Research Article

Standard Instruments Versus Microdebrider in Endoscopic Sinus Surgery-An Outcome Based Comparative Study: A Tertiary Care Hospital Experience

Muhammad Asim Shafique,[1] Muhammad Saleem Sheikh,[2] Masood Akhtar,[3] Nayab Anjum,[4] Muhammad Omer Khan Balouch[5]

[1,3,4,5]Department of ENT & Head & Neck Surgery, QAMC / Bahawal Victoria Hospital Bahawalpur; [2]Head of ENT Department, Nishtar Medical University (NMU), Multan

Abstract

Background :In endoscopic sinus surgery (ESS) for chronic rhinosinusitis with nasal polyposis, the standard instruments have been in use to remove diseased mucosa and polyps since decades. The powered instrument like microdebrider is a current innovation to replace the conventional instruments during ESS.

Objective: To compare the outcome after using standard instruments versus microdebrider in endoscopic sinus surgery for restoring sinus drainage.

Methods: This Randomized Controlled Trial (IRCT Id:78723) was conducted at Department of Otorhino-laryngology, Bahawal Victoria Hospital Bahawalpur from 1st April 2022 to 31st December 2022. About 130 patients of chronic rhinosinusitis with nasal polyposis from 15-65 years of age were included after informed written consent. Patients were equally divided in two groups. In Group A, patients underwent endoscopic polypectomy and clearance of the sinuses with widening of ostia using microdebrider while in group B, standard conventional instruments were used. All patients were followed for 8 weeks and outcome (duration of procedure, per-operative bleeding, post-operative pain, synechiae formation and recurrence) was noted. The data was analyzed by using the SPSS version 25.

Results: Out of 130 patients 49 were females and 81 were males. Mean duration of surgery was 53.58 ± 6.97 minutes in microdebrider group and 76.18 ± 6.80 minutes in standard instruments group. Mean intraoperative blood loss was 81.57 ± 9.28 ml in microdebrider group and 104.80 ± 10.44 ml in standard instruments group. Mean post-operative pain (by Visual Analogue Scale) was 1.25 ± 1.00 in microdebrider group and 3.83 ± 1.26 in standard instruments group. Synechiae formation and recurrence were seen in 4.62% and 3.08% respectively after ESS with microdebrider (group A) while in 13.85% and 16.92% respectively after ESS with standard instruments (group B).

Conclusion : There is significantly less post-operative pain, duration of surgery and per-operative blood loss in patients having endoscopic sinus surgery with microdebrider as compared to standard instruments.

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Corresponding Author | Dr Muhammad Asim Shafique, Associate Professor, Department of ENT & Head & Neck Surgery, QAMC / Bahawal Victoria Hospital Bahawalpur **Email** : drasimkemc@yahoo.com

Keywords | endoscopic sinus surgery, microdebrider, synechiae formation

Introduction

Sinonasal polyposis and chronic rhinosinusitis (CRS) are the common diseases of the nose and paranasal sinuses. In United Kingdom over 30 per cent of community become the victim of chronic rhinosinusitis (CRS).[1] A recent study conducted in Karachi, Pakistan on the prevalence and determinants of CRS unfolds that CRS mostly hits adult students due to over exposure worsening the quality of life.[2] Endoscopic sinus surgery (ESS) is a widely adopted surgical treatment for various sinonasal disorders especially when conservative treatment

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is failed.[1] Endoscopic sinus surgery is minimally invasive, fast, and tolerable surgical procedure. It includes some basic and relatively simple procedures like endoscopic turbinectomy / turbinoplasty, endoscopic septal surgery and functional endoscopic sinus surgery along with advanced surgery like endoscopic dacryocystorhinostomy, endoscopic skull base procedures and endoscopic orbital/optic nerve decompression. The advantages and benefits are avoiding external scars, less normal mucosa and bone damage and decreased recovery duration and hospital stay.[3] With the passage of time, the technique has been improving and one of the revolutionary changes in this regard is the use of the microdebrider, an electronically operated instrument that has a fine blade to cut the polyploidal tissues. It also has a sucker that sucks the debrided tissues at the same time which additionally minimizes the chances of the complications.[4]

