as the consequences of long term repeated exposure to asymptomatic low-grade bubbles are still unknown. It is the practice at the Royal Adelaide Hospital to limit the number of dives in the chamber to one a day for each attendant, on a maximum of 4 days a week. Certainly, more than one hyperbaric exposure per day would not be recommended, although we have not examined the incidence of Doppler-detectable bubbles under this circumstance.

Further investigation is warranted examining other treatment tables currently in common use. More detailed higher mental function testing may be useful in excluding any "subclinical" deleterious effect of exposure to these low-grade bubbles, and confirming the safety of the treatment tables currently in use.

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FUNCTIONAL ENDOSCOPIC SINUS SURGERY IN DIVERS WITH RECURRENT SINUS BAROTRAUMA.

Jim Bartley

Abstract

Advances in endoscopic technology combined with computerised tomography have dramatically changed our understanding of sinus disease. Functional endoscopic sinus surgery (FESS) significantly enlarges the maxillary sinus ostia, the drainage pathways from the frontal sinuses and removes obstructed or diseased ethmoid cells. If necessary, the ostia of the sphenoid sinuses can also be enlarged. FESS techniques have treated successfully aviators with recurrent sinus barotrauma. Divers who suffer from recurrent sinus barotrauma should also benefit from these techniques. This paper documents early FESS experience with two divers suffering from recurrent sinus barotrauma.

Introduction

Divers are at risk of developing sinus barotrauma while diving due to repeated large fluctuations in pressure. Acute sinus barotrauma which commonly occurs following a recent viral upper respiratory tract infection responds to conservative medical management and is usually self limiting. Infrequently, recurring attacks of sinus barotrauma may occur. Recurrent sinus barotrauma may be refractory to conservative medical measures. Newer endoscopic sinus surgical techniques have treated successfully aviators with recurrent sinus barotrauma.[1] FESS techniques should also be useful in divers suffering

recurrent sinus barotrauma. Early experience using FESS with two divers is reported.

Case Histories

CASE 1

This 49 year old male patient had suffered intermittent sinus barotrauma for many years. Pain over the left frontal sinus occurred frequently on descent. Discomfort also occurred on ascent over the frontal region and the bridge of the nose. This discomfort often persisted for several days following a dive. Occasional episodes of epistaxis also occurred.

Nasal endoscopy with a 4 mm 30 degree Hopkins rod telescope showed a septum deviated towards the left middle meatus as well as polyps arising in both middle meati. CT scan confirmed the above findings as well as showing diffuse bilateral ethmoid disease, opacification of both frontal sinuses and mucosal thickening in both maxillary sinuses. Under general anaesthesia a septoplasty was performed followed by bilateral endoscopic sinus surgery. Polyps were cleared from the ethmoid sinuses on both sides. The maxillary and frontal sinuses were opened. Three months later revision surgery was performed under local anaesthesia because of scarring on the right side. When last examined , with a 4 mm 30 degree telescope in the clinic, openings to both frontal and maxillary sinuses were easily visualised and widely patent.

Following surgery the patient has continued to dive on a regular basis with no further problems.

CASE 2

This 24 year old male presented with a 6 month history of chronic nasal discharge, recurring sinus infections, nasal obstruction, a reduced sense of smell and facial pain. The facial pain was present over both zygomas, the nasofrontal area and both maxillae, radiating into the teeth. The pain occurred on descent and it was difficult to equilibrate the middle ears. Conservative management had included numerous prolonged courses of antibiotics as well as a reducing course of steroids. He was unable to continue work which involved repeated diving on a daily basis.

Nasal endoscopy with a 4 mm 30 degree Hopkins rod telescope was unremarkable apart from narrowed middle meati. CT scans showed bilateral thickening of the maxillary sinus walls and occlusion of the right infundibulum. Bilateral endoscopic sinus surgery was performed under local anaesthetic with intravenous sedation. Bilateral anterior ethmoidectomies were performed. The normal maxillary ostia were widely opened. Thick mucus was present in both maxillary sinuses. In the absence of pathology the frontal sinuses were not surgically opened. The opening to the left frontal sinus however was readily identified. The openings into the left frontal and maxillary sinuses were easily visualised when last examined with a 4 mm 30 degree telescope in the clinic.

Post-operatively diving was resumed on a regular basis without further problems. His difficulties equilibrating the middle ears have also ceased.

