a month later, community SLT had advised pacing with bottles and to use the NG tube when she was not managing full amounts, coughing, spluttering, increased work of breathing, turning head away or getting fatigued. ENT referred to the joint ENT/SLT clinic for follow up.

During joint ENT/SLT initial clinic at age four months, parents reported that she has had four episodes of “broncholiths” but had been slowly continuing with bottles (with pacing), NG top ups and tasters of apple puree.

On FEES examination stertor was noted and the uvula was sucking in posteriorly to posterior pharyngeal wall. No vocal cord palsy or obvious stridor was detected. Increased secretions were noted at vallecular and periform fossa, frank aspiration seen with milk from the fast flow bottle (unable to trial slower flow rate due to reduced oral strength). No frank aspiration seen with apple puree from weaning spoon therefore recommended:

- NBM for milk (all via NG tube)
- IDDSI (international dysphagia diet standardisation initiative) level 4 (purred)16 tasters to develop oral skills
- SLT suggested review of supportive seating by OT’s
- Handover to community SLT service for ongoing therapy for hands to mouth play and oral skill development

At Joint ENT/SLT follow up clinic two months later (aged six months old) parents report that she has been managing her purées “very well” with improved head control, and now has supportive seating from OT. On going chest infections could be related to 22q immunodeficiency but chest x-ray showed right upper lobe shadowing suggesting possible aspiration (intra-swallow) or reflux. VFSS is now planned if the chest does not improve. Repeat FEES showed fatigue following IDDSI level 4 testing therefore not assessed with fluids. IDDSI level 4 revealed appropriate base of tongue movement and pharyngeal wall contraction, vocal cords normal, some nasal secretions noted however cleared on swallow, appropriate swallow trigger with IDDSI level 4 diet with no residue, no aspiration or penetration. Recommendations for her:

- Continue to promote oral intake of IDDSI level 4
- Refer back to her paediatrician for review of immunodeficiency

- Continued development of her gross and fine motor skills for sitting and feeding along with continued community SLT input.

Joint ENT/SLT follow up clinic: seen at nine months of age, parents report increased puree intake, ongoing NG feeding but now able sit up with independent head control. FEES assessed her safe with IDDSI level 1 fluids which are now to be encouraged.

VFSS summary: penetration with IDDSI level 1 fluids but no frank aspiration seen. She continued therefore with IDDSI level 1 fluids using an open cup and regular pacing with single sips.

Conclusion

Joint ENT/SLT FEES clinics enable ENT and SLT teams to develop robust and comprehensive services for children with dysphagia. Clear decisions regarding feeding strategies may reduce hospital stays, time with NG feeding and subsequent ongoing difficulties with adequate nutrition and hydration. The SLT’s role enables the child to receive a holistic approach to feeding and increases communication with secondary care and community based teams regarding recommended input to develop fine and gross motor skills for feeding (for example seating/ hand to mouth play, weaning to solids advice and developmental appropriate feeding skills and thickness). The use of FEES and intermittent VFSS is also instrumental in the assessment and subsequent development and review of safe feeding strategies. This integrated care system across a network of providers offers new perspectives on feeding and the management of feeding throughout the child’s life.

References

Complications of dermal fillers

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Abstract

Facial rejuvenation is evolving rapidly and the use of injectable dermal fillers has been increasing. Although generally well tolerated, both short and long term complications can occur and can be serious. The main goal in to reduce these complications. It is therefore important to have a good understanding and management of complications in order to provide safe care to patients.


Key words

Injectable, dermal fillers, complications, management

Introduction

The use of injectable dermal fillers, which can temporarily eliminate facial lines, rhytides and defects, has become increasingly popular with patients seeking facial rejuvenation. In recent years, the number of providers offering dermal fillers has rapidly increased owing to the relative ease and lucrative nature of the procedure. Although the procedure is minimally invasive and generally has a good safety profile, complications can arise.

Adverse effects of dermal fillers tend to be minor and localised; however severe complications can occur. Complications can be divided into early and late and range from bruising to necrosis.1,2 There are now over 60 dermal fillers available on the UK market and all have the potential to cause complications. They include hyaluronic acid (HA), poly-L-lactic acid, calcium hydroxylapatite and collagen fillers. Occasionally complications can be attributed to the selection of filler material, but in many circumstances can be related to incorrect technique and region selection. In order to provide safe care to patients and to achieve optimum outcomes, it is vital to have a full understanding of these issues.1,3

Complications: Early Onset

Early complications are those which occur within days to weeks of the initial injection.4 Minor complications in the early stage include bruising, swelling and discomfort.1 The use of local anaesthetic and recommendation of regular analgesia post procedure can reduce patient discomfort.5

Bruising

Bruising can occur within a few hours and may take several weeks to fully resolve. It is almost invariably minor; however, may be troublesome for the patient. Bruising is observed more frequently after injection into thin delicate skin, such as the lips and eyelids, and when into the dermal and subdermal planes.6 The popular fanning technique of injection has been reported to increase the risk of bruising.7 Steps can be taken to minimise the risk, including withholding medications known to thicken the blood prior to the procedure such as aspirin, warfarin and non-steroidal anti-inflammatory drugs, as well as over the counter remedies such as St John’s Wort, ginseng and fish oil.8 Avoiding vigorous exercise for the first 24 hours to minimise hyperventilation, using fillers incorporating adrenaline (causing vasoconstriction), using the smallest gauge needle possible to deliver the filler and fewer injection sites, may all limit bruising.9 Generally, bruising is self-limiting and will resolve. Advising the patient to immediately apply pressure and a cold compress for fifteen minutes to the area post procedure and using vitamin K cream may treat bruising. Rarely, persistent hemosiderin staining may require treatment with pulsed dye light or potassium titanyl phosphate lasers.6

Swelling

Temporary swelling immediately post-procedure is normal and common. Treatment and prevention is as for bruising, and should settle within a week.6 Oedema may be more significant when associated with hypersensitivity to the dermal filler, which may be an antibody-mediated or non-antibody mediated (delayed) reaction.10 Some patients may develop hypersensitivity on initial or repeated exposure to the filler agent due to an immunoglobulin E (IgE) mediated response, which results in swelling, pain, erythema and itching within hours of injection.10 Rapidly progressive angioedema is a medical emergency, but other patients may suffer angioedema that progresses more slowly but lasts several weeks and is not dangerous. For most, the swelling is short term and responds well to antihistamines. If antihistamines fail, oral prednisolone can be used. Chronic angioedema lasts more than 6 weeks and is challenging to treat and may require referral to immunology.11,12

Delayed hypersensitivity reactions mediated by T-lymphocytes can occur between 24 hours to several weeks post-procedure. Antihistamines are of no benefit and treatment involves removal of the allergen. Hyaluronidase can be used for HA fillers. Other fillers may require treatment with oral prednisolone whilst the filler resorbs, followed by laser or extrusion if ongoing.10

Importantly, malar oedema can occur following injection into the infraorbital hollow and tear troughs. Injection of filler into the superficial compartment of the superficial suborbicularis oculi fat can impede lymphatic drainage of the compartment (which already has poor drainage due to the malar septum) leading to fluid accumulation in the infraorbital region.13 Malar oedema is chronic and treatment resistant and therefore it has been recommended that injection into the infraorbital hollow is performed solely with HA, allowing for use of hyaluronidase if malar oedema is to occur.10

Swelling following dermal filler injection may present similarly to other facial swellings and need careful assessment. Further investigations such as fine needle aspiration may be required to determine the nature of the swelling and surgical intervention may be required in some cases (Figure 1).

Infection

Infection can be an early complication and cellulitis can occur following injection of dermal fillers due to inoculation of bacteria into the skin or entry of microorganisms through the disrupted skin barrier. Cellulitis presents with skin erythema, warmth and oedema around the injection site. It is important to distinguish this from hypersensitivity reaction which also causes erythema, but there is also usually an itch and the patient is apyreal.13 Abscess formation is rare but requires treatment with antibiotics, incision and drainage. Unlike granulomas which shall be discussed later, abscesses are fluctuant with notable tenderness and warmth.14 Antibiotics covering Staphylococcus and Streptococcus are the choice of treatment and may need to be given intravenously if the patient is systemically unwell or immunosuppressed.6,15 Percutaneous and midfacial infection require prompt treatment due to the risk of intracerebral spread.

It is important to check for any history of cold sores as infections in the perioral region can lead to reactivation of the herpes virus. It has been suggested that the topographic course of aciclovir may be of benefit for those with a history of the virus. If infection does occur, aciclovir can be used if infection is recognised early and in combination with antibiotics if there is superimposed bacterial infection.14

Implant visibility

Other early complications include under and overcorrection and implant visibility.1 Knowledge of the unique characteristics and mechanism of action of each dermal filler agent, in addition to correct technique, is crucial in placing the right amount of filler at the correct skin depth in order to avoid filler visibility or nodularity.15 Injecting a filler agent too superficially can result in implant visibility.16 Intervention is required in these events. Firm massage can be used to disperse excess HA or hyaluronidase can be injected. For other particulate dermal filler materials such as calcium hydroxylapatite or poly(methylmethacrylate), Figure 1: Purulent swelling following filler injection that required excision to treat discharge and rule out malignancy, as fine needle aspiration was inconclusive.
excess may need to be removed using dermabrasion or unroofing with a needle.  

