ISSN: 0975-3583,0976-2833 VOL13, ISSUE 05, 2022

ORIGINAL RESEARCH

Cardiovascular risk assessment in functional endoscopic sinus surgery (FESS) under general anaesthesia

[1]Dr. Subash C., [2]Dr. Abhilash S., [3]Dr. Ila M. S.

[1] Assistant Professor, [2]Senior Resident, Department of ENT & Head and Neck Surgery, Mysore Medical College and Research Institute, Mysore, Karnataka, India
[3]Senior Resident, Department of Anaesthesia, D. Y. Patil Medical College, Kolhapur, Maharashtra, India

Correspondence:
Dr. Abhilash S.
Senior Resident, Department of ENT & Head and Neck Surgery, Mysore Medical College and Research Institute, Mysore, Karnataka, India
Email: dr.abhilashs@yahoo.in

Abstract

Objectives: In this study, patients with nasal polyps (NP) will have their right ventricular functions assessed both before and after functional endoscopic sinus surgery (FESS).

Methods: A total of 56 patients with grade II and III NP were enrolled in the trial between March 2021 and January 2022 (36 men, 20 women; mean age, 30±10 years; range, 19 to 40 years). All patients had their right ventricular fractional change area (RVFAC), pulmonary artery systolic pressure (PASP), tricuspid annular plane systolic excursion (TAPSE), and peripheral oxygen saturation using a pulse oximeter assessed before and one month after surgery.

Results: During the postoperative phase, the PASP statistically considerably decreased (p=0.003). Right ventricular systolic metrics TAPSE and fractional change area of the right ventricle both considerably improved following FESS (p=0.009 and p=0.005, respectively). During the postoperative period, peripheral oxygen saturation increased from 94.0±0.9 to 94.7±0.8 (p=0.005).

Conclusion: Our study, findings suggest that treating upper airway obstruction in NP adult patients may enhance right ventricular systolic performance and significantly lower PASP values.

Keywords: Functional endoscopic sinus surgery; nasal polyposis; right ventricular function.

Introduction

In the field of otorhinolaryngology, functional endoscopic sinus surgery (FESS) is now a routine surgical treatment. For patients with chronic polypous rhinosinusitis and medically refractory chronic rhinosinusitis with polyposis, it has a high success rate (around 90%) for symptomatic relief [1]. Adverse outcome with FESS are uncommon, and the majority of them are caused by the paranasal sinuses closeness to the brain and orbits. Meningitis, orbital and optic nerve injuries, severe haemorrhage, dura puncture, cerebrospinal fluid leak are some of the worst complications [2,3]. As a result, choosing to have the treatment done under general anaesthesia has several benefits, and the anaesthetist plays a crucial part in these procedures.

Initially, sedation was used in conjunction with topical anaesthesia during the traditional FESS technique. In this way, patients would be awake and able to express any pain or discomfort, notifying the surgeon and enabling him or her to do complications and trauma

ISSN: 0975-3583,0976-2833 VOL13, ISSUE 05, 2022

[4,5]. Modern surgical technique has advanced, enabling surgeons to be much more aggressive with the scope of their resection. An effective airway protection, sufficient analgesia, and patient comfort are subsequently made possible by a general anaesthesia. At the moment, local anaesthesia is still seen to be appropriate for simple procedures in some patients, but general anaesthesia is typically used to handle more difficult surgical needs [6].

Nasal polyposis (NP) is a chronic inflammatory condition characterised by hanging masses into the paranasal sinuses and edematous swellings of the nasal mucosa. One of the most frequent causes of upper airway obstruction in adults is nasal polyposis occurs in 1-4% of cases. Chronic alveolar hypoxia and hypercapnia are brought on by this obstruction over time, increasing pulmonary vascular resistance and pulmonary hypertension (PHT). It may eventually cause right ventricular hypertrophy and dilatation, a rise in right ventricular (RV) pressure, hepatic congestion, peripheral edema, and ascites if the disease causing PHT is not identified and addressed. Failure of the right ventricle does not just occur in isolation. It interacts with the left ventricle, affecting its functionality over time and eventually causing systemic disease. Therefore, it's critical to get diagnosed and treated before RV dysfunction manifests [7].