Discussion

Advances in endoscopic technology combined with computerised tomography have dramatically changed our understanding of sinus disease.[2] Conventional sinus surgical techniques focused on the larger maxillary and frontal sinuses. Such procedures include Caldwell Luc procedures, naso-antral windows, frontal sinus trephinations and intranasal and external ethmoidectomies. However research and analysis of these procedures in the treatment of recurrent sinus barotrauma is lacking.[1] Newer, minimally invasive, techniques preserve as well as restore the natural mucociliary clearance mechanisms enhancing the drainage and aeration of the sinuses while retaining as much of the normal anatomy as possible. On the basis of these principles endoscopic sinus surgery has revolutionised the management of sinus disease.

The management of recurrent sinus barotrauma in divers and aviators has received little attention in the literature. Recurrent sinus barotrauma is a problem for some divers.[3] Endoscopic surgical techniques are successful in aviators suffering from recurrent sinus barotrauma.[1] If conservative medical measures fail, similar surgical techniques would appear useful in divers. The surgery can often be performed under local anaesthesia using intravenous sedation. Most patients find the lack of nasal packing, absence of external scars, and short hospital stay a far less daunting proposition than conventional surgery. In experienced hands the complication rate is very low.

Although the surgery is relatively simple, accurate diagnosis is important. Myofascial pain referred from the neck or temporomandibular joint also needs to be considered in the differential diagnosis. Cold water, the extended position of the head and the clenching of the mouthpiece during diving can all aggravate myofascial pain.[4,5] Chronologically the facial pain in sinus barotrauma occurs with pressure changes and predominantly over the frontal region with the ethmoid and maxillary being less common.[6] Pain usually occurs and increases on descent and is relieved by ascent when blood may be noticed. Sometimes descent is normal but pain develops on ascent (reverse block). Congested nasal mucosa at depth presumably blocks expanding gas during ascent.

Clinically the pain is believed to be related directly

to the affected sinuses themselves. Experimentally however pressure changes have been demonstrated to be inadequate stimuli for producing serious discomfort in these cavities.[7] The pain is probably referred from the more pain sensitive sinus ostia, infundibulum and turbinates. This explains partly why the clinical referral patterns in Fagan's series[6] did not correlate radiologically with the affected sinuses.

The surgical management of recurrent sinus barotrauma is rarely discussed. Edmonds reported that 12% of cases in his series required surgery. Endoscopic surgery was mentioned as showing promise.[3] The predisposing factor for recurrent sinus barotrauma is ostial insufficiency. FESS opens affected sinuses, usually with minimal patient morbidity. Early experience indicates that FESS is a useful technique in divers suffering from recurrent sinus barotrauma if surgical intervention is being considered.

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Acknowledgment

I wish to thank Dr A Veale for his advice in the preparation of this paper.

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THE WORLD AS IT IS

THE 1994 HYPERBARIC TECHNICIANS AND NURSES ASSOCIATION MEETING

Robert Borer

The Hyperbaric Technicians and Nurses Association (HTNA) held their 2nd Annual Scientific Meeting on Diving and Hyperbaric Medicine in Fremantle, Western Australia in early September 1994. The Esplanade Hotel was a superb venue, satisfying all the Meeting's requirements, as well as providing a pleasant place for old and new colleagues to discuss hyperbaric activities occurring throughout Australia.

The program highlights were the four presentations from the invited guest speaker, Professor Jon T. Mader, former president of the Undersea and Hyperbaric Medical Society (UHMS) and current Head of Internal Medicine and Marine Medicine at the University of Texas, Galveston, Texas, USA. There was an even balance between medical and diving related topics in the papers presented during the two day meeting. Scattered within each session were reports and technical papers that provided information on unique diving practices such as; wreck location with magnetometry and side scanning sonar, medical hyperbaric chamber design, training and operations of police divers, marine archaeology and hyperbaric aspects of extravehicular activity in space.

The first day, medically oriented program, was begun by Professor Mader presenting a clear description of the mechanisms by which adjuvant hyperbaric oxygen (HBO) enhances recovery from chronic infections such as osteomyelitis. Subsequent papers reported on the adjuvant use of HBO in mucormycosis, chronic inflammatory otolaryngological problems and soft tissue injury caused by radiation therapy. Two papers described toxicity risks; the first, carbon monoxide poisoning in new Asian immigrants using charcoal briquettes indoors; and the second, a seven year incidence of acute CNS oxygen toxicity during chamber operations with 2.8 bar 100% oxygen exposure. Aural barotrauma in a general practice was presented with cases illustrating pitfalls in assessment and diagnosis. Jon Mader concluded the medical presentations with a comprehensive review of the adjuvant use of HBO in