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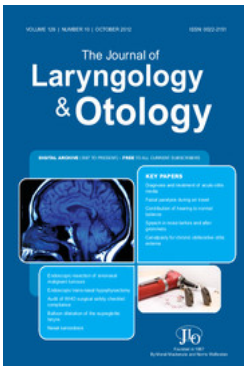

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The Future of ORL-HNS and Associated Specialties Series

The future of rhinology, anterior skull base and facial plastic surgery

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'*Future n*. That period of time in which our affairs prosper, our friend are true and our happiness is assured.'

The Devil's Dictionary, Ambrose Gwinnett Bierce (1842–1914).

Rhinology

Advances in the treatment of inflammatory sinonasal disease will follow upon increased understanding of the molecular biology involved in pathogenesis. Patients with rhinosinusitis that is allergic in origin are perhaps most easily described for study and the allergic process is now well described.[1,2] More recently cytokine profiles have been described for rhinosinusitis with, and without, polyposis.[3] Proposed mechanisms for polyp formation based upon cellular interaction, particularly involving the eosinophil have been proposed.[4] Similar cells may also be important in non-polypoid rhinosinusitis.[5] The Mayo Clinic group have proposed that eosinophilia in cases with, and without, polyps is related to fungal colonization[6] and there is likely to be a move for the use of anti-fungal therapy in many cases of chronic rhinosinusitis.

Understanding of inflammation at the cellular and mediator level creates potential for new therapeutic agents. Leukotriene pathway modifiers are being used in the treatment of asthma and may have a place in chronic rhinosinusitis, particularly for aspirin-sensitive cases but disappointingly a recent study in patients with seasonal allergic rhinitis failed to demonstrate any benefit.[7] Other mediators are also potential targets such as antagonists to adhesion molecules, inter-leukin 5 or immunoglobulin E. Autoantibodies may also be developed to key orchestrating cells such as T lymphocytes that are CD23 positive. New generation anti-histamines with greater specificity, wider anti-inflammatory activity and fewer side-effects may be discovered and hydrolysable steroids may be engineered that have no systemic availability.

As the molecular nature of chronic inflammatory airway disease is better understood it is possible that aetiological gene sequences may be discovered. Mucin messenger RNA in nasal polyps has recently been described as having a characteristic pattern, distinct from normal nasal mucosa.[8] Since the identification of the cystic fibrosis gene, the same gene has been found in some cases of severe nasal polyposis unassociated with cystic fibrosis, although there is no consistent link.[9] Nasal delivery gene therapy for cystic fibrosis has demonstrated correction of basal nasal potential[10] so the future may see nasal delivery gene transfer for chronic polypoid rhinosinusitis.

Nasal delivery of drugs generally is likely to see further development.[11] Application of topical nasal corticosteroids may see improved mechanisms for intranasal distribution of the drug.[12]

Some cases fulfilling the clinical criteria for 'rhinitis' may be neurogenic in origin rather than inflammatory. Success with neuropeptide nerve ablation therapy involving topical application of capsaicin has been reported[13] which may lead to the development of tachykinin and neurokinin antagonists in the treatment of these patients.

Bacterial antibiotic resistance patterns will continue to evolve and so the choice of antibiotics for infective rhinosinusitis will be modified. Viral and bacterial immunization therapy will also change the spectrum of pathogens that result in infective rhinosinusitis. There is a developing trend to consider bacterial infection less important in the pathogenesis of chronic rhinosinusitis than was traditionally the case.[14] The use of antibiotics in this condition is likely to be refined and should in future also be less prevalent for acute cases.[15]

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Intranasal and sinus surgery instrumentation and techniques will continue to develop and systems that improve accuracy and safety and that minimize trauma to normal tissues will be refined. Pre-operative imaging with software data manipulation can now provide triplanar views and 3D reconstructions. These views may act as considerable perceptional aids to the understanding of involved anatomy in more difficult cases and morphological areas such as the frontoethmoidal recess and pituitary fossa, particularly in revision cases. These images can also be linked to real-time computer-aided navigation systems for use during surgery.[16] The debate continues in relation to the routine use of facial nerve monitoring during tympanomastoid surgery and a similar argument will develop regarding endoscopic sinus surgery and routine use of peri-operative image navigation. The possible disadvantages of monocular endoscopic vision will be addressed and the use of 3-D dimensional systems may bring benefits in depth perception as have been described in laparoscopic surgery.[17] Computed-assisted surgery should also bring advances that can be applied to surgical training. Virtual reality simulation systems of increasing complexity will help surgeons practise procedures and enable mesurements of competence (Ota and Loftin, http://www.vetl.uh.edu/surgery.vrse.html:).