In daily practice, conventional echocardiographic parameters can be used to simply and noninvasively assess and reliably determine RV functioning [7]. We sought to assess the RV functions of Nasal Polyps (NP) patients both before and after functional endoscopic sinus surgery in this study (FESS). Hence, the present study was done to assess the cardiovascular risk in FESS under general anaesthesia.

Methods

The present study was conducted from March 2021 to January 2022 in Mysore Medical College and Research Institute, Mysore. Hospital Ethical Committee gave permission for the study. The Declaration of Helsinki's guiding principles were followed in the design of the study. All of the patients were made aware of the study and given the opportunity to provide their written consent. In total, 56 NP patients (36 men, 20 women; mean age, 30 ±10 years; range, 19 to 40 years) who were diagnosed by anterior rhinoscopy, diagnostic nasal endoscopy and coronal plane paranasal sinus computed tomography and admitted to our otorhinolaryngology clinic with symptoms of nasal congestion, rhinorrhea, and snoring were included in the study. They possessed NPs of grades II and III.

A 4 mm rigid, 0–30-degree endoscope was used for the endoscopic examination. For paranasal sinus computed tomography (CT) staging, the LundMackay system was employed [8]. There was no sinus opacification, partial opacification, complete opacification, 0 for an open osteomeatal complex, and 2 for an obstructed osteomeatal complex on each sinus side. The highest score for each side was therefore 12, for a total of 24. The study excluded patients with known cardiovascular disease, evidence of RV failure, pulmonary disease, grade I NP, and a history of another illness such as asthma, aspirin sensitivity and severe allergy symptoms and conditions that result in nasal congestion. Patients in the study had evaluations prior to and one month following surgery. Pulse oximetry was used to measure the peripheral oxygen saturation of each patient both before and one month after surgery. While nasal steroid was utilised for four weeks before to surgery, none of the patients received oral steroids before or after the procedure. The same surgeon performed the surgeries in each case under general anaesthesia. Patients underwent FESS using standard tools.

The usual anterior to posterior technique for FESS (uncinectomy, middle meatal antrostomy, anterior and posterior ethmoidectomy, sphenoidotomy, and frontal sinus clearance) was used in all instances during general anaesthesia with oral endotracheal tubes. All removed polypoidal tissue was sent for histological analysis. 25 individuals had septoplasty and

ISSN: 0975-3583,0976-2833 VOL13, ISSUE 05, 2022

conchal surgery. The outcomes for this patient group remained the same. On the morning following surgery, the intranasal packing was taken out. Patients were released from the hospital the next day and began using a regular saline nasal lavage solution. Analgesics and postoperative antibiotics were prescribed. Following surgery, cases were examined one week and one month later.

Images of the apical four chambers were used to measure the right ventricular transverse diameter, RV systolic and diastolic area. Right ventricular fractional change area (RVFAC) was calculated after formulating the right ventricular systolic and diastolic areas. By using M-mode on the RV lateral tricuspid annulus, the tricuspid annular plane systolic excursion (TAPSE), a measure of RV systolic function, was determined in the apical 4 chamber. TAPSE is calculated as the difference between basal and apical systolic motion in millimetres (mm). By using the tricuspid flow velocity and the right atrial pressure (a mean of 5 mmHg), which was determined based on the respiratory collapse of the inferior vena cava, the pulmonary artery systolic pressure (PASP) was computed. On the tricuspid valve, the pulsed-wave (PW) Doppler method was used to assess the peak early diastolic flow velocity (E), peak late diastolic flow velocity (A), and the ratio of peak early and late flow velocities (E/A).

Categorical variables were reported as percentages, whereas numerical values were shown as mean standard deviation. The distribution of the variables was analysed using the Kolmogorov-Smirnov test. The continuous variables were all distributed normally. The pre- and post-operative parametric characteristics of NP patients were compared using the independent samples t test. The software programme IBM SPSS version 20.0 (IBM Corp., Armonk, NY, USA) was used to conduct the statistical analysis.

