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Original Research Article

Clinical outcomes of endoscopy assisted conventional adenoidectomy and endoscopic adenoidectomy with microdebrider: a prospective randomized control study

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ABSTRACT

Background: Adenoidectomy is amongst common procedures in pediatric ENT. Conventional adenoidectomy is performed with traditional curettage method, which has limitations of visualization and incomplete tissue removal. This study aims to evaluate whether adding endoscopic visualization to traditional methods enhances outcomes, or if integrating a powered instrument with endoscopy is essential for improved efficacy.
Methods: A prospective, randomized controlled trial was conducted from December 2012 to January 2015 at a tertiary care center, with IEC approval. Pediatric patients scheduled for adenoidectomy were randomized into two groups: endoscopy-assisted conventional adenoidectomy (EACCA) or endoscopic adenoidectomy with microdebrider (EAM). Data were collected on demographics and clinical parameters, and follow-up at two months was performed to assess efficacy, using a significance threshold of $p<0.05$.
Results: The analysis included 50 patients (ages 5-13), with 25 in each group. No significant differences were observed in age, sex, surgical duration, blood loss, or pain scores. Both groups showed significant improvement in sleep-disordered breathing. However, the EAM group presented no residual adenoid tissue or eustachian tube injuries and had superior outcomes for otitis media with effusion (OME) compared to the EACCA group.
Conclusions: While both techniques effectively alleviate sleep-disordered breathing, conventional adenoidectomy may leave residual tissue leading to OME. For patients primarily suffering from sleep issues, EACCA may suffice if cost is a concern; however, for otitis media cases, endoscopic powered adenoidectomy is recommended to prevent long-term complications.

Keywords: Adenoidectomy, Curette, Endoscope, Microdebrider, OME, Sleep disordered breathing

INTRODUCTION

Adenoidectomy is surgical removal of adenoids or nasopharyngeal tonsils. Whether conducted independently or in conjunction with tonsillectomy or myringotomy, adenoidectomy ranks among the most frequently performed surgeries in paediatric ENT practice.[1] Adenoidectomy is an effective treatment for various conditions, including paediatric sleep-disordered breathing, middle ear pathologies, chronic rhinosinusitis and recurrent adenotonsillitis.[2] Conventional adenoidectomy is age old practice, performed using an adenoid curette, relies on palpation rather than vision, leading to potential disadvantages such as incomplete removal of adenoid tissue and injuries to surrounding structures like medial end of Eustachian tube, soft palate,

anterior atlantooccipital ligament, and aberrant internal carotid artery in rare instances.[3-5] With the advent of endoscopes, its use in adenoidectomy has been popularized and is considered a natural progression of endoscopic technology for a more complete removal of adenoids.[6] This study intended to evaluate whether the addition of endoscopic visualization to conventional curettage alone can improve clinical outcomes, or whether use of a more advanced ablative device i.e. microdebrider alongside the endoscope is necessary to achieve the best possible clinical outcomes.

METHODS

This is a prospective parallel design comparative randomised control study, conducted from December 2012 to January 2015 at a general tertiary care centre after IEC approval (Ref: BJMC/IEC/Pharmac/D1112093-26 date 27/11/2012). Consecutive patients scheduled for adenoidectomy with indications of sleep disordered breathing (SDB) and/or OME willing to participate and provide consent were included in the study. Patients with bleeding disorders/coagulopathies, submucous cleft palate, acute pharyngeal infections, asymptomatic adenoidal hypertrophy or residual symptomatic adenoids after previous adenoidectomy were excluded from the study. Patients were randomized in 1:1 fashion to either EACCA arm or EAM arm. Surgical intervention performed as per study protocol. Demographic, clinical, intra-operative, postoperative and follow up data recorded prospectively. All patients underwent preoperative lateral skull soft tissue radiograph for gross assessment of nasopharyngeal soft tissue.[7,8] Preoperative middle ear otoscopy and tympanometry was performed to document baseline middle ear status. Paediatric sleep questionnaire was used to asses sleep disordered breathing.[9,10] Score of 0.33 i. e., answering 33% questions positively was taken as sleep disordered breathing. Consort guidelines were used for reporting of the study.[11] Study was performed in accordance with declaration of Helsinki, 2013 amendment.

