The Adenoid in Children: A comparison of two methods of performing adenoidectomy and two methods of preparing the nose prior to endoscopy to assess adenoidal size

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DECLARATION

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INTRODUCTION

The nasopharyngeal lymphoid aggregate was first described in 1724 by Santorini. In 1870 Wilhelm Meyer first used the term adenoids to describe nasopharyngeal lymphoid vegetations.

Adenoidectomy (alone or in association with tonsillectomy) is one of the oldest and most frequent ENT procedures performed in children. [1] Adentonsillar hypertrophy, obstructive sleep apnoea, otitis media with effusion, recurrent otitis media and nasal obstruction remain the most common indications for adenoidectomy.

Embryology and anatomy of the adenoids:

Adenoids start developing in the third month of foetal development with the subepithelial infiltration of lymphocytes in the posterior nasopharynx. The adenoids are completely formed by the seventh month. At birth neonates are exposed to the outside world and the adenoids become colonized with bacteria. Adenoids grow in childhood (until 5 to 7 years of age) in response to antigenic challenges (e.g. virus or bacteria) and start to regress just before puberty. [2, 3] Adenoids are usually not visible in adults, unless associated with a specific disease such as Human Immunodeficiency Virus (HIV).

The adenoid tissue is positioned in the midline of the posterior nasopharyngeal wall immediately inferior to the rostrum of the sphenoid. It makes up the most superior portion of the pharyngeal lymphoid tissue termed Waldeyer's ring. The superior part of the nasopharynx communicates with the posterior portion of the nasal cavity via the choanae. The adenoids can be enlarged enough to obstruct the choanae. The percentage of obstruction of the choanae is often used to grade the size of adenoids. [4, 5]

The space created lateral to the adenoid and postero-medial to the Eustachian tube orifice is termed the fossa of Rosenmuller. Gerlach's tonsil is lymphoid tissue within the lip of the fossa of Rosenmuller and can extend into the Eustachian tube. Inferiorly, the adenoid tissue abuts the superior margin of the superior constrictor or Passavant's ridge.

The blood supply to the adenoid tissue arises from branches of the external carotid artery, namely the ascending pharyngeal, ascending palatine, pharyngeal branch of maxillary artery, artery of the pterygoid canal and sphenopalatine artery. Venous drainage is into the facial and internal jugular system. Branches of the Glossopharyngeal (IX) and Vagus (X) nerves provide sensory innervation and will explain the referred pain to the ear and throat associated with adenoid infection.

The surface of the adenoids differs from the tonsils in that the adenoids have deep folds and few crypts, while the tonsils have a large number of crypts (10-30). Ciliated pseudostratified columnar epithelium lines the adenoids and is important for mucociliary clearance. Neither the tonsils nor the adenoid tissue possess afferent lymphatics. [2, 3]

Function of the adenoid:

The adenoids form part of the secondary immune system and are thought to be involved in protecting the host against pathogens invading the upper respiratory tract. Human adenoids and tonsils are known to be immunologically reactive lymphoid organs, which manifest specific antibodies as well as B and T cell activity in response to a variety of antigens. Since the adenoids are located at the back of the nasal airway, they provide defence against inhaled substances [6].

A system of clefts covered by specialized epithelium allows intimate contact between antigens and immune competent cells. Antigens are transported by membrane cells in the specialized squamous epithelium to a tubo-vesicular system where they are captured by APC

(antigen processing cells) and transported to the next layer, the extra-follicular area. This layer, rich in T-cells, contains abundant vasculature allowing circulating lymphocytes to gain access to the adenoids. The lymphoid follicle is encased by the mantle zone where mature lymphocytes reside. At the core of the lymphoid follicle is the germinal centre where immunoglobulin production takes place by B cells. [2, 3]

Lower doses of antigen may induce plasma cells to differentiate from B cells; higher doses may induce a polyclonal B cell proliferative response, with resultant hyperplasia. The more mature lymphocytes reside in the mantle zone of lymphoid follicle, which usually faces the crypt epithelium. They probably play a more important role in local immunity [6, 7, 8].

The importance of tonsil and adenoid tissue in host immune defences is unclear. Most studies have failed to demonstrate significant differences in immunoglobulin production in children with recurrent tonsillitis. The possible immunological effects of tonsillectomy and adenoidectomy are still controversial. In a review of long-term follow-up studies, Paulussen et al showed that while tonsillectomy may lead to certain changes in the cellular and humoral immune system, these alterations are clinically insignificant and no increase in immune-modulated diseases should be expected. [8] In the early period after adenotonsillotomy there is a statistically significant decrease in the values of humoral and cellular immunity parameters. This, however, normalizes 6 months after surgery. [9]

Pathology

At birth, the nasopharynx and adenoids are accessible to many organisms due to the establishment of the upper respiratory tract. Normal flora found in the adenoid consists of alpha-hemolytic streptococci, enterococci, Corynebacterium species, coagulase-negative staphylococci, Neisseria species, Haemophilus species, Micrococcus species, and Stomatococcus species. The adenoids can become infected and harbour pathogenic bacteria, which may lead to the development of diseases of the ears, nose, and sinuses. The most common pathogenic bacteria are resistant subtypes of Streptococcus pneumoniae, beta-

lactamase producing and non-typable Haemophilus influenzae and Moraxella catarrhalis. [10] Chronic infection of the adenoids results in impaired mucociliary clearance and stasis of secretions. Increased exposure time to antigenic stimuli then results in an increased inflammatory tissue response. [3]

Based on the current literature, adenoids can contribute to recurrent sinusitis and persistent or recurrent ear disease by harbouring a chronic infection. The type and amount of pathogenic bacteria seem to vary based on the disease present and the age of the child

Recurrent or persistent middle ear effusion

The etiology of recurrent or persistent otitis media in children is multifactorial. The two main factors accounting for disease in the middle ear are immune function and Eustachian tube function. Infants have poor immune function and impaired Eustachian tube function, both of which improve with age. Many children outgrow their ear infections because of this maturity. Persistent ear infections in children are usually related to persistent immature Eustachian tube function. Dysfunction can either be related to chronic adenoid infection, or dysfunction related to congestion. Several studies indicate that Eustachian tube function is improved and fluid collection in the middle ear is prevented following adenoidectomy, independent of the size of the adenoids. [11, 12]

A number of studies have evaluated the role and possible mechanism of the adenoids in causing ear infections. It has been established that the adenoids are involved, but the mechanism of Eustachian tube dysfunction remains unclear. The debate was whether Eustachian tube dysfunction was related to a physical obstruction or the harbouring of a chronic infection within the adenoids. A further debate was whether the bacteria that are harboured in the adenoids cause irritation of the Eustachian tube lining, resulting in dysfunction, or whether they cause a chronic low-grade infection in the middle ear space, resulting in persistent fluid collections in the middle ear. [11, 13]

Pillsbury et al demonstrated more pathogenic bacteria in the adenoid beds of patients with recurrent otitis media than in the adenoids of patients with persistent serous otitis media or adenoidal hypertrophy. [14] Additionally, Brodsky and Koch cultured more bacteria from the adenoids of patients with either recurrent otitis media or persistent otitis media than from the adenoids of patients without infections in the head and neck. When they compared the number of pathogenic bacteria in the adenoids of patients with otitis media and rhinosinusitis to patients with adenoid hyperplasia alone causing nasal airway obstruction, they found no difference. [15] Even more confusing is the fact that Maw and Speller found the same amount of pathogenic bacteria in the adenoids and tonsils of patients with otitis media with effusion as was found in patients without any head and neck disease. [16]

Regardless of the mechanism or size of the adenoids, adenoidectomy has been shown to be effective in resolving chronic persistent otitis media with effusion and possibly recurrent otitis media in children. [17]

Chronic sinusitis

For patients with chronic sinusitis, the adenoids appear to act as a reservoir for infection. This is based on the improvement observed following adenoidectomy independent of the weight of the adenoids in children with symptoms of chronic sinusitis as shown by Lee and Rosenfeld [18]. Additionally, Brodsky et al showed that the same pathogenic bacteria in the adenoids were cultured from the middle meatus. [15] McClay also showed that resistant bacteria were present in significant amounts in the adenoids of children with middle ear disease and rhinosinusitis symptoms compared with patients without those diseases or symptoms. [19]

Nasal airway obstruction

Enlarged adenoids can cause nasal airway obstruction by physically blocking the posterior aspect of the nasal airway. The clinical symptoms of nasal congestion, snoring, and mouth breathing may overlap with chronic sinusitis symptoms, and the physical obstruction may actually cause sinusitis by blocking normal nasal flow posteriorly, resulting in stasis of secretions and obstruction of the sinus outflow tract.

