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Endoscopy in Nasopharyngeal Adenoid Surgery

W. F. Ezzat

ORL- Head and Neck Surgery,
Consultant Pediatric Otolaryngologist,
Ain-Shams University, Cairo
Egypt

1. Introduction

Adenoid diseases include acute adenoiditis, recurrent acute adenoiditis, chronic adenoiditis, and obstructive adenoid hyperplasia. The latter, that constitutes a triad of symptoms including chronic nasal obstruction (with snoring and obligate oral breathing), nasal discharge, and nasal intonation of voice, is the most common cause necessitating surgical intervention. Differentiating adenoid infection from that of the sinuses may be challenging due to similarity of signs and symptoms, and the high incidence of coexistence of both diseases adds to the dilemma, as one may even lead to the other. An additional factor that has been recently recognized is the effect of extraesophageal reflux disease and its role in inducing both adenoid and sinus infection, when this is identified and treated, and treatment fails, surgery should intervene, usually adenoidectomy, putting in mind that the associated sinus affection may take a few weeks to months to clear out.

The diagnosis of adenoid hyperplasia and hypertrophy needing surgery is best achieved by both history and physical examination, the aforementioned triad of symptoms is quite non-specific, as it may be present in other conditions, as allergic rhinitis, non allergic rhinitis, sinusitis, and reflux esophagitis. The physical examination should guide to the possible disease, and indicate if further investigations are needed. The classic “adenoid facies” appearance, luckily enough, is rarely seen now, as both the parents and physicians diagnose and treat such conditions early enough to avoid such drastic affection of prolonged nasal obstruction. One of the important investigations that are frequently needed is a sleep study, and a variety of tests are used according to need and facilities, starting from simple overnight oximetry, to a full sleep laboratory test, but these are used only in cases where more severe conditions are suspected, such as in cases of resistant nocturnal enuresis without definite history or physical findings of obstructive condition. When the condition is also not clear cut, a CT scan of the nasopharynx and sinuses may be done. It is the authors personal experience that for symptoms of nasal obstruction to occur in the very young child (below one year of age), to be attributed to simple adenoid hypertrophy, and to be severe enough to need surgery, a lateral radiograph of the nasopharynx would not suffice, but a CT scan should be done to exclude other more serious conditions that can cause nasal obstruction, as –and not restricted to– meningeocles, encephaloceles, dermoid cysts, and

unilateral cases of choanal atresia. These conditions may present by mild nasal obstruction since birth but become aggravated during the next few months of life.

Till relatively recent, the well decided upon treatment to adenoid hypertrophy was surgical removal, but the understanding of the role of environmental inflammation from allergies and reflux, understanding the role of chronic infection, alterations in the relationship with commensal microorganisms, and the appearance of alternative therapeutic modalities has led us to revisit this concept. Alternatives to surgical interference in mild to moderate cases of adenoid hypertrophy implies judicious use of antibiotics and other possible contributing factors as allergy or reflux. The antibiotics used usually involve those acting on beta lactamase producing organisms, aiming to regain normal nasopharyngeal flora, and this was found very useful in some studies, especially when there is associated otitis media with effusion (Bernstein et al., 2002), of course this should not give the impression that adenoidectomy should be postponed as much as possible, but a judicious assessment should be done, to avoid the known "adenoid facies" of chronic nasal obstruction, which –as aforementioned- luckily enough is rarely encountered nowadays.

Adenoidectomy may be the most widely performed otolaryngologic procedure done worldwide, whether alone or in combination with other procedures, with rates reaching 65 per 10,000 children in England, and 50 per 10,000 children in the United States (Van Den Akker et al., 2004). Although it might seem as a very simple procedure, it is not without complications. Changes in technique have progressed over the years parallel to the advances in instrumentation and technology used in surgery.

Still, the classic technique of adenoidectomy is widely performed and adopted by many, if not most, otolaryngologic surgeons all over the world, regardless the economic status. This classic technique of adenoidectomy implies blind curettage of the adenoid tissue, which may or may not be followed by digital –still blind- palpation of the nasopharynx by the surgeon, to assure removal. A survey was performed among otolaryngologic surgeons in the United Kingdom, and showed –despite all the facilities and the total coverage of health services by insurance- that still approximately 80% of the surgeons performed this blind adenoidectomy, and approximately 70% performed digital palpation of the nasopharynx at the end of the procedure, even though about 40% of them recognize a possible need for revision surgery (Dhanasekar et al., 2010). Even mirror examination during or after the curettage procedure is not agreed upon nor done universally.

The most common complication of adenoidectomy is recurrence. The recurrence rates of adenoid regrowth needing revision surgery are so diverse and un-agreed upon, Tolczynski (1955) published a paper in 1955 reviewing earlier studies which showed recordings or recurrence ranging from as low as 4-8% as reported by Lundgren, to 23.7-50% according to Hill's investigation, and may even reach above 70% according to Crowe!!!

Residual adenoid tissue is now becoming to be recognized as a cause of persistence of symptoms, or early recurrence of symptoms with regrowth of adenoid tissue. Several studies have shown significant remaining adenoid tissue after the classic "blind" adenoid curettage technique, and Ark (2010) reported that only about 20% of patients had complete removal of their adenoid tissue when only digital palpation was done without any type of visualization. A study conducted by Saxby and Chappel (2009), where they performed nasopharyngoscopic examination postoperatively, showed that 68% of cases had some residual adenoid tissue evident of which 24% had significant obstruction (grade 2 or 3), Bross-Soriano D et al. (2004) even stated that less than 30% of adenoidectomies are complete in absence of use of endoscopy!

