Original Research Article

Role of navigation system in functional endoscopic sinus surgery

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ABSTRACT

Background: Functional endoscopic sinus surgery (FESS) is a challenging procedure for otorhinolaryngologists. Navigation can reassure the surgeon's judgement and enhance surgical performance and prevent complication. The study done with aim of comparison between FESS with navigation and conventional FESS and explore other indication of navigation in endoscopic sinus surgery in difficult clinical scenario.
Methods: This is a cross-sectional study on patients with sino-nasal disease. 100 patients in whom the ability to identify surgical site is assumed to be compromised by various conditions like previous surgery, massive/ recurrent polyposis, front oethmoidal mucocele, frontal, sphenoid sinus disease were included in the study. Patients were randomly allocated into two groups, group A (50 patients) FESS with navigation and group B (50 patients) conventional FESS. Pre-operative preparation time, intraoperative time, blood loss (Fromme–Boezzaart scoring), surgeon satisfaction, patient satisfaction (SNOT-20), complications were documented on a preformed, pretested proforma. Equipments used were –StealthStation S7 system, CD for recording intraoperative findings.
Results: Preoperative preparation time duration was applicable for group A only. Intraoperative time was slightly and insignificantly higher in group A. Blood loss according to Fromme-Boezzaart scoring had lesser scoring values in group A and difference among gradings was statistically insignificant. Surgeons satisfaction and confidence was statistically significant higher in group A. The SNOT-20 score values were lower and insignificant in group A.
Conclusions: FESS with navigation is more convenient to surgeon, appears to be safer tool.

Keywords: FESS, FESS with navigation, Surgeon's satisfaction

INTRODUCTION

Functional endoscopic sinus surgery (FESS) usually of 2-4 hours duration is a minimally invasive surgical treatment which uses nasal endoscopes to improve sinus ventilation.[1] Generally used to treat inflammatory and infectious sinus diseases, including chronic rhinosinusitis that doesn't respond to drugs, nasal polyps, cancers and graves ophthalmopathy.[2-4] An otolaryngologist removes the uncinate process of the ethmoid bone while visualizing the nasal passage using a fiberoptic endoscope.[1] FESS can be performed under local anesthesia as an outpatient procedure.[4] Despite the minimally invasive and gentle nature of FESS, increased use of FESS accompanied by the complex anatomy of the sinuses and skull base, proximity of critical structures (eye and brain) to the surgical field and deformation in anatomical landmarks due to tumors or revision surgery have raised concern about intraoperative complications. Although the rate of major intraoperative complications associated with FESS is reported to be low (0.3-3.0%), intracranial and orbital penetration have resulted in catastrophic adverse events. Orbital hematoma, vision changes, cerebrospinal fluid leak, blindness, intracranial

damage, and death have been documented as major complications of FESS. Minor complications of FESS include anosmia/hyposmia, periorbital ecchymosis, orbital emphysema and epistaxis.[5-9]

Computer assisted surgery (CAS) represents a surgical concept and set of methods, that use computer technology for pre-surgical planning, and for guiding or performing surgical interventions. CAS is also known as computer aided surgery, computer assisted intervention, and image guided surgery and surgical navigation. Navigation systems provide information to guide surgical planning and approach. With the use of 3 reference points and the principles of triangulation, any point in space can be localized. The surgeon can precisely identify the position of the surgical instrument without losing his way.[2]

Over the last thirty years, the field of sinus surgery has advanced from open surgical procedures focused on mucosal stripping as standard of care to functional endoscopic procedures using state of the art instrumentation, high definition cameras, and intraoperative stereotactic surgical navigation. The indications have expanded from primarily inflammatory disease to sino-nasal-tumours, skull base and orbital pathology. Ever since navigation technology was introduced into endonasal surgery, its impact on process and result of surgery has been debated.

Aims and objective

Comparison between FESS with navigation and conventional FESS in terms of the preoperative and intraoperative time, the complication associated with surgery time, the surgeon satisfaction following surgery, to explore other indication of navigation in endoscopic sinus surgery in difficult clinical scenario.