Often, enlarged adenoids can obstruct breathing patterns in children and can cause obstructive breathing with or without apnoea. In this case obstruction is based on the size of the adenoid alone and reduction of the adenoids will improve symptoms.

Rationale behind this study

There are two aspects regarding adenoidectomy that warrant further investigation. The first problem is that of adenoid recurrence and whether it is related to the method used for the primary adenoidectomy. In this regard I decided to compare the standard curettage technique to a method currently gaining wider acceptance, the suction diathermy technique by means of a prospective randomized controlled study. I decided to compare not only some aspects regarding removal of the adenoids, but more importantly the effect of each of these methods on the size and or recurrence of any residual adenoidal tissue six months after surgery. To compare accurately the two methods I had to visualize and grade the adenoids accurately at the patients' six-month follow-up visit.

The second problem that faces the clinician is regarding the visualization of the adenoids during examination. This can be very difficult as the adenoids are situated in an essentially hidden area. The current gold standard examination is direct visualization using a flexible fibreoptic endoscope, which is a minimally invasive technique with the potential for causing

anxiety and perhaps pain to the patient. In this regard I decided to compare the standard method of preparing the nasal cavity using a combination of topical decongestion and topical anaesthesia, with a decongestant alone, to see if discomfort increases in the absence of a topical anaesthetic.

References

1. Curtin JM. The history of tonsil and adenoidectomy surgery. Otolaryngology Clin North Am; 20 (1987) 415-419.

2. Dorn MT, Friedman NR. Tonsillitis, Tonsillectomy and Adenoidectomy. 1999 [cited; Available from: http://www.utmb.edu/otoref/Grnds/TandA-9912/TandA-9912.htm.

3. McClay JE. Adenoidectomy. 2006 [cited; Available from: http://www.emedicine.com/ent/topic316.htm.

4. Cassano P, Gelardi M, Cassano M. Adenoid tissue rhinopharyngeal findings: a novel approach to therapeutic management. Int J Pediatr 2003;67:1303-9

5. Santos R, Cipolotti R, D'Avila J, Gurgel RQ. Schoolchildren submitted to nasal fiber optic examination at school: findings and tolerance. J Pediatr (Rio J). 2005;81(6):443-6

6. Richtsmeier WJ, Shikhani AH. The physiology and immunology of the pharyngeal lymphoid tissue. Otolaryngol Clin North Am., 1987; 20(2): p. 219-28.

7. Wong D T, Ogra P L. Immunology of tonsils and adenoids—an update. Int. Pediatr. Otorhinolaryngol. 2 (1980), pp. 181–191

8. Paulussen C, Claes J, Claes G, Jorissen M. Adenoids and Tonsils, indications for surgery and immunological consequences of surgery. Acta Otorhinolaryngol Belg. 2000; 54(3): 403-8

9. Zielnik-Jukiewicz B, Jurkiewicz D. Implication of immunological abnormalities after adenotonsillectomy. Int J Pediatr Otorhinolaryngol. 2002 Jun 17;64(2):127-32

10. Karlidag T, Demirdag K, Kaygusuz I, Ozden M, Yalcin S, Ozturk L. Resistant bacteria in the adenoid tissue of children with otitis media with effusion. Int J Pediatr Otorhinolaryngol. 2002 May 31;64(1):35-40

11. Gates GA. Adenoidectomy for otitis media with effusion. Ann Otol Rhinol Laryngol Suppl 1994;163:54–58

12. Kadhim AL, Spilsbury K, Semmens JB, Coates HL, Lannigan FJ. Adenoidectomy for middle ear effusion: a study of 50 000 children over 24 years. Laryngoscope 2007 Mar;117(3):427-33

13. Maw AR, Parker A. Surgery of the tonsils and adenoids in relation to secretory otitis media in children. Acta Otolaryngol Suppl. 1988; 454:202–207

14. Pillsbury HC 3d, Kveton JF, Sasaki CT, Frazier W. Quantitative bacteriology in adenoid tissue. Otolaryngol Head Neck Surg 1981 May-Jun; 89(3 Pt 1): 355-63.

15. Brodsky L, Koch RJ. Bacteriology and immunology of normal and diseased adenoids in children. Arch Otolaryngol Head Neck Surg 1993 Aug; 119(8): 821-9.

16. Maw AR, Speller DC. Are the tonsils and adenoids a reservoir of infection in otitis media with effusion (glue ear)? Clin Otolaryngol 1985 Oct; 10(5): 265-9.

17. Maw AR, Herod F. Otoscopic, impedance, and audiometric findings in glue ear treated by adenoidectomy and tonsillectomy. A prospective randomised study. Lancet 1986;1:1399–1402

18. Lee D, Rosenfeld RM. Adenoid bacteriology and sinonasal symptoms in children. Otolaryngol Head Neck Surg 1997 Mar; 116(3): 301-7.

19. McClay JE. Resistant bacteria in the adenoids: a preliminary report. Arch Otolaryngol Head Neck Surg 2000 May; 126(5): 625-9.

Study 1

HYPOTHESIS:

That suction diathermy adenoidal ablation will be superior to simple curettage with respect to adenoidal "regrowth"

OBJECTIVE:

To compare adenoidectomy using suction-diathermy ablation to curettage adenoidectomy with respect to operative time and adenoid regrowth at six months after surgery

STUDY DESIGN:

A prospective, randomized, single blind, study to compare two methods of performing adenoidectomy. A group of 100 children, undergoing adenoidectomy alone or in combination with tonsillectomy, were randomized into two groups and underwent either suction diathermy or curettage adenoidectomy by a single surgeon

SETTING:

A tertiary care Paediatric Hospital

METHOD:

Indication for surgery, adenoidal size, duration of surgery and complications were recorded and compared. Six-month follow up was conducted and adenoidal size and symptom status were recorded and compared. Statistical analysis was performed using Microsoft Excel.

RESULTS:

One hundred patients participated in this study and underwent adenoidectomy alone or adenotonsillectomy. Ninety two patients returned for follow up and ninety one patients completed the study. The two treatment groups were well matched for age and gender. The main indications for both groups were snoring, nasal obstruction and obstructive sleep apnoea.

For adenoidectomy alone there was no significant difference in duration of surgery between the curette and suction diathermy groups. When performing tonsillectomy and adenoidectomy together suction diathermy took significantly longer to complete than curettage ($p < 0.001$). Overall 96% of patients' symptoms had either improved or resolved. The post-operative comparison at six months showed a significant difference in the residual adenoidal size between the two groups, the suction diathermy group being generally smaller than the curettage group.

CONCLUSIONS:

Suction diathermy was better at reducing the adenoidal size six months after surgery. Although the difference in size was statistically significant it did not seem to be of clinical significance. The only complication encountered was primary adenoidal bleeding in two patients in the curette group.

LITERATURE REVIEW / INTRODUCTION

Adenoidectomy (alone or in association with tonsillectomy) is one of the oldest and most frequent ENT procedures performed in children. [1] Adentonsillar hypertrophy, obstructive sleep apnoea, otitis media with effusion, recurrent otitis media and nasal obstruction remain the most common indications for adenoidectomy. Historically recommended instrumentation for performing adenoidectomy has varied from the surgeon's fingernail, a steel nail, cutting or biting forceps, adenotomes and adenoid curettes. [2] Although Guggenheim in1957 described a technique of direct adenoidectomy[3], the most commonly used technique today remains an essentially blind procedure using Beckman or La Force adenotomes. Using this procedure the surgeon relies on palpation (or occasionally mirror examination) to assess the adenoid tissue and pressure using postnasal packing for haemostasis. [4] Blood may pool and clot in the nasopharynx during the procedure. Before waking the patient up the nasopharynx should be gently suctioned to clear any clot. Failure to perform this may lead to potentially life threatening acute airway obstruction secondary to a clot falling into the larynx, (the "coroner's clot").

