

The Future of ORL-HNS and Associated Specialties Series

Highlights of the development of ENT in the 20th century

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This paper heralds a series entitled *The Future of ORL-HNS and Associated Specialties* which the *Journal* will run through each issue of the year 2000.

Key words: History of medicine, 20th century; Otolaryngology

Introduction

The specialty of otorhinolaryngology is a product of the early 20th century for it was then that the separate fields of otology and laryngology were joined together. Otolologists were surgeons whereas laryngologists were physicians who also treated diseases of the nose and chest.

The 20th century has witnessed unparalleled change. At its opening brave attempts were made to perform skilful surgery under the condition of primitive anaesthesia and no antibiotics. The stimulus of two world wars led to immense advances in technology and with them greater opportunities to explore new and resurrect old surgical procedures. The discovery of antibiotics saw an end to acute mastoiditis and the major complication of otitis media, as well as a decline in the number of tonsillectomy and adenoidectomy operations. It also saw an emergence of otitis media with effusion (“glue ear”) the treatment of which by drainage and insertion of a grommet (B. W. Armstrong, 1954) has become the commonest operation performed under general anaesthetic throughout the Western World.

Otology

Although Carl Nylen of Sweden introduced a monocular operating microscope in 1921 and various forms of operating loupes were available, modern microsurgery of the ear really only became possible with the design of the first binocular operating microscope for otology by the Zeiss Optical Company in 1953. Training in the use of the operating microscope and increased knowledge of the underlying pathology of middle ear disease have reduced the need for radical surgery. Advances in anaesthetic techniques, both local and general now produce ideal operative conditions for reconstruction of the middle ear.

Attempts at the beginning of the 20th century to perform stapedectomy resulted in failure and loss of inner ear function. Fenestration of the lateral semicircular canal as an alternative approach to the management of otosclerosis gained popularity in the 1920's and 30's. It was perfected by Julius Lempert of New York (1938) and remained the operation of choice until Samuel Rosen, also of New York, by chance rediscovered stapes mobilization (1952) by touching the bone to assess the degree of fixation prior to performing a fenestration operation under local anaesthesia. Sadly the improvement in hearing was temporary but it prompted John Shea of Memphis, Tennessee to re-establish stapedectomy (1958). Subsequent refinements of stapedotomy, microdrills and the laser have been introduced.

Whilst the pathology of Menière's disease was described in 1938 by Hallpike and Cairns the aetiology of the condition is still not fully understood hence the wide range of medical and surgical treatments developed throughout the century. Intracranial vestibular nerve section was first successfully performed by R. H. Parry (1904), labyrinthectomy by F. H. Quix of Utrecht (1912) and endolymphatic sac decompression by Georges Portmann of Bordeaux (1926). Each of these techniques has been refined by modern microsurgery and the recent introduction of endoscopy of the posterior fossa has reduced the morbidity of vestibular nerve section. Destruction of the balance mechanism by ototoxic drugs such as gentamicin is enjoying a renewed popularity.

From the earlier years of the 20th century surgery for tumours of the internal auditory meatus and cerebellopontine angle has been described by both neurosurgeons and otologists. R. Panse (1904) proposed a translabyrinthine approach but Harvey Cushing who practised the suboccipital approach warned that “while the otologist doubtless will be the first to recognize and diagnose these cases ...

there is no possible route more dangerous or difficult than this one . . . proposed by Panse"; Sir Charles Ballance merely dismissed the technique as "objectionable for obvious reasons". One of the principal causes of mortality in the suboccipital approach was disturbance of the anterior inferior cerebellar artery. W. J. Atkinson (1949) drew attention to the importance of this artery but most neurosurgeons at this time were reluctant to advise surgery unless the tumour was pressing on the brainstem or giving rise to hydrocephalus. This was the scene which prompted William House of Los Angeles and his neurosurgical colleagues in the early 60's to resurrect the translabyrinthine approach resulting in a marked reduction in mortality and morbidity. Nowadays the emphasis is on hearing preservation in the removal of smaller tumours and in larger tumours where this was not possible auditory brainstem implants have been fitted.

William House's desire to help the profoundly deaf led to his involvement in the early research into cochlear implants. Direct stimulation of the auditory nerve had been achieved by a Russian group in 1934. The modern advances in cochlear implantation were led in the 1960's by groups in California, France, Germany, Austria and Australia and the technique, which is very much a team effort of otologist, audiological technicians and scientists and teachers of the deaf, is now well established and used for both the prelingually and postlingually deaf.