Vascular compromise and necrosis  
Skin necrosis following filler injection is a much feared complication. Necrosis is caused by vascular compromise resulting from obstruction of arterial or venous blood supply. The blood supply may be interrupted by inadvertent intravascular injection into an artery and embolisation, trauma to the blood vessel wall, or from external pressure of the needle tip on the vessel wall causing compression.  

Not only can vascular compromise result in skin loss and scarring, reports of acute blindness, stroke and death are made in the literature as a result of ocular and cerebral embolism.  
The glabella is suggested to be the site at greatest risk of necrosis, but the nasolabial fold also carries a risk. Recognition of vascular compromise and immediate treatment is vital in order to avoid serious adverse effects. Those performing dermal filler injections should also have a sound understanding of the anatomy of the vasculature surrounding the injection sites. 

There are several factors which increase the risk of vascular compromise and those performing dermal filler injections can take measures to minimise them by doing the following:  
1. Aspirating prior to injection to ensure the needle tip is not within a vessel.  
2. Avoid overcorrection and minimise the amount of filler volume used.  
3. Injecting at a low pressure.  
4. Avoiding deep injection of the filler product (larger blood vessels are located deep to the dermis).  
5. Use a blunt needle of the smallest size (blunt tip separates key structures including vessels rather than puncturing them, as with a sharp tip).  
6. Using a temporary product such as HA which has the option of hyaluronidase to quickly resorb some of the product.  
7. Avoid the use of autologous fat injections which are highlighted in the literature as being associated with embolisation and visual loss.  
8. Avoiding scarred tissue areas (scars may fix vessels and fibrous tissue)  
9. The glabella region should be reserved for those more experienced.  
The classical signs of impending vascular compromise are immediate-onset skin changes, with blanching, violaceous, or mottled appearance, and severe pain that is inconsistent with that of the typical injection.  

There is also the possibility of delayed-type necrosis with symptoms occurring several hours after injection. Swift recognition of vascular compromise and urgent intervention can potentially prevent progression to necrosis, and therefore if suspected, the injection should be stopped immediately. Aspiration of the filler can be attempted before taking steps to improve blood flow. This includes massaging the area, application of warm compresses, as well as 2% nitroglycerin to promote vasodilation.  

The topical nitroglycerin paste can be applied every one to two hours initially. Hyaluronidase should be injected into the site of HA fillers, and some suggest the use of hyaluronidase regardless of the filler used. A course of aspirin to prevent further clot formation has been suggested, as well as low molecular weight heparin for more severe cases. The use of hyperbaric oxygen therapy may be helpful in patients with impending extensive skin necrosis.  

Once necrosis has occurred, good wound care with daily dressing changes are important to minimise scarring, as are antibiotics for any superadded skin infection. Antivirals should be considered if necrosis occurs around the mouth. Intralesional steroid injections, light dermabrasion and surgical revision may be considered for persistent scarring.  
The patient should be made aware of the risk of visual impairment and blindness. Direct injection of filler material into one of the distal branches of the ophthalmic artery (dorsal nasal, angular artery, zygomaticotemporal, zygomaticofacial, supraorbital and supratrochlear arteries) can lead to retinal artery occlusion. Urgent referral to an ophthalmologist is needed if there are any concerns regarding vision following injection.  

Complications: Late Onset  
Late complications occur weeks to years after injection and comprise chronic inflammation and infection, nodules and granulomas, filler migration and scarring.  

Migration  
Soft tissue fillers may migrate to a location away from their site of injection and may occur some years post-injection. It can lead to mass lesions and swellings in other areas, including a ‘popcorn lip’ and patient dissatisfaction. It can also result in inadvertent compression of other structures (Figure 2). Migration is more commonly associated with permanent and semipermanent fillers, such as calcium hydroxylapatite and silicone, rather than temporary fillers, which are reabsorbed before migration can occur. However, cases of migration with temporary fillers such as HA are reported. It may occur due to poor technique; large volumes injected under high pressure for example, and may be triggered by chronic inflammation or granuloma formation. Treatment options may include resorption with hyaluronidase or surgical removal.  

Nodules  
Subcutaneous nodules are a known complication of dermal filler injections and usually trouble the patient. They may be non-inflammatory or inflammatory, and present as lumps weeks to months following treatment.  
Non-inflammatory nodules tend to be painless and palpable lumps that do not grow in size. They are usually localised to the injection site, but it is possible for the nodules to migrate. Localised accumulation of filler is the most common cause of non-inflammatory nodules which may be due to overcorrection, injection of the filler too superficially or failure to discontinue the injection prior to removal of the needle. Fillers such as HA, calcium hydroxylapatite and poly-L-Lactic acid require injection into dermis or deeper and nodules will form if injected superficial to this. Whilst it may seem that a deeper injection is better, it is important to consider that the risk of vascular compromise will increase and the augmentation effect may not be as evident.  
Appropriate depth of HA injection is also important to avoid the complication referred to as the ‘tyndall effect’ which describes a bluish discolouration of the skin due to too superficial placement of the filler. It occurs because of the light-scattering capacity of the filler material and is more likely to occur in areas with thin skin such as pinnaeally and tear troughs. It may be mistaken for a bruise, but does not resolve within a few days unlike bruising. Careful skin assessment pre-procedure and avoidance of areas of thin skin is important to prevent discolouration, and firm massage, aspiration and hyaluronidase injections can be used for treatment.  
Non-inflammatory nodules occurring after HA injection usually resolve with hyaluronidase. Those that form following injection with other filler types can be treated with massage in combination, with or without, either lidocaine or normal saline, before a trial of intralesional steroid injections. Further treatment options include injections of 5-fluorouracil (5-FU) and surgical excision as a last resort.  

Non-inflammatory nodules should be distinguished from granulomas and biofilms, which occur as a result of inflammation around the foreign-body filler material and can be differentiated from a non-inflammatory nodule by tenderness, swelling, possible erythema and expression of pus. Granulomas typically appear later than non-inflammatory nodules (several months to years as opposed to several weeks) and form in an attempt to contain any foreign material by encasing it in a capsule of immune cells such as macrophages. Intralesional corticosteroid injections remain the mainstream of granuloma treatment. Other therapies such as intralesional injections of 5-FU and hyaluronidase for HA fillers may be helpful, and surgical excision is required if other therapies fail.  

A biofilm is an accumulation of microorganisms that are either associated with a surface, such as a foreign implant, or attached to another and form a living colony. They typically present as chronic and recurrent infections at the injection site and although antibiotics may provide some temporary relief, usually definitive treatment is with removal of the filler and its biofilm.  

Although most complications including infection are not specific to a particular dermal filler, polyacrylamide gel (PAAG) is particularly biocompatible and provides bacteria an excellent material on which to multiply. This can lead to late infections, abscesses and fillers. If not...
response to conventional antibiotic treatment, it is imperative to consider infection with atypical species.18

Conclusions
Dermal fillers are becoming increasingly popular. Clinicians should be fully aware of the signs and symptoms of complications and how to avoid them as much as possible. Adverse effects can occur early and appear to be minor but may still be concerning for the patient. Serious complications such as skin necrosis can be life-changing and even life-threatening. Good anatomical knowledge and proper technique can help to reduce the risk of complication, and when a complication does occur, the clinician should understand how to manage them from observation to surgical intervention.

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Mechanisms and treatment options for chronic non-allergic rhinitis

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Abstract
Patients who present with chronic rhinitis are very frequently encountered in the physician’s office. The best-studied form of chronic rhinitis is allergic rhinitis, however, the prevalence of non-allergic rhinitis amongst the chronic rhinitis population is high and the disorder is an important cause of widespread morbidity. Despite this fact almost no diagnostic tests and very little treatment strategies are available for this patient group. Chronic non-allergic rhinitis covers an extensive range of differential diagnoses and comprises drug-induced, hormonal, occupational, gustatory and idiopathic rhinitis. The causal factors and pathophysiological mechanisms are only defined for some of these forms. This review summarizes the causes of non-allergic rhinitis as well as the available options for diagnostic work-up and treatment strategies. It aims at providing a tool for a more precise-based approach of non-allergic rhinitis patients in order to obtain an improvement of their quality of life.


Key words
Non-allergic rhinitis, nasal hyperreactivity, capsacian, nasal provocations

Introduction
The prevalence of chronic rhinitis is estimated to be around 30% of the Western population and is a significant cause of widespread morbidity, health care costs and reduced work productivity. Chronic rhinitis is defined as a symptomatic inflammation of the nasal mucosa, leading to nasal obstruction, rhinorrhea, sneezing and/ or nasal ocular itch. Two of these nasal symptoms should be present for at least 1 h daily for a minimum of 12 weeks to define the chronicity. Although sometimes mistakenly viewed as a disease of the skin, symptoms of rhinitis may significantly impact a patient’s quality of life.