Complete removal of the adenoids is difficult to determine when performing curette adenoidectomy. The importance of removing laterally based adenoidal tissue when performing adenoidectomy for otitis media with effusion has been well described. [5] Studies to evaluate the efficacy of this conventional method in completely removing adenoidal tissue concluded its efficacy in less than 30% of patients. [6]

The search for an instrument to perform bloodless adenoidectomy successfully under direct vision has been the topic of numerous clinical trials. A number of instruments have been implemented to perform adenoidectomies, including electronic molecular resonance tool, suction diathermy, microdebrider and laser. [7, 8, 9]

One method that seems to be gaining popularity is transoral suction diathermy adenoidectomy while using a laryngeal mirror. This approach provides a direct-targeted route to the nasopharynx, improved visualization, a bloodless surgical field and improved evaluation of

the adenoids, the Eustachian tube and the posterior nasal choanae. The improved visualization enables the surgeon to remove choanal adenoids, which are present in 10% of patients. [10] It also allows the surgeon to avoid adjacent structures such as the Eustachian tube orifices. Adenoidal tissue encroaching on the Eustachian cushions can be suctioned medially and then ablated, therefore avoiding trauma to the Eustachian tube openings.

The benefit of suction diathermy in reducing intra-operative blood loss and post-operative bleeding has been well documented. [4, 8, 11, 12] Another benefit of this method is the ability to perform partial adenoidectomy, in cases where velopharyngeal insufficiency is considered a risk, for example in patients with submucous cleft palates. [11] Severe velopharyngeal insufficiency is rare following adenoidectomy and is estimated to occur in between 1:1500 and 1:10 000 procedures. It may lead to significant problems with hypernasal speech and swallowing with nasal regurgitation of fluids. [13]

Length of performing suction diathermy adenoidectomy has been reported as varying between five and 18 minutes. [11] Operating time has also been shown to vary with the experience of the surgeon. [14] A reduction in operative time was demonstrated by Wright et al when comparing curette and suction diathermy adenoidectomy alone. [14]

A prospective study by Wong et al concluded that there were no complications in the early (6-8 week) post-operative period in patients undergoing suction diathermy adenoidectomy. Seventeen percent of patients had evidence of minimal regrowth of adenoidal tissue. [15] To date there has been no published reports of nasopharyngeal stenosis following the use of suction diathermy ablation.

The long-term effect of suction diathermy on adenoid regrowth and symptom control has not been investigated sufficiently. In a cross sectional follow-up study of 175 children who underwent curettage adenoidectomy guided by a mirror and haemostasis achieved using suction electrocautery, adenoid regrowth, significant enough to cause nasal obstruction, was reported as rare. Seventy-one percent of patients had no residual obstructing adenoids. However, the criteria used for obstructing adenoids were tissue occupying more than 50 percent of the nasopharynx. [16] This conservative figure is supported by other studies where symptoms were encountered only at or above 50 percent obstruction. [17, 18, 19] The follow up of the patients in the study by Buchinsky et al [16] were between two and five years and it

could be argued that follow-up was too long. Since some children with adenoidal hyperplasia will undergo spontaneous resolution or improvement of symptoms during a two year period.

[20] Very few institutions perform long-term follow-up on adenoidectomy and/or tonsillectomy patients. It is therefore essential to compare this relatively new method with the tested conventional method in terms of medium to long-term efficacy.

The diagnosis of bovine spongiform encephalopathy (BSE) has prompted the search for a disposable instrument to perform adenoidectomy and therefore lessen the risk of transmission of the human form of BSE (variant Creutzfeldt-Jakob disease). Compared to disposable microdebrider blades, suction diathermy appears to be a more cost effective option.

AIMS OF STUDY

1. To determine the difference in operative time between suction diathermy adenoidectomy and curettage adenoidectomy.
2. To determine the long-term effect (6 months) on adenoid regrowth following suction diathermy adenoidectomy compared to curettage adenoidectomy.
3. To assess the long term (6 months) efficacy in symptom improvement of the two methods of adenoidectomy

MATERIAL AND METHOD

A prospective, randomized, single-blind, clinical trial was conducted. One hundred patients were recruited for the study from children scheduled for first time elective adenoidectomy alone or in combination with tonsillectomy. Patients were randomized into 2 groups (50 patients in each study group) by randomly picking pre marked pieces of paper (with curette or suction diathermy written on it) from a container prior to surgery. Parents all consented for inclusion of their children in the study. Routine surgical and anaesthetic pre-treatment investigations were performed.

The indications for surgery were recorded, and included obstructive sleep apnoea, snoring and nasal obstruction, recurrent otitis media with effusion and recurrent adenotonsillitis. Exclusion criteria included previous adenoidectomy and patients with bleeding disorders.

Intra-operative assessment of adenoidal size was made by nasopharyngeal mirror examination and graded according to the three level classification described by Wormald and Prescott. This grading system is based on the degree of choanae obstructed by adenoids. The grading system consists of grade 1 (<1/3 of posterior choanae obstructed), grade 2 (1/3 – 2/3 of posterior choanae obstructed) and grade 3 (>2/3 of posterior choanae obstructed). [17]

Length of procedure was recorded from insertion of Boyle-Davis gag until haemostasis was obtained. For adenotonsillectomy patients undergoing curette adenoidectomy the adenoidectomy was done first. The time was recorded from insertion of the gag until the post nasal space was packed for haemostasis and then again from the time the packs were removed until haemostasis was obtained. It therefore did not include the time the post nasal space was packed during the tonsillectomy. Although this is not a true reflection of the duration of the procedure it made practical sense as that is the general sequence in which adenotonsillectomies are performed. On the other hand in the suction diathermy group the time was recorded from insertion of the tonsil gag until the adenoidectomy was completed. All the surgery was performed by the same surgeon (first investigator). The patients received standard post operative care.

The patients were reviewed six months following the surgery and symptoms were compared to the pre-operative symptoms (resolved, improved, unchanged, worse). Furthermore the adenoidal size was assessed by flexible nasopharyngoscopy in the clinic and graded again (Grade 1-3). Previous studies have concluded that there is good correlation between nasendoscopy and mirror examination in assessing adenoidal size. [23] Flexible fibreoptic nasendoscopy is now considered the gold standard for evaluation of adenoidal size. [17, 21, 22] All endoscopies were performed by the same person (first investigator). An attempt was made to "double blind" this assessment by making a point of not reading operative notes of the procedure prior to endoscopy. Follow up was therefore double blinded as neither the surgeon nor the patients or parents knew which procedure the patient had. The pre and post operative adenoidal size was compared between the two treatment groups.

The data were entered into an Excel spreadsheet and statistically analyzed. Tests implemented in analyzing the data included Chi-square test, two-sample t-test, Mann-Whitney test and paired t-test.

The study was approved by the Ethical and Research Departments of this institution **(Ref: 036/2006)**.

SURGICAL METHOD

The procedure was performed under general anaesthetic. The patients were positioned supine with a sandbag under the shoulders and the neck extended. All the tonsillectomies were performed in a standard way using bipolar diathermy. The adenoidectomies were performed using either an adenoidectomy curette or suction diathermy. A Boyle-Davis gag was inserted. The palate was palpated to exclude a possible submucosal cleft. The posterior and lateral nasopharyngeal walls were palpated for pulsation, to exclude a possible aberrant carotid artery. The adenoidal size was assessed using a laryngeal mirror and graded according to the amount of the posterior choanae obstructed by the adenoids.

The suction diathermy method

A single small bore suction catheter was inserted into the nostril and brought out through the mouth. The two ends were then clamped under tension to retract the soft palate. The malleable suction coagulator was inserted into the nasopharynx by inserting it into the mouth behind the soft palate. The tip of the suction coagulator was then placed against the adenoidal tissue under vision using a laryngeal mirror. A coagulation diathermy current was then applied simultaneously with suction. The lowest current necessary to achieve tissue liquification (usually between 25 and 30 W) was used. The adenoids were therefore removed by a combination of coagulation and suction. Caution was taken not to damage the Eustachian tube openings. Meticulous attention was given to remove all the adenoidal tissue in the area of the posterior choanae. The diathermy machine used in all the cases was a Siemens Radiotom 905.

Intermittent blocking of the suction coagulator caused accumulation of smoke, obscuring the surgical field. This was overcome by introducing an additional suction device into the oral cavity during the procedure, which removed the smoke and secured optimum visualisation. The procedure was complete when the choanae were clearly visible and the nasopharynx had a smooth contour.