The place of residual adenoid tissue with conventional curettage is also controversial, and Regmi et al (2011) reported that when curettage was used alone, it failed to completely remove adenoid tissue from the superiomedial choanae and anterior vault in all cases; incomplete removal was also seen in other parts of the choanae in 67.2% of patients, the Eustachian tube opening in 63 %, the nasopharyngeal roof in 61.78% and the fossa of Rosenmuller in 61%. Ezzat (2010) reported that even with the aid of a mirror, 14.5% of patients had residual adenoid tissue, 35% of which had remnants at the vault of the nasopharynx, 47% at the lateral walls of the nasopharynx (peritubal), and 18% at the posterior choana.

Although the rates of residual adenoid tissue, even in modern literature when postoperative assessment is done, is relatively significant, the number or incidence of patients actually needing revision surgery is not as high as would be expected, thus other factors must be present that would favor or induce further regrowth of the residual adenoid tissue, but to date these factors are still to be determined, although theories as reflux or infection by *Helicobacter pylori* have been proposed by some as Bulut et al., (2006).

Although the history of endoscopy goes back to the early nineteenth century when it was introduced by Bozzini, it was not practically used for nasal and nasopharyngeal assessment until the early nineteen seventies, and the earliest published papers in this field addressed the use of endoscopy in merely assessing the size of the adenoid tissue as a survey (Weymuller E, 1974), later on with advancement of scopes and refinement of technique the uses were widened.

Adenoidectomy is not only indicated in cases of enlarged and obstructing adenoid tissue, other indications may be any type of chronic otitis media, resistant to treatment, whether secretory otitis media, or chronic suppurative otitis media, where any adenoid tissue should be removed, and especially from the area of the opening of the nasopharynx. Also in cases of sinusitis, especially in children, whether recurrent or chronic, adenoid enlargement must be suspected. Other conditions where adenoid tissue is suspected and should be excluded or removed even if not extensively enlarged are cases of obstructive sleep apnoea, or nocturnal enuresis.

Evaluation of the adenoid status includes symptoms, signs and some investigations (outlined in table 1), in order to differentiate adenoid hyperplasia from other causes presenting with similar symptoms such as rhinitis, sinusitis, deviated septum, reflux disease, or even lymphoproliferative disorders.

The general indications for adenoidectomy are usually classified into obstructive, infective, and neoplastic, the various indications are enumerated in table 2.

Preoperative preparation of a candidate for adenoidectomy does not differ than any other type of surgery, the general status of the patient should be assessed for any contraindications of surgery, but otherwise, especially in children, a blood picture and the bleeding profile usually suffices, although it is still a controversial matter (Hartnick and Ruben, 2000; Wei et al., 2000)

Since most patients are children, an addition to the preoperative assessment is to check the status of teeth, as the mouth gag may dislodge loose teeth, and risk of aspiration may occur. Also checking for overt or submucous cleft palate should be done preoperatively, even by simple palpation, to avoid the risk of developing velopharyngeal insufficiency if a complete adenoidectomy is done in presence of such condition.

<i>Cause</i>	<i>Symptoms</i>	<i>Signs</i>	<i>Investigations</i>
Obstruction	-Obligate oral breather -Sleep disordered breathing -Change in tone of voice	-Hyponasality -Adenoid facies	-Endoscopy of the nose and nasopharynx -X-ray lateral view skull -Polysomnography
Infection	-Nasal and postnasal discharge -Halitosis -Recurrent cough (increase at night) -Possible recurrent vomiting and gastric upset	-Nasal and postnasal discharge, clear or colored -Possible cobblestone appearance of posterior pharyngeal wall	-CT scan, nasopharynx and sinuses -24-h pH probe acid monitoring

Table 1. Evaluation of adenoid status

A factor that seems overt but sometimes missed by junior staff is putting in mind the status of the atlantoaxial joint and the cervical spine, which can be affected by the hyper extension done during exposure, and the author has personally seen two cases with postoperative acute disc prolapse of the cervical spine in adults undergoing adenoidectomy. In young patients this is quite rare except in cases with congenital laxity of the ligaments, which is usually overt and diagnosed previously, or in cases of Down’s syndrome. Depending on the type of adenoidectomy to be performed, one or more techniques can be used for tissue removal:

- Primary adenoidectomy can be performed using a curette, suction coagulator, or a microdebrider. The suction coagulator is ideal for small adenoids, although it can be used routinely regardless of adenoid size.
- Secondary (revision) adenoidectomy can also be performed using curette, suction coagulator, or microdebrider; however, greater precision is achieved by the latter two methods. The suction coagulator generally results in the least bleeding.
- Partial superior adenoidectomy is performed in children at risk for Velo-Pharyngeal-Insufficiency. The suction coagulator and microdebrider are best suited for this procedure (Kakani et al., 2000).

