Postgrad Med J 2000;**76**:65–69 © The Fellowship of Postgraduate Medicine, 2000

History of medicine

Otorhinolaryngology

Neil Weir

Summary
Otorhinolaryngology, a product of the early 20th century, developed from the joining together of the separate departments of otology, whose practitioners were surgeons, and laryngology which was managed by physicians who also treated diseases of the nose and chest. The 20th century opened with brave attempts to perform skilful surgery under conditions of primitive anaesthesia and no antibiotics. The stimulus of two world wars led to significant advances in technology and greater opportunities to explore new and resurrect old surgical procedures. The discovery of antibiotics saw an end to acute mastoiditis and the complications of otitis media and sinusitis, as well as a decline in the number of tonsillectomy and adenoidectomy operations.

Over the last 30 years the specialty has undergone dramatic development and has taken advantage of new advances in endoscopy, microsurgery, the use of lasers, cytotoxic drugs, flap reconstruction and microchip technology. During the same period, although still calling themselves otorinolaryngologists, individual surgeons have subspecialised in otology, otoneurosurgery and skull-base surgery, head and neck surgery, phonosurgery, rhinology and facioplastic surgery, and paediatric otothinolaryngology. Each of these subspecialties has its own societies and specialist journals.

Keywords: otorhinolaryngology; history of medicine

2 West Road, Guildford, GU1 2AU Surrey, UK
N Weir

Submitted 3 June 1999
Accepted 13 August 1999

The specialty of otorhinolaryngology (or ear, nose and throat surgery (ENT)) is a product of the early 20th century, for it was then that the separate fields of otology and laryngology were joined together. Otologists were surgeons while laryngologists were physicians who also treated diseases of the nose and chest.

During the first half of the 18th century the great advances in anatomical knowledge of the area, combined with an early understanding of its physiology and pathology, were not matched by advances in treatment which was entirely empirical. Eustachian tube catheterisation (1724), myringotomy or piercing of the ear drum (1801) and early attempts at mastoidectomy (1774) were to remain the main surgical treatments until the middle of the 19th century when anaesthetics and antisepsis were introduced.

The origin of laryngology, by contrast, can be traced to that day in September 1854 when Manuel Garcia (1805–1906), a singing teacher, at last achieved his lifelong ambition to view his own larynx with a mirror. It is likely though, that Benjamin Babington (1794–1866), a physician at Guy's Hospital, London performed the first laryngoscopy with his 'glottiscope' in 1829. The significance of these observations of the larynx was applied clinically by Ludwig Türck (1810–1868) and Johann Czermak (1828–1873), who effectively founded the discipline of laryngology. The first university clinics of both otology and laryngology were established in Vienna in the 1870's.

Until Friedrich Voltolini (1819–1889) introduced the oxyhydrogen incandescent light (1859) and later Thomas Eddison (1847–1931) invented electric light (1879), it was only possible to view the hidden structures of the ear, nose and throat in daylight or by the light of a candle. The traditional otologist's concave mirror with a central perforation to look through appeared in 1841, first as a hand held device but later worn on a head band (1855). Carl Nylen (1892–1978) of Sweden introduced the monocular operating microscope in 1921 but modern microsurgery of the ear only became possible with the design of the first binocular operating microscope for otology by the Zeiss Optical Company (1953). Fibre-optic light sources, developed by Hopkins in 1954, heralded a new era of endoscopy and flexible fibrescopes used to examine the nose, nasopharynx, larynx and pharynx in out-patients have in many instances obviated the need for hospital admission.

The 20th century has witnessed unparalleled change. At its opening brave attempts were made to perform skilful surgery under conditions 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 complications 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').

In the sphere of rhinology, a greater understanding of immunology and the function of the nose has expanded the knowledge of rhinitis and led to more conservative nasal surgery. The complications of sinus infection have become rare. 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. Coupled with cytotoxic drugs, this has served to reduce much of the potentially mutilating surgery of the head and neck. The emphasis on reconstruction after extensive removal of malignancy has been aided by the introduction of skin, muscle, and microvascular flaps (1960s and 1970s) which has enhanced functional and cosmetic rehabilitation.