When performing an adenoidectomy in combination with tonsillectomy the tonsillectomy often has to be performed first to create adequate space for the mirror and suction diathermy device in the oropharynx.

The curettage technique:

After positioning the patient in the appropriate position and inserting the Boyles-Davis gag the adenoids were removed using variable sized adenotomes. Complete removal was then confirmed by digital palpation. Haemostasis was achieved by gauze swab tamponade in the post nasal space.

When performing tonsillectomy together with adenoidectomy the adenoidectomy is usually performed first and the adenoidal bed packed with gauze swabs before commencing with the tonsillectomy. This has time saving benefits as the adenoid haemostasis can be achieved while performing the tonsillectomy.

RESULTS / OUTCOME MEASURES

One hundred patients participated in this study and underwent adenoidectomy alone or adenotonsillectomy. Fifty patients had curette adenoidectomies and fifty patients had suction diathermy adenoidectomies. Ninety two patients returned for follow up and ninety one patients completed the study. One patient experienced severe anxiety and discomfort during endoscopy and assessment of his adenoidal size could not be done. This high rate of follow up was secured by establishing a good relationship with all the parents and patients. All the pre-op assessments, surgery and post-operative follow ups were performed by the same surgeon (first investigator). Patients who failed to turn up for their initial follow up visits were contacted via telephone and alternative appointments were scheduled. The eight patients that failed to return for follow-up could not be contacted.

The two treatment groups were well matched for age and gender (Table 1 and 2). There was no significant difference for age or gender. The total mean age was 6 years and 4 months and the patients ranged from 1year 2months to 13 years.

Surgical method	Male	Female	Total
Curette	28	22	50
Suction diathermy	21	29	50
Total	49	51	50

Table 1: Gender distribution. P = 0.161 (Chi-squared test)

Surgical method	Mean age	SD	Range
Curette (n 50)	6y 2m	35.1	1y 2m-13y
Suction diathermy (n 50)	6y 5m	33.9	1y 10m-12y 11m
Total	6y 4m	34.4	1y 2m-13y

Table 2: Age distribution. P=0.6420 (Two-sample t test)

The distribution of adenoidectomy alone and adenotonsillectomy were similar for both treatment groups. (Table 3) The majority of patients underwent adenoidectomy and tonsillectomy.

Surgical method	Adenoidectomy	Adenotonsillectomy	Total
Curette (n 50)	6	44	50
Suction diathermy (n 50)	8	42	50

Table 3: Distribution of adenoidectomy alone and adenotonsillectomy.

The distribution for surgical indications is outlined in table 4. The main indication for both groups was snoring and nasal obstruction followed by obstructive sleep apnoea, recurrent adenotonsillitis and recurrent otitis media with effusion.

Indication for surgery	**Curette**	**Suction diathermy**	**Total**
Snoring / nasal obstruction	19	29	48
OSA	16	12	28
Recurrent adenotonsillitis	10	7	17
Recurrent OME	5	2	7
Total	50	50	100

Table 4: Indications for surgery.

Duration of surgery showed wide variation in both groups (Table 5A and B). For adenoidectomy alone there was no significant difference between the curette and suction diathermy groups. When performing tonsillectomy and adenoidectomy together the suction diathermy took significantly longer than the curette ($p < 0.001$). As mentioned earlier, for curette adenotonsillectomy patients, the time was recorded from insertion of the gag until the post nasal space was packed for haemostasis and then again from the time the packs were removed until haemostasis was obtained. It therefore did not include the time the post nasal space was packed during the tonsillectomy. Although this is not a true reflection of the total duration of the procedure and achievement of haemostasis, it made practical sense as that is

the general sequence in which adenotonsillectomies are performed. Two patients in the curettage group had primary adenoid bleeds and one patient had subsequent laryngospasm and profound bradycardia. The time required to successfully treat these complications were not included in the procedure time for the relevant patients.

Surgical method	n	A	Total range
Curette	6	7.5	5.1-17.05
Suction diathermy	8	8.6	5.4-19
Total	14	8.03	5.1-19

Table 5A: Duration of surgery (in minutes) for adenoidectomy alone. P = 0.3017 (Mann-Whitney) test

Surgical method	n	T+A	Total range
Curette	44	5.15	2.35-21.54
Suction diathermy	42	8.3	3.06-22
Total	86	6.75	2.35-22

Table 5B: Duration of surgery (in minutes) for adenotonsillectomy. P < 0.001 (Mann-Whitney) test

When comparing the symptom improvement, there was no significant difference between the two groups. 63-73 percent of patient's initial symptoms resolved. A further 23-33% of patients improved. Only 2% of patients symptoms were unchanged and a further two percent of patients' symptoms were worse. Overall 96% of patients' symptoms had either improved or resolved.

Symptom improvement	Curette	Suction diathermy	Total
Resolved	32	30	62
Improved	10	16	26
Unchanged	1	1	2
Worse	1	1	2
Total	44	48	92

Table 6: Symptom improvement at six month follow up visit.

The median adenoidal size before surgery was 2.4 in both groups, thus between grade 2 and 3. Both procedures caused significant reduction in adenoidal size (Table 7 and 8). The post-operative mean adenoidal size was 1.9 in the curette group and 1.5 in the suction diathermy group.

Adenoid size	Mean	STD
Before (n 44)	2.4	0.69
After (n 44)	1.9	0.82
Difference (n 44)	0.5	0.76

Table 7: Pre and post-op adenoidal size for curettage adenoidectomy patients.

Adenoid size	Mean	STD
Before (n 47)	2.4	0.74
After (n 47)	1.5	0.75
Difference (n 47)	0.9	0.88

Table8: Pre and post-op adenoidal size for suction diathermy adenoidectomy patients.

There was a significant difference in post-operative adenoidal sizes between curette and suction diathermy groups. Suction diathermy showed superior reduction of the adenoidal size six months after surgery (0.0184). (Table 9B)

Group	Mean	Standard deviation
Curette (n 50)	2.3	0.72
Suction diathermy (n 50)	2.4	0.73

Table 9A: Comparing adenoidal size between curette and suction diathermy before surgery. P = 0.5820 (Two sample t-test)

Group	Mean	Standard deviation
Curette (n 44)	1.9	0.82
Suction diathermy (n 47)	1.5	0.75

Table 9B: Comparing adenoidal size between curette and suction diathermy six months after surgery. P = 0.0184 (Two sample t-test)

Comparing the distribution of adenoidal size between the two groups before and after surgery showed that the two groups were well matched before surgery (Table 10 A). The post-operative comparison showed significant difference in the distribution of the adenoidal size between the two groups, the suction diathermy group being significantly smaller (Table 10B). This will fit in with the suction diathermy being more effective in reducing adenoidal size.

Adenoidal size	Curette	Suction diathermy	Total
Grade 1	7	7	14
Grade 2	19	15	34
Grade 3	24	28	52
Total	50	50	100

Table 10A: Distribution of adenoid size before surgery. P = 0.678 (Chi-squared test)

Adenoidal size	Curette	Suction diathermy	Total
Grade 1	18	32	50
Grade 2	14	8	22
Grade 3	12	7	19
Total	44	47	91

Table 10B: Distribution of adenoid size at six months follow-up. P = 0.034 (Chi-squared test)

Two patients experienced complications a few hours after surgical intervention. Both patients had a primary adenoid bleed and one patient had subsequent laryngospasm and profound bradycardia. This was successfully treated by the anaesthestist and surgeon. Both patients were in the curettage group. This additional time to treat the complications was not included in the "duration of procedure"

DISCUSSION

Adenoidectomy alone or in combination with tonsillectomy is one of the most common operations performed by Otolaryngologists. Reduction of adenoidal size, removal of adenoidal tissue in the choanae and clearance of adenoidal tissue around the Eustachian tube openings are the important aspects in performing an adequate adenoidectomy. This should be easier to achieve with a method that can be performed under direct vision.