While viral infection is the most common cause of acute allergy, allergy is the best-studied form of chronic rhinitis. Allergic rhinitis (AR) is relatively easy to diagnose by the combination of typical symptoms and positive skin prick tests (SPT) or the detection of allergen-specific IgE in the serum. However, a large group of patients suffering from chronic rhinitis has no systemic signs of allergy and they are consequently classified as non-allergic rhinitis (NAR). This patient group forms a diagnostic and therapeutic challenge and probably accounts for about half of the total chronic rhinitis population. In contrast to large-scale and well-conducted epidemiological and immunological studies on AR, data on the prevalence, pathophysiology and treatment of NAR is scarce. Currently, it is believed to be a heterogeneous patient population suffering from symptoms that are often indistinguishable from allergic rhinitis. This review summarizes the currently known etiologies of NAR and proposes a more accurate diagnostic work-up as well as therapeutic strategy.

Classification of NAR

Drug-induced rhinitis
The best known form of drug-induced rhinitis is ‘rhinitis medicamentosa’ which defines the nasal congestion that occurs with overuse of topical nasal vasoconstrictors. The exact mechanism is poorly studied, but it is believed that recurrent nasal tissue hypoxia and negative neural feedback with chronic decreased α2-receptor responsiveness are involved.

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In certain individuals suffering from a disorder of the in the eicosanoid synthesis, aspirin and NSAID’s can induce the symptoms.
In addition, antihypertensive medication like methyldopa, hydralazine, guanethidine, ACE-inhibitors and α- and β-receptor antagonists down-regulate the activity of the sympathetic nervous system, possibly inducing nasal congestion. Also immunosuppressive medication, oral contraceptives and psychotropic agents can lead to nasal symptoms.

**Rhinorrhea**

Rhinorrhea, often in the absence of other nasal symptoms. Senile rhinitis

**Senile rhinitis**

Senile rhinitis is the characteristic clinical picture of elderly patients, suffering from a persistent clear rhinorrhea, often in the absence of other nasal symptoms. Senile rhinitis is believed to be caused by an age-related dysregulation between the sympathetic and parasympathetic nervous systems that innervate the nasal mucosa, causing a cholinergic hyperreactivity, since anticholinergic drugs are effective in these patients.

**Smoking-related rhinitis**

Unlike its effect on lower airway physiology, the impact of tobacco smoke on the nasal mucosa is not well studied. Still, there is growing evidence that such exposure can have a significant impact on nasal function. Smokers show a higher prevalence of chronic rhinitis compared to non-smokers and several authors have reported that tobacco smoke exposure overall is associated with acute and chronic nasal symptoms. Chronic cigarette exposure leads to mucosal recruitment of CD4+ T lymphocytes, as well as decreased cilia beat frequency. Several components of cigarette smoke such as formaldehyde and acrolein act as a local irritant on the nasal mucosa.

**Hormonal rhinitis**

The most prevalent form of hormonal rhinitis is pregnancy rhinitis, which has been estimated to have a cumulative incidence of 22% by a large multicenter study. Pregnancy rhinitis typically starts during the second month of pregnancy, usually disappearing rapidly after delivery. But nasal congestion can even occur in conjunction with the rise in serum estrogen that occur at ovulation in the normal menstrual cycle. The pathophysiology remains largely unexplained, but estradiol has been shown to increase vasodilation and vascular leakage by stimulating nitric oxide production in addition to its general pro-inflammatory effects such as induction of eosinophilic migration and degranulation.

Increased nasal secretion in hypothyroidism has been reported on an anecdotal basis. It has been proposed that nasal symptoms occur in acromegaly, however, a Swedish study could not demonstrate the induction of nasal congestion in response to a growth hormone treatment.

**Occupational rhinitis**

Occupational rhinitis is defined as a rhinitis attributable to a particular work environment. Occupational agents are either biological proteins that induce a classic IgE-mediated allergic inflammation (high molecular weight [HMW] agents) or low molecular weight (LMW) agents. LMW sensitizers are capable of activating the adaptive immune system leading to a sensitization to the agent. They are mostly chemicals; but also, several drugs, metallic agents and wood types own this sensitizing capacity and only a minority of these agents induce detectable antigen-specific IgE, thus complicating diagnosis.

The non-sensitizing LMW agents are addressed as airway irritants. A single exposure to high concentrations of irritant induces an acute toxic effect on the respiratory mucosa, but recently there is increasing evidence that also long-term exposure to lower concentrations of irritants can induce a more chronic dysfunction of the nasal mucosa. Mechanisms responsible for irritant-induced rhinitis are not well known and are thought to involve epithelial damage and neurogenic inflammation.

The transient receptor potential (TRP) A1 channel that is expressed on the sensory nerve endings of the non-adrenergic, non-cholinergic (NANC) neural system in the nasal mucosa has emerged as being a major irritant detector.

**Idiopathic rhinitis**

In about 50% of NAR patients, the causative factor of their rhinitis remains undetermined. These patients are addressed as idiopathic rhinitis (IR) patients, formerly known as intrinsic or vasomotor rhinitis.

IR patients often report nasal hyperreactivity (NHR) as a key feature which is defined as the induction of nasal symptoms upon encounter of environmental stimuli, such as temperature/humidity changes, strong odours, cigarette smoke and other respiratory irritants. Although it is present in all types of rhinitis (infectious rhinitis, AR and NAR), it is the specific hallmark of IR.

**Local allergic rhinitis**

Multiple studies suggest that a subgroup of NAR suffer from a local allergic rhinitis (LAR). Despite a negative test for systemic specific IgE, some patients react positively to a nasal allergen provocation test with the induction of a Th2-type mucosal cell infiltration similar to AR. In some of these patients, allergen-specific IgE can be detected in the nasal mucosa. However, a lot of uncertainty exists about the prevalence of LAR and the exact pathophysiology and diagnostics.

**Diagnosis of NAR:**

By definition, a patient suffering from chronic rhinitis with a negative SPT and serum specific IgE test, suffers from NAR. Several explorations can help with further differentiation of diagnosis:

**History:**

For most subtypes of NAR, medical history is the key for diagnosis. Full evaluation should always include a determination of the pattern, triggers, duration of the symptoms, and the presence of any local nasal symptoms. Full evaluation should always include a determination of the pattern, triggers, duration of the symptoms, and the presence of any local nasal symptoms.

**Mechanisms of sensory nerve activation by chemical and thermal respiratory stimuli leading to nasal secretion and blockage via low threshold release of neuropeptides upon activation of TRP channels.**

**TRPV1:** Transient Receptor Potential (original, adapted from ref 28).
could be directive in choosing a therapy. Inflammatory or non-inflammatory pathology, which rhinitis but may help to distinguish between an currently, nasal sampling (cytology and nasal biopsies) is useful tools in provocation testing in NAR patients. However, these methods are mainly considered subjective sensation of nasal blockage and with each resistance. All techniques correlate relatively well with the method of choice to diagnose LAR. Nasal provocation tests During nasal provocation tests, the nasal mucosa of the patient is exposed to the suspected provocative agent and consequent changes in nasal patency and symptom scoring can prove the link between the administered agent and the symptoms. In case of a typical history of AR in the absence of systemic IgEis, provocation with the suspected allergen is the method of choice to diagnose LAR. When occupational rhinitis is suspected, nasal provocation testing with the suspected agent is the golden standard for making a definite diagnosis. To diagnose NHR, several provocation tests have been explored in the past, including metacholine, histamine, hypertonic saline and capsaicin. However, most of these substances are ineffective in discriminating IR patients from healthy controls or are too patient- or examiner-unfriendly. In 1998, the group from Amsterdam showed that intranasal exposure to cold dry air (CDA) was the most reliable method for measuring NHR symptoms. Recently these results were confirmed by Van Gerven as nephrology and Peak Nasal Inspiratory Flow meters objectively measure nasal airway resistance. All techniques correlate relatively well with subjective sensation of nasal blockage and with each other; however, these methods are mainly considered useful tools in provocation testing in NAR patients. 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and objective symptoms in NAR patients and therefore to medical therapy. Surgical intervention should be considered in those patients who respond insufficiently with IR but comes with surgical risks. Therefore it should be reserved for patients with important quality of life reduction and performed by experienced surgeons.

Conclusions

In this review, we discuss the diagnostic and therapeutic challenge of NAR. A consensus on classification, diagnostic work-up and treatment for the affected patients is needed, especially in the light of more treatment options becoming available nowadays. In this way, we can account for the growing need for precision medicine in upper airway disease.

References


Endoscopic repair cerebrospinal fluid (CSF) rhinorrhea

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Abstract
Cerebrospinal fluid (CSF) rhinorrhea is the result of an abnormal communication between the subarachnoid space and the sinonasal cavity, through a skull base defect. The vast majority of traumatic leaks will heal with conservative measures with surgical intervention reserved for patients who fail to respond to conservative management due to risk of meningitis. A careful diagnostic work up includes testing nasal fluid for Beta trace protein and identifying the site of leak with high resolution CT and or MRI imaging. Intrathecal injection of fluorescein can be extremely helpful in the diagnosis and also used intraoperatively to aid repair. The results of transnasal endoscopic repair have high success rates and are usually the first line treatment strategy.


Key words
CSF, rhinorrhea, repair.