Moreover, endoscopic sinus surgery especially by using microdebrider is associated with rapid healing of the mucosa, less crust formation as well as least chances of synechiae formation, rapid healing and faster healing of the nasal mucosa,[5,6] With the more advance technology that is by using the 3D navigation, even outcomes can be improved in terms of less chances of complications and more successful prevention of intracranial complications during the skull base endoscopic surgery.[7]

The use of conventional standard instruments like Blackslay's forcep, Ball probe, Sinus currette, Tilley's hankle, Backbiting and Luc's forceps during the endoscopic sinus surgery is easy, does not require much expertise and is comfortable to handle with.[8] But at the same time it is also associated with injury to the normal mucosa of the nose and paranasal sinuses and leads to the formation of scars and neo-osteogenesis.[9] Hence this ultimately leads to the need of developing fine instruments in order to avoid such complications and getting much better results. So microdebrider is regarded as the best advancement in endoscopic sinus surgery but at the same time, it requires more expertise in order to prevent the probable complications due to restricted field of vision.[8,10] Therefore we decided to conduct this comparative study in our settings to find the better operative technique for our patients.

The rationale of this study was to compare the outcome results of the microdebrider with standard instruments in endoscopic sinus surgery in our population and settings. This study will provide us with more effective method for the treatment of sinonasal disease. Based on the results, the selection of particular equipment/s can be adopted routinely for endoscopic sinus surgery to treat these patients in order to reduce their morbidities.

Methods

Study was conducted with the study design as Randomized Controlled Trial (IRCT Id:78723) at Department of Otorhinolaryngology, Bahawal Victoria Hospital Bahawalpur from 1st April 2022 to 31st December 2022. Approval from the institutional ethical review board was taken vide letter number 2245/DME/QAMC. With the informed written consent, total 130 patients presenting to outdoor department of Otorhinolaryngology, Bahawal Victoria hospital, Bahawalpur were selected in the study of both gender from 15 to 65 years of age meeting the inclusion and exclusion criteria. Sampling technique was non probability consecutive type and sample size was calculated by using WHO calculator taking 95 % level of significance. All the patients having chronic allergic fungal rhinosinusitis(CRS) with nasal polyposis having equal and similar disease extension confirmed on radiology(Computed Tomography scan) were included in the study. Whereas those patients who had recurrent/post surgery sinonasal disease(Nasal polyposis and CRS), sinonasal mass/tumours, sinonasal disease along with deviated nasal septum and history of previous nasal trauma or surgery were excluded from the study. Moreover patients of sinonasal disease with known heart disease, diabetes mellitus or any hepatic or renal pathology were also excluded along with those too taking anti platelet drugs. Patients having un equal extension of sinonasal disease which was confirmed on CT scan were also not included. Lottery method was used to divide the patients, and all selected subjects were asked to choose and pick a slip from all mixed up slips whereas half-slips were containing letter 'A' and other half had letter 'B' and then the particular case was placed in that respective group accordingly. All patients in Group A underwent ESS (Endoscopic polypectomy, Ensoscopic stripping of diseased sinuses mucosa with removal of disease and sinus lavage,

Endoscopic middle meatus antrostomies) using microdebrider while in group B patients underwent ESS with conventional instruments like Freer's periosteal elevator, Blackslay's forcep, Ball probe, Sinus currette, Tilley's hankle and Backbiting forceps. Uncinectomy, middle meatus antrostomy, anterior and posterior ethmoidectomy, sphenoid sinus clearance and frontal sinus lavage were done endoscopically in all cases. Zero and seventy degrees nasoendoscopes were used during ESS. All polypoidal tissue was removed and sent for histopathology. All the surgeries were performed by the same surgical team with the same suction machine to eliminate bias. Intra operative and post operative outcome variables liketime duration of surgery, intra/per operative blood loss,post-operative pain (by using the Visual Analogue Scale of pain), synechiae formation and recurrence were recorded and collected on predesigned Performa. Follow up duration was 8 weeks. For outcome assessment, Nasoendoscopic examination and CT Scanning were used in follow up period. One side of nose and paranasal sinuses meeting the criteria was taken into account for recording the variables and comparison between two groups.