The benefit of suction diathermy in reducing blood loss has been well described in the literature [4, 8, 11, 12]. Being one of the most common operations performed, procedure time is therefore important. Procedure time when performing adenoidectomy alone, were similar when using either curette or suction diathermy. Although the numbers for adenoidectomy alone were small in this study similar results have been documented in other studies. [14]

When performing adenotonsillectomy, the suction diathermy technique took significantly longer ($P < 0.001$). As mentioned earlier, for adenotonsillectomy patients in the curette group, the time was recorded from insertion of the gag until the post nasal space was packed for haemostasis and then again from the time the packs were removed until haemostasis was obtained. It therefore did not include the time the post nasal space was packed during the tonsillectomy. Although this is not a true reflection of the duration of the procedure it is of practical importance as that is the general sequence in which adenotonsillectomies are performed.

The additional operating time required to successfully treat the two patients with primary bleeding in the curette group were not included in the procedure time for the relevant patients. Including this probably would have decreased the difference in procedure time between the two groups.

Although the actual procedure time has some relevance, the total time the child spends in theatre is probably of more importance. This is specifically important in children with upper

airway obstruction where the time taken to induce adequate anaesthesia and the time taken for the patient to emerge from anaesthesia is often long and unpredictable. In these patients the procedure time is probably not as important.

Both the curette and suction diathermy method provided symptom improvement in over 95 percent of patients for six months. Both methods were therefore very effective in controlling the symptoms associated with adenoidal pathology.

The suction diathermy technique was superior in reducing adenoidal regrowth during the 6 month follow up period (P = 0.0184). Although this reached statistical significance, we are unsure whether it is of practical significance, as the symptom improvement for both groups were in excess of 95 percent. The critical size for adenoids to cause symptoms is when they fill more than 50 percent of the posterior choanae [17, 18, 19]. That probably explains why even though the mean adenoidal size in the curette group was significantly larger; it was still small enough not to cause significant symptoms. Longer follow up will be necessary to establish if there will be a difference at a later stage.

Age of the patient at time of surgery can influence the amount of regrowth (ie. the older the patient, the higher the chance of natural regression of the adenoid). This was corrected for by the randomization process which revealed that the two groups were well matched for age.

REFERENCES

1) JM Curtin. The history of tonsil and adenoidectomy surgery. Otolaryngology Clin North Am 20 (1987) 415-419
2) Gibson JL. (1890) Adenoid vegetations in the nasopharynx, with special reference to position for operating. The Australian Medical Gazette. Aust J Otolaryngol 2000; 3: 438-439
3) Guggenheim P. (1975) Direct adenoidectomy. Arch. Otolaryngol. 66, 26-34
4) Hartley BEJ, Papsin BC, Albert DM. Suction diathermy adenoidectomy. Clin Otolaryngol. 1998, 23, 308-309
5) Wright ED, Pearl AJ, Manoukian JJ. Laterally hypertrophic adenoids as a contributing factor in Otitis media. Int J Paed Otol. 1998; 45: 207-214
6) Bross-Soriano, Schimelmitz-Idi J, Arrieta-Gomez JR. Endoscopic adenoidectomy; use or abuse of technology? Cir Cir. 2004 Jan-Feb; 72(1): 15-9; discussion 21-2
7) Tarantino V, D'Agostino R, Melagrana A. Safety of electronic molecular resonance adenoidectomy. Int Jour Ped Otol (2004) 1519-1523
8) P Walker. Pediatric adenoidectomy under vision using suction-diathermy ablation. Laryngoscope 2001 Dec; 111 (12): 2173-7
9) Sorin A, Bent JP, April MM. Complications of microdebrider-assisted powered intracapsular tonsillectomy and adenoidectomy. Laryngoscope 2004 Feb; 114(2): 297-300
10) Pearl AJ, Manoukian JJ. Adenoidectomy: indirect vision of choanal adenoids. J Otolaryngol. 1994, 23, 221-224
11) Wynn R, Rosenfeld M. Outcomes in suction coagulator adenoidectomy. Arch Otolaryngol Head Neck Surg. 2003; 129: 182-5
12) Clemens J, Mcmurray JS, Willging JP. Electrocautery versus curette adenoidectomy: comparison of postoperative results. Int J Pediatr Otorhinolaryngol 1998; 43:115-122
13) Saunders NC, Hartley BEJ, Sell D, Sommerlad B. Velopharyngeal insufficiency following adenoidectomy. Clin Otolaryngol 2004;29, 686-8
14) Wright E, Manoukian J, Shapiro R. Ablative adenoidectomy: A new technique using simultaneous liquefication/aspiration. J Otolaryngol 1997; 26: 36-43
15) Wong L, Moxham JP, Ludemann JP. Electrosurgical adenoid ablation, J Otolaryngol. 2004 Apr; 33(2): 104-6

16) Buchinsky FJ, Lowry MA, Isaacson G. Do adenoids regrow after excision? Otolaryngology Head Neck Surg. 2000; 123: 576-581

17) Wormald PJ, Prescott CA. Adenoids: comparison of radiological assessment methods with clinical and endoscopic findings. J Laryngol Otol. 1992; 106: 342-4

18) Kemaloglu YK, Gosku N, Inal E, et al. Radiographic evaluation of children with nasopharyngeal obstruction due to the adenoid. Ann Otol Rhinol Laryngol. 1999;108: 67-72

19) Elwany S. The adenoidal-nasopharyngeal ratio (AN ratio). Its validity in selecting children for adenoidectomy. J Laryngol Otol. 1987;101: 569-73

20) Paradise JL. Tonsillectomy and adenoidectomy. In; Bluestone CD, Stool SE, Maragret KA, editors. Pediatric otolaryngology. 3rd ed. Philadelphia: WB Saunders; 1996. p. 1054-65

21) Demain JG, Goetz DW. Pediatric adenoidal hypertrophy and nasal airway obstruction: reduction with aqueous nasal beclomethasone. Pediatrics 1995; 95: 335-64

22) Poole MD. Obstructive sleep apnea. In: Bailey BJ, Johnson JT, Kohut RI, et al, editors. Head and neck surgery-otolaryngology. 1st ed. Vol 1. Philadelphia: JB Lippincott; 1993. p. 598-611

23) Chisholm EJ, Lew-Gor S, Hajioff D. Adenoid size assessment: a comparison of palpation, nasendoscopy and mirror examination. Clin Otolaryngol. 2005 Feb; 30(1): 39-41

Study 2

HYPOTHESIS

That addition of topical local anaesthetic will result in less patient discomfort during nasal endoscopy than simple nasal decongestion with topical decongestant

OBJECTIVE

To evaluate the effectiveness of Lignocain 2% and Oxymetazoline 0,025% compared to Oxymetazoline 0,025% alone when administered prior to fibreoptic nasendoscopy in paediatric patients.

STUDY DESIGN

Prospective, randomized controlled, double blind study. A group of 56 children, undergoing nasendoscopy to determine adenoidal size, were randomized into two groups and received either Lignocain 2% and Oxymetazoline 0,025% or Oxymetazoline 0,025% alone prior to fibreoptic nasendoscopy.

SETTING

A tertiary care Paediatric Hospital

METHOD

The endoscopist recorded the ease of performance of the procedure, cooperation of patient and quality of the view achieved using a visual analogue scale (VAS).

The pain and anxiety levels of the child were recorded before, during and immediately after the procedure, using a VAS. Parental anxiety and parental satisfaction were also recorded by the pain specialists.

The duration of performing the procedure was recorded from insertion of the endoscope into the nostril until removal.

RESULTS

All 56 children were able to undergo the endoscopy and the full anxiety and pain assessment was done. Three children were excluded because they have undergone nasendoscopies before. Of the 53 patients included, 27 children received solution A (Oxymetazoline 0.025%) and 26 children received Solution B (Oxymetazoline 0.025% and Lignocain 2%).

There was no statistical difference between the two groups regarding the duration of the endoscopy, quality of view, ease of performance and cooperation of the patients. The median pain and anxiety scores were not significantly different between the two groups.

CONCLUSIONS

This study concludes that the use of a decongestant (Oxymetazoline) for paediatric nasendoscopy is just as effective as the use of Oxymetazoline with Lignocain. Pain and anxiety is not increased in the absence of Lignocain.

INTRODUCTION / LITERATURE REVIEW

Nasendoscopy is a minimally invasive diagnostic medical procedure. The use of a fibreoptic nasal endoscope in the paediatric otolaryngology patient is essential for making the correct diagnosis. It forms an important part of the examination of the nasal cavity, post nasal space, pharynx and larynx. Several authors have emphasized the importance of fibreoptic nasendoscopy for the diagnosis of conditions of the upper respiratory tract in the paediatric population. [1, 2]

Regarding the examination of adenoids, fibreoptic endoscopy has been shown to be superior to the traditional lateral neck x-ray in the diagnosis of enlarged obstructing adenoids. Firstly the x-rays cannot be used to diagnose small amounts of obstructing tissue or stasis of secretions obstructing the choanae and secondly they are highly dependent on patient positioning and cooperation.