Audiology has become a specialty in its own right and the sophisticated tests of hearing and balance, together with the provision of investigation and treatment of deaf children and elderly people, are managed by audiological physicians. The early audiometers were derived from two inventions: the induction coil in 1849 by Emil de Bois Reymond (1818–1896) and the telephone in 1876 by Alexander Graham Bell (1847–1922). The thermionic valve was pioneered by J A Fleming and Lee de Forest at the beginning of the 20th century and was rapidly developed during World War I. It was incorporated into the Western

Electric IA audiometer (1922) designed by the American E P Fowler (1873–1966). Valves were replaced by transistors in the 1950s and at the same time printed circuits were introduced. The transistor has since been superseded by the microchip. Hearing aids, too, have benefited from similar advances and have now entered the digital era.

Although still calling themselves otorhinolaryngologists, there has been a tendency over the last 35 years for individual surgeons to subspecialise into otology, otoneurosurgery and skull base surgery, head and neck surgery, phonosurgery, rhinology, facioplastic surgery, and paediatric otorhinolaryngology. Each of these subspecialties has its own societies and specialist journals.

With the great expansion of knowledge and the availability of sophisticated investigations and treatments, 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% of the world's population.

Otology

The virtual disappearance of the emergency cortical mastoidectomy, frequently performed in the past with hammer and gouge, on the arrival of antibiotics, led to an awareness and dominance of the lesser degrees of middle ear disease such as otitis media with effusion. Although not a new condition, the term 'glue ear' was only introduced in 1960 and the first grommet or ventilation tube of the modern era was reported in the USA by B W Armstrong (1954). The purpose of the grommet is to equalise pressure on either side of the eardrum and to allow resolution and absorption of the middle ear effusion. Drainage of the fluid and insertion of the grommet is now said to be the commonest operation performed under general anaesthetic throughout the Western World. Acute otitis media is treated by the family doctor. Despite the use of a wide range of new and potent antibiotics, chronic infection of the middle ear remains a continued cause of ear discharge. With improvements in community health and standards of living, the number of affected patients is decreasing.

Training in the use of the operating microscope and increased knowledge of the underlying pathology of middle-ear disease have led to a reduction in the need for radical surgery. With advances in anaesthetic techniques, both local and general, producing ideal otological operative conditions the emphasis today is on reconstruction of the middle ear rather than ablation. Tympanoplasty techniques include repairing the ear drum and restoring continuity of the three ossicles of the middle ear.

The third ossicle is called the stapes (or stirrup). The condition of otosclerosis results in fixation of this bone and reduced sound transmission to the inner ear. Attempts at the beginning of the 20th century to remove the stapes (stapedectomy) resulted in failure and loss of inner ear function. As an alternative approach the operation of fenestration of the lateral semicircular canal, in order to short circuit the otosclerotic focus by conveying sound through the canal to the inner ear, gained popularity in the 1920s and 30s. It was perfected by Julius Lempert (1890–1968) in New York in 1938 and remained the technique of choice until Samuel Rosen (b1897), also of New York, by chance rediscovered stapes mobilisation (1952) by touching the bone to assess its degree of fixation prior to proceeding to a fenestration operation under local anaesthesia. There was a sudden restoration in the patient's hearing. Although lasting improvement was only achieved in 25% of patients, this finding and the arrival of the binocular microscope served to re-awaken interest in stapes surgery. John Shea (b1924) of Memphis, Tennessee, first re-established stapedectomy in 1958 using a nylon replica stapes. Many different prostheses have been recommended since but nowadays a very small (0.8 mm) hole is drilled in the stapes footplate (stapedotomy). This hole can be covered with a thin piece of vein to seal the interface between middle and inner ear and the ossicular continuity is restored by interposing a Teflon piston between the second ossicle (the incus) and the stapedotomy, thus offering patients an excellent prospect of long-term improvement in hearing.