Results

Table 1 lists the patient's fundamental characteristics. Of the patients, 34 (61%) had grade III NP while 22 (39%) had grade II NP. 18.4±4.5 was the average paranasal sinus CT score (range 10 to 24). Table 2 shows the patient's oxygen saturation, pre- and postoperative echocardiographic data. In the postoperative phase, it was discovered that the right ventricle end-diastolic area (mm^2) had drastically decreased (p=0.042). Similar to this, RVFAC (%) significantly increased in the days following surgery (p=0.005). When compared to the preoperative period, the TAPSE (mm) was shown to have significantly increased following surgery (p=0.009). PASP (mmHg) showed a highly significant postoperative decline (p=0.003). Other echocardiographic parameters did not differ statistically significantly. We found a significant postoperative increase in SpO2 measured at room temperature compared to the preoperative values (p=0.005).

Table 1: Basal characteristics of patients with nasal polyposis (n=56)

Variable	n	%	Mean ± SD
Age (in years)			30±10
Gender Male Female	 36 20	 64 36	
Body mass index (kg/m^2)			26.1±3.2
Grade II nasal polyposis	22	39	
Grade III nasal polyposis	34	61	

ISSN: 0975-3583,0976-2833 VOL13, ISSUE 05, 2022

Table 2: Pre- and postoperative echocardiographic parameters and oxygen saturation data of the patients

Variable	Pre operative Mean ± SD	Post operative Mean ± SD	P value
Peripheral arterial oxygen saturation	94.0±0.9	94.7±0.8	0.005
Right ventricle end-diastolic area (mm^2)	16.0±3.2	15.0±2.8	0.042
Right ventricle fractional area change	47.4±4.2	50.6±3.9	0.005
Tricuspid annular plane systolic excursion (mm)	23.7±1.9	25.4±2.7	0.009
Pulmonary arterial systolic pressure (mmHg)	29.5±3.8	26.4±3.8	0.003
Tricuspid E (cm/s)	60.3±11.3	63.9±11.3	0.24
Tricuspid A (cm/s)	47.3±12.5	49.5±10	0.48
Tricuspid E/A	1.3±0.3	1.3±0.2	0.65
Right ventricular diameters (mm)	33±7	32.6±6	0.42

Discussion

In individuals with nasal polyps, our study demonstrated that RV systolic functions significantly improved with FESS. In patients with adenotonsillar hypertrophy, nasal septum deviation, and related illnesses, it was demonstrated in earlier research that RV functions recovered and pulmonary artery pressure fell markedly after surgical repair of upper airway obstruction. [8-11] To the best of our knowledge, this is the only study published in the English-language literature in which patients who underwent surgery for severe NP had their postoperative RV function assessed.

Upper airway obstruction in NP causes cardiovascular problems, which in turn causes PHT. The main causes of pulmonary vasoconstriction are a combination of hypoxia and hypercapnia brought on by upper airway obstruction. Pulmonary hypertension induces RV hypertrophy, RV dilatation, and ultimately RV dysfunction by raising RV pressure. [11-13] Before RV dysfunction manifests, there is typically a protracted period of asymptomatic state. [12] The majority of the process is irreversible once the patient has symptoms. As a result, early evaluation of RV functioning in patients with upper respiratory tract obstruction is still essential, and early surgery can stop potentially dangerous effects in patients who show indicators of RV failure.

Chronic alveolar hypoxia, hypoxic pulmonary vasospasm, and pulmonary vascular resistance all decline after the pathology causing upper airway obstruction is treated. After FESS, our study showed that SpO2 values considerably rose. We also saw a 3 mmHg drop in pulmonary artery pressure, which may have been brought on by the reduction in hypoxia. On postoperative third month evaluation, it was demonstrated in two earlier trials with a comparable design that there was a mean drop in pulmonary artery pressure of 4 and 6 mmHg, respectively. [14-15] In our study, the first month following surgery was used to evaluate the patients. We might be able to see a much more significant decrease in pulmonary artery pressure with a longer follow-up period.