Introduction
Cerebrospinal fluid (CSF) rhinorrhea is the result of an abnormal communication between the subarachnoid space and the sinonasal cavity, through a skull base defect. Persistent CSF leaks are divided into traumatic and non-traumatic. Between 80-90% of CSF rhinorrhea cases are traumatic and can range from between 10% to 37% if managed conservatively, underscoring the importance of early detection and timely repair.1,2 Historically, open intracranial approaches have been used to manage such cases, however advances in endoscopic endonasal surgery have revolutionised treatment of CSF rhinorrhea due to significantly less morbidity and higher success rates ranging from 87% to 100%.3

Accidental trauma
Traumatic CSF leaks can be a result of head injuries with anterior skull base fractures. This is seen in 15 to 30% of cases of skull base fractures and more frequently in comminuted fractures. These leaks often occur through the cribiform plate of ethmoid sinus roof due to tightly adherent dura in these areas. Most patients (80%) will present with CSF rhinorrhea in the first 48hrs and 95% of these patients will manifest within 3 months.4 In such cases, leaks rarely require treatment as up to 85% heal spontaneously with conservative management.5 Surgical intervention is usually indicated in patients who fail to respond to conservative management due to risk of meningitis.

Iatrogenic trauma
Iatrogenic CSF rhinorrhea accounts for 16% of traumatic cases.6 It can occur following routine endoscopic sinus surgery as well as more advanced skull base surgery. The most common site of injury is the lateral cribiform lamella with other sites being sphenoid sinus and posterior fossa ethmoidal sinuses. Risk of CSF leak following functional endoscopic sinus surgery is quoted as 0.5%, increasing with more complex skull base procedures such as clival tumours and revision surgery.6 The majority of these will be repaired immediately at the time of injury or will be transferred to a skull base centre for surgical repair.

Non-traumatic leaks
Spontaneous leaks account for the majority of non-traumatic leaks. The exact pathogenesis of spontaneous CSF rhinorrhea is unknown, however it is thought to be related to elevated intracranial pressures (ICP), commonly due to idiopathic intracranial hypertension (IIH). Patients with IIIH are classically middle aged overweight women and present with headaches, visual disturbance and papilledema. There is an increased prevalence of this disease in the western world over the last few decades, most likely as a result of the obesity epidemic.7 Spontaneous leaks secondary to sustained raised ICP are thought to result from increased dural pulsation with remodelling and thinning of the skull base creating an osteodural defect in pneumatised parts of the skull base.8 However, although elevated ICP has been implicated in spontaneous leaks, it is not the case in all patients with spontaneous CSF rhinorrhea.9,10,11 Historically, non-traumatic spontaneous leaks accounted for 4% of CSF leaks, however more recent data suggests spontaneous leaks may be more common, ranging from 20.8% to 40% of all CSF leaks.12

Other causes of non-traumatic leaks include tumours, mucoceles or infective processes eroding the skull base. Congenital causes can occur with or without raised ICP and these include encephaloceles, persistent craniopharyngeal canal (with or without tumour) and congenital widening of diaphragma sella.9

Diagnosis
It is very important to have a high index of suspicion based on the history of presenting patients. This includes a recent history of trauma or surgery, which holds true for the majority of patients with CSF rhinorrhea. The most common clinical manifestation is persistent clear rhinorrhea, often unilateral, made worse by bending over or Valsalva manoeuvre.13 Some patients may report a history of headaches in the presence of raised ICP or intracranial lesions.

A quick bedside test for CSF fluid is the presence of a double ring sign when drops of the fluid is placed on absorbent filter paper or the “halo sign” on a pillowcase. Bedside glucose detection using test strips is not recommended due to its lack of sensitivity and specificity.14 The gold standard test for CSF fluid is to test for Beta 2 transferrin by immunofixation electrophoresis, with a sensitivity of 94% to 100% and specificity of 98% to 100% 15. If there is a high index of suspicion or once the nasal discharge is confirmed as CSF, imaging is required to help locate the precise site of leak.

Imaging
Comparative tomography: (Fig 1) High resolution (0.5mm slice thickness) CT (HRCT) of the paranasal sinuses and skull base is the first line imaging modality, offering detailed osseous anatomy with greatest spatial resolution to pinpoint a site of dehiscence. HRCT has a sensitivity of 88% to 95% in identifying skull base defects with confirmed CSF leak.9 HRCT is also useful in delineating sinonasal anatomy for surgical planning and for use of intraoperative image guidance navigation. At the time of imaging an active leak does not have to be present to identify an osseous defect, however in the presence of multiple fractures or defects it can become difficult to identify which defects are responsible for the CSF leak.16 Another limitation of HRCT is that it offers poor soft tissue detail.

Having said that, if only one clinically correosponding osseous defect is identified, no additional imaging is required before proceeding to surgical repair17 unless there is concern that there may be a meningocoele or meningoencephalocele.

Magnetic resonance Cisternogram: (Fig 2) Coronal Magnetic resonance Cisternography (MRC) is performed with heavily T2 weighted (T2w) fat saturated images and serves as a complementary imaging modality alongside HRCT in cases of suspected intracranial herniation, due to poor osseous detail.18 A positive finding will highlight a CSF column communicating from the subarachnoid space with or without any meningeal or brain herniation. Sensitivity of MRC imaging in identifying the source of leaks is up to 94%.19

Computed tomography cisternography (CTC): This involves the use of intrathecal non-ionic iodinated contrast with scans taken in the prone and supine position,
The use of intrathecal fluorescein is off-licence yet can be very useful in identifying the location of CSF leaks intra-operatively. Commonly 0.1 ml of 10% fluorescein (10mg) is diluted in 10ml of CSF and injected intrathecally via a catheter over 10 minutes. This can be directly visualised intra-operatively and enhanced with the use of a blue light filter. Side effects reported from the use of fluorescein such as seizures are dose dependent and associated with much higher doses. Generally speaking, no side significant side effects have been reported with doses less than 10mg.2

Management

Conservative Management:
The vast majority of traumatic CSF rhinorrea can be managed conservatively for up to two weeks, with up to 85% of CSF leaks healing spontaneously.23 Failing this, the risk of meningitis necessitates for definitive surgical repair. Conservative measures include bed rest, laxatives, and the avoidance of anything that will increase ICP such as lifting heavy weights.

The use of a lumbar drain may also be considered but this carries additional morbidity and the evidence for its use is limited. The use of prophylactic antibiotics is a controversial topic and practice can vary due to conflicting evidence.24

A recent evidence based review conferred no added benefit from the use of prophylactic antibiotics in traumatic leaks.25 All patients should also be given pneumovax vaccination to prevent meningococcal meningitis.

Contrast Enhanced Magnetic resonance cisternogram (MRC):
This technique employs intrathecal gadolinium with subsequent T1 weighted sequences. Like with CTC, a positive study will show contrast leakage through dural and oesophageal disruption. Similar to CTC, MRC also requires HRCT for interpretation. MRC is particularly useful in cases of slow flow or intermittent leaks and offers increased sensitivity in comparison to HRCT with non-contrast MRC14,15. In high flow leaks sensitivity has been reported up to 100% with slow flow leak sensitivity being between 60-70%.26 Strengths of this technique include less radiation and easier interpretation in comparison to CTC due to better soft tissue/bone differentiation. Although gadolinium has been used safely worldwide at low doses, there is potential risk of neurotoxicity and so patient selection is very important19,20.

Intrathecal fluorescein: (Fig 3)
The use of intrathecal fluorescein is off-licence yet can be very useful in identifying the location of CSF leaks intra-operatively. Commodity 0.1 ml of 10% fluorescein (10mg) is diluted in 10ml of CSF and injected intrathecally via a catheter over 10 minutes. This can be directly visualised intra-operatively and enhanced with the use of a blue light filter. Side effects reported from the use of fluorescein such as seizures are dose dependent and associated with much higher doses. Generally speaking, no side significant side effects have been reported with doses less than 10mg.

Surgery

Open:
Open approaches to anterior skull base repair is far less common than historically. This can be either with an intracranial or extracranial approach. Open approaches are only rarely indicated. These may include: large encephaloceles, in patients with extensive multiple defects and for leaks associated with intracranial lesions or haematomas. Leaks difficult to manage endoscopically, such as fluid in the posterior frontal sinus wall, may sometimes require an open cranial approach. However, these techniques are associated with a significantly higher rate of morbidity compared to purely endoscopic approaches21.

Transanal Endoscopic:
Advances in endoscopic sinus surgery have led to it being the preferred method of repairing CSF leaks, due to significantly reduced morbidity and excellent outcomes. Success rate from endoscopic repair ranges from 70% to 100% on first attempt and 86% to 100% in revision/redo surgery.27 A variety of graft material can be used for repair of the skull base, including fat, bone, allografts, free mucosal or fascial grafts, vascularized flaps as well as synthetic grafts and sealants to hold the repair in place. There is currently no evidence that supports one material to be superior to another and their use very much relies on the site and size of defect as well as surgeon’s preference28.

However, in the presence of large defects (>3cm) or high flow leaks, vascularized grafts (eg nasoseptal or pericranial) confer improved outcomes with lower post-operative leaks rates29,30, especially in tumour surgery in which patients may receive post-operative radiotherapy. In reality, surgeons often use a mulitlayer technique with variety of graft material or haematomas. Leaks difficult to manage endoscopically, such as fluid in the posterior frontal sinus wall, may sometimes require an open cranial approach. However, these techniques are associated with a significantly higher rate of morbidity compared to purely endoscopic approaches21.