The condition of endolymphatic hydrops or Ménière's disease produces the three debilitating symptoms of deafness, tinnitus and vertigo. Whilst the pathology of the disease is known, the causal factor is not. A wide range of both drug therapy and surgical treatment techniques has thus been developed over the years. In cases not responding to the former, the choice of surgical treatment rests between operations which are designed to relieve the patient of vertigo but to retain hearing (saccus decompression first described by Georges Portmann of

Bordeaux in 1926, or intracranial vestibular nerve section described by R H Parry in 1904) or operations to ablate the balance mechanism where there is no remaining useful hearing (translabyrinthine or total labyrinthectomy first described by F H Quix (1874–1946) of Utrecht in 1912). Each of these techniques has been refined by modern microsurgery and with the recent introduction of endoscopy of the posterior cranial fossa the previous potential morbidity of vestibular nerve section is much reduced. Destruction of the balance mechanism using ototoxic drugs such as gentamycin is enjoying a new popularity as it is simply achieved and carries only a small risk of damage to the hearing.

The internal auditory meatus is, in a sense, the meeting point between the territories of the neurosurgeon and the otologist. Over the last 35 years, through the pioneering work of William House (b1923) of Los Angeles, California, these two disciplines have collaborated to achieve optimum results for the removal of tumours from the cerebellopontine angle, the commonest of which is the benign vestibular schwannoma which arises from one of the vestibular nerves as it passes from the temporal bone to the base of the brain. Hearing can be preserved in the course of removal of smaller tumours, and auditory brainstem implants have been fitted to patients with large tumours where hearing preservation has proved possible.

All these advances have not, however, influenced the degenerative process which is an integral part of human life. Our hearing ability probably starts to decrease early in life, and severe hearing impairment, often accompanied by tinnitus, is now an important cause of social deprivation in the elderly. In addition, many drugs have proved damaging to the inner ear producing permanent profound deafness. This situation, combined with desire to help prelingually deaf children, led to research into cochlear implants. The concept of electrical stimulation producing hearing sensations in the deaf was not new, for Alessandro Volta (1745–1827) had placed metal rods in both his own ears in 1800 and connected them to a source of electricity. He apparently heard the sound of boiling water before losing consciousness! True direct stimulation of the auditory nerve was achieved by a group of Russians in 1934. The modern advances in cochlear implantation were led in the 1960s 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.

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 which ensure a firm attachment to the skull.

The future of hearing research is rapidly progressing, particularly in the field of molecular genetics. Over the last year many deafness genes have been identified. Furthermore, the combination of the Human Genome Project and DNA 'chip' technology will provide further stimulus, culminating in an understanding of inner ear development and the mechanisms necessary for hair cell repair and regeneration. With this knowledge, therapeutic regimens can be identified that could supplant hearing aid technology in the management of sensorineural deafness.

Audiological medicine

Not all otologists wish to be surgeons, and the need to perform sophisticated tests of hearing and balance, together with the provision of investigation and treatment of deaf children and elderly people, has led to the emergence in the 1970s of this new specialty.

Prior to the late 19th century, tests of hearing were mostly effected using either the human voice or various mechanical devices such as the watch, tuning fork, whistles or acoumeters. The main weakness of all these methods was the lack of quantitative measurements. Considered, however, in the context of the degree of therapeutic techniques existing at the time, such quantitative sophistication was irrelevant. The first audiometers, in which sounds of various intensity were produced electrically, only appeared after the key inventions of the induction coil and telephone. The term audiometer was first used in 1879 by David Edward Hughes (1831–1900) and his clinical collaborator Benjamin Ward Richardson (1828–1896). Presently complex computer-driven audiometers can not only test hearing subjectively but also objectively assess hearing at all levels from the cochlea to the temporal lobes where hearing is appreciated in the brain, thus differentiating between sensory (cochlea) and neural hearing loss. Objective tests are particularly useful in determining the ability to hear in newborn babies as about 1 in 10 000 suffer from hearing impairment. In 1978, Kemp discovered oto-acoustic emissions (sounds made within the ear) and the ability to capture these sounds has led to perhaps the most sophisticated test of hearing for '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 at the inception of the National Health Service in 1948, soon gave way to smaller transistor postaural aids (1955). Miniature circuits and microchips made even smaller 'in the ear' or 'in the canal' devices possible. 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 introduction 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.

