Neurosurgical Practice in 2020: Looking beyond Surgery and Technical Expertise

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“The future ain’t what it used to be” - Mark Twain
“The problem with the future is that it is always ahead of schedule”

In the last 2 days, 34 fascinating, highly technical lectures including “How I do it Sessions” have been delivered. As one belonging to the BC era (Before Christ and Before Computers are one and the same), who started his neurosurgical residency by injecting air into the lumbar CSF and manipulated the patient’s head, so that one could visualise air in various CSF cisterns, hopefully displaced due to a tumour, neurosurgery has indeed changed. However, the change will be much more, the practice of neurosurgery in the coming decade will reflect truly radical and exponential transformations, not just incremental changes.

Peeping into the future, is a past time that has prevailed for centuries. There has always been a place for the soothsayer, the astrologer and the prophet. Futurology, assumes that the future is an extrapolation of the present and the past. This of course, is a very simplistic and naïve concept. More changes are occurring and will occur in this decade than perhaps has occurred in the past. In spite of this, there are several among us who refuse to think of the future, but cling desperately to the present, not realising that we are already in Jurassic Park.

Let us spend a moment looking at the world in 2020. The average age of the population would have increased. With several million centenarians, geriatric neurosurgery would be a sub-speciality. 15 to 20% of the population of several countries like Japan will be octogenarians. Congenital malformations would steadily reduce. Privatisation of neurosurgical services would be increasing. Postgraduate training in neurosurgery would be more common in corporate hospitals and private medical universities, than in the erstwhile government medical colleges. Choice of a treatment option may perhaps be influenced by the payer. Health care delivery will primarily aim at cost containment. Healthcare will be delivered by organizations with an eye on RoI (Return on Investment). Early diagnosis and prevention, to reduce surgical procedures, will be the daily mantra. Promoting wellness will be a business. Surgeons could even be compensated more, for using medical therapy in lieu of surgery!

The neuro-oncologist of the future will not be a knife toting aggressive surgeon but a Ph.D in molecular neuro-oncology. The P53 gene which will piggy back on a virus, will enter the cancer cell in the brain encouraging the cancer cell to commit suicide. Drugs will inhibit growth of blood vessels feeding tumours. Thus nutrition will be selectively cut off to cancer cells, resulting in their mass starvation and death. Cancer cells will also no longer be able to travel where they want. “Fetus as a Patient” societies are already in existence. Treating the unborn patient, will be a logical
sequel to sophisticated antenatal diagnosis. Biochemical and chromosomal studies of fetal blood may one day predict the occurrence of Alzheimers disease seven decades later. The new breed of endovascular neurosurgeons will be able to block the blood supply to tumours, close aneurysms and deliver high doses of drugs into a tumour.

The terrorist of the next decade will no longer have to be in prison. He could be on parole with an electronic chip implanted in the amygdala. The chip will continuously monitor cellular electrical activity. When even a thought, of an antisocial nature occurs, the change in electrical activity could be detected, and further impulse propagation to the effector organ arrested. The neurosurgeon of the next decade may be able to visualise a tumour thro’ the intact skin and skull. (Sony had to withdraw see through infra red cameras after protests from women’s organizations – the technology already exists ! for a non osseous environment) Special goggles, through which the MRI image of the lesion will be superimposed three dimensionally, on looking through the intact skin over the skull, may eventually be a reality.

Neuroimaging is increasingly identifying associations between biology and violence. This could be construed as evidence for preventive detention in public interest. Would the principle of \textit{mens rea} - the act does not make a person guilty unless the mind is also guilty - combined with the doctrine of \textit{res ipsa loquitur} - the thing speaks for itself - result in acquittals. Will 7T MRI images create more problems than solutions?

Could the phenomenal advances in neurogenetics result in opportunities for genetic enhancement creating genetic haves and genetic have nots. Will economic status determine biological differences leading to “damaged goods” and insurance discrimination. Identification of the preproendothelin-1 gene, vascular endothelial growth factors and detailed molecular studies may eventually result in molecular treatment of cerebral AVM’s rather than resorting to surgery, radiosurgery and embolization.

Will bionic intelligent robotic prosthesis be \textit{integrated} with the Nervous System making Cyborgs a reality. The first Robotic Telesurgery was done on Sep 7th 2001 with the mentor in New York and the patient in Strausbourg. Using just 8Mbps bandwidth for a round trip of 14,000 km the time delay was just 155 msec. Today, the National Knowledge Network in India has made available hi speed bandwidth at 1 Gigabyte per second. In 2020, the technology for tele robotic neurosurgery across continents will certainly be available. Several years ago at the Virtual Laboratory at Stanford University the author did a tubal ligation and a para thyroidectomy. Almost a 120 steps were elaborated for the procedure and the operator was taken thro’ every step. Imagine if neurosurgical procedures could be broken down to its minutiae in a surgical simulation skills laboratory. Improbable Yes. Impossible No!

In this milieu, where fundamentals itself are being challenged and obsolescence is the name of the game, the neurosurgeon of 2020 must look beyond technology and surgical expertise. Rudyard Kipling had once remarked “What do they know of England, who only England know?” In the coming decade, this would be very true of the neurosurgeon. Understanding that developing traits, quality, character and sterling values will ultimately make one a better neurosurgeon, than mere access to sophisticated armamentarium, is the first step.
The Empathising Neurosurgeon should learn to communicate, communicate and communicate. He/she should be the embodiment of clinical judgement and wisdom. One must remember that even today there is a role for no intervention, delayed / less aggressive intervention. One must also treat the family, treat the individual with the tumour, not just the tumour or the image on the MRI. There are many ways to skin a cat and one should be humble enough to acknowledge, the lack of familiarity with all of them. One should never forget that we can die with meningioma or schwannoma not necessarily of one. Operatis prurandi often afflicts the aggressive neurosurgeon. The surgeon may be bold, but often it is the patient who is bolder in giving consent!

The Ideal Neurosurgeon is a master craftsman and superb technician probably knowing more and more about less and less: A Specialist among Specialists, constantly innovating in a rapidly changing world with the realisation that if one does not continually change you will be history. New Skills must be acquired – what got you where you now are, will not keep you there! Today unlearning and relearning is more important than learning. Mid course corrections and responding rather than reacting is crucial. We are, what we repeatedly do and for success one has to do the job you hate the most! No Man is an island unto himself. In tomorrow’s world one has to delegate - true delegation is giving up something to a colleague or a subordinate. One has to be realistic, not bite more than one can chew, change course whenever and wherever necessary. Changes can never be isolated and reactions to changes will always be different.

Traits of a Neurosurgeon: The ability to interact with those outside one’s immediate job and to trust colleagues is important. To reach the top, new skills need to be developed, not doing more of what one is already doing well. Leadership must be participatory not authoritative. Looking far afield, helps one see better, what is close to home. A doer who wants to get things done yesterday, being passionate about work, highly motivated, focusing on long term results and goals, acknowledging uncertainty, and using one’s support network are all essential traits. A leader willing to listen and look from the balcony, a frontrunner who has realised that there is no I in TEAM (Together Everyone Achieves More), a head who understands strategy, planning and execution. Raising the bar - not being content with low hanging fruits and looking at every failure as a learning experience – these qualities should be in the very DNA of every neurosurgeon. In neurosurgery as failure is not an option, we have to learn from other’s failures, that is acquire wisdom, not just factual knowledge. Every experienced neurosurgeon has learnt that it is better to loose the battle and win the war. One can always come back another day. “Ego” has no place in the neurosurgeon’s lexicon. Being a perfectionist is not necessarily always the right thing to do. The ability to take a quick effective decision, drawing on insights from those in the front lines, retreating if necessary, defines not only a platoon commander but also the neurosurgeon encountering an intraoperative aneurysm rupture!

The multi faceted Neurosurgeon: A clinician par excellence never, ever discounts history/ and observations of the patient and the family. When managing an eloquent area glioblastoma, the family and patient’s long term and short term objectives must be taken into account. It is not just patient survival, but at what cost – financial, emotional and Quality of Life are equally important. Harvard Business School, citing examples of decisions taken by Fortune 500 CEO’s, concede that there is a place for Emotional Intelligence. “Gut feeling” sometimes scores over sophisticated
business analytics and this is often so, in clinical neurosurgery. Evidence based medicine is a guideline, not an absolute end. Problems must be reduced to its individual constituents. The neurosurgeon of the third decade of the 21st century will necessarily have to be a scientist. Measure, Measure and Measure: Document, Document and Document: Update, Update and Update: Continually assess what is working and what is not. These will be the buzzwords deployed in daily practice.

**ICT and Neurosurgery:** ICT will no longer mean only *Intra Cranial Tension*. It will signify the even more important term – *Information and Communication Technology*. Distance today has become meaningless and Geography has become History!! Tomorrow’s neurosurgeon will be part of Digital Health, Digital Hospitals, EMR, HIS, telemedicine, telementoring and mHealth. With a mini iPad or equivalent low cost tablet, he/she will be available to anyone, anytime anywhere. Prof Google and Dr Facebook will ensure that the patient is truly empowered, having real time access to almost the same exabytes of information the neurosurgeon has. “Caveat emptor” – let the buyer beware – the neurosurgeon of 2020 could very well be on the receiving end!! Familiarity with Medical Social Networking Sites like PatientsLikeMe.com, Sermo.com, iMedExchange.com, ICYou.com, CarePages.com and DailyStrength.com will become mandatory. These will be the channels for patients and Health Care Providers to learn from each other. Multiple opinions from difficult cases, exchanging observations, getting help with patient care, practice management etc all in an electronic medium transcending regions and even continents will be commonplace. Patients have already started sharing their challenges, hopes and victories, treatment experiences and support. How does one face a life-altering health event. More than 500 online support groups with a comprehensive health network of patients, share advice, make