Complications of repair include headache, meningitis, pneumocephalus, haematomas, abscess formation and recurrence.31 In cases where localising the defect is difficult, intrathecal fluorescein can be used intra-operatively to confirm the exact location of the dural defect and observe CSF leaking using a blue light filter. Complications such as seizures have rarely been reported after its use but this is eliminated when lower concentrations of fluorescein are used.

Conclusion

Trauma still continues to be the most common cause of CSF rhinorrea. Early diagnosis and swift intervention is the key to managing these patients. In most cases the site of leak can be identified with appropriate imaging and repaired with a transanal endoscopic approach.

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Orbital and optic nerve decompression

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Abstract

Background: The concept of orbital decompression was first described in 1890 by Julius Dollinger. However, in recent decades the endoscopic approach to the orbit and optic nerve has evolved. The underlying pathologies that lead to increased intraorbital pressure secondary to extrinsic compression of the globe or that lead to optic nerve compression are varied, but they are linked as they all impact on optic nerve perfusion pressure and can cause optic neuropathy.

The indications for orbital decompression can be acute or chronic. However, optic nerve decompression should only be considered if there is evidence of compressive optic neuropathy with deteriorating visual acuity, unresponsive to medical treatment, in the presence of an intact optic nerve. Prior to surgery thorough work up in conjunction with an ophthalmologist is essential.

We discuss developments in surgical techniques for orbital and optic nerve decompression.


Key words
Orbit, optic nerve, decompression, endoscopic

Anatomy

The orbit is a rigid anatomical structure made up of 7 bones, bound by 4 bony walls and bound anteriorly by the eyelids and orbital septa. The posterior aspect of the orbit narrows to a confluence forming the orbital apex where the optic canal, superior orbital fissure and inferior orbital fissure transmit nerves and vessels into the orbit. The rigid boundaries of the orbit create a fixed capacity of approximately 30ml and there is little room to accommodate any significant increase in volume of the globe or extraocular soft tissue. As a consequence, changes in volume are associated with extrinsic compression of the globe and sequelae such as proptosis, diplopia and visual loss.

Likewise, the optic canal which runs through the lesser wing of sphenoid and transmits the optic nerve and ophthalmic artery, is a fixed capacity bony canal and any change in volume of its contents can result in compressive optic neuropathy.

This often manifests as slowly progressive decrease in visual acuity, with dyschromatopsia; a relative afferent pupillary defect; visual field defect; and optic atrophy or oedema.

Background

The concept of orbital decompression was first described in 1890 by Julius Dollinger. The traditional external approaches are well established i.e. trans conjunctival, transcranial and lateral orbitotomy. However, in recent decades the endoscopic approach to the orbit and optic nerve has evolved, initially endonasally, as pioneered by Kennedy et al in 19901 and more recently via endoscopic transorbital neuroendoscopic surgery (TONES).2 These approaches are minimally invasive and allow good access and visualization of ocular structures.

Aetiology

The underlying pathologies that lead to increased intraorbital pressure secondary to extrinsic compression of the globe or that lead to optic nerve compression are varied, but they are linked as they all impact on optic nerve perfusion pressure and can cause optic neuropathy (see table 1). The most commonly encountered of all these pathologies is thyroid eye disease.

Indications

The indications for orbital decompression can be acute or chronic. (See table 2) The indications for optic nerve decompression are, however, more tenuous and the literature is inconclusive. There have been studies to show...
that it is of no benefit in traumatic optic neuropathy due to the high rate of spontaneous resolution in visual acuity. However, the literature suggests that optic nerve decompression should be considered if there is evidence of compressive optic neuropathy with deteriorating visual acuity, unresponsive to medical treatment, in the presence of an intact optic nerve.

**Work up**

Ophthalmological assessment is essential prior to the procedure. This includes measurement of visual acuity, assessment of colour vision, evaluation of proptosis and assessment of eye movements and diplopia.

A CT scan evaluating the orbits and sinuses is required to rule out anterior ethmoid artery, presence of an Onodi cell and extent of the middle turbinate attachment, location and course of the posterior ethmoid artery, and the presence of an Onodi cell as the optic nerve may course through the lateral aspect of the cell. Furthermore, MRI imaging of the orbit and brain is the imaging modality of choice when assessing the optic nerve and soft tissue within the orbit.

**Procedure**

The goals of surgery are in optic nerve decompression are to reduce or reverse vision loss. Orbital decompression has the additional goals to prevent ocular surface damage; relieve orbital pain and congestion; reduce proptosis, diploto, lid retraction, chemosis, lid oedema, and fat prolapse.

There are 4 areas in which orbital decompression can be achieved (See table 3). Each has unique considerations and can impact on subsequent rehabilitative ocular surgery e.g. eyelid and strabismus procedures, therefore we feel these patients should be managed in conjunction with ophthalmology colleagues. In this article we will focus on transnasal orbital decompression.

**Technique**

Endoscopic visualization via the trans nasal route allows access to the medial aspect of the orbit, orbital floor and orbital apex making it an ideal approach for accessing both intra and extra conal structures located in the medial and posterior aspect of the orbit. It has the advantage that it is low morbidity when compared to other techniques and does not leave a scar. However, it can be associated with new onset or worsening of pre-existing strabismus, double vision and globe dystopia, therefore patients must be counselled on the possible need for subsequent strabismus surgery.

**Orbital Decompression**

After adequate decongestion of the nose the surgeon first performs a large middle meatal antrostomy with removal of the uncinate process anteriorly and bony removal extending posteriorly to the posterior maxillary wall. The superior limit is the orbital floor and inferior limit is the superior margin of the inferior turbinate.

Then a complete spheno – ethmoidectomy is performed to keep the eyeball in the same axial position reducing the risk of double vision. An inferiormedial orbital strut is preserved (Figure 3) to keep the eyeball in the same axial position reducing the risk of double vision.

If an inferior decompression is required, the medial aspect of the orbital floor is often thicker than the lamina papyracea and is thinned carefully with a high speed diamond Burr with the inferior orbital nerve used as the landmark as it is of no benefit in traumatic optic neuropathy due to the high rate of spontaneous resolution in visual acuity.

**Table 1: Underlying Aetiology of Globe and Optic Nerve Compression**

<table>
<thead>
<tr>
<th>Inflammatory disorders</th>
<th>Trauma</th>
<th>Neoplasia</th>
<th>Benign masses</th>
<th>Infection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thyroid eye disease</td>
<td>Bony displacement</td>
<td>Sella/parasellar masses</td>
<td>Mucoceles</td>
<td>Abscess</td>
</tr>
<tr>
<td>Ocular myositis</td>
<td>Hematoma</td>
<td>Orbital/orbital apex masses</td>
<td>Meningiomas</td>
<td>Post sepal cellulitis</td>
</tr>
<tr>
<td>Systemic inflammatory</td>
<td>Oedema</td>
<td>Nasal/paranasal masses</td>
<td>Fibrodyplasia</td>
<td></td>
</tr>
<tr>
<td>disease</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Table 2: Indications for orbital decompression**

<table>
<thead>
<tr>
<th>Acute</th>
<th>Chronic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute optic neuropathy</td>
<td>Disturbing proptosis</td>
</tr>
<tr>
<td>orbital compartment syndrome</td>
<td>chronic pain/discomfort</td>
</tr>
<tr>
<td>corneal decompensation</td>
<td>congestion</td>
</tr>
<tr>
<td>acute globe subluxation</td>
<td>corneal exposure/ulceration</td>
</tr>
<tr>
<td>Severe orbital inflammation</td>
<td>Progressive orbitopathy not responding to other measures</td>
</tr>
</tbody>
</table>

**Table 3: Areas of Orbital Decompression and Surgical Access**

<table>
<thead>
<tr>
<th>Fat Compartment</th>
<th>Transcutaneous</th>
<th>Transconjugal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Orbital floor</td>
<td>Transorbitral</td>
<td>Transantral</td>
</tr>
<tr>
<td>Medial Wall of Orbit</td>
<td>Transorbitral</td>
<td>Transnasal</td>
</tr>
<tr>
<td>Lateral Wall of Orbit</td>
<td>Tranorbital</td>
<td>Transsyndival</td>
</tr>
</tbody>
</table>

**Figure 1:** Image of left skull base after complete ethmoidectomy (white arrow)

**Figure 2:** Left lamina papyracea being removed with cottles elevator.

**Figure 3:** Coronal CT scan showing inferomedial strut of bone that is preserved between the medial orbital wall and inferior orbital walls.

**Figure 4:** Posterior lateral limit. The periorbita is carefully lifted off the floor of the orbit and the floor is then carefully removed with a j shaped curette or sicle knife.
Auricular prominence and otoplasty – An overview

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Abstract
Auricular prominence is a common cosmetic variation which has significant psychological effects on school-aged children. Though the definition prominence itself is highly subjective, it is well documented that alterations in ear size, shape, position and projection having significant influences on overall individual appearance. It can ultimately lead to poorer educational performance and longer lasting psycho-emotional issues. While moulding techniques are commonplace in the first six months of life, thereafter there needs to be the consideration of potential surgical intervention if required. These can be divided in cartilage-preserving and cartilage-cutting techniques. In this article we give an overview of auricular prominence, ear anatomy, clinical evaluation, historical management, current treatment options, and potential complications.