Surgical procedure

Adenoidectomy was performed under general aesthesia, orotracheal intubation. And patient in supine position. Diagnostic nasal endoscopy was performed with 2.9 mm paediatric rigid endoscope (Figure 1a), adenoid enlargement is graded with Clemens and McMurray grading in all cases.[12] Eustachian tube occlusion with peritubal adenoid tissue documented separately. Surgical intervention in both arms performed as described below.

EACCA

Primary surgeon stands at head end of patient. Assistant surgeon standing by side of patient, inserts 0^0 rigid nasal endoscope. Primary surgeon inserts adenoid curette perorally in the nasopharynx under endoscopic guidance to reach upper edge of adenoid. Now endoscope is removed, neck is gently flexed, adenoid curette is held like a dagger, and adenoid tissue is scraped with back to front swiping movement of curette. Peroral postnasal packing was done for haemostasis. After pack removal, nasopharynx visualised with endoscope to look for residual adenoid tissue. Curettage repeated not more than thrice to remove residual tissue if any and findings documented at the end of procedure.

EAM

Nasal decongestion achieved by nasal packing with cotton pledgets soaked in 4% lidocaine with 1:1000 adrenaline.[13] Under endoscopic vision microdebrider shaver cannula with suction irrigation aid (60 degree, with debrider tip along concave border) is inserted perorally into nasopharynx (Figure 1b). Adenoid tissue is shaved off under endoscopic vision with debrider at speed <1500 rpm in front to back fashion till perimysium is reached (Figure 1c). Peroral nasopharyngeal packing done for haemostasis. If any bleeding point is observed after pack removal, then controlled with precise electrocoagulation with bayonet bipolar cautery inserted via opposite nostril. Findings documented at the end of procedure.

Intraoperative assessment

Operative time calculated from handing over of case by anaesthesiologist to handing case back to anaesthesiologist. Time for haemostasis is calculated as completion of adenoidectomy to handing over of case to anaesthesiologist for reversal when only adenoidectomy is performed, and handing over to proceed with tonsillectomy. Bleeding is calculated in EACCA arm by calculating difference in the weight of dry and soaked tape gauze. Bleeding in EAM arm calculated by measuring amount of fluid in suction drain and subtracting with amount of saline wash used in addition to weight of tape gauze. Site of residual tissue documented at the end of procedure in both arms.

Postoperative assessment

Pain scores were recorded in postoperative period with Wong and Baker visual scale during anaesthesia recovery period.[14,15] All patients received perioperative antibiotics, antihistaminic and topical decongestants. Hospital stay is calculated from day of surgery to discharge. If patient is readmitted within 30 days of surgery, then number of days are added as hospital stay.

Follow up

All patients were followed up at 1 week, 1 month and 2-month interval post-surgery. Otoscopy, nasal endoscopy, tympanometry, and sleep questionnaire was documented at 2 months follow up to be compared with preoperative status to assess clinical efficacy. Change in the tympanogram from type B to type A was taken as

improvement in OME and type A or B to B or C was taken as worsening or no improvement of OME in at least one ear.

Statistical analysis

Sample size was calculated using Cochran's formula.[16] Quantitative data was analysed using frequencies and measures of central tendencies. Statistical significance for parametric data was assessed using 2-sided Chi-squared and Fisher Exact tests, and Kruskal Wallis and Mann Whitney tests for non-parametric data. $P<0.05$ was considered statistically significant. All statistical analyses were performed using SPSS version 25@ (IBM, New York, USA). CONSORT guidelines were followed while conducting and reporting the study.[11]

RESULTS

The study flow is summarized in the CONSORT diagram (Figure 2). Based on eligibility criteria, 90 patients were screened for the study, out of which 37 were excluded. A total of 53 patients were randomized: 27 patients in EACCA arm and 26 EAM arm. All patients underwent surgical intervention as per protocol. Three patients were lost to follow-up at 2 months and thus were excluded from analysis. A total of 50 patients were analysed, of which 23 were males and 27 were females. Patient demographics are summarized in Table 1. Average age was 6.64 (Range 5-13) years. Out of the total patients, 8 experienced sleep disordered breathing as their main complaint, 10 had OME as their main issue, and 32 patients had both conditions concurrently.