Flexible fibreoptic nasal endoscopic examination has the major advantage of being feasible without general anaesthesia. This has major financial and time saving benefits. A study performed by Santos et al concluded that nasendoscopy can be performed with excellent tolerance in schoolchildren out of the hospital setting. [3]

Although the application of a topical anaesthetic before fibreoptic nasendoscopy is routine practice in many otolaryngology departments, the actual benefit to the patient of this procedure remains in doubt. The use of topical local anaesthesia in the paediatric population is generally regarded as safe, but there have been some reports of toxicity including arrhythmias and methemoglobinemia. [4, 5] A number of studies have been done in adults to compare various local anaesthetic agents. [6, 7]

The value of local anaesthesia in the adult population has been disputed in the literature [8] and one published study has actually shown no difference between local anaesthesia and placebo. [9] A study done by Frosh et al also showed no difference in benefit between local anaesthesia and placebo and they postulated that local anaesthesia actually makes the experience worse for the patient. [10] The authors also showed that the application of any

nasal spray, including normal saline actually makes the procedure more painful and overall more unpleasant for the patient. In addition topical anaesthesia applied to the nose leaves an unpleasant bitter taste in the mouth. [9, 10]

The use of topical intranasal anaesthesia in the paediatric patient can be very distressing for the patient. The bitter taste and discomfort in the throat caused by the anaesthetic will far outlast the pain and discomfort caused by the nasendoscope.

A study published by Sadek et al showed that decongestant alone is just as effective as decongestant with local anaesthetic in the adult patient. Pain was not increased in the absence of local anaesthetic and general unpleasantness was significantly reduced by a decongestant. [6]

This randomized controlled double blind study will investigate the benefit in using topical local anaesthetic when performing paediatric nasal endoscopy.

OBJECTIVE

To evaluate the effectiveness of Lignocain 2% and Oxymetazoline 0,025% compared to Oxymetazoline 0,025% alone when administered prior to fibreoptic nasendoscopy in paediatric patients. To compare pain and anxiety, ease of performance of nasendoscopy, quality of view and cooperation of patient in the two treatment groups.

DESIGN

Prospective, randomized controlled, double blind study.

SETTING

Red Cross Children Hospital, University of Cape Town, South Africa

PARTICIPANTS

56 patients were recruited from an existing study where patients were followed up to determine adenoidal size 6 months post adenoidectomy (Chapter 1). The patients were scheduled to undergo outpatient flexible nasendoscopy to determine the size of adenoidal tissue in the post nasal space. The exclusion criteria included allergy to any of the agents, and patients who have previously undergone flexible nasendoscopy.

METHOD

The patients were reviewed in specifically arranged follow up clinics. Patients and parents were counselled as a group at the start of each clinic and consent for the additional arm of the study was obtained. The patients were asked to wait in a separate waiting area away from the endoscopy room. The patients were called one by one to enter the endoscopy room.

The patients were randomized into two groups and either received Solution A (Oxymetazoline 0.05% and water) or Solution B (Oxymetazoline 0.05% and Lignocain 4%). Solution A consisted of equal amounts of Oxymetazoline 0.05% and water. This meant the concentration of Oxymetazoline administered was 0.025%, which is the required paediatric concentration. Water was used as dilutent to ensure the taste of the solution was not altered. Solution B consisted of equal amounts of Oxymetazoline 0.05% and Lignocain 4%. This ensured an Oxymetazoline concentration of 0.025% and Lignocain 2%. Both these solutions were mixed prior to each clinic to ensure a fresh and stable solution.

The randomization and administration of the test solution was done by a nurse practitioner behind closed doors. The endoscopist and pain specialists were therefore blinded. Randomization was done by randomly picking pre-marked pieces of paper from a container. The pieces of paper were marked either A or B representing the two trial solutions.

The patients each received 0.5 ml of the solution in each nostril ten minutes prior to the nasendoscopy. The nasal preparation was administered using a single use Mucosal Administration Device (MAD). **(See figure 1)** This device has the advantage of administering

an accurate dosage and volume in the form of a fine mist-like spray. This fine mist targets the desired mucosal region of the nasal cavity. The use of this device is thought to be more comfortable for the child and therefore cause less anxiety.

After administration of the solution the endoscopist and pain specialists entered the room. The pain specialists then asked the parent some questions and also did a pre-procedure anxiety assessment on the patient and parent. The endoscopist used this time to explain the procedure to the child and the child was shown the equipment that will be used. The child was encouraged to touch the tip of the scope with his/her finger or cheek to prove to themselves that the light was not dangerous or hot. The child was then given the choice of sitting unrestrained on his own or restrained on his/her parents lap. If the child decided to sit on the parents lap he/she was wrapped up in a blanket and held by the parent while facing forward. The child's head was supported on either side by a nurse standing behind the parent.

After lubricating the tip of the endoscope it was slowly introduced into the left nostril and carefully advanced to the nasopharynx. The nasal cavity was examined for any abnormalities and when reaching the posterior choanae an assessment of the size of the adenoids was made. Adenoid size was assessed according to the three level classification described by Wormald and Prescott and based on the degree of choanae involvement. [11] The right nostril was only used if the left nostril was too narrow (septal deviations, nasal cycle etc.) to advance the scope as far as the posterior choanae. Children who were found to have otolaryngological pathology were treated appropriately and referred for outpatient follow up.

The endoscope used was a 3.2mm Pentax flexible fibreoptic endoscope with a suction port. The suction port was very useful in getting rid of nasal secretions while performing the endoscopy.

The endoscopist noted the ease of performance of the procedure, cooperation of patient and quality of the view achieved. This was rated using a visual analogue scale (VAS). All endoscopies were performed by the same person (first investigator).

The pain and anxiety levels of the child were recorded before, during and immediately after the procedure using a VAS. During this examination the two pain specialists asked the mother to rate her anxiety on a VAS scoring sheet before, during and after the procedure. Two pain

specialists recorded their findings independently to enable us to compare their results and improve reliability of observation and assessment.

The duration of performing the procedure was recorded from insertion of the endoscope into the nostril until removal.

The visual analogue scale (VAS) is used to translate the intensity of pain or anxiety into a number. Patients or observers mark the level of pain or anxiety on a 10 cm hatched VAS (visual analogue scale). The scale is marked at one end as "no pain" or "no anxiety" and at the other end as "worst possible pain" or "worst possible anxiety". The advantage of this numeric scale is that it is easy to use, provides reproducible results and is applicable in a variety of practice settings [12 – 14] Huskisson in 1974, was the first to describe the use of VAS in the measurement of pain. [15] Since then it has been proven to be both accurate and effective in the assessment of paediatric pain. [16, 17]

Changes in behaviour indicative for pain and anxiety in children are:

- Vocal reactions: crying, moaning, whimpering and screaming
- Body movements: balled fists, toes pulled up, motionless and tensed body
- Facial expression: brow bulge, nasolabial furrow, grimacing and facial contortion [12]

After undergoing the endoscopy the patients left via a separate exit as to avoid any contact between pre and post endoscopy patients. We felt that this will make the anxiety observations more accurate.

All the study data of the two groups were recorded in an Excel spreadsheet and SPSS database. SPSS (version 12.0) was used to analyze the data. The two conditions were compared using Mann-Whitney U test, Pearson X^2 correlation coefficient, Fisher's exact test and Spearman's rho correlation coefficient for abnormally distributed data. When data was normally distributed, independent-samples T test was used. Data is presented as means (SD) when normally distributed, otherwise as medians (IQR). The mean VAS of two pain specialists was used as these are considered more reliable than scores from only one observer. Interrate reliability of the two pain specialists was calculated using the intraclass correlation coefficient (ICC two-way mixed model).

Ethical committee approval was obtained for this additional arm to the existing approved study (chapter 1) **(Ref: 358/2006).**

RESULTS

A total of 61 patients were identified to potentially participate in this study. Five patients could not be contacted and were therefore lost to follow-up. Three patients were excluded because they had undergone nasendoscopy before.