Rhinology

The arrival of antibiotics reduced the necessity for radical surgical procedures for major sinus disease. Together with the fascination of microsurgery of the ear and later the larynx, this led to a diminished interest in rhinology, which consisted largely of 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 sub-labial route.

Three important factors have led to a resurgence of interest in rhinology. Firstly, our increased understanding of immunology has enabled the rhinologist to differentiate between allergic rhinitis and the commoner non-allergic rhinitis. The availability of local steroids for application to the nasal mucous membrane has provided a 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 computed tomography (CT) by Sir Geoffrey Hounsfield (1969) and the re-introduction of sinus and nasal endoscopy (originally conceived by M Reichert in 1902 and also pioneered by Alfred Hirschmann (1903) together with Etienne Escat (1911)), using fibre-optic endoscopes heralded the era of functional conservative endoscopic sinus surgery. Thirdly, the shrouds of mystique surrounding facioplastic surgery and particular 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 has led to the logical involvement of ENT surgeons 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 a general surgeon. Sir Felix Semon (1849–1921) was appointed as the first laryngologist to St Thomas's Hospital, London in 1882, and was fortunate to have as a colleague Sir Henry Butlin (1843–1912), 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, which was not only the commonest neoplasm of the head and neck but was also invariably associated with smoking. By 1928 Sir St Clair Thomson (1859–1943) was able to report only two operative deaths and a 76% 3-year survival in a series of 74 patients.

The first total laryngectomy for cancer was performed in 1873 by the general surgeon Professor Theodor Billroth (1829–1894) at the Allgemeine Krankenhaus, Vienna. The patient survived the operation and lived for a further 7 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 (1853–1942), in 1881, resolved this major problem such that by the early 1920s 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 George Washington Crile (1864–1943) promoted the operation of *en bloc* removal of the cervical glands with the primary tumour. The results of laryngofissure operations improved with better patient selection, particularly when surgery was confined to small lesions on the edge of the vocal folds.

In the UK, the move in the 1930s was towards developing radiotherapeutic techniques to treat primary laryngeal cancer. The stimulus to atomic research

given by World War II led to the development of teletherapy radium units, new radioactive isotopes and the early linear accelerators. Greater sophistication in dosage, field size and avoidance of skin damage and mucositis all resulted in radiotherapy becoming the first-line treatment for early neoplasms, with surgery held in reserve for failures and more advanced tumours.

For some years workers have been studying the problems involved in transplanting the larynx, and the first human laryngeal transplant took place in Cleveland, USA, in 1998.

Carl Gussenbauer (1842–1903) developed a voice prosthesis (1874) for use by Billroth's first laryngectomy patient. By 1900 Nicholas Taptas (1871–?) of Constantinople rehabilitated 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 in 1980, 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. Plastic reconstruction of the pharynx, larynx and oral cavity using stomach transposition, myocutaneous flaps and microvascular anastomoses have succeeded in providing patients with acceptable levels of appearance and function after the most radical of operations. 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 reliable stroboscopy and the means to analyse the quality of voice have led to a greater 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 delicate form of microlaryngeal surgery (phonosurgery). This not only permits excision of minute lesions of the vocal folds but also encompasses vocal fold medialization techniques, thus enabling restoration of the voice.

Paediatric otolaryngology

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

Removal of the tonsils and adenoids, once the mainstay of ENT 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 most important contribution is in the management of congenital abnormalities of the ear, nose and throat where specialised facilities and expertise have markedly reduced the risks of treatment.

Conclusion

There can be few specialties which have undergone such dramatic development within the past three decades as otorhinolaryngology. 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. Today's otorhinolaryngologist can offer his patient a wide range of skills in diagnosis and treatment.

Further reading

1 Kerr AG, ed. *Scott-Brown's Otolaryngology*, 6th edn, vols 1–6. London: Butterworths, 1997 .

2 Weir N. *Otolaryngology - an illustrated history*. London: Butterworths, 1990.