Average duration of surgery in EACCA group was 14.43 min whereas in EAM group was 19.09 min, and the difference was not statistically significant. Average blood loss in EACCA group was 84 ml and in EAM group was 96.61 ml and was not statistically significant. All patients in EACCA group had residual tissue with 21/25 (84%) having residual tissue at medial end of eustachian tube. None of EAM group had residual tissue. Injury to medial end of eustachian tube was evident in 7/25 (28%) patients in EACCA group whereas none in EAM group had eustachian tube injury. During follow up, 4 patients in EACCA arm had resolution of residual tissue at sites other than medial end of eustachian tube. All patients in both arms showed improvement in SDB symptoms. Improvement in OME as evident by tympanogram change from type B/C to type A was seen only in 1/19 (7.69%) patient of EACCA arm whereas 21/22 (94.73%) patients in EAM arm showed improvement which was statistically significant.

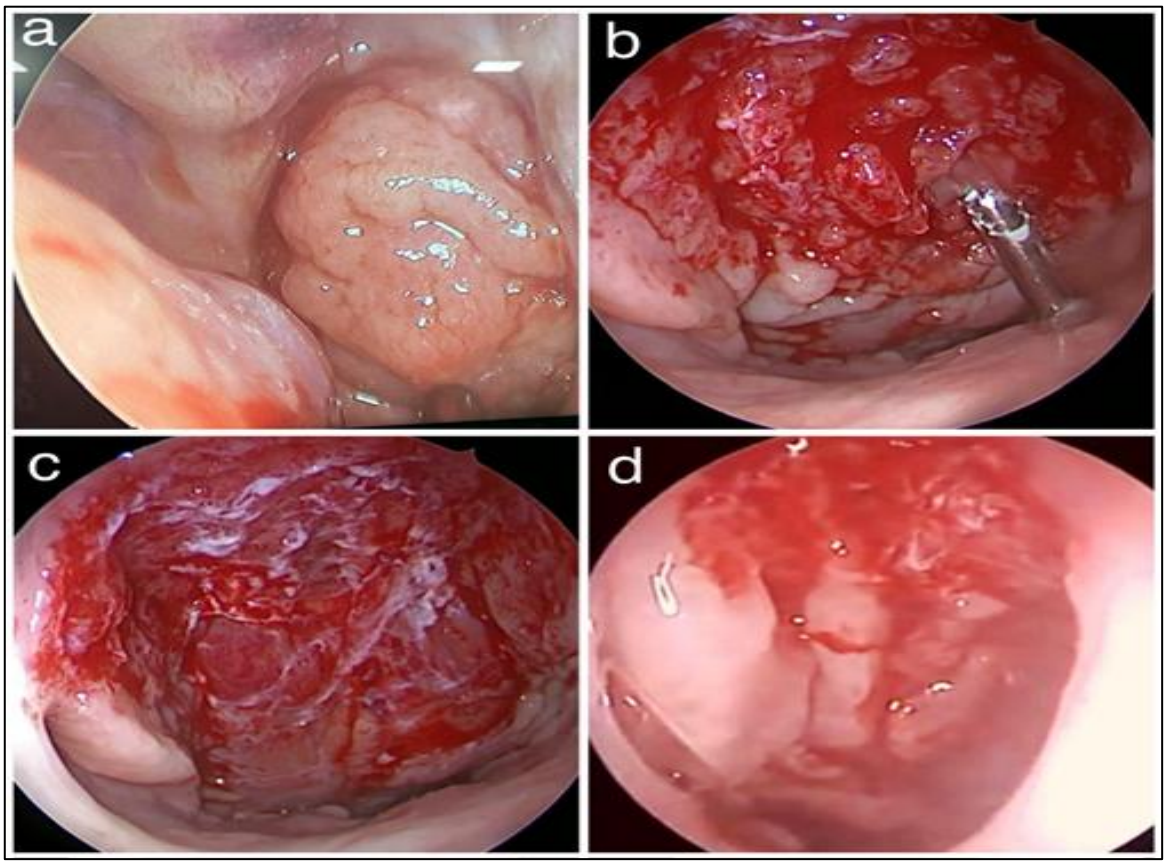

Figure 1 (A-D): A endoscopic pictures showing grade 4 adenoid enlargement extending into choana, 600 angled microdebrider blade with front facing tip (i.e. along concave border) *in situ*, inserted perorally, cutting in back to front fashion, complete adenoid removal with microdebrider and incomplete removal of adenoid after conventional curettage.

