

Diagnostic functional endoscopic sinus surgery (FESS) in sinus and otitic barotrauma

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A significant number of aviators suffer from varying degrees of sinus and otitic barotrauma which is usually precipitated by any rhinogenic condition which causes mucosal oedema and increased viscosity of mucus preventing mucociliary clearance leading to narrowing of the tubal opening and sinus ostia. The commonest nasal conditions are acute or chronic infections of nose, nasal allergy, vasomotor rhinitis, sometimes minor anatomical variations and rarely polyps and growths in the nose which prevent ventilation. Functional Endoscopic Sinus Surgery (FESS) has brought about a revolution in the diagnosis and treatment of nasal pathology. The keystone of FESS is the ability to accurately diagnose even minor changes in the osteomeatal (OM) complex. This study evaluated 25 candidates who underwent decompression chamber (DC) runs. Diagnostic FESS is a definitely superior indicator to pinpointing of disease thereby almost predicting the possibility of otitic and sinus barotrauma in candidate who underwent DC Run.

Keywords: Aircrew evaluation, altitude chamber test, nasal endoscopy.

Otitic and sinus barotrauma

These are well established clinical entities in Air Force practice. Now with the expansion of aircraft industry, they have gained importance even in civil practice. A significant number of aviators and passengers suffer from varying degrees of sinus and otitic barotrauma during ascent and descent. While in the passengers its occurrence may not compromise flight safety, in case of Aircrew, this is the time when all his faculties are important as most of aircraft accidents are at take off and landing. The symptoms of otitic and sinus barotrauma may vary to a great degree in people exposed to flying environment. They may vary from just discomfort in the ear or over sinuses to acute pain in the ears and frontal area to sometimes even rupture of drum or bleeding from nose.

Sinus and otitic barotrauma are usually caused by narrowing of tubal and sinus ostia due to mucosal oedema or reduced mucociliary clearance as a result of:

- Acute and chronic infections of nose
- Nasal allergy
- Vasomotor rhinitis
- Anatomical malformations of nasal skeleton
- Rarely due to polyps or growths in the nasal cavity.

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Diagnostic Functional Endoscopic sinus surgery or Nasal Endoscopy is considered as the most exciting development in ENT since the introduction of microscope in Otolaryngology. This involves the use of Hopkin rods rigid endoscopes with a system of lenses which provides exceptionally clear and well illuminated field, also enables us to inspect recesses, thereby providing us with accurate assessment of disease and anatomical variations in the nasal cavity. The clarity also enables us to understand the rationale or the pathophysiology of aetiology of disease in the nose and nasal sinuses. The study published by Messer-Klinger (father of endoscopy) in 1978 showed that whenever two mucosal layers came into contact, localised disruption of the mucociliary clearance occurs causing retention of secretions in the area of contact thus preventing or slowing down drainage. This predisposes patient to infection and oedema thus increasing further contact and entering a vicious cycle, anatomically the areas of close mucosal contact are likely to be in the narrow meatus, now increasing evidence and recognitions of the impact obstruction in this very area (middle meatus and anterior ethmoid) in the pathogenesis of subsequent frontal and maxillary sinus disease.

The keystone of diagnostic FESS is the ability to accurately diagnose even relatively minor changes in the ostiomeatal (OM) complex and the eustachian tube opening that may impair clearance of maxillary and frontal sinuses during or descent of flight, the eustachian tube opening, pathology around it, and its dynamic covering on swallowing showing its possibility to equate pressure changes in middle ear during descent.

The two important tools that we had to diagnose disease were:

a) Anterior rhinoscopy gives us very little information with regard to middle meatal cleft, the infundibulum and maxillary sinus orifice, also in case of a narrow nose with hypertrophied turbs or

presence of vibrasae we may get no information at all.

b) X-ray PNS tells us very little about the anterior ethmoid and OM complex; it only shows gross opacifications of the frontal or maxillary sinuses which is quite a late development in the disease.

c) CT scan gives us very good information on the extent of disease and the OM area, however in our kind of set up when its availability is restricted to mainly the metros, its cost is enormous and sometimes waiting period may extend upto months, besides being contra-indicated in pregnant women as any radiological technique has adverse effects on the foetus.

d) FESS or nasal endoscopy therefore has an advantage for understanding of the underlying mechanisms of etiology of PNS disease and the ability to diagnose the cause correctly under direct vision, having practically no side effects, low cost and being an OPD procedure.

Our study

This was conducted at the ENT Department of Airforce Central Medical Establishment (AFCME) in conjunction with 3 aeromedical unit and involved 30 candidates/officers who were required to take the attitude chamber run for other causes like establishing:

- a) Stability of scar on ear drum
- b) Eustachean tube dysfunction

The individuals were exposed to pressure variations in the decompression chamber, after an ear-clearance run upto 8,000 ft, the chamber was raised to 10,000 ft with ascent/descent rates of 3000 ft/min, simulating a flight environment. All individuals

were taken up for pre run diagnostic nasal endoscopy by zero deg 4 mm Wolf Rod Endoscope under local anaesthesia. This was done by spraying the nostril with 4% Lignocaine or packing in case of presence of a severe deviation.