Audiological medicine

The increasing need to perform sophisticated tests of hearing and balance, together with the provision of investigations and treatment of deaf children and elderly people led to the emergence in the 1970's of this new speciality.

By the beginning of the 20th century the audiometer (invented in 1879 by Hughes) was complementing the voice, watch, tuning fork, whistle and acoumeter as a means of testing hearing. The thermionic valve, pioneered by J. A. Fleming and Lee de Forest was incorporated into the Western Electric 1A audiometer (1922) designed by the American E. P. Fowler. Valves were replaced by transistors and printed circuits in the 1950's and have since been superseded by the microchip. A range of evoked response objective tests of hearing evolved during the 60's and 70's and in 1978 Kemp discovered oto-acoustic emissions. The ability to measure these sounds has produced the most sophisticated and reliable test of hearing of "at risk" babies.

Dramatic progress has been made in the development of hearing aids. The bulky battery pack body worn aid available, free of charge with the inception of the National Health Service (1948), soon gave way to smaller transistor postaural aids (1955). Miniature circuits and microchips made available even smaller "in the ear" or "in the canal" devices. Attention is now drawn to developments in signal processing and the introduction of the "digital" age of sound will go some way to appeasing the frequent complaint of the

hearing aid user that they have difficulty in understanding speech against background noise. In the UK a major improvement in the rehabilitation of patients with sensorineural deafness has occurred with the creation of hearing therapists. Semi implantable middle ear hearing aids are now undergoing evaluation and the hope is that the first years of the new millennium will see the evolution of totally implanted devices. For those patients unable to wear conventional air conduction hearing aids the technique of osseointegration with titanium has been applied to bone-anchored hearing aids thus ensuring a firm attachment to the skull.

The future of hearing research is rapidly progressing particularly in the field of molecular genetics. Over the last few years many deafness genes have been identified. Furthermore, the combination of the Human Genome Project and DNA "chip" technology will provide further stimuli eventually culminating in an understanding of inner ear development and the mechanisms necessary for hair cell repair and regeneration. With this knowledge therapeutic regimens may be identified which will in time reduce the need for a hearing aid in the management of sensorineural deafness.

Rhinology

The arrival of antibiotics reduced the necessity for radical surgical procedures for major sinus disease. This together with fascination of microsurgery of the ear and later the larynx led to a diminished interest in rhinology which amounted largely to the practice of straightening the nasal septum but not reshaping the nose, washing out the sinuses, removing nasal polyps with a snare, and eradicating chronic maxillary sinusitis by a sublabial route.

Three important factors have led to a resurgence of interest in rhinology. Firstly the understanding of immunology and the availability of local steroids to apply to the nasal mucous membrane have provided suitable non surgical treatment. The modern rhinological clinic is now staffed by both an immunologist and a rhinologist. Secondly a much greater understanding of the anatomy, physiology and pathology of the nose and sinuses led Professor Walter Messerklinger of Graz, Austria to place an emphasis on the anterior ethmoid air cells as the key to effective sinus drainage and aeration (1967). The development of computerized tomography (CT) by Sir Geoffrey Hounsfield (1969) and the reintroduction of sinus and nasal endoscopy (originally conceived by M. Reichert (1902) and Alfred Hirschmann (1903) together with Etienne Escat (1911)), using fiberoptic endoscopes (developed by Hopkins in 1954) heralded the era of functional conservative endoscopic sinus surgery. Thirdly, the shrouds of mystique surrounding facio-plastic surgery and particularly rhinoplasty have been removed largely by the work of the American Academy of Facial Plastic and Reconstructive Surgery, founded in 1964, and the European Academy of Facial

Surgery (the Joseph Society), founded in 1977. This led to the logical involvement of rhinologists in what was hitherto the domain of the plastic surgeon.

Laryngology, head and neck surgery and phonosurgery

Laryngology was originally practised by physicians who learnt to remove small lesions of the larynx and adjacent pharynx using the mirror and curved forceps. Any larger lesions required the need of a general surgeon. Felix Semon was appointed in 1882 as the first laryngologist to St Thomas's Hospital, London and was fortunate to have as a colleague Sir Henry Butlin a general surgeon, who shared an interest in diseases of the throat. Together they promoted the operation of laryngofissure for early cancer of the larynx. By 1928 Sir St Clair Thomson was able to report only two operative deaths and a 76 per cent three year survival in the series of 74 patients.