Health purchasers will increasingly require evidence of the level of effectiveness of present and future treatments. Clinical audits, such as that currently being carried out by the Royal College of Surgeons of England on sinonasal surgery, will demonstrate the results of current practice, for generic groups of patients, and research, hopefully conducted through multi-centre trials, will assess the relative merits of new developments. This should complement the long-term results on large numbers of cases of chronic rhinosinusitis who have now been treated by this approach. It is also likely that the extended applications of endoscopic surgery such as ligation of the spheno-palatine artery,[18] dacryocrystorhinostomy and orbital decompression will become routine as their track record is established. There is certainly an increasing shift towards endonasal repair of CSF leaks resulting from congenital dehiscence or trauma to the anterior skull base. Again this may become a more routine undertaking with results that rival those of formal craniotomy and it is likely that the interface between our ophthalmic and neurosurgical colleagues will continue to develop in a very positive way.

Increased understanding of immunopathology and neurophysiology of sinonasal disease will eventually enable us to reach the gold standard of accurately defining disease for individual patients. With this knowledge individual treatments can be appropriately determined rather than relying on results from large trials usually involving a heterogenous population. As the disease process is better understood nasal and sinus symptoms such as congestion and blockage will be better explained. Objective measurements that relate to these symptoms will be developed and these may then be used to quantify disease and assess interventions. For example, current interest is directed at nasal nitric oxide levels.[19]

Facial plastic surgery

Computer-assisted surgery will develop in facial plastic surgery as in rhinology. Its role is most clearly seen in craniofacial surgery (Robb and Camp, http://www.mayo.edu/bir/home.html:). It will find application in 3-D surface rendering and quantitative analysis prior to surgery. This enables accurate planning. Similar analysis after surgery will also provide data for statistical analysis. 3-D digital surface photogrammetry, which allows instant image capture will also be applicable to rhinoplasty. Computed tomography (CT) image-guided surgery has now been described in conjunction with facial skeleton surgery.[20] Facial and profile analysis is the key stone to successful aesthetic surgery. A surgical plan based on these analyses relates to a concept of what constitutes beauty. The future will see changes in the fashion of beauty as society evolves and surgical trends will reflect these changes.

Biomedical technology will advance. Bioresorbable skeletal fixation plates will perhaps become routinely used and current trends have seen the utilization of alloplastic implant materials with osteogenic proteins as bone substitutes. The ideal alloimplant material may eventually be developed but it is likely to compete with tissue-engineered cartilage and bone cultured in vivo.[21]

Grafts, particularly autogenous cartilage, have found increasing use in rhinoplasty. This has particularly followed the increasing application of open-structure rhinoplasty, where the emphasis is on reconstruction and re-orientation rather than resection.[22] We will be in a better position to judge the long-term aesthetic results of tip grafting. A graduated approach to the use of structural and tip grafting rather than routine application is already being advocated. Nasal reconstructive surgery has improved dramatically over the last decade and the described techniques should become more available. Attention is now paid to three layer reconstruction, including mucosal lining flaps, a structural framework and external tissue coverage. Dramatic results for total nasal reconstruction have been presented.[23] New materials are being developed for the nasal framework such as vitallium or titanium mesh.[24]

Facial reconstruction and rehabilitation will encompass techniques looking to improve facial nerve repair. Nerve guidance conduits enriched with growth factors and Schwann cells are under investigation as are the effects on regeneration of local electrical stimulation.[25]

The endoscope has seen application in facial plastic surgery particularly with regard to forehead lift. Greater experience has now been gained in midface and orbital complex endoscopic surgery and the technique may gain increasingly widespread acceptance.[26]

Despite the oucome of most facial plastic surgery having a dominant aesthetic component this branch of surgery will need to develop standard outcome measures and assessment techniques. This will enable new procedures and all of us as individual surgeons to stand up to critical scrunity and comparison in the future.

Anterior skull base

The surgical 'gold standard' for malignant and some extensive benign tumours affecting the anterior skull base is likely to remain the cranio-facial resection for the foreseeable future.[27] However, the way in which this is undertaken may change in an effort to avoid facial scarring. At present this can be done by combining a bi-coronal and mid-facial degloving approach but endoscopic resection may be possible for the intranasal component. It is difficult to see how an entirely endoscopic approach, as is being advocated by some European centres, will compare favourably with the actuarial survival provided by craniofacial resection for tumours such as olfactory neuroblastoma and adenocarcinoma given their natural history. Unfortunately with tumours that occur relatively infrequently and which may recur anything up to 15 to 20 years after the original intervention it will be difficult to make any meaningful comparisons for some time to come. However, it is possible for benign lesions such as inverted papilloma to be excised by an experienced endoscopic surgeon, even when it involves the skull base and large series may be accrued in the future to support this contention.[28]

Confucius said: 'if you would define the future, study the past'. It is interesting to reflect that many important advances in understanding nose and sinus problems were made in the 1890s and that a century later we have seen a second renaissance in rhinology. It is probably beyond our imagination to predict what the next hundred years will bring but it seems a reasonably safe bet that interest in this area will continue unabated and patients will seek our help for the foreseeable future.

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