Our study does have certain limitations. Major limitations include the small sample size and the short evaluation period following surgery. In our study, only the patient's post-treatment recovery period was assessed. More objective results can also be obtained through acoustic rhinometry measures, although this wasn't achievable due to technical limitations.

Conclusion

We can infer that after treating upper respiratory tract blockage with FESS in adult patients with nasal polyps, right ventricle systolic functions improve and pulmonary artery pressure falls. However, additional research with bigger sample sizes is required to corroborate these findings.

ISSN: 0975-3583,0976-2833 VOL13, ISSUE 05, 2022

References

1. Senior BA, Kennedy DW, Tanabodee J, Korger H, Hassab M, Lanza D. Long term results of functional endoscopic sinus surgery. Laryngoscope 1998;108(2):152–7.
2. Cumberworth VL, Sudderick RM, Mackay IS. Major complications of functional endoscopic sinus surgery. Clin Otolaryngol Allied Sci 1994;19(3):248–53.
3. Sharp HR, Crutchfield L, Rowe-Jones KM, Mitchell DB. Major complications and consent prior to endoscopic sinus surgery. Clin Otolaryngol Allied Sci 2001;26(1):33–8.
4. Lee WC, Kapur TR, Ramsden WN. Local and regional anesthesia for functional endoscopic sinus surgery. Ann Otol Rhinol Laryngol 1997;106(9):767–9.
5. Fedok FG, Ferraro RE, Kingsley CP, Fornadley JA. Operative times, postanesthesia recovery times, and complications during sinonasal surgery using general anesthesia and local anesthesia with sedation. Otolaryngol Head Neck Surg 2000;122(4):560–6.
6. Gittelman PD, Jacobs JB, Skorina J. Comparison of functional endoscopic sinus surgery under local and general anesthesia. Ann Otol Rhinol Laryngol 1993;102(4):289–93.
7. Kukulski T, Hübbert L, Arnold M, Wranne B, Hatle L, Sutherland GR. Normal regional right ventricular function and its change with age: a Doppler myocardial imaging study. J Am Soc Echocardiogr 2000; 13:194-204.
8. Yilmaz MD, Onrat E, Altuntaş A, Kaya D, Kahveci OK, Ozel O, et al. The effects of tonsillectomy and adenoidectomy on pulmonary arterial pressure in children. Am J Otolaryngol 2005;26:18-21.
9. Potsic WP, Pasquariello PS, Baranak CC, Marsh RR, Miller LM. Relief of upper airway obstruction by adenotonsillectomy. Otolaryngol Head Neck Surg 1986;94:476-80.
10. Fidan V, Aksakal E. Impact of septoplasty on pulmonary artery pressure in patients with markedly deviated septum. J Craniofac Surg 2011;22:1591-3.
11. Ozkececi G, Akci O, Bucak A, Ulu S, Yalım Z, Aycicek A, et al. The effect of septoplasty on pulmonary artery pressure and right ventricular function in nasal septum deviation. Eur Arch Otorhinolaryngol 2016;273:3747-52.
12. McGowan FX Jr. Cardiovascular and airway interactions. Int Anesthesiol Clin 1992;30:21-44.
13. Şimşek E, Şimşek Z, Taş MH, Kucur C, Günay E, Üçüncü H. Evaluation of right ventricular functions in patients with nasal polyposis: an observational study. Anadolu Kardiyol Derg 2013;13:251-6.
14. Elguindy Wm, Sobhy Ts. Adenoid hypertrophy and its relation with right ventricular function. Life Sci J 2013;10:545-50.
15. Tezer MS, Karanfil A, Aktaş D. Association between adenoidal-nasopharyngeal ratio and right ventricular diastolic functions in children with adenoid hypertrophy causing upper airway obstruction. Int J Pediatr Otorhinolaryngol 2005;69:1169-73.