- OBSTRUCTIVE
 - Chronic nasal obstruction attributed to adenoid tissue hyperplasia, proven by endoscopy, X -ray, or CT scan
 - Obligate nasal breathing attributed to adenoid tissue hyperplasia, proven by endoscopy, X -ray, or CT scan.
 - Sleep disordered breathing attributed to adenoid tissue hyperplasia
 - Obstructive sleep apnoea/hypopnoea syndrome
 - Obstructive hypoventilation syndrome
 - Upper airway resistance syndrome
 - Speech abnormalities (closed nasality) attributed to adenoid tissue hypertrophy.
 - Dental and orofacial abnormalities attributed to chronic nasal obstruction
 - Failure to thrive attributed to chronic nasal obstruction
 - Cor-pulmonale attributed to chronic nasal obstruction
 - Lymphoproliferative disorders
- INFECTIVE
 - Repeated, or chronic adenoiditis
 - Recurrent otitis media
 - Chronic otitis media with effusion, non responsive to medical treatment
 - Chronic suppurative otitis media
 - Chronic sinusitis
- NEOPLASTIC
 - Documented or suspected tumor, benign or malignant

Table 2. Indications for adenoidectomy

2. Endoscopy in nasopharyngeal adenoid surgery

Indications, uses and benefits of endoscopic use in nasopharyngeal adenoid surgery have varied over the years, but still to date, it has not become routine in this type of surgery, in spite of all the evidence and published studies that show the benefit of such use!!!

The uses of endoscopy in nasopharyngeal adenoid surgery imply use in diagnosis, during surgery, and in follow up.

The types of rigid endoscopes used in adenoid surgery are illustrated in figure 1, and an example of the photo documentation systems that is optional but very beneficial is illustrated in figure 2.

2.1 Use of endoscopy in diagnosis of nasopharyngeal adenoid size

Although the most important factor in diagnosing adenoid size is the symptomatology the patient presents with, which is mainly nasal obstruction, mouth breathing, and/or snoring, other tools have been used to verify or exclude adenoid as the cause of nasal obstruction, the most commonly used is the X-ray of a lateral view of the skull, but this is not flawless. X-

rays have over and under estimated sizes of adenoid tissue in many instances. Another issue is that adenoid tissue may be present in areas causing obstruction and not that well apparent in the X-ray, especially in recurrent or persistent cases after adenoidectomy, such as choanal adenoids. Therefore, a more realistic and accurate estimate is to perform an office endoscopy by a rigid sinoscope or flexible nasopharyngoscope, this is quite simple and applicable in adults, adolescents and cooperative older children, which are rarely the case where adenoid hypertrophy is a major problem. In younger children, which compromise most cases, to perform such office type endoscopy is quite difficult and challenging, but it can be used using short acting sedatives such as chloral hydrate which has been used safely in children and infants since 1869 (Buck, 1992), the recommended dose of chloral hydrate is 50 to 75 mg/kg given orally or rectally. In other studies, higher single doses of up to 100 mg/kg have been used with increased success in children and infants over 1 month of age (Steinberg, 1993). It is the author's belief that such endoscopy is much more beneficial in assessing the whole upper airway for proper planning of the treatment modality, whether surgical, medical or both.

Endoscopy is also valuable in case symptoms are present other than obstruction, such as loss of appetite, slower development than peers, and decreased hearing which is related to Eustachian Tube dysfunction, in absence of apparent X-ray enlargement of the adenoid tissue, in such cases surgery may be indicated to remove tubal adenoid tissue even in absence of X-ray evidence of enlargement or significant nasal obstruction. Another important issue to be addressed is that there may be an element of septal deviation that is causing the obstruction, which was missed by anterior rhinoscopy and X-ray, although this is quite rare below the age of 5 (Reitzen et al. 2011).