All data was entered and analyzed using SPSS 25 version. Shapiro wilk test was used to know normality of data. Mean, median, mode and SD were calculated for age, duration of disease, post-operative pain, intra/per operative blood loss and duration of surgery. Frequency and percentage were calculated for gender, synechiae formation and recurrence (yes/no). Comparison of post-operative pain, duration of surgery and intra-operative blood loss between both groups was done by independent 't' test and synechiae formation and recurrence by chi-Square test and p-value ≤0.05 was taken as significant. Effect modifiers like age, gender and duration of disease were controlled through stratification. Post-stratification independent 't' test for quantitative variables and chi-square test for qualitative variables were applied and p-value of ≤0.05 was taken as significant.

Results

Range of age in this study was from 15 to 65 years with mean of 30.45 ± 10.32 years. 97 patients (74.62%) were between 15 to 35 years of age. Out of these 130 patients, 81 (62.31%) were male and 49 (37.69%) were females with ratio of 1.6:1.Mean duration of disease was 5.34 ± 2.80 months (Table I).

Table 1: *Distribution of patients according to duration of disease (n =130)*

Duration of symptoms	Group A (n=65)	Group B (n=65)	Total (n=130)
	Frequency	Frequency	Frequency
	48(73.85 %)	49 (75.38%)	97 (74.62%)
>6 months	17(26.15%)	16 (24.62%)	33 (25.38%)
Mean ± SD	5.40 ± 2.82	5.35 ± 2.80	5.34 ± 2.80

In this study, mean duration of surgery on one side was 53.58 ± 6.97 minutes in microdebrider group and 76.18 ± 6.80 minutes in standard instruments group (Figure 1), mean intraoperative blood loss was 81.57 ± 9.28 ml in microdebrider group and 104.80±10.44 ml in standard instruments group(single side) shown in Figure 2, and mean post-operative pain was 1.25 ± 1.00 in microdebrider group and 3.83 ± 1.26 in standard instruments group with statistically significant difference (p value: 0.0001) between the two groups (Table 2). Outcome in terms of synechiae formation and recurrence in patients having endoscopic sinus surgery with microdebrider versus standard instruments is shown in Table 3. Synechiae formation (Figure 3) and recurrence were seen in 4.62% and 3.08% respectively after endoscopic sinus surgery with microdebrider (group A) while in 13.85% and 16.92% respectively after endoscopic sinus surgery with standard instruments (group B). Here the recurrence found in microdebrider group is significantly less than in the patients of standard instruments group (p value 0.009).

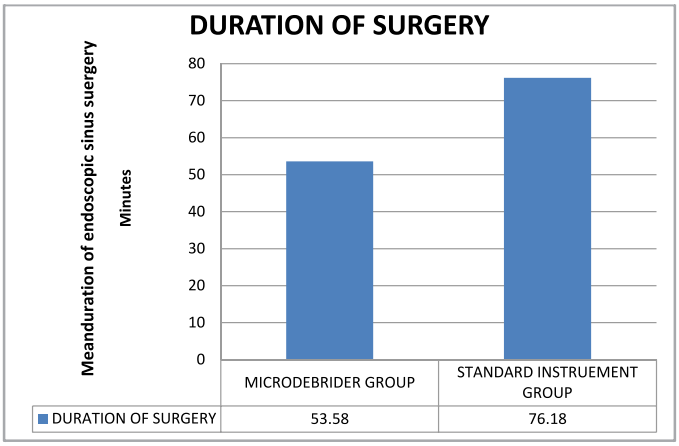

Figure 1 : *Difference in duration of surgery between patients of group A and B*

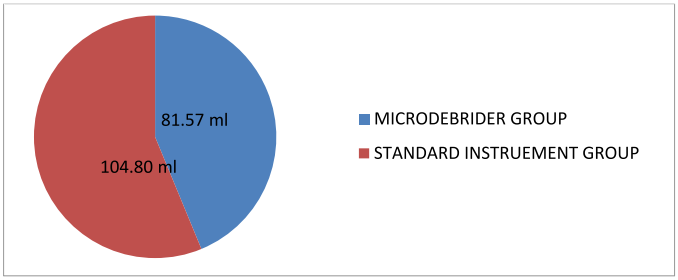

Figure 2: *Mean intraoperative blood loss during endoscopic sinus surgery with microdebrider vs standard instruments*