Key words
Otoplasty, Pinaplasty, Auricular Prominence, Bat Ears, Ear Protrusion

Introduction
Affecting 5-10% of the population, auricular prominence is a common cosmetic deformity, with ear size, shape, position and projection having significant influences on overall individual appearance.1,2,3 Though there are no significant associated functional deficits, it has a profound psychological impact, especially in a younger demographic and school-age children.3,4

These individuals have been found to have difficulties in social integration, manifesting as behavioural problems and worsening school performance.4 Being bullied, teased and ostracized eventually leads to feelings of inadequacy, as well as eventual social and economic disadvantages from lack of attendance or engagement with education. Ultimately the backlash from this cosmetic deformity can lead to psycho-emotional issues lasting a lifetime.5,6

Ear correction surgery is the fourteenth most frequent cosmetic surgery in females, and sixth in males.6 With evidence highlighting enhanced self-confidence, as well as positive subjective impacts on general health and well-being, in addition to improved school performance, parents often refer their children for surgical options. It has been shown that early treatment has greater positive impacts.7,8

It was for the aforementioned reasons that the National Health Service (NHS) released guidelines for consideration of surgery in those under the age of nineteen years. However, in this economic climate there has been an increased scrutiny regarding most forms of aesthetic surgery including otoplasty.

Anatomy
The architecture of the auricle primarily involves the helix, antihelix, concha, trigus and lobule. There are also ancillary structures such as the antitragus, intertragal incisures and Darwin’s tubercle.1 While the otic placode presents during the third week of gestation, the external ear continues to grow even after skeletal maturity with ear length increasing for a longer duration than width.1,2 Even with increasing age, gradual microscopic changes with regards to cartilage cell density and numbers of elastic fibres play important roles when considering intervention, with regards to cartilage cell density and numbers of elastic fibres play important roles when considering intervention, such as decreased skin elasticity and resilience.1,3

The astrocyte is a common source of fat, elastin, keratin and other fibres play important roles when considering intervention, such as decreased skin elasticity and resilience.1,3

With regards to innervation, the auricle receives its supply from the auriculotemporal branch of the trigeminal nerve, facial nerve, glossopharyngeal nerve, Arnold’s nerve from the vagus and nerves from the second and third cervical plexus. Vascular supply is typically from the superficial temporal artery, the posterior auricular artery and the lesser occipital arteries.4

References
There have been numerous anthropomorphic studies with regards to defining the ideal ear, finding common distances and angles. The distance between the lateral helix to the scalp should ideally be 30mm, producing an auriculocsephalic angle ranging from 20 to 30 degrees. The conchal bowl extends to a depth of 15mm, and produces a conchascophal angle which is normally less than 90 degrees. 9,15,16

When considering vertical height and width, the latter should be approximately 55% of the former. If the typical height is approximately 60mm, this would make the width around 35mm. Irrespective of ethnicity, males have been found to have longer and wider ears when compared to females across all age groups.2,3,14,15

Auricular Prominence

In this review we will mainly consider prominurias, the most common indication worldwide when performing otoplasty. However, it must be noted that there are other aetiology resulting in malformation which require surgical intervention.

Prominuria is typically seen when the auriculocsephalic angle is greater than 30 degrees or the conchascophal angle is equal to or greater than 90 degrees. 6,9,17,18

It can be inherited in an autosomal dominant pattern, with questions regarding family history important during consultation. The two main factors resulting in this condition include a poorly developed antihelical fold and a retro-auricular skin with subsequent conchomastoid angles.2,3,10,12,13

These irregularities may occur in isolation, but most frequently produce protrusion together in varying degrees. If considering the mechanism, when the antihelical fold is inadequately curved, there is a prevention of the normal posterior folding of the helical-scaphal unit, which in turn lengthens the distance between the mastoid skin and the helical rim, leading to greater ear prominence. Specifically, this variation leads to prominence of the upper and middle thirds of the ear. In contrast, conchal hypertrophy deepens the bowl and displaces the helical rim, forcing the auricle away from the scalp and brings forward the middle third of the auricle.2,3,15

Optimal Age of Intervention

It is universally accepted that the ideal time of therapeutic or operative intervention is between the ages of four and six. Between these ages, the external ear reaches approximately 85% of its maximal width and 50 to 60% of its maximal height, in addition to having a patient demographic not yet fully subjected to bullying.1 By the age of six, the ear is technically classified as a mature ear. Cartilage pliability is still malleable enough to contribute to higher rates of success and delaying management to this age has not shown to contribute significantly to psychological morbidity long term, though there are studies showing poorer quality of life leading up to this point from peer ridicule.6,12,21,22 If the patient is far older, the auricular cartilage becomes more calcified and less malleable, resulting in higher rates of failure.1

It is important to note we are considering patients who have grown beyond the age of nonsurgical moulding or splinting techniques. While these are an effective avenue in the first few weeks of life and up to six months, beyond this the rigidity of the cartilage makes it resistant to conventional moulding techniques.2,20

Patient Evaluation and Analysis

There are numerous anatomical variables which are used to evaluate the auricle. When analysing the ear in isolation it is important to consider whether in general it is oval, round, triangular, rectangular or variations and combinations of these shapes. The position and size of the intertragal notch must be noted, with significant variations noted between individuals. With regards to the lobule, it must be attached or free, as well as variable in size and shape.2

However, analysing the ear without consideration of the face globally will eventually lead to suboptimal surgical results. The Frankfort horizontal plane is an axis used to gauge spatial relationships between the ear, eyebrow, eyes and nose.14 This passes through the inferior orbital rim to the top of the tragus. Above this, the superior edge of the ear should theoretically be level with the eyebrow and lie parallel to the Frankfort line. Below it, the lobule should lie at the level of the nasal tip, with the overall length of the ear equal to that of the nose, from the nasion to the subnasale.3,5,12,23

There is no requirement for pre-operative imaging in patients with normal acoustic function, but pre-operative photographs must be taken anteriorly, posteriorly and laterally.

As mentioned previously, psychological impact of auricular prominence is well noted and must be addressed during the consultation. It is important to manage expectations of surgical outcomes, as well as garnering an insight into the patient’s viewpoints and understanding. Self-confidence and social interactions are two topics which should be spoken about individually. There are also calls for psychological evaluation, especially in a paediatric population pre-operatively, with hopes of engagement in the decision-making process.1,2,6

Aesthetic Goals for Intervention

The primary goal of therapeutic intervention is to restore acceptable auriculocsephalic, conchascophal and conchomastoidal angles.4 The results should be reliable, stable and satisfactory for the patient, as well as creating a closely symmetrical result.

More specifically, McDowell has previously listed a set of goals with regards to otoplasty.2 These included to correct the protrusion of the upper, middle and lower third of the auricle, with protrusion of the upper third the most important. If examining the patient anteriorly, the helix should extend beyond the antihelix, at least up to the mid-ear. The helix should have a smooth regular line. The postauricular sulcus should not be markedly distorted. The ear should not be placed too closely to the head and the positions of the two ears should match closely, ideally within 3mm at any given point.

Historical Intervention

Dieffenbach reported the first documented technique of otoplasty in 1845, where he described the resection of retro-auricular skin with subsequent conchomastoid fixation.6 He did this when managing auricular prominence post-traumatically, but it only corrected the cephalic auricular angle and there was significant recurrence.4 The technique was enhanced in 1881, by Ely who included conchal and triangular fossa cartilage excision as a second-stage procedure.1 He corrected the antihelical fold and its fixation.28 He did this when managing auricular prominence resulting in malformation which require surgical intervention.25 This the rigidity of the cartilage makes it resistant to conventional moulding techniques.2,20

Mustarde’s and Furnas’s techniques are both cartilage-preserving. Mustarde’s technique involves full thickness horizontal mattress suturing through the antihelical perichondrium along the posterior cartilage using non-absorbable sutures to re-create the antihelical rim, but not conchal bowl. A cartilage tattoo with methylene blue can be used to mark the location if required. There are typically three to four sutures required when recreating an antihelical fold placed about 10mm apart.2,24 The Furnas technique on the other hand focused on the management of excessive conchal cartilage.15 Four permanent conchomastoidal sutures are placed, avoiding the anterior conchal skin and help with relocation.

Cartilage Splitting

Cartilage-splitting techniques were started by Gibson and Davis, who noticed that when the cartilage was incised it tended to splay to the opposite side. Subsequently, there has been a large number of subsequent modifications involving scoring, scratching, scraping, filing, rasping or abrading.30,36-38 Criticism of these techniques include the creation of sharp contours, but with modifications, this is gaining greater advocacy when used appropriately.19

There has also been the rise of incisionless otoplasty such as transdermal abrasion of the cartilage at site of a desired fold and percutaneous Mustarde-type sutures, as well as laser-assisted cartilage remodelling, however these are not yet commonly encountered.19,19 Though skin is excised in some techniques, with subsequent conchomastoid angles. The results should be reliable, stable and satisfactory for the patient, as well as creating a closely symmetrical result.

Current Surgical Intervention

With over 100 reported procedures in the literature there is likely no gold standard, but we will attempt to give a brief overview of popular management options.2,20 Techniques can be subdivided in cartilage-preserving and cartilage-cutting, though most surgeons use a combination of these.

Both techniques require access, using a postauricular incision eventually hidden in the postauricular sulcus. Though skin is excised in some techniques, with adioposalic tissue left behind, others advocate that this is not necessary and may result in hypoplastic ear. The scaphal region and mastoid fascia are both exposed when raising anterior and posterior skin flaps.