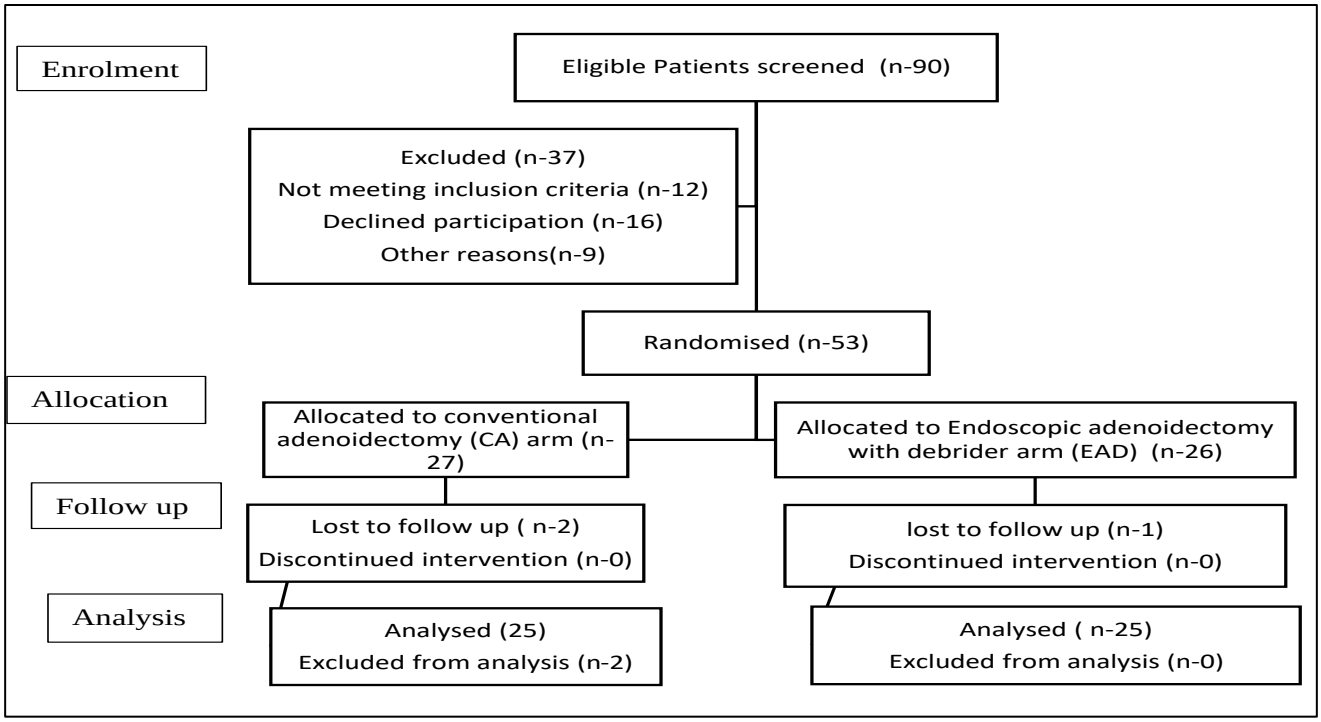

Figure 2: Consort diagram of the study.

Table 1: Patient demographics.

Parameter/ variables	Total	EACCA group, (n=25)	EAM group, (n=26)
Total number of patients	50	25	25
Males	23	12	11
Females	27	13	14
Age (in years) (Average, min, max)	6.64 (5-13)	6.64 (5-11)	6.64 (5-13)
Weight (in kg) (Average, SD)	20.06 (SD-4.31)	19.32 (SD-4.29)	20.8 (SD 4.33)
Indication of adenoidectomy			
Only sleep disordered breathing (SDB)	8/50 (16%)	5/25 (20%)	3/25 (12%)
Only OME	10/50 (20%)	4/25 (16%)	6/25 (24%)
Both	32/50 (64%)	15/25 (60%)	16/25 (64%)
SDB (Total)	40/50 (80%)	20/25 (80%)	19/25 (76%)
OME (Total)	42/50 (84%)	19/25 (76%)	22/25 (88%)

Table 2: Comparative analysis of study parameters between 2 groups.