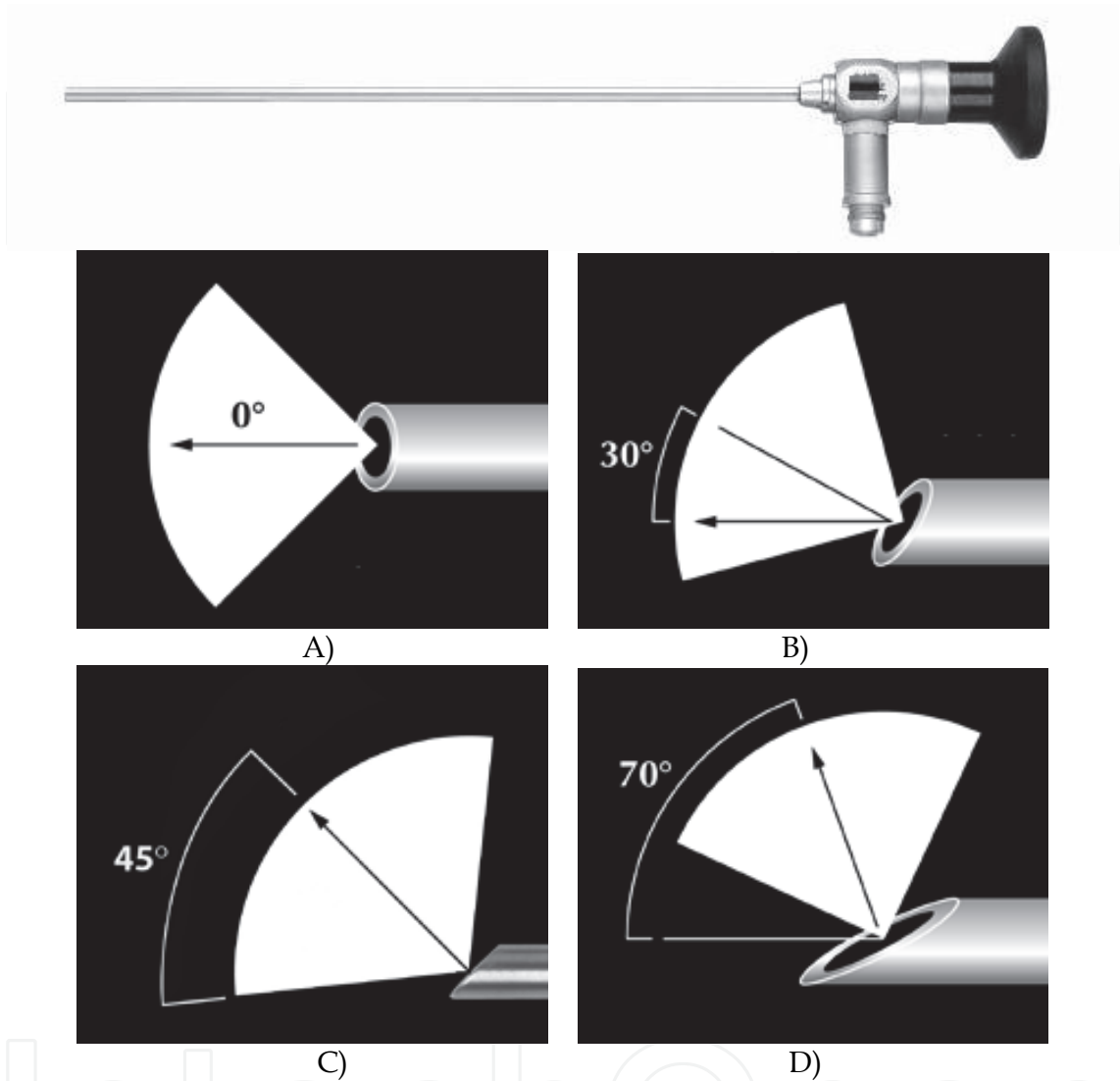
2.2 Use of endoscopy in nasopharyngeal adenoid surgery

Although many studies have reached a prevailed conclusion that endoscopic aided adenoidectomy has benefits covering any added cost or time, in terms of better exposure or complete removal, still regrettably it is not the standard teaching in many parts of the world, not only in developing countries, which might have some concern for cost, but also in developed countries. The application of endoscopy in adenoidectomy has several techniques, from full endoscopic power aided adenoidectomy to adenoidectomy by conventional curettage but with endoscopic visualization, to simple endoscopic examination at the end of conventional adenoidectomy to assess complete excision.

2.2.1 Simple endoscopic examination after conventional adenoidectomy

One of the simplest ways of using an endoscope for assurance of complete surgery and total removal of adenoid tissue is the mere transnasal endoscopic examination of the posterior choanal and the nasopharynx after conventional curettage adenoidectomy, with or without mirror assistance, and to proceed with completion adenoidectomy -if needed- under endoscopic guidance. In such case, after the surgeon has removed the main bulk of the adenoid tissue and established hemostasis, the endoscope -size of which is determined by age of patient- is introduced through BOTH SIDES of the nasal fossae to visualize the posterior choana and the nasopharynx (Ezzat 2010) (figure 3), and if any adenoid tissue is found it is removed either with a smaller adenoid curette, with a Blakesly-Wigand Nasal Forceps ® (figure 4), or a Blakesly Rhinoforce ® Ethmoid forceps (figure 5), straight or with upward curve. Further hemostasis should be accomplished if needed. An important sign of

complete adenoid removal, without injury of the underlying pharyngeal bed, at least to the author’s experience, is the lack of need for packing the nasopharyngeal bed after surgery, although there has been no published literature highlighting this fact



The endoscope used can be the conventional 4.5mm or the pediatric 2.3 mm sinoscope. The angulations of the endoscope used is determined by the approach it is used in, when the endoscope is introduced and used through the nasal fossa, a 0° , or 30 ° endoscope can be used, as they give a more direct view of the nasopharynx (A, and B), but when the endoscope is used transorally, a 45 ° or 70 ° endoscope is needed to obtain a better view by angulating the view (C, and D)

Fig. 1. Endoscopes used in adenoid surgery

2.2.2 Endoscopic visualization with routine curettage adenoidectomy

To start the surgery of adenoidectomy under direct endoscopic visualization has been described by many (Wan et al, 2005, Songu et al, 2010), this technique implies the introduction of the endoscope endonasally at the beginning of surgery, attachment to a monitor, then using the regular mouth gag and conventional curette in excision of the adenoid tissue.



The system is optional, but helps in documentation, illustration to the patient and for teaching purposes.

Fig. 2. The photo documentation system of use with endoscopes.