Though some surgeons prefer operating under local anaesthesia in adults, general anaesthesia is commonly required in children.

Surgical Complications and Sequelae

These can be divided into early and late complications. The most concerning early complication is haematoma formation leading to cartilage and skin necrosis, ultimately
form a cauliflower deformity. This can also occur secondary to overtightening of sutures and occasionally excessive pressure from the dressing. Other early complications include bleeding, infections including perichondritis and dehiscence.

Late complications can include excessive scarring and keloid formation, a hidden helix anteriorly, extrusion, hypersensitivity and deformities such as a telephone ear deformation, reverse telephone ear or a vertical post deformation. The most common aspect to consider in patients, however, remains dissatisfaction and poor aesthetic outcomes. Residual asymmetry is apparent six months postoperatively and loss of correction occurs in 6.5 to 12% of cases, requiring re-operation.42

Conclusion

It is clear that otoplasty is a useful surgical management option for patients with auricular prominenence which can provide a vast improvement in patient quality of life. There can be various management options which must be considered during consultation for optimal outcomes.

References

Lyme disease is infection with bacteria of the genus Borrelia – typically Borrelia burgdorferi. The vector is a tick (genus Ixodes, usually in nymphal form). In Europe, Ixodes ricinus (the tick-borne bean tick) is the usual culprit, and transmits the infection more rapidly than Ixodes scapularis, the typical North American vector. The disease is not known to be transmissible between people, via other animal vectors, or through faeco-oral routes.

Facial palsy may be the only symptom of Lyme disease, can be unilateral or bilateral, and usually resolves within eight weeks if the underlying infection is treated. It is the most common cranial neuropathy in Lyme meningitis14,15, but can occur secondarily to Lyme disease without meningeval involvement. One theory is that this relates to direct invasion of the nerve trunk by Borrelia; however, evidence is weak, comprising retrospective studies showing that a high percentage of children with confirmed neuroborreliosis and unilateral palsy had an ipsilateral source such as a tick bite in the head & neck region13,14.

HIV infection rarely causes facial palsy in children directly, although it can do so, typically presenting during the serconversion illness17. Where HIV infection leads to direct involvement, although where it does, it typically occurs during HIV infection rarely causes facial palsy in children branchial arch development sequence disorders26. Two and multisystem dysmorphia. It can occur secondary to 1000 live births, and risk factors include large head size delivery compounds the problem. The incidence is 1.8 per infant mastoid, the mandibular angle and the maternal perinatally acquired. The facial nerve position relative to the infant mastoid, the mandibular angle and the maternal may result in palsy18.

In areas without access to vaccination programmes, compression from mumps parotitis may be a common cause17.

Other infections which have been linked to onset of facial palsy in children include CMV, EBV, adenovirus, rubella, mumps, influenza B, coxsackie virus and Rickettsia (Mediterranean spotted fever)19,20,21. Facial palsy has been noted in 38% of patients with CHARGE syndrome13, and some reports detail patients with an aberrant facial nerve course, complicating cochlear implantation16.

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and also with those individuals showing a typical onset of idiopathic palsy but failing to show any improvement at six months85. Presence of forehead sparing (facial palsy with preserved temporal branch function) mandates imaging. Facial movement may be voluntary or emotional in origin, and the lower motor neurone pathway is common to both. Dissociation of voluntary facial movement from emotional movement therefore suggests a supratentorial problem and mandates imaging.

Imaging is also indicated if clinical findings suggest cholesteatoma, chronic otitis media, mastoiditis, temporal bone trauma or neoplasia.

Electrophysiology

Electrophysiological tests can determine the extent of facial nerve dysfunction, and therefore do have prognostic value. They may also assist in determining when surgical decompression may be recommended and when facial reanimation should be considered. If performed in series, they may allow monitoring of recovery, and so may guide management. In the case of palsy noticeable shortly after birth, electrophysiology can help distinguish between traumatic and congenital lesions.

In the first few days after onset of palsy, assessment of the blink reflex (via stimulation of the supraorbital nerve and recording of activity in the orbicularis oculi muscle) can provide useful information. The amplitude in comparison to the unaffected side is reduced significantly in both traumatic and congenital facial palsy. The blink reflex is normally present at birth and disappears by six months58.

Electroneuronography (ENoG, also known as a motor nerve conduction study) compares nerve conduction between the two sides, and therefore requires a functioning contralateral nerve. The main trunks are stimulated at the stylo-mastoid foramen, and compound muscle action potentials (CMAPs) are detected at the nasolabial fold. Their amplitude in comparison to the unaffected side is reduced in both traumatic and congenital facial palsies. The reduction of the amplitude of the CMAP normally begins within three days, and reaches differing conclusions on the merits of antiviral therapy. Most evidence for this comes from studies that, of those (adult) patients with CMAPs >30% of normal, 84% recovered normal facial function95. CMAPs <10% of normal are generally agreed to represent poor prognosis, although even in this group up to one-third of patients may show near-complete recovery96.

Idiopathic (Bell’s) palsy

Direct evidence is poor in the paediatric population, as there are no high-quality trials, however the prognosis is generally favourable63,64. The mainstay of treatment in adults is early administration of oral steroids – a recommendation supported by several high-quality trials46,47,48,49,50 and meta-analyses51,52,53,54,55. Trials have reached differing conclusions on the merits of antiviral agents administered with steroid therapy; antiviral monotherapy was found to be no better than placebo.

In the absence of high-quality evidence in children, national bodies and learned societies recommend early intervention with oral steroid. A typical regime might be Prednisolone 2mg/kg od (maximum 60mg) starting within 3 days of symptom onset, continuing for 5 days, followed by a short taper87.

Although large well-regarded clinical trials have not found additional benefit with added antiviral therapy, some trials have found benefit in particular for (adult) patients with severe palsy88. Some bodies therefore also suggest combining steroid therapy with an oral antiviral such as valaciclovir 20mg/kg (maximum 1g) tds for 7 days. Expert opinion has not reached consensus on this point89.

Ramsay-Hunt syndrome

Patients with herpetic zoster oticus should be treated with antiviral therapy and oral steroid.

Other infections

AOM and neuroborreliosis should be managed according to local protocols, in consultation with expert microbiologists. Bacterial meningitis is often treated with dexamethasone, or with amoxicillin plus cefuroxime.

Surgical intervention

There are no high-quality studies concerning early surgical management of facial palsy in children. One non-controlled study in adults evaluated surgical decompression of the labyrinthine segment via a middle cranial fossa approach, showing benefit in patients with severe palsy (defined as ≥90% reduction in CMAPs on electrophysiology)90. Another study reported that early surgical decompression was not associated with improved recovery but was associated with reduction in future episodes of palsy91. Guidance from the American Academy of Neurology in 200192 and AAO-HNS in 201393 do not recommend surgical decompression, owing to the paucity of high-quality evidence and the potential for surgical complications.

Children with congenital or permanent palsy may be offered surgical intervention, either for static appearance or reanimation94,95. Static procedures aim to achieve oral and labial symmetry at rest; reanimation techniques aim to allow some facial expression. These techniques cannot restore normal function, although even a modest improvement may be of great psychological benefit96,97. The timing of such procedures is best decided in a multidisciplinary team.

Prognosis

True congenital facial palsy has a relatively poor prognosis, owing to underdevelopment of crucial structures. Conversely, perinatally-acquired traumatic palsy has a good prognosis, with nearly all studies showing some improvement over time95.

Most studies have investigated the prognosis of idiopathic palsy, and observational studies of children have been conducted. Overall, the current literature finds that the majority of children recover with minimal or no dysfunction, and that likelihood of complete recovery correlates with severity, with partial/incomplete palsies more likely to recover to normal function than dense/complete palsies. Typically, improvement is seen within six months96,98,99. The largest cohort of children studied to date was 463, within an overall cohort of 2570 in the 25-year Copenhagen study; 90% of children recovered full facial function88.

Prognosis is generally more favourable if some recovery is seen within 21 days of onset100. If no improvement has been seen within 4 months, a diagnosis of idiopathic palsy should be questioned, and confirmatory investigations arranged91. Severe lesions, requiring extensive axonal regrowth, are more likely to lead to axonal misdirection, and thereby synkinesis or “crocodile tears”.

The House-Brackmann grading system is intended to be a shorthand for severity, and thereby provide prognostic information. Although the literature bears this out, one study (in adults) has suggested that muscle electrophysiology provides superior prognostication, particularly in more severe cases90.

Work is underway to determine reliable prognostic thresholds based on electrophysiology. One study reports that, of those (adult) patients with CMAPs >30% of normal, 84% recovered normal facial function95. CMAPs <10% of normal are generally agreed to represent poor prognosis, although even in this group up to one-third of patients may show near-complete recovery96. There are no recent studies evaluating surgical decompression; those conducted 30–40 years ago agreed that surgical intervention was unlikely to alter prognosis, and carried significant risks94,98.

Recurrent of idiopathic palsy is unusual in all age groups, and should provoke further investigation, including imaging and serial blood pressure measurement91. One series reported a 6% recurrence rate (11 of 182 children), of which two cases were associated with Melkersson-Rosenthal syndrome91.

