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Technological Advances in Medical Science with Special Relevance to Otolaryngology

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Introduction

General clinical practice of Otolaryngology has evolved rapidly over last two decades with the advent of new technology. One of the most extensive changes in the clinical practice in the past one year is the introduction of day case surgeries in addition to the new diagnostic techniques and surgical procedures. Such day case surgeries include grommet insertion and reduction of the fractured nose. Several hospitals are carrying out adenoidectomy, tonsillectomy and other forms of nasal surgeries and ear surgeries. The advancement in the surgical practices has led to changes in the clinical practices as well as safety measures. The technical advances in the field are led by molecular biology, optical fibers, computational aspects, microelectronics and metallurgy [1].

The complexity and the variability of the middle and inner ear anatomy required training on the cadaver temporal bone to avoid operative errors. The virtual reality programs with computational programming is becoming increasingly sophisticated and with widespread applications. This made it possible to make a virtual cadaver system for the purpose of training the medical students and junior surgeons. The construction of the virtual temporal bone allows the construction of the three dimensional anatomy of the temporal bone establishing the interconnection middle ear ossicular, cochlea, vestibular labyrinth and the facial nerves. These systems allow for viewing from any particular angle and it makes possible to view the middle ear content from the inner ear.

Some of the recent advances in the field of otolaryngology include advanced surgical training, otoacoustic emission testing for the diagnosis of the hearing impairment, characterization of the physiology of smell, precision surgery using lasers, laryngeal reinnervation and palatial surgery, implantation of the hearing aids [2].

For the treatment of the recurrent otitis media tympanostomy and ventilating tubes were found to be efficacious. This has found to reduce the number of episodes of the acute otitis media and effective prophylaxis when compared to the conventional antibiotic therapy. Auditory processing with persistent middle year effusions was a matter of concern due to anatomical differences in the central auditory pathways in association with auditory deprivation. Educational programs for the children with untreated middle ear based on visual sequential memory skills were found to be beneficial for the rehabilitative efforts. Tympanostomy tubes are effective in the treatment of the serous otitis media.

Even though hearing aids are available free of cost less than half of the people generally benefit from them. The advent of the new implantable hearing aids bypasses the use of auditory feedback with concomitant high frequencies. Endoscopic stapling diverticulotomy was found to be the safe treatment for most symptomatic pharyngeal pouches and this has reduced the time of the hospital stays. Endoscopic sinus surgeries showed subjective improvement in the patients over a long term. The use of the endoscopes inserted through the nose has reduced the morbidity and hospital stay for the patients requiring orbital decomposition, daryocystorhinostomy and closure of the cerebrospinal fluid leak [3].

The head and neck surgery spans across different tissue types, function that include the hearing, balance, air infiltration, humidification, smell, facial animation, deglutition, breathing, vocal sounds, speech articulation. If any of these functions are affected then this could lead to other morbidities and even mortality. Traditional treatment strategies for the replacement of tissues include graft from other tissues, artificial materials and transplants. Incorporation of the grafts can incur donor site morbidity. Lack of customized grafts and lack of their availability of the grafts are some of the limitations. The use of the artificial materials can induce immune response and also pose the risk of infection. Such transplantations require the use of the immune suppressing drugs. Limitations are also posed by the lack of functional replacements. In such cases the use of the regenerative medicines restores the function of the cells, tissues and organs [4].

The current clinical research in otolaryngology is driven by information technology. The computational power and analytics and the communication science and the availability of the multidimensional data over the last two decades have influenced every aspect of life. The management of information via informatics has become essential. The advancements in the genetics and molecular biology has generated large amount of data. Next generation sequencing can potentially generate base pair sequence data of the entire genome within a matter of weeks. The microarray technology can generate gene expression data or the status of methylation of tens of thousands of genes, probe million single nucleotide polymorphisms in entire human exome.

Bioinformatics approach has enabled acquisition, storage, analysis, interpretation, and application of the biological data for efficient and effective patient care including improved diagnosis, prognostication and treatment. These advancements have already exerted great impact on the medical practices in the field of otolaryngology. Several forms of congenital, inflammatory, immunological, infectious, neoplastic disorders can be efficiently diagnosed and treated effectively with these modern approaches [5].

Conclusion

Especially in the pediatric otolaryngology has advanced due

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to significant progress in medical and paramedical specializations. The advent of the operating microscopes it is now possible to repair the tympanic membrane perforation, restoration of the ossicular continuity, reposition of congenitally deformed ossicular to restore hearing in children. The operating microscope was extremely useful for congenital atresia of the external canal in children. These technologies has enabled better speech and learning capabilities. The facial nerve stimulation tests can now be operated on intratemporal portion. The use of operating microscope in the rhino logic areas made possible to repair choanal atresia Trans nasally and augments the Trans palatal approach. The advancement in the audiology has also immensely contributed to otolaryngology with significant improvement in hearing mechanism.

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Conflict of Interest

None

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