All 53 children were able to undergo the endoscopy and the complete anxiety and pain assessment was done. 27 children received solution A (Oxymetazoline 0.025%) and 26 children received Solution B (Oxymetazoline 0.025% and Lignocain 2%).

Table 1 shows patient-related demographics for the two groups. There was no significant difference in gender distribution (Pearson X^2 1.5, $P = 0.2$) or age (Mann-Whitney U test, Z = -0.0, $P = 1.0$) between the two groups. The median age at the time of nasendoscopy was 7 years (IQR 6 to 10 years).

	Trial solution A (n = 27)	**Trial solution B** (n = 26)	*P*
Gender			
Female	18	13	*0.2*
Male	9	13	
Age during procedure in months	86 (71 - 116)	88 (64 - 116)	*1.0*

Table 1. Patient-related demographics

Data given as median (IQR).

The time it took to perform the procedure varied from a few seconds to just over a minute. There was no statistical difference between the two solutions regarding the duration of the endoscopy. (Mann-Whitney U test, Z = -0.9, *P* = 0.4) (Table 2)

The total days between surgery and nasendoscopy (Mann-Whitney U test, Z = -0.1, *P* = 1.0) were similar for both groups. (Table 2)

	Trial solution A (n = 27)	**Trial solution B** (n = 26)	*P*
Length of procedure in seconds	23.3 (14.8 - 41.3)	28.3 (16.7 - 40.8)	*0.4*
Time between surgery and procedure in days	197 (188 - 202)	202 (176 - 204)	*1.0*

Table 2. Procedure-related demographics

Data given as median (IQR).

Quality of view (independent-samples T test, *P* = 0.4), ease of nasendoscopy (independent-samples T test, *P* = 0.7) and cooperation of the patient (Mann-Whitney U test, Z = -0.3, *P* = 0.8) were not significantly different between the two groups. (Table 3)

	Trial solution A (n = 27)	Trial solution B (n = 26)	*P*
Quality of view (0 - 10) (mean, SD)	7.7 (1.5)	7.3 (1.8)[1]	*0.4*
Ease of procedure (0 - 10) (mean, SD)	6.9 (2.2)	6.6 (2.3)[1]	*0.7*
Cooperation of patient (0 - 10) (median, IQR)	7.0 (3.0 - 9.0)	7.0 (3.0 – 9.0)[1]	*0.8*

Table 3. Procedure-related demographics

[1] information of 1 patient is missing

There was no significant difference between the number of patients sitting unrestrained on their own (p= 0.3). The majority of patients (83%) were restrained.

Restrained	Trial solution A (n = 27)	Trial solution B (n = 26)
Yes	21	23
No	6	3

Table 4. Number of patients restrained

Interrate reliability scores of the two pain specialists for VAS pain was 0.91(95% CI 0.87 to 0.94) and for VAS anxiety 0.84 (95% CI 0.77 to 0.89). The median pain and anxiety scores of the children before, during and after nasendoscopy were not significantly different between the two groups (Table 5A, B, C).

Twenty-one mothers were anxious before nasendoscopy, 23 mothers during nasendoscopy and 5 mothers after nasendoscopy (VAS score ≥ 4.0). The median anxiety scores of the mothers before, during and after nasendoscopy were not significantly different between the two groups (Table 5A, B, C).

Before procedure	**Trial solution A** (n = 27)	**Trial solution B** (n = 26)	**Mann-Whitney U test** Z	P
VAS anxiety mother	3.0 (0.0 - 5.0)	2.0 (0.0 - 5.0)	-0.4	*0.7*
VAS pain child	0.0 (0.0 - 0.0)	0.0 (0.0 - 0.0)	-1.0	*0.3*
VAS anxiety child	4.0 (3.0 - 6.0)	4.0 (3.0 - 6.0)	-0.2	*0.8*

Table 5A. Summarized VAS anxiety and pain scores before procedure

Data given as median (IQR).

During procedure	Trial solution A (n = 27)		Trial solution B (n = 26)		Mann-Whitney U test	
					Z	*P*
VAS anxiety mother	3.0	(1.0 - 5.0)	5.0	(2.0 - 6.0)	-0.9	*0.4*
VAS pain child	4.0	(2.0 - 6.5)	4.3	(3.4 - 5.1)	-0.4	*0.7*
VAS anxiety child	4.0	(3.0 - 6.0)	4.0	(3.0 - 5.3)	-0.5	*0.6*

Table 5B. Summarized VAS anxiety and pain scores during procedure
Data given as median (IQR).

After procedure	Trial solution A (n = 27)		Trial solution B (n = 26)		Mann-Whitney U test	
					Z	*P*
VAS anxiety mother	0.0	(0.0 - 1.0)	0.0	(0.0 - 0.3)	-1.1	*0.3*
VAS pain child	1.0	(0.0 - 2.0)	0.3	(0.0 - 1.0)	-1.1	*0.3*
VAS anxiety child	1.5	(1.0 - 2.5)	1.5	(0.5 - 2.3)	-0.5	*0.6*

Table 5C. Summarized VAS anxiety and pain scores after procedure
Data given as median (IQR).

In study group A, 5 females and 1 male were not restrained. In study group B, 3 females were not restrained. The incidence of restrained children was not significantly different between the two groups (Pearson X^2 1.1, Fisher's exact test 0.5, $P = 0.3$) (Table 4). Of the 44 restrained children, median pain and anxiety scores were respectively 4.5 (IQR 3.0 to 5.9) and 4.0 (IQR 3.5 to 6.0). The median pain and anxiety score of unrestrained children (n = 9) were

respectively 2.0 (IQR 1.5 to 5.0) and 2.0 (IQR 1.5 to 3.5). The pain scores (Mann-Whitney U test, Z = -2.0, $P = 0.046$) and anxiety scores (Mann-Whitney U test, Z = -3.5, $P = 0.000$) were significantly different between restrained and unrestrained children. The median age of the restrained group was 7 years (IQR 5 to 9 years). Age was not significantly different between restrained children and children who sat unrestrained on their own (Mann-Whitney U test, Z = -1.8, $P = 0.1$).

No significant differences regarding pain and anxiety were found between boys and girls (Mann-Whitney U test, Z = -0.4, $P = 0.7$ and Z = -1.3, $P = 0.2$). There was also no significant difference between gender and cooperation of patients (Mann-Whitney U test, Z = -0.8, $P = 0.4$).

Anxiety and pain during the procedure were significantly correlated in the patients (Spearman's rho correlation coefficient 0.40, $P = 0.003$). This was also true for anxiety and pain after nasendoscopy (Spearman's rho correlation coefficient 0.41, $P = 0.002$).

VAS anxiety scores of the parent before, during and after nasendoscopy was not significantly correlated with VAS anxiety scores of the child before, during and after nasendoscopy (respectively, Spearman's rho correlation coefficient -0.08, $P = 0.6$, 0.17, $P = 0.2$ and 0.14, $P = 0.3$).

Pain and anxiety during nasendoscopy were not significantly correlated with the length of the procedure (respectively, Spearman's rho correlation coefficient -0.07, $P = 0.6$ and -0.13, $P = 0.3$).

DISCUSSION

Flexible nasendoscopy is an essential diagnostic procedure in the paediatric Otolaryngology patient. Two percent Lignocain and other topical anaesthesia are widely used in Otolaryngology practice to facilitate examination of the nose. Numerous studies have failed to demonstrate significant benefit when using topical local anaesthesia prior to flexible nasendoscopy in the adult population. [6, 9, 10] This study has used objective visual analogue scale scores to assess pain and anxiety in the paediatric patients undergoing flexible nasendoscopy.

This study has demonstrated that the use of Oxymetazoline alone is just as effective as Lignocain in combination with Oxymetazoline in paediatric patients during nasendoscopy. Pain, anxiety, ease of performance, cooperation of the patient and the quality of view were comparable for both groups.

It is a conspicuous result that the majority of children (83.0%) had to be restrained during the procedure. Only 9 children could sit on their own unrestrained. Furthermore this study has shown that the procedure is associated with significant pain (VAS 4.5) and anxiety (VAS 4.0) when the child is restrained during the procedure. The pain and anxiety scores (p values 0.046 and 0.000 respectively) were significantly higher in restrained children compared to unrestrained children. The use of Lignocain does not appear to be of any benefit in reducing this. This possibly indicates that anxiety plays an important role when performing this procedure in children. Ideally additional measures should be implemented to try and decrease anxiety and make the procedure more comfortable for the patient. Distraction has been shown to be a very effective way in achieving reassurance and subsequently decreasing anxiety. [18] This can be achieved by using music, toys, cartoons and a comforting environment.