Key points

• Idiopathic (Bell’s) palsy is the most common cause of acquired facial palsy in childhood.

• Other important causes of acquired palsy include hypertension and Lyme disease.

• The anatomy of the childhood facial nerve accounts for its vulnerability during birth trauma.

• Imaging and electrophysiology are the most valuable investigations.

• The prognosis of idiopathic palsy in childhood is generally good.

• Treatment involves supportive measures, particularly eye care, oral steroid therapy and possibly antiviral therapy. Most evidence for this comes from studies conducted in adults.
Abstracts: ENT Masterclass Trainees’ Gold Medal 2019

Accuracy of clinical coding and financial renumeration for endoscopic sinonasal procedures: Multidisciplinary changes through a two cycle quality improvement project

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ABSTRACT

Background
Clinical coding is the process of translating medical terminology into an international syntax familial to the non-medical staff. Health resource grouping (HRG) is the method to summarize disease diagnosis and procedure into informal units of Hospital Episode Statistics (HES).

Aims
Assess the accuracy of clinical coding in endoscopic sinonasal procedures. Investigate the effect of intervention to improving the accuracy.

Methods
A two-cycle service evaluation including all rhinology patients operated on at a single tertiary centre in the UK in 2017. Each cycle lasted 4 months. The operation notes were reviewed by two clinicians briefed in clinical coding to generate the ‘standard’ codes template. The ‘original’ clinical codes assigned and their related HRG retroactively obtained. A Second cycle piloted the generated multidisciplinary standard template (MST) to improve accuracy between a rhinology firm who used the template and another who didn’t.

Results
45 and 49 procedures were recorded in the 1st and 2nd cycle respectively. From the first cycle, accuracy of original coding was 62%. Of the miscoded procedures 18%, 9% and 11% were over, under and wrongly coded respectively. The inaccuracy in coding resulted in a tariff over-payment of £109.92 per procedure. In the second cycle, streamlining coding procedures significantly improved in the firm who used MST.

Conclusion
There were significant inaccuracies in translation of endoscopic sinonasal procedure into clinical coding. The inaccurate financial remuneration cause constrained on healthcare systems. MST is easy to interpret by clinicians and non-medical staff. It can reduce errors in coding and enable more accurate funding allocation to hospitals.

Streamlining tonsillitis and peritonsillar abscess treatment. The new 4 hour target!

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Introduction
There has been a significant rise in tonsillitis and peritonsillar abscess related admissions and complications. This can be attributable to a substantial reduction in tonsillectomies since the introduction of procedures of limited clinical effectiveness (POLCE). As a result there has been an increasing amount of bed days associated with these common ENT presentations with significant financial burden. Data suggests there have been no net savings as a result of these additional bed days.

Objective
To create, implement and evaluate an evidence based 4 hour treatment bundle for the management of tonsillitis and peritonsillar abscess.

Method
All patients who presented to a large teaching hospital with tonsillitis or peritonsillar abscess over two, one month periods were included, between which the 4 hour treatment bundle was implemented. This treatment included the use of intravenous fluids, analgesia, antibiotics, corticosteroids, plus needle aspiration in peritonsillar abscess patients. Patients were reassessed on completion of treatment bundle. Outcomes measured were overnight admission and re-admission rates.

Results
Admission rates prior to the introduction of the treatment bundle was 75% with 3 readmissions. Admissions reduced to 25% after the introduction of the treatment bundle and reassessment with no readmissions.

Conclusion
The introduction of a 4 hour treatment bundle safely reduces admission rates of patients with tonsillitis and peritonsillar abscess. This data is being used to introduce an ambulatory day unit on the ward, to further provide a streamlined, safe treatment service to reduce pressure on beds as well as reduce financial burdens associated with patient admissions.
Canalostomy as a surgical approach to local drug delivery into the inner ears of adult and neonatal mice

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Objective:
Local delivery of drugs into the inner ear is a promising therapy for inner ear diseases. In this study, we aimed to evaluate the effectiveness and safety of the drug delivery through semicircular canals (canalostomy) in both adult and neonatal mice.

Methods
A fast-green dye or adeno-associated virus serotype 8 with the green fluorescent protein gene (AAV8-GFP) was inoculated into the inner ear of mice through canalostomy. Following surgery, animals underwent swim tests and auditory brainstem response (ABR) measurements. Then inner ears were harvested for morphological studies and immunohistochemistry.

Results
The canalostomy facilitated broad distribution of fast-green dye in both cochlea and vestibular end-organs. In mice after AAV8-GFP injection, no signs of vestibular dysfunction were found, and there were no changes of ABR thresholds after surgery. Extensive GFP expression and no morphological lesions were detected in the cochlear and vestibular end organs. Robust GFP expression was found in inner hair cells, marginal cells, spiral ganglion neurons, vestibular hair cells, vestibular supporting cells and vestibular ganglion neurons.

Conclusion
Canalostomy is an effective and safe approach to drug delivery into the inner ears of adult and neonatal mice and may be used to treat human inner ear diseases in the future.

Neuroprotective effects of NMDA-Rs blocker on the Auditory Cortex in salicylate-induced tinnitus

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Abstract
Object
To examine the effect of administering NMDA-Rs blocker at different times on the changes of neurochemicals and electrophysiology in the auditory cortex (AC), the center of auditory perception, in a rat tinnitus model induced by salicylate (SS).

Method
This study simultaneously monitored the dynamic change of ascorbate and glutamate in the AC during SS-induced tinnitus and its response to intraperitoneal administration of MK-801 by in vivo microdialysis with an online electrochemical system (OECS) and high-performance liquid chromatography (HPLC).

Result
We found that the levels of both ascorbate and glutamate were more significantly suppressed in the groups of MK-801 given at 30 min pre or post SS injection than the levels in the group of MK-801 given at 60min post SS injection compared with the SS only injection group. Electrophysiological recording performed on the SS-injection animals revealed that the spontaneous firing rate (SFR) of neurons in the AC was dramatically increased. The animals treated with MK-801 showed a significantly attenuation of hyperactivity in AC both in the groups of MK-801 given at 30 min-pre or -post SS injection and 60min-post SS injection.

Conclusion
These findings suggest that NMDA-Rs are involved in the pathological mechanism underlying salicylate-induced tinnitus, and also indicate that therapeutic effects on tinnitus are depend on the administration time of the blocker of NMDA-Rs , which might advance studies on understanding the therapeutic potential of NMDA-Rs antagonist in tinnitus therapy.
Outcomes of Parotidectomy from a single surgeon in a District General Hospital setting

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Abstract

Introduction
80% of all salivary gland tumours occur in parotid. 80% of these are benign pleomorphic or mixed adenomas. Purpose of parotidectomy is to remove abnormal growths in parotid gland. During the procedure the facial nerve is at risk and great care is taken to preserve this.

Aim
To evaluate the outcomes of patients who had surgery under a single surgeon for parotid lumps from April 2004 to Nov. 2018

Methods
A retrospective case notes review of parotid surgeries, by a single surgeon, was performed. Data collected included patient demographics, presentation, radiological and histological investigations, operative findings, outcomes, complications and histopathology.

Results
Between 2004 – 2018, 339 patients underwent parotidectomies. 95.6% of the parotid tumours were benign. 59% of these were pleomorphic adenoma. FNA could accurately confirm diagnosis in 62.5% cases. Temporary facial weakness was noticed in 33% of operated cases. Permanent palsy was seen only in one which was preoperative. Other postoperative complications (seroma, wound infection, Frey’s) found in 13% of the studied group.

Conclusion
Outcome rates were comparable with published data. The incidence of postoperative complications is influenced by the pathology, with inflammatory lesions significantly increasing the risk of facial nerve dysfunction and other complications. Overall, the incidence of permanent facial paralysis was less than 1%, but temporary nerve palsy was common at 33%, with most patients regaining normal function within 1 year of the operation. In most cases facial weakness improves to normal or near-normal levels within 6 weeks.

A Study Evaluating The Effects of Throat Packs During Nasal Surgery – A Randomised Controlled Trial

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Objectives
The aims of this study were to identify differences in post-operative nausea and vomiting (PONV) and throat pain between throat packed and non-packed patient groups in nasal surgery.

Methods
This was a prospective, double blind, randomised controlled trial. Patients were randomised into throat and non-throat pack groups. A validated PONV questionnaire was completed 6 hours post-operatively. Visual analogue scores (VAS) for throat pain were completed in recovery, 2, and 6 hours post-operatively.

Results
80 patients were enrolled (40 into each group based on power calculation). The mean PONV score for the throat pack group was 2.5 and the mean PONV score for the non-packed group was 0.36. The difference in PONV was not statistically significant (P value = 0.018 (95% CI = 1.13 - 2.52)). At 2 hours and 6 hours post-operatively, statistical analysis showed no difference in the mean throat pain VAS scores for the throat packed group experiencing more throat pain in recovery (P value = 0.018 (95% CI = 1.13 - 2.52)). At 2 hours and 6 hours post-operatively, statistical analysis showed no difference in the mean throat pain VAS scores for the throat packed group (2.1 and 2.3 respectively) and non-throat packed group (2.3 and 1.4 respectively).

Conclusion
The use of throat packs in nasal surgery does not confer PONV reduction benefit. The use of throat pack however is associated with a small but statistically significant more throat pain in the recovery period.