Table 2: *Comparison of post-operative pain, duration of surgery and intra-operative blood loss in both groups*

Outcome	Group A (n=65)	Group B (n=65)	p-value
	Mean ± SD	Mean ± SD	
Duration of surgery (minutes)	53.58 ± 6.97	76.18 ± 6.80	<0.001
Intra-operative blood loss (ml)	81.57 ± 9.28	104.80±10.44	<0.001
Post-operative pain	1.25 ± 1.00	3.83 ± 1.26	<0.001

Table 3: *Comparison of synechiae formation and recurrence in both groups (n=130).*

Outcome		Group A (n=65)	Group B (n=65)	P value
		No.	No.	
Synechiae formation	Yes	03 (4.62%)	09 (13.85%)	0.069
	No	62 (95.3%)	56 (86.15%)	
Recurrence	Yes	02 (3.08%)	11 (16.92%)	0.009
	No	63(96.9	54 (83.08%)	

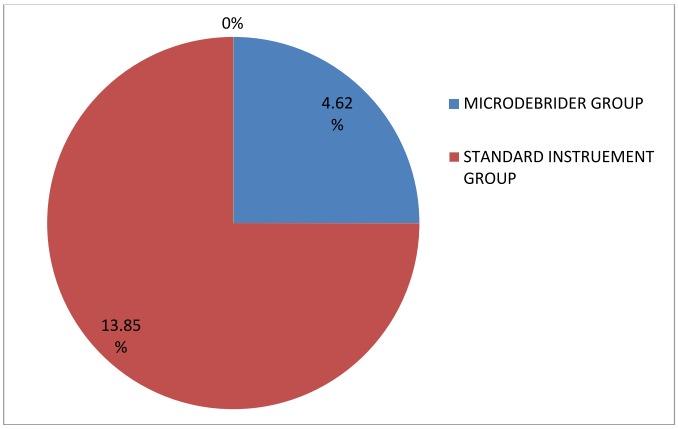

Figure 3: *Synechiae formation after surgery with microdebrider vs standard instruments*

Discussion

Endoscopic sinus surgery (ESS) has been in routine use for almost 20 years and more for the treatment of sinonasal pathologies. Kennedy used the term Functional endoscopic sinus surgery (FESS) in 1985 and it was Walter Messerklinger from Austria who did the initial research work on FESS.[11] Defining FESS remains variable, but can be described as a minimal invasive technique where an angled rigid nasoendoscope is used to have the restoration of nasociliary clearance mechanism, drainage and ventilation of the paranasal sinuses. The invention of the rigid nasoendoscope for diagnosing and surgically treating the various sinus and nasal diseases is the single most valuable innovation in the discipline of rhinology up till now. With the help of endoscopy, improved visualization and understanding of the sinus and nasal anatomy became possible which directed towards the way of safety for sinus surgery far from the limits of nasal cavities and paranasal sinuses. To achieve the drainage of the sinuses with preservation of respiratory mucosa is of key importance, which if removed, the future relining of the mucosal surfaces should be the main objective. Rapid and early post operative restoration of mucociliary clearance mechanism depends on the regeneration of cilia and minimal bare bone exposed during the surgical procedure which is often not possible in radical surgical removal of the mucosa.[14] The instrumental innovation dated back in 1879 when small cystoscope was invented by Nitze that later on Hirschman used in 1901 to visualize the maxillary sinus through an oroantral fistula.[12] When with endoscopes surgical procedures were started as a routine practice the limitation to use one hand only during such procedures was realized. To overcome this major obstacle the ultimate requirement of such an instrument was logically felt which could provide multiple functions in a single go. This novel thought let the powered sinus instruments come into the landscape of endoscopic sinus surgery many decades ago, with the development and arrival of the microdebrider. The initial design of what we recognize today as the microdebrider was displayed in 1969 by Urban as vacuum rotary dissector. The same was in the use of House group in 1970 for handling acoustic neuromas, and later on for arthroscopy. Setliff and Parsons firstly introduced such devices for the use of sinonasal operations in 1994.[13]

Current study revealed after the comparison of the outcome of the microdebrider with standard conventional instruments in endoscopic sinus surgery (ESS) that the

use of microdebrider in ESS significantly improves the results in terms of duration of surgery, intra operative pain and bleeding along with recurrence.