METHODS

This was across-sectional hospital based comparative study on 100 patients with sino-nasal disease done at ENT OPD at PBM hospital Bikaner, Rajasthan from July 2018- December 2019. 100 patients in whom the ability to identify surgical site was assumed to be compromised by various conditions like previous surgery, massive/ recurrent polyposis, front oethmoidal mucocele, frontal, sphenoid sinus disease were included in the study. Patients were randomly allocated into two groups i.e. in group A, 50 patients who underwent FESS with navigation and in group B, 50 patients who underwent conventional FESS.

Pre-operative preparation time, intraoperative time, blood loss (Fromme – Boezzaart scoring), surgeon satisfaction, patient satisfaction (SNOT-20), complications were documented on a preformed, pretested proforma.[10,11] Equipments used were –StealthStation S7 system, CD for recording intraoperative findings.

Computed tomography specification for StealthStation S7 were standard soft tissue alogorithm, no gantry tilt, contiguous slices, 1mm slice thickness and 1 mm slice interval, axial slices preferred, field of view equal to up to 250, square image matrix of 256×256 or 512×512.

Data thus collected, was entered in the pre-structured, pre-tested proforma were then transferred into Microsoft Excel sheet and analysed with the help of Epi-Info software in terms of tables, diagrams, proportions, measures of central tendency and appropriate tests of significance wherever applicable. P value <0.05 was considered as cut off for statistical significance.

RESULTS

Conventional FESS and FESS with navigation both had maximum 26% cases were in 21-30 years age group. FESS with Navigation had 72% females whereas conventional group had 58% females. In both conventional as well as FESS with navigation occupation of study population were either farmers, housewives or students (24-26%, 24-36% and 26% each). Majority of cases in both groups were residing in rural areas. On local site-specific examination >50% cases in both groups demonstrated findings related to nasal obstruction. FESS with navigation had 46% cases having chronic rhino sinusitis followed by 26% cases of nasal polyp whereas in conventional FESS group, equal proportion of chronic rhino sinusitis and nasal polyp (40% each) were observed. Hemoglobin values, blood urea and serum creatinine were also observed to be statistically insignificant (p>0.05).

Maximum 26% cases were in 21-30 years age in both groups. With no significant difference in mean age (p>0.05) in both groups majority was female 72% in FESS with navigation and 58% in conventional FESS. Majority of patients were resident of rural area.

The Surgeon's vitals (difference of pre to intra operative) was observed and found that pulse rate, respiratory rate, mean systolic blood pressure, mean diastolic blood pressure was statistically significant (p<0.05).

Mean blood loss in ml was lower in FESS with navigation as compared to conventional FESS (48.06±21.85, 52.98±16.72) and this difference was statistically insignificant (p>0.05). The preoperative time duration was applicable for FESS with navigation group only because of setup time. The intra op time (mins) was slightly higher in FESS with Navigation cases initially (52.58±20.74 vs 51.96±11.13) though the difference was statistically insignificant (p>0.05).

As Table 4 shows FESS with Navigation cases had lesser scoring values than conventional FESS and the difference among gradings was statistically insignificant (p>0.05). The difference between the scores in two groups was statistically insignificant (p>0.05).

Table 1: Sociodemographic profile.

Variables	FESS with navigation		Conventional FESS	
	N	%	N	%
Age (in years)				
0-10	1	2.00	0	0.0
11-20	6	12.00	7	14.00
21-30	13	26.00	13	26.00
31-40	9	18.00	9	18.00
41-50	9	18.00	5	10.00
51-60	7	14.00	8	16.00
61-70	5	10.00	8	16.00
Mean age	35.72±15.10		36.84±16.21	P=0.72
Sex				
Male	14	28.00	21	42.00
Female	36	72.00	29	58.00
Residence				
Rural	29	58.00	31	62.00
Urban	21	42.00	19	38.00

Table 2: Surgeon's vitals measurements.

Measurement	FESS with navigation mean±SD	Conventional FESS mean±SD	P value
Pre to intra op pulse diff	12.04±4.78	4.9±2.6	0.002
Pre to intra op respiratory rate diff	3.46±1.65	2.4±1.15	0.001**
Pre to intra op mean systolic blood pressure diff	11.89±1.05	2.3±1.01	0.001**
Pre to intra op mean diastolic blood pressure diff	6.6±2.05	1.96±0.65	0.001**

Table 3: Mean blood loss (ml) and duration of pre-operative time and intra-operative time (mins).