Parameter/ independent variables	EACA group, (n=25)	EAM group, (n=25)	P value
Intraoperative			
Average duration of surgery (Min)	14.43 (SD-1.16)	19.09 (SD-1.04)	0.23
Blood loss (ml)	84 (SD-10)	96.61 (SD-34.56)	0.14
Residual tissue	25/25 (100%)	0/25 (0%0	<0.001
Residual tissue-peritubal	21/25 (84%)	0/25 (0%)	<0.001
Injury to medial end of eustachian tube	7/25 (28%)	0/25 (0%)	<0.001
Time taken for haemostasis (min)	16.60 (SD-1.55)	14.80 (3.32)	0.60
Postoperative			
Average hospital stays (days)	2	3	0.80
Median pain score	3	4	0.13
Follow up (2 months)			
Residual tissue-Peritubal	21/25 (84%)	0/25 (0%)	<0.001
Improvement in SDB	20/20 (100%)	19/19 (100%)	0.9
Improvement in OME (Tympanogram)	1/19 (7.69%)	21/22(94.73%)	0.02
No improvement/ worsening of OME (Tympanogram)	18/19 (94.73%)	1/22 (4.54%)	0.01

DISCUSSION

Conventional adenoidectomy with a curette itself is a blind procedure, which relies on palpation and is associated with limitations of residual tissue and injury to surrounding structures. These problems can be partially addressed with use of rigid endoscope. We performed post curettage endoscopy to visualise residual tissue, which was seen in all patients of EACCA. Despite visualising residual tissue, repeat curettage cannot effectively target peritubal area tissue, due to limited reach of the curette. In attempt to angulate the curette laterally and scrape remnant adenoids in peritubal area, medial end of eustachian tube gets injured as evident by our study. This peritubal residual tissue leads to persistence of OME. Canon et al popularised use of endoscope in adenoidectomy. They used 4 mm 0^0 endoscope transnasally to visualise residual tissue after transoral adenoidectomy and reported invariable presence of residual tissue after conventional adenoidectomy.[6] They used paediatric pituitary forceps under endoscopic guidance to remove residual tissue and not the adenoid curette, emphasising the fact that additional instrumentation to conventional curette is needed for complete removal of adenoids. Regmi et al used rigid endoscope for visualisation of remnant adenoid tissue and found residual tissue at eustachian tube opening in 63% cases.[18] They reported that subsequent visualisation with endoscope could remove residual tissue from all nasopharyngeal sites except medial end of eustachian tube. Elnasher et al used endoscope to visualise and objectively quantify residual adenoid tissue after conventional adenoidectomy and reported substantial residual tissue left behind after conventional adenoidectomy.[19] Findings of our study coincide with available literature.

We have observed that the visualization of the nasopharynx using an endoscope is comfortably feasible only before and after a conventional adenoidectomy procedure and not while performing curettage. In order to perform a nasal endoscopy, the patient is placed in a supine head elevated position while the surgeon stands on the side of the patient. During adenoid curettage, surgeon has to position himself at the head end of the patient and carries out the procedure while gently flexing and stabilizing the patient's neck with their other hand. This precautionary measure is taken to reduce cervical lordosis, to prevent potential injury to the anterior longitudinal ligament, which could result in Grisel syndrome.[20-22] The concurrent use of an endoscope while doing curettage mandates need of assistant surgeon to hold endoscope. Moreover, with neck flexion, long axis of the endoscope-camera unit collides with the patient's chest, potentially resulting in wear and tear of endoscope-camera unit and also interferes with dagger like movements of curette. It is difficult to effectively coordinate the procedure due to the positioning of the surgeons, patient, and endoscopy unit, which potentially increases surgical duration. Similar findings are noted in study by El-Badrawy et al who simultaneously used 70^0 rigid endoscope tranorally with curette and reported limitation of unacquainted transoral view and increases wear and tear of endoscope.[23] Bradoo et al performed curettage under endoscopic vision, however they did not describe technical specifications of simultaneous use of endoscope and curette.[24] Based on our study, we emphasise technical limitations of concurrent use of endoscope while performing conventional curettage.

Microdebrider can be comfortably used with endoscope in a supine head elevated position. Endoscope is inserted transnasally and microdebrider 60^0 curved blade with tip on concave side is inserted tranorally which easily reaches nasopharynx up to tubal tonsils, compared to adenoid curette. Microdebrider is powered with suction which sucks adenoid tissue into the tip and safely shaves of every bit of adenoid tissue in back to front fashion under constant vision of endoscope, minimising injury to surrounding structures. Irrigation and suction aids of microdebrider clear blood and tissue bits effectively to provide unhampered vision. Shiny perimysium of superior constrictor can be easily identified which is posterior limit of adenoidectomy. According to our study, EAM could achieve significant tissue clearance compared to EACCA pertaining to technical superiority (Figure 2).