According to the size of the adenoid tissue as assessed endoscopically, a curette is chosen and should fit snugly over the adenoid and is inserted up to the septal vomer, the curette is swept inferiorly with a side-to-side rocking motion to completely remove all adenoid tissue. Care is taken to avoid deep muscular or vertebral injury, injury to the torus region, and injury to the choana. Again, if endoscopy reveals any residual tissue, a smaller curette or a St Clair adenoid forceps or a Blakesly-Wigand Nasal Forceps ® (figure 4), or a Blakesly

Rhinoforce ® Ethmoid forceps (figure 5), straight or with upward curve is used to remove any retained tissue noted.

Although this technique might seem appealing, in practice it is quite cumbersome, too many instruments and connections, and lack of direct eye-to-hand sense is difficult for beginners, although it is very useful in teaching and monitoring trainees. The cost of such a setting might also be a burden in less funded establishments, and no additional benefit over the routine adenoidectomy followed by mere examination by the endoscope at the end of surgery has been documented in any study published over the past years.

Some have described using the a 45° or 70° endoscope through the oral cavity to guide the excision of adenoid tissue all through the surgical procedure (Jong & Gendeh, 2008), this might seems more appealing, especially in younger children, as their nasal cavities are smaller, but even with the transoral approach to insert the endoscope, the field may be somewhat narrow.

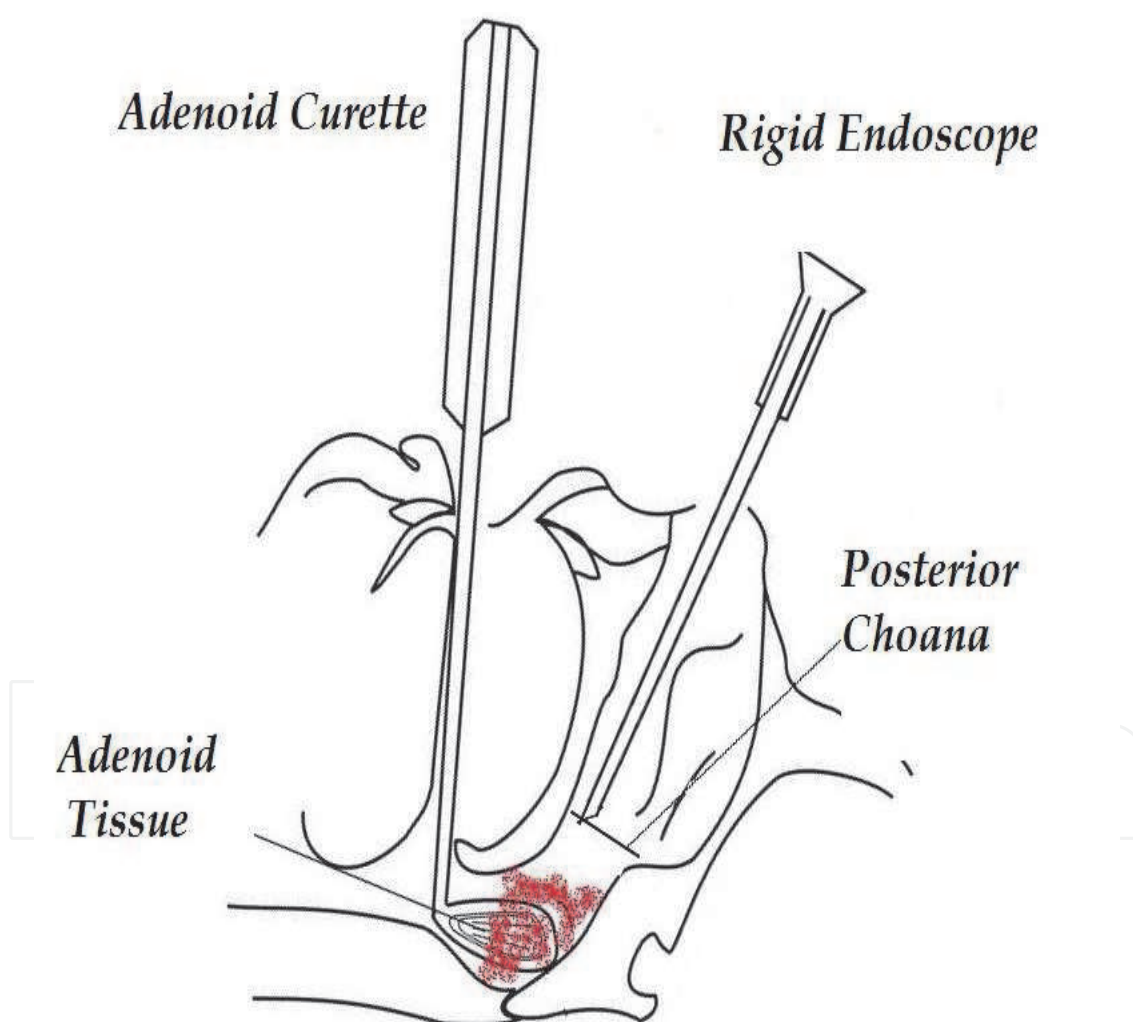


Fig. 3. Simultaneous use of the endoscope and adenoid curette

2.2.3 Fully endoscopic diathermy aided ablation adenoidectomy

The use of diathermy in adenoidectomy has been used since the nineteen sixties (Remington-Hobbs C, 1968), but with the regular monopolar blade, and was not widely