The first total laryngectomy for cancer was performed in 1873 by the general surgeon Professor Theodor Billroth at the Allgemeine Krankenhaus, Vienna. The patient survived the operation and lived for a further seven months. The chief complication of the early laryngectomies was aspiration of food and drink. By severing the larynx from the trachea and suturing it to the skin. Themistokles Gluck (1881) resolved this major problem such that by the early 1920's good results were being reported throughout the world. Both Gluck and his colleague Soerensen were aware of the significance of removing cervical lymph node metastases at the same time as removing the primary tumour but in 1906 the American Crile promoted the operation of *en bloc* removal of the cervical glands with the primary tumour.

The discovery of radium by the Curies in 1898 and its first application to malignant disease by Danysz in 1903 subsequently led to the development of radiotherapy. In the UK radiotherapeutic techniques to treat primary laryngeal cancer were introduced in the 1930's. The stimulus to atomic research given by World War II led to the creation of teletherapy radium units, new radioactive isotopes and the early linear accelerators. Greater sophistication in the dosage, field size and avoidance of skin damage and mucositis all resulted in radiotherapy becoming the first line of treatment for early neoplasms with surgery held in reserve for failures and more advanced tumours. Alongside radiotherapy has been treatment with cytotoxic drugs.

The emphasis on reconstruction after extensive removal of malignancy has been aided by the introduction of skin, muscle and microvascular flaps (1960's and 1970's) which has enhanced functional and cosmetic rehabilitation. For some years workers have been studying the problems involved in transplanting the larynx. The first human laryngeal transplant took place in Cleveland, USA in 1998.

Carl Gussenbauer developed a voice prosthesis (1874) for use by Billroth's first laryngectomee. By 1900 Nicholas Taptas of Constantinople rehabili-

tated a patient using a direct connection between the tracheostomy tube and a deliberately created pharyngeal fistula thus enabling the patient to speak by merely occluding the tracheostomy cannula with his finger. This was the forerunner to the tracheo-oesophageal puncture and valved prosthesis introduced by Eric D. Blom and Mark I. Singer (1980) which is now the most frequently used form of post laryngectomy voice prosthesis.

Over the last 30 years the surgeon laryngologist has gradually evolved into the head and neck surgeon capable of managing, often in collaboration with the radiotherapist, medical oncologist, neurosurgeon and other experts, malignancies of the head and neck with the exception of the eye and the brain. The feasible limits of excision have now been reached, and further progress lies in the realm of molecular biology as a new approach to cancer therapy.

Paradoxically the laryngologist has on the whole only been interested in gross lesions of the vocal folds rather than voice abnormalities. Greater sophistication in endoscopy, with either rigid or flexible fibrescopes, combined with stroboscopy and the means to analyse the quality of the voice have led to an enhanced understanding of vocal function. By working closely with speech therapists and teachers of voice and singing the laryngologist can participate in diagnosis and treatment and is able to offer a sophisticated form of microlaryngeal surgery (phonosurgery).

Paediatric otolaryngology

An appreciation that children are not simply young adults has led some ear, nose and throat surgeons to restrict their practice to this younger age group. Paediatric otolaryngology as a speciality was first promoted in 1938 by Danielowitz of Warsaw, Poland.

Removal of the tonsils and adenoids, once the mainstay of ear, nose and throat surgery, has shown a welcome decline in popularity, coincidental with an appreciation that recurrent upper respiratory infections may be the means whereby a child acquires immunity. The practice of intubation of preterm infants with chest problems led to the development of subglottic stenosis and with it a range of surgical corrective procedures. Perhaps the paediatric otolaryngologist's best contribution is in the management of congenital abnormalities of the ear, nose and throat where specialized facilities and expertise have markedly reduced the risks of treatment.

Conclusion

There can be few specialties which have undergone such dramatic developments within the past three decades as otorhinolaryngology – head and neck surgery. There has been a tendency for the individual practitioners to subspecialize into otology, otoneurosurgery and skull base surgery, head and neck surgery, phonosurgery, rhinology, faciplastic surgery and paediatric otorhinolaryngology. Each of

these subspecialties has its own societies and specialist journals. The specialty has taken advantage of the new advances of each decade whether in endoscopy, microsurgery, the use of lasers, cytotoxic drugs, flap reconstruction or the microchip.

With the vast expansion of knowledge and the availability of sophisticated investigation and treatment the inevitable problems of the cost of provision of a service have to be addressed. The way this is done varies from country to country but wherever the provider is based the need to be conscious of the

standards and quality of care offered should be paramount. The otorhinolaryngologist should also be aware that the majority of these advances are still not yet available to approximately 70 per cent of the world's population.

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