Koltai et al who pioneered use of microdebrider for adenoidectomy, compared outcomes of microdebrider with conventional adenoidectomy in a retrospective study and reported significant less operative time with insignificant difference in the blood loss and hospital stay.[25] However, they used no. 5 laryngeal mirror and not endoscope. Stanislaw et al from same group confirmed these findings prospectively, again visualisation was with laryngeal mirror and concluded powered adenoidectomy is significantly faster, with less blood loss, more complete resection and greater surgeon satisfaction.[26] Saibene et al did retrospective analysis of 1006 patients treated with endoscopic adenoidectomy with 400 curved blade microdebrider and concluded that endoscopic adenoidectomy requires more operative time but is associated with lesser blood loss, less complications and less treatment failures.[27] Somani et al prospectively studied 34 patients and concluded that EAM is a secure and efficient procedure.[28] They found no cases of eustachian tube stenosis at the one-year follow-up. However, they also highlighted several drawbacks including cost, limited availability of tissue for histopathology, difficulties in manoeuvring, and a learning curve associated with the procedure. In a systematic review and metanalysis of 17 prospective randomised Studies comparing conventional and other powered adenoidectomy techniques, by Malas et al no statistically significant difference was found in blood loss and operative time.[29] Interventional groups other than conventional group had 97% less likelihood of having residual tissue, which was significant. Individual studies comparing perioperative morbidity and outcomes of conventional and powered technique, have been

summarised in Table 3. Considering perioperative morbidity; we did not find statistically significant difference in operative time, time required for haemostasis, blood loss, pain score and hospital stay, which is more or less in accordance with the available literature. Suction irrigation aided microdebrider blade with 60^0 angulation and front facing tip (i.e. along concave border), combined with transnasal 0^0 endoscope for visualisation provides technical superiority in complete, precise and safe adenoidectomy without perioperative morbidity.

Studies have reported completeness of surgical resection of adenoids, but whether this translates into symptomatic relief at follow up has not been documented in majority of studies. Bradoo et al reported a prospective randomised study of 32 patients comparing conventional adenoidectomy with endoscope assisted adenoidectomy with conventional curette and reported near complete removal of adenoid tissue with endoscopic assistance.[24] As per their study, minimal residual adenoid tissue may not have immediate clinical implications, but may regrow to become symptomatic later on. In contrast to the aforementioned study, our study indicates that the presence of residual tissue at the eustachian tube opening is associated with the persistent OME. We compared follow up findings at 2 months with preoperative findings to see the clinical efficacy. Adequate improvement in symptoms of SDB were noted in both arms as central part of adenoids is adequately removed. As described earlier, residual peritubal tissue in EACCA arm translated into persistent OME at follow up. Injury to medial end of eustachian tube explains worsening of OME in EACCA arm possibly due to post traumatic scarring. Major limitation of powered microdebrider is availability of the equipment, recurring cost of blades and learning curve. Based on our study, we suggest conventional adenoidectomy coupled with endoscopes can be effectively used in symptoms of SDB, if cost is a constraint. But considering long term sequalae and associated cost for treatment of OME, EAM is strongly advocated.

Table 3: Studies comparing conventional curettage adenoidectomy (CCA) and EAM.