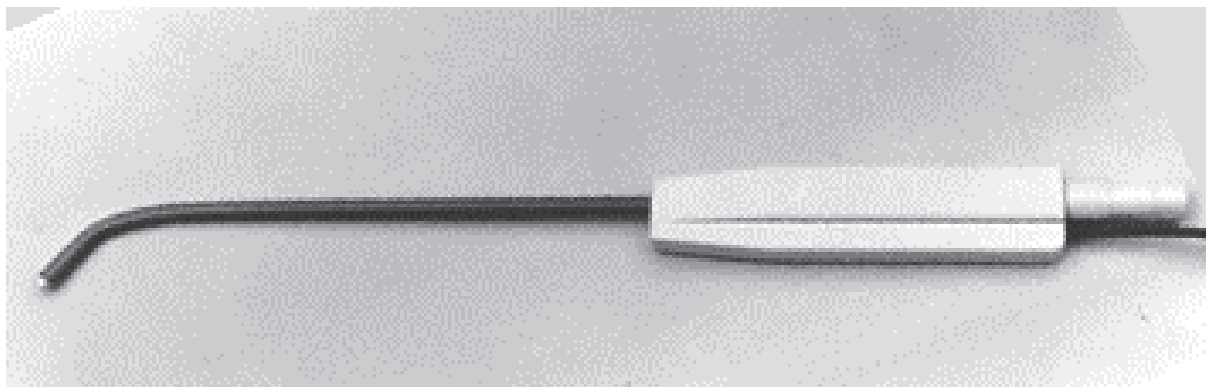
used, as issues of pharyngeal stenosis and post operative pain were addressed, and many used such a technique for control of bleeding in cases where simple packing was not enough. The suction diathermy was introduced in the late nineteen nineties and gained popularity rapidly due to several reasons, the procedure is simple, with minimal blood loss, not associated way any risk of pharyngeal stenosis (Walker P., 2001) or recurrence, although it is repeatedly reported to have longer working time than conventional curettage adenoidectomy (Jonas NE., 2007). The price is not an issue, as the disposable hand piece is relatively cheap, and is even cheaper than other disposable more sophisticated instruments used (Walker P., 2001). (figure 6)



Fig. 4. Blakesly- Wigand Nasal Forceps



Fig. 5. Blakesly- Rhinoforce Forceps



The tip of the handpiece is flexible and can be manipulated according to need

Fig. 6. The suction diathermy handpiece

The original description of such use dictated that the nasopharynx is exposed by means of two catheters introduced through the nose, and brought out of the mouth, retracting the soft palate. Often, a mirror was used to guide the suction diathermy to visualize the adenoid tissue, but the use of endoscopes with this suction diathermy technique is very beneficial. Endoscopes have been used by two approaches, the first of which a 45° endoscope is introduced ORALLY for visualization, and then with the other hand the suction is introduced and surgery completed (Lo and Rowe-Jones, 2006), the second of which a fully transnasal endoscopic ablation adenoidectomy is done (Shin and Hartnick, 2003). Although this second type has the benefit of not needing hyperextension of the neck, it is not suitable for all age groups as it requires a certain wideness of the nasal fossa, but it is optimal in certain situations –if applicable– such as lack of neck stability as in children with Down’s syndrome.

2.2.4 Endoscopic coblation (hydrodebrider) adenoidectomy

Coblation adenoidectomy (figure 7) is a relatively recent introduction in the field of otolaryngologic surgery. Coblation, that uses lower temperatures than electrocautery to remove tissue and achieve hemostasis, has been shown to reduce pain and decrease postoperative narcotic use, leading to shorter recovery times and a quicker return to normal in children (Benninger M and Walner D, 2007). The use of coblation can be used by guidance of mirror viewing, but of course endoscopic guidance gives much more accurate view, whether used transnasally to transorally, and does not add any cumbersome to the surgical field, as the hand that uses the mirror uses the endoscope. As with most guided techniques, this approach dictates the partial exposure of the surgical field by using 2 catheters introduced transnasal and delivered orally, to retract the soft palate.

2.2.5 Endoscopic micro-debrider-aided adenoidectomy

Microdebrider (power) aided adenoidectomy was introduced and started to be common in the early 21st century, the use of the microdebrider (figure 8) has been used for adenoidectomy in several modes and approaches, the more common approach and practical one is introduction of the endoscope through the nasal fossa and the hand piece of the microdebrider through the mouth, and under endoscopic vision, shaving the adenoid tissue piece by piece. Both the hand piece and the endoscope can be introduced through the oral cavity if the nasal fossa is too narrow, in younger children.



Fig. 7. Hydrodebrider Hand piece



Fig. 8. Microdebrider hand piece

One of the major advantages of using the microdebrider is having the option to remove adenoid tissue only partially (Rodriguez et al., 2002; Koltai et al., 2002), as in cases of insufficient velopharyngeal valve, in cases of repaired cleft palate, and those with submucous cleft palate.

Blood loss is comparable to other methods used, and although the time used may be more than with conventional curette adenoidectomy, the clearer field and more complete surgery seems to justify the extra time, to save time, some have used such powered instrumentation after removal of the main bulk of the adenoid tissue by conventional curettage (Pagella F et al., 2009). The main limitation is the price of the disposable hand piece that exceeds by far all other modes of adenoidectomy. Figure 9 shows the typical setting for use of combined endoscopic guided powered instrumentation adenoidectomy.