Varman and colleagues in their study has shown the synechiae formation in microdebrider group as 2% as compared to standard instruments group which was 16.0%. Recurrence was found in 8% patients for microdebrider group and 36.0% in standard instruments group.[9]

Setliff and Parsons who pioneered the introduction of microdebrider in nasal surgeries observed in their study minimal loss of blood, rapid healing, less adhesion formation and middle turbinate injury.[13] Khalily and others found the endpscopic sinus surgery in nasal polyposis more effective with microdebrider as compared with convention tools. However the difference in terms of synechiae formation was not discernible.[14] Souvagini and colleagues in their comparative study found that there was significant decrease in intraoperative blood loss and duration of surgery during ESS by using microdebrider as compared to the routine instruments while no significant difference was noted in post operative synechiae formation and disease recurrence.[15] Similar findings were noted in another study conducted by Ahmad Aboul Wafa with significant less intraoperative bleeding and duration of surgery among patients having ESS with microdebrider as compared to conventional instruments.[16]

In our study there is statistically significant difference in blood loss and operative time in both the groups (p value 0.0001). Cameron et al concluded in their study that a caution must be exercised for orbital structures while operating ESS with microdebrider due to their close proximity.[17] Although these reports are rare. Generally the use of microdebriders is safe for sinus surgery. An interesting study done by Ramiya and others in 2019 however found equal results between conventional instruments and microdebrider for ESS provided the surgical team is well trained with the good anatomical knowledge, availability of good quality instruments and hypotensive anesthesia.[18] In one latest study conducted by Elias et al in June 2023 the microdebrider related complications were studied for the period of 20 years and in total 641 events the commonest noted complication was over heating of the powered equipment which could harm the patient.[19] However in another study published in 2022 again found statistically significant post operative outcome results in ESS with the use of microdebrider based on post operative Lund Mackay Radiological and Visual Analogue Scoring.[20] In Pakistan multiple studies have been conducted on endoscopic sinus surgery and in one of these where frequency of post operative synechiae formation was studied among patients having ESS with and without using microdebrider, Tabassum and colleagues found significantly less synechiae formation with microdebrider as compared to the other group where ESS was done without microdebrider.[21] In our study the difference in synechiae formation between the two groups is statistically not significant which is an emerging finding.

In our part of province the ESS is not so frequently practiced because of the lack of complete gadgets and full expertise. Therefore this study also provides the better overview, benefits and applicability of the endoscopic intervention to deal with the chronic rhinosinusitis and nasal polyposis instead of doing old radical procedures for this particular disease. This study has some limitations and weaknesses. The technical errors, power and equipment failure which may occur with microdebrider during the surgery have not been assessed that can increase the duration of surgery remarkably. Furthermore the cost effectiveness of the two techniques were also not studied as the powered instrument along with shaver considerably puts some financial burden over the patients or institution.

Finally the take away message is that endoscopic sinus surgery with microdebrider should be used in routine for these patients having chronic rhinosinusitis and nasal polyposis in order to minimize the morbidity and to have safer and quick operative management with better outcome.

Conclusion

This study concludes that there is less post-operative pain, duration of surgery, intraoperoperative blood loss, synechiae formation and recurrence in patients undergoing endoscopic sinus surgery with microdebrider as compared to standard instruments.

Ethical Approval: The Institutional Ethical Review Board, Quaid-e-Azam Medical College, Bahawalpur approved this study vide letter No. 2245/ DME/ QAMC Bahawalpur.

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Authors' Contribution:

MAS: Conception & design, analysis & interpretation of data, drafting of article, final approval

MSS: Critical revision for important intellectual content, final approval

MA: Analysis & interpretation of data, final approval

NA: Acquisition of data, drafting of article

MOKB: Acquisition of data, analysis & interpretation of data

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