Nasal endoscopy was done in sitting position, after briefing the individual the instrument is held very lightly in the hand, after defogging it, so that examiner readily detects undue pressure and avoids discomfort.

The telescope is passed first along the floor of the nose and we study

- a) Overall nasal anatomy
- b) Presence of pathological secretion
- c) Nasal mucosa
- d) Adhesion/synaechae
- e) Openings of sinuses
- f) Turbinates (Inferior, middle and superior)

In some cases it is possible to identify, nasolacrimal opening in the inferior meatus or even presence of an operated antrostomy. We further advance into the nasopharynx. Secretions on the lateral wall are identified, Drainage from the OM area usually passes below the tubal orifice, and that from post ethnoids and sphenoid passes above the torus. But in case of disease the thickened pathological secretions may pass directly over the tubal orifice. The condition of mucosa around the tubal orifice and presence of any scarring is documented, the dynamic action of the tubal opening on swallowing may also be seen.

All the findings were documented on the left and right nostrils separately.

Findings/Results/Interpretations

30 individuals were taken up for study, 15 of these were candidates for NDA or F (P) direct course, 5

were individual who came for free fall, 5 were officers of Army and Navy who came for evaluation for Army Aviation or Coast Guard and 10 were officers who came for review medical either after otitic barotrauma or after surgery in the ear, before flying. This group also included one officer who had pain in the ears while flying and was not found to have any clinical finding in the nose or PNS.

Out of 30, 17 had DNS right and left Only posterior gross DNS was known to cause problem which was in four of the cases. Anterior DNS did not perse cause a problem except in one case in which it was also associated with a compensatory hypertrophy of inferior turbinate of the other thus resulting in problem in the other ear.

Acute symptoms with congestion of nasal mucosa bilateral thick discharge and PND was found in only 3% of cases. People with acute infections and pathological discharge were treated with antibiotics, decongestants for 5 days, before taking up for chamber run.

Allergic symptom were found in 52% of cases Pale, polypoidal nasomucosa with bilateral hypertrophy of inferior and middle turbs, polypoidal yellowish-blue oedematous ethmoidal area and mucoid discharge (one case who was normal on anterior rhinoscopy, had small polyp in the middle meatus).

One case, who developed otitic barotrauma, was operated for adeno tonsillectomy in childhood, the eustachian tube opening was distorted due to adhesions and was only a chink (? post operative).

Post operative/traumatic synaechae were seen in two cases who developed sinus barotrauma.

Inflamed congested mucosa was seen on bulla in one of the cases indicating infection in bulla.

Out of 30, nine of the individuals developed otitic symptoms and five developed frontal sinus pain, none of our series developed maxillary sinus pain in fact one individual with post operative synaechia (ac polyp) was expected to develop maxillary pain but he did not because the sinus was totally sealed even to pressure variation.

Three of the individuals who developed otitic symptom could not descend at 3000 ft/sec and had to be taken up and then brought down by slowly after nasal decongestant drops. Despite these precautions one individual who was well motivated, developed rupture of the TM with haemorrhages into TM.

To sum it all

Nasal endoscopy was the most important clinical examination proving positive in predicting the possibility of sinus or otitic barotrauma in more than 80% cases, minor infection were found in 43% cases, minor anatomical variations were found in 70% cases and allergy in 52% cases, thus giving us the clue of nasal pathology.

Conclusion

a) There is good evidence of the importance of OM unit (anterior ethmoid - middle nasal area) as a site of early involvement of most inflammatory sinus disease. This is also the site where mucociliary clearance from the maxillary sinus and frontal sinuses gets obstructed leading to recurrent or persistent infection.

b) The ethmoid sinuses are usually the key to any problem involving infectious sinusitis. Infection usually begins here and persistence of infection usually is the reason for failure of therapy directed at any other sinuses. This is not really a new concept

but disease in this area was frequently not evident on anterior rhinoscopy or X-ray PNS.

c) The technique of nasal endoscopy and CT scan are complimentary to each other in assessment of OM unit. However in our scenario, CT scan is not available or is very expensive, also the harmful effects on pregnant woman and unborn foetuses cannot be risked. Diagnostic FESS is therefore a very important OPD procedure. However, considerable experience may be required in nasal endoscopy to identify significant findings.

d) Diagnostic FESS almost predicts the possibility of sinus and otitic barotrauma in individuals, when exposed to flying environment.

Extended scope of FESS

a) *In nasal surgery:* Our study only skims the surface of the uses of FESS. This increases the uses of endoscopes to diagnostic pathology in sinus osteitis or eustachian tube opening within the nasal cavity. However there are much wider applications of FESS. It provides a clear and well illuminated field during operation. Thus making surgery more precise and atraumatic by facilitating the ventilation and drainage of sinuses and helping in widening the ostia with almost negligible post operative complications. Older conventional methods of treatment entailed drastic operations with external incisions and indwelling tubes to establish and maintain ventilation. FESS reduced post operative observation and grounding of aviators. Thus not only does it cause savings on terms of pilot hours, but it also prevents the psychological setback to pilots due to protracted grounding.

b) *In closely related fields of surgery:* Eg.: In DCR, Orbital decompression, CSF leaks, Neuro surgical operations, Pituitary-fossa surgery.

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