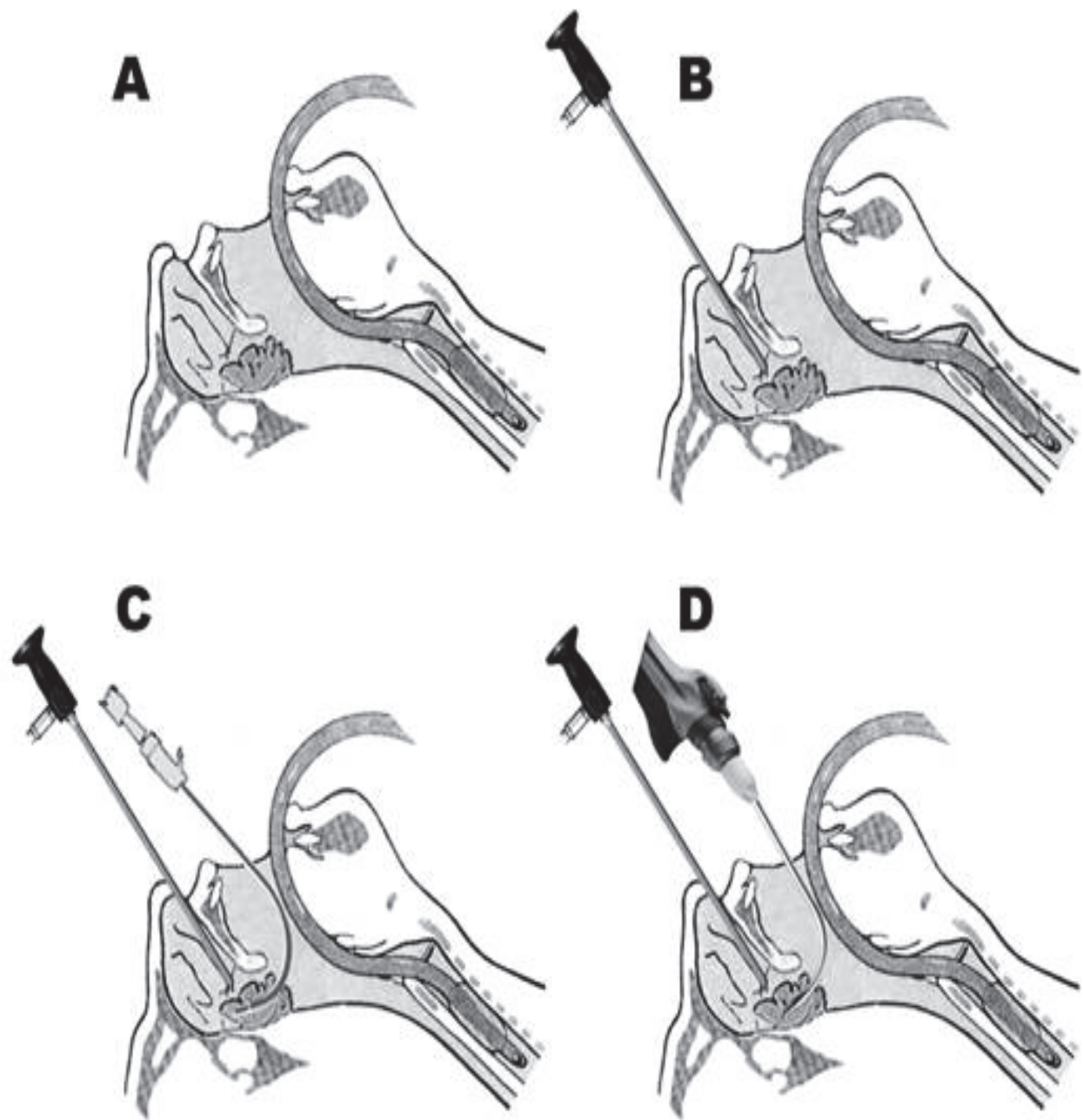


Fig. 9. Typical setting for use of combined endoscopic guided powered adenoidectomy a; positioning of the patient with endotracheal tube inserted orally, b; introduction of the endoscope trans-nasally, c; introduction of the microdebrider hand piece, d; attachment of the hand piece to the micromotor and commencing surgery (Courtesy of Prof Dr MZ Helal with permission)

2.3 Follow up after adenoidectomy

Postoperative follow up after adenoidectomy does not entail any special proceedings; the child is usually discharge from the hospital on the same day of surgery. The usual regime is to advice soft diet for 24 hours, and then regular diet allowed after that, usually no antibiotics are used. A mild analgesic may be prescribed. Nasal decongestant drops may be used with caution for 2-3 days, as the child is more liable to toxicity from the raw surface of the adenoid bed. The child is usually scheduled for a post operative visit after 3-4 days to assure that everything is going in order. Some have advised postoperative endoscopy to assess any residual adenoid tissue, but this is of no value except if the patient develops symptoms of regrowth of the adenoid.

2.4 Limitations of use of endoscopy in adenoid surgery

In younger children with small nasal fossae, the introduction of the endoscope nasally can be quite difficult, if not impossible, but this can be overcome if the endoscope is used trans-oral, otherwise there are no limitations. Excessive bleeding in the operative field may limit the view, but this should not be an indication to abort the surgery except in very rare cases, and if such case occurs it can be managed by regular packing for a few minutes, and then continuing surgery.

2.5 Complications of endoscopy use in adenoid surgery

No additional complications during adenoid surgery have been recorded with the additional use of endoscopy to guide the surgical procedure. Complications –if occur– would be those of the technique, and not from use of endoscopy. Complications related to surgery are outlined in table 3, with their presentation and possible management lines.

Noniatrogenic complications after adenoidectomy include (Randall and Hoffer, 1998)

- Regrowth of adenoid tissue, particularly in very young children, which may require revision (secondary) adenoidectomy.
- Hypernasality, because of temporary pain splinting. Persistent hypernasality is rare and probably caused by unrecognized pre-existing velopharyngeal weakness. Management includes speech therapy or a sphincter pharyngoplasty, if refractory.
- Atlantoaxial subluxation (Grisel's syndrome), which presents with persistent torticollis 1-2 weeks after surgery. Neurological or orthopedic consultation may be required.

Iatrogenic complications after adenoidectomy include

- Dental injury, from intubation or the mouth gag. Dentition should be checked prior to inserting and removing the mouth gag. Urgent laryngoscopy and bronchoscopy must be performed for any newly discovered missing teeth.
- Nasopharyngeal stenosis, caused by excessive tissue removal. Repair is difficult and may include dilation, steroid injection, or a tissue flap (rotational, advancement, or free flap) (Giannoni et al., 1998).
- Eustachian tube injury, if the torus tubarius is cauterized or denuded
- Meningitis, after injecting lidocaine and epinephrine into the posterior nasopharynx prior to adenoidectomy. Injections are unnecessary and should be avoided.
- Lingual nerve palsy, caused by pressure from the tongue blade of the mouth gag.
- Cautery burns, caused by operator error or equipment malfunction. (Zinder and Parker, 1996).

Complication	Presentation	Management
Hemorrhage	Bleeding from mouth or nose	Local control (vasoconstricting agents, cautery)
Airway obstruction	Stridor/stertor, palatal swelling	Nasopharyngeal airway +/- steroids
Dehydration	Dry mucous membrane	Hydration
Persistent velopharyngeal valve insufficiency	Hypernasal speech (>2 months postoperative)	Speech therapy/ palatal surgery
Pulmonary edema	Difficult oxygenation and pink secretions from endotracheal tube	Positive end expiratory ventilaton
Nasopharyngeal stenosis	Progressive nasal difficult breathing and closed nasality	Palatal surgery
Torticollis	Neck pain and deviation to one side	Physiotherapy/ surgery
Cervical spine subluxation	Neck pain +/- neurologic deficit	Neurological/ orthopedic consultation
Dental injury	Defective teeth	?? reinmplantation
Eustachian Tube injury	Hearing loss and otitis media	?? Ventilation tube
Lingual nerve palsy	Poor tongue movement	Conservative
Cautery burns	Burning sensation and ulcers	Surface anesthetics
Nasal adhesions	Nasal bleeding and obstruction later on	?? Lysis
Recurrence	Progressive nasal obstruction	Revision surgery

Table 3. Complications related to adenoidectomy

Complications related to use of endoscope

- Nasal mucosal injury, with subsequent scarring and adhesions, this is very rare, and occurs only after rough manipulation.

3. Conclusion

Adenoidectomy is a very widely and commonly performed surgery, although the standards for surgery have changed due to the better understanding of the etiopathology. There is no worldwide agreement on the “typical technique” for adenoidectomy, thus various procedures and aids for such surgery have been used, all aiming at better removal and reducing recurrence rates. The use of endoscopy to guide adenoidectomy aids in achieving better results –in terms of complete surgery- with all techniques of adenoidectomy, whether conventional curettage, or with more recent methods, and whether for obstructive or non obstructive causes, and whether for complete or partial adenoidectomies. It is simple to use, does not add to time or expenses of surgery.

4. Acknowledgment

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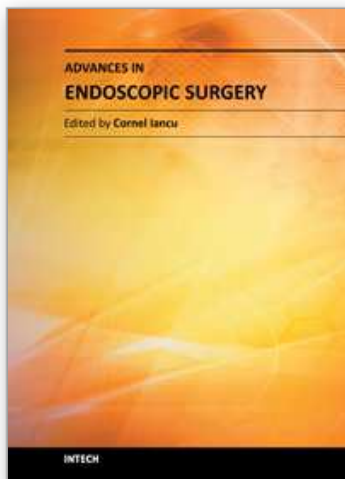
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Surgeons from various domains have become fascinated by endoscopy with its very low complications rates, high diagnostic yields and the possibility to perform a large variety of therapeutic procedures. Therefore during the last 30 years, the number and diversity of surgical endoscopic procedures has advanced with many new methods for both diagnoses and treatment, and these achievements are presented in this book. Contributing to the development of endoscopic surgery from all over the world, this is a modern, educational, and engrossing publication precisely presenting the most recent development in the field. New technologies are described in detail and all aspects of both standard and advanced endoscopic maneuvers applied in gastroenterology, urogynecology, otorhinolaryngology, pediatrics and neurology are presented. The intended audience for this book includes surgeons from various specialities, radiologists, internists, and subspecialists.

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Phone: +86-21-62489820
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