It would be ideal to reassure children and make them more relaxed prior to performing the nasendoscopy and therefore ensure that restraining would not be necessary.

However there is a downside to not restraining children. Flexible endoscopes are expensive, delicate instruments and the possibility of damage exists if an unrestrained child were to grasp the instrument during periods of anxiety

CONCLUSION

This study concludes that the use of a topical decongestant (Oxymetazoline) for paediatric nasendoscopy is just as effective as the use of Oxymetazoline with Lignocain. Pain and anxiety is not increased in the absence of Lignocain. Alternative measures i.e.; distraction should be investigated to try and make this essential examination more manageable for children.

FIGURES

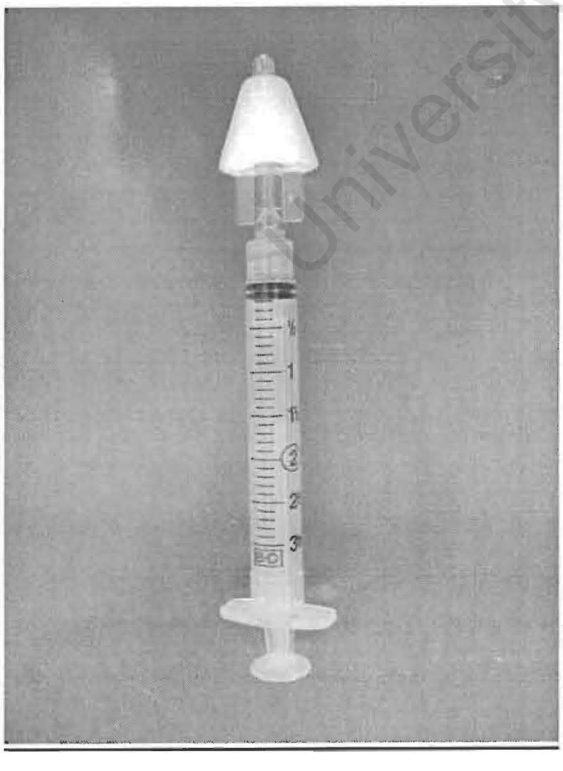

Fig 1: Mucosal Administration Device (MAD)

REFERENCES

1) Souza BB, Hannemann GG, Ancelmo-Lima WT. Importance of nasal fibreoptic examination in the presence of a normal X-ray of the cavum. Int J Pediatr Otorhinolaryngol. 2000;15:29-32
2) Cassano P, Gelardi M, Cassano M. Adenoid tissue rhinopharyngeal findings: a novel approach to therapeutic management. Int J Pediatr 2003;67:1303-9
3) Santos R, Cipolotti R, D'Avila J. Schoolchildren submitted to nasal fiber optic examination at school: findings and tolerance. J Pediatr (Rio J). 2005;81(6):443-6
4) Seibert RW, Seibert JJ. Infantile methemoglobinemia induced by a topical anaesthetic, Cetacaine. Laryngoscope. 1984;94:816-17
5) Benowitz NL. Lidocaine, metiletine and tocaine. In: Haddad LM, Winchester JF, editors. Clinical management of poisoning and drug overdose. 2nd ed. Philadelphia. WB Saunders Co;1990, p 1371-9
6) Sadek SAA, De R, Scott A, White AP. The efficacy of topical anaesthesia in flexible nasendoscopy: a double-blind randomised controlled trial. Clin. Otolaryngol. 2001;26:25-28
7) Smith JC, Rockley TJ. A comparison of cocaine and "co-phenylcaine" local anaesthesia in flexible nasendoscopy. Clin. Otolaryngol. 2002; 27: 192-196
8) Singh V, Brockbank MJ, Todd GB. Flexible transnasal endoscopy: is local anaesthetic necessary? J Laryngol. Otol. 111, 616-618
9) Cain AJ, Murray DP, Mcclymont LG. The use of topical nasal anaesthesia before flexible nasendoscopy: a double-blind, randomized controlled trial comparing cophenylcaine with placebo. Clin. Otolaryngol. 2002; 27: 485-488
10) Frosh AC, Jayaraj S, Porter G. Is local anaesthesia actually beneficial in flexible fibreoptic nasendoscopy? Clin Otolaryngol. 1998; 23: 259-262
11) Wormald PJ, Prescott CA. Adenoids: comparison of radiological assessment methods with clinical and endoscopic findings. J Laryngol Otol. 1992; 106: 342-4
12) U.M.C., R (postoperatief) Pijnprotocol voor kinderen. 2002 [cited; Available from: www. Umcn.nl/userfiles/other/Protocol Pijn bij kinderen.pdf.

13) Deloach LJ, Higgins MS, Caplan AB. The visual analog scale in the immediate postoperative period: intrasubject variability and correlation with a numeric scale. Anesth Analg 1998 Jan;86(1):102-6

14) Wewers ME, Lowe NK. A critical review of visual analogue scales in the measurement of clinical phenomena. Res Nurs Health, 1990; 13(4): 227-36

15) Huskisson EC, Measurement of pain. Lancet 1974 Nov 9;2(7889):1127-31

16) Champion GD, Goodenough B, Van Baeyer CL. Measurement of pain by self-report. In: Finley GA, McGrath PJ (Editors). Measurement of pain in infants and children: Progress in pain research and management. Vol 10. Seattle IASP Press 1998:123-160

17) Thompson KL, Varni JW. A developmental cognitive-biobehavioral approach to pediatric pain assessment. Pain 1986 Jun;25(3):283-96

18) Sinha M, Christopher NC, Fenn R et al. Evaluation of nonpharmacologic methods of pain and anxiety management for laceration repair in the pediatric emergency department. Pediatrics. 2006. 117(4): p. 1162-8.

Conclusion

Adenoidectomy alone or in combination with tonsillectomy is one of the most common operations performed by Otolaryngologists. The majority of patients (95%) in this study experienced symptom improvement after six months, regardless of the method used to perform the adenoidectomy. Both methods were therefore very effective in controlling the symptoms associated with adenoidal pathology.

Procedure times when performing adenoidectomy alone were similar when using either curette or suction diathermy. However when performing adenotonsillectomy, the suction diathermy technique took significantly longer. As mentioned earlier, the time for adenotonsillectomy patients in the curette group did not include the time the post nasal space was packed during the tonsillectomy. When adding this time to the duration of anaesthesia and comparing the total time spent in theatre the difference probably loses significance.

The suction diathermy technique was superior in reducing adenoidal regrowth at six months. Although this reached statistical significance, it is uncertain whether it is of clinical significance, as the symptom improvement for both groups were in excess of 95 percent. Probably even though the mean adenoidal size in the curette group was significantly larger; it was still small enough not to cause significant symptoms. It is known that a few children regress over time [Reference 16, study 1] and perhaps longer term follow up is warranted. But certainly at 6 months after surgery suction diathermy adenoidectomy has been shown to be at least equal, if not superior to the conventional curette adenoidectomy.

The accurate assessment of the adenoidal size was achieved by using a flexible nasendoscope which is currently the gold standard for assessment of adenoidal size and is an essential

diagnostic tool in the paediatric Otolaryngology patient. 2% Lignocain and other topical anaesthesia are widely used in Otolaryngology practice to facilitate examination of the nose

but numerous studies have disputed the benefit of using topical local anaesthesia prior to flexible nasendoscopy in the adult population. This study has used objective visual analogue scale scores to assess pain and anxiety in paediatric patients undergoing flexible nasendoscopy and concludes that the use of a topical decongestant (Oxymetazoline) for paediatric nasendoscopy is just as effective as the use of Oxymetazoline with Lignocain. The ease of performance, cooperation of the patient and the quality of view were comparable for both groups. Pain and anxiety was not increased in the absence of Lignocain.

The fact that the use of Lignocain did not alter the pain and anxiety scores probably means that anxiety plays a more important role than pain. Alternative measures i.e.; distraction should be implemented and investigated to try and make this essential examination more manageable for children.

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