Duration of pre-operative time and intra-operative time (mins)	FESS with navigation mean±SD	Conventional FESS mean±SD	P value
Pre op time	8.80±2.01	-	NA
Intra op time	52.58±20.74	51.96±11.13	0.853
Blood loss (ml)	48.06±21.85	52.98±16.72	0.209

Table 4: Fromme–Boezzaart scoring for Blood loss assessment.

Fromme-Boezzaart scoring	FESS with navigation mean±SD	Conventional FESS mean±SD	P value
Mean±SD	1.92±0.72	2.32±1.53	0.098

Table 5: SNOT-20 scoring for patient satisfaction assessment.

SNOT-20 score	FESS with navigation mean±SD	Conventional FESS mean±SD
Mean±SD (N1=N2=50)	1.72±1.1	2.08±1.29

P value=0.136

DISCUSSION

Present study entitled "role of navigation system in functional endoscopic sinus surgery" with the objectives of comparison of the pre-operative and intra-operative time, the complications associated and surgeon's satisfaction between FESS with navigation and conventional FESS was conducted at ENT OPD of PBM hospital and AGH, S. P. Medical College, Bikaner from January 2019 to December 2019 among 100 patients with

sinonasal disease, distributed equally between both study groups.

In our study, out of 50 cases of FESS with navigation, maximum 26% cases were in 21-30 years age group and almost similar pattern was observed in conventional FESS group. FESS with navigation had 72% females whereas conventional group had 58% females. Majority of cases in both group were residing in rural areas. On assessment of demographic and clinical parameters, mean age of conventional FESS cases was higher than FESS with navigation group but the difference was statistically insignificant.

The surgeon's pulse rate difference of pre to intra op was statistically significant ($p<0.05$) also the difference of pre to intra op respiratory rate was statistically significant ($p<0.05$). The difference of pre to intra op mean systolic and mean diastolic blood pressure was also statistically significant ($p<0.05$). The surgeon found the FESS with navigation more satisfactory and convenient as compared to conventional FESS. Also, Carrau et al, Strauss et al found that navigation assistance led to lower the workload of the surgeons.[12,13] Dixon et al observed that performance was increased ($p=0.02$) by use of augmented real-time image guidance during endoscopic sinus surgery.[14]

Mean blood loss in ml was lower in FESS with Navigation as compared to conventional FESS (48.06 ± 21.85 ml, 52.98 ± 16.72 ml). According to Fromme-Boezzaart scoring for blood loss assessment, FESS with Navigation cases had lesser and insignificant scoring values than conventional FESS ($p>0.05$) whereas Fried et al found that an average estimated blood loss of 134 cc.[15] The non- image guidance system group had an average estimated blood loss of 94 cc.

The preoperative time duration was applicable for FESS with navigation group only (mean-8.8 mins). Similar results were found by Heermann et al (<10 min).[16]

The intra op time (mins) was slightly and insignificantly higher in FESS with navigation cases initially (52.58 ± 20.74 vs 51.96 ± 11.13 ($p>0.05$). Strauss et al found that navigation assistance led to reduced intra operative time consumption.[13] Also, Al-Swiahb et al and Eliashar et al average operative time was greater in the navigation group.[17,18]

The SNOT 20 score values were lower and insignificant in FESS with Navigation as compared to Conventional FESS ($p>0.05$) whereas Tabaee et al found no statistically significant difference in postoperative SNOT-20 scores.[19]

In present study 2 patients of conventional FESS underwent FESS with navigation on follow up visit. Also, Fried et al found only one patient who needed repeat surgery.[15]

CONCLUSION

Navigation is not an essential tool but a useful tool. if u have a navigation system, precision to remove the disease increases and the operating surgeon can be more confident for removing of the disease completely. It helps in visualizing difficult areas and reduces even the slightest risk of injury to the vital structures.

However, anatomical knowledge and endoscopic skills of surgeon is paramount importance as machine can never replace the human brain. They can only be used to aid in the safety of the procedure.

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