Authors	Year	Study design	Age group (in years)	Sample size	Study arms	Conclusion
Stanislaw et al[26]	2000	Prospective randomised	1-13	87	CCA Vs microdebrider adenoidectomy (Visualisation with laryngeal mirror No.5)	Power assisted adenoidectomy provides faster, dryer, more complete and surgically satisfying resection than conventional adenoidectomy
Datta et al[30]	2009	Prospective randomised	6-12	60	CCA Vs EMA	CCA is associated with less bleeding, lesser operative time whereas EMA provides completeness and accuracy of resection, lesser collateral damage and faster recovery.
Bradoo et al[24]	2011	Prospective randomised	5-13	32	CCA vs CCA (Endoscope assisted)	Endoscopic assisted CCA is safe, effective in achieving complete adenoidectomy and preventing complications.
Hussein et al[31]	2012	Prospective randomised	4-20	40	CCA Vs EMA	EMA is a safe, allows complete removal of tissue under direct vision and useful in recurrent cases, adenoids extending to nasal cavity and partial resection (in submucous cleft palate). EMA has limitations of need for special equipment, more operating time and expertise.
Ravishankar et al[32]	2018	Prospective randomised	60	6-15	CCA vs EMA	EMA is safe, effective, more complete, accurate with minimal chance of injury to surrounding structures compared to CCA and useful for choanal and recurrent adenoids. However, EMA needs special equipment, expertise and more operating time.
Juneja et al[33]	2019	Prospective randomised	4-12	50	CCA vs EMA	EMA is safe and precise method for complete adenoid removal and excellent teaching aid.
Atilla et al[34]	2020	Prospective randomised	5-10	65	CCA (Visualisation with laryngeal mirror) vs EMA	Postoperative eustachian tube dysfunction is less with EMA than with CCA in post-operative period (day 1 and 7).

Continued.

Authors	Year	Study design	Age group (in years)	Sample size	Study arms	Conclusion
Singh et al[35]	2020	Prospective randomised	5-15	120	CCA vs EMA	EMA is safe adenoidectomy tool and scores extra in terms of lesser residual tissue, controlled bleeding, accurate tissue removal, minimal collateral damage, less postoperative pain, less recovery time with limitations of cost and expertise.
Harugop et al[36]	2020	Prospective randomised	3-16	45	CCA vs EMA	EMA provides complete clearance at the expense of slight increase in bleeding and operative time.
El-Bahrawy et al[37]	2021	Prospective randomised	6-18 r	18	CCA vs EMA	EMA is more complete, accurate and associated with lower recurrence compared to CCA.
Manhas et al[38]	2022	Prospective	5-14	60	CCA vs EMA	Operative time and intra operative bleeding are less with CCA whereas complete removal with less collateral injury is seen with EMA. Costly setup, more operative time and intraoperative bleeding are disadvantages of EMA.
Wadia et al[39]	2022	Prospective randomised	5-10	60	CCA vs EMA	EMA is more complete, accurate, with less pain and lower incidence of recurrence. Increased operative time, cost and learning curve are limitations of EMA.
Beemrote et al[40]	2023	Prospective randomised	5 -13	50	CCA vs EMA	EMA has better completeness of resection, better control of depth of resection, minimal collateral damage intraoperatively and less postoperative pain, complications and faster recovery.
Yanilmaz et al[41]	2023	Retrospective	3-12	833	CCA vs EMA	EMA is safer than CCA considering residual adenoid tissue, need for re surgery and lesser incidence of postoperative OME
Raj et al[42]	2024	Prospective observational	3-23	36	CCA vs EMA	Both procedures are safe considering perioperative morbidity and residual tissue. EMA has additional advantage of surgical removal under vision
Current study	2024	Prospective randomised	5-13	50	CCA (Endoscope assisted) vs EMA	EMA is technically superiority over EACCA, in complete and precise removal of adenoids, without collateral damage and insignificant perioperative morbidity which translates into better clinical efficacy in long term.

Strength and weaknesses of study (SWOT analysis)

The study's strength lies in its prospective randomised design, enabling real-time data collection from consecutive patients. Precise selection criteria were used which can be directly attributed to adenoid enlargement and can be compared objectively for efficacy of the treatment during follow up period. Conducted in a general hospital, the study provides a representative sample of the general population. Sleep disordered breathing needs sleep study for accurate diagnosis and documentation. Due to non-availability, questionnaire-based assessment of sleep disordered breathing was performed, which is a limitation of the study.

CONCLUSION

Clinical efficacy of endoscopic adenoidectomy with a powered microdebrider surpasses that of endoscope assisted conventional curettage. Conventional curettage adenoidectomy, in spite of endoscopic assistance, may still result in the presence of residual tissue especially at medial end of eustachian tube which translates into persistent symptoms of OME in long term. Both techniques however provide effective resolution of symptoms of sleep disordered breathing. Considering cost of powered instrument, if adenoidectomy is indicated only for sleep disordered breathing, then endoscope assisted conventional curettage method is advocated. But if indication is OME, then endoscopic powered

adenoidectomy should be preferred, considering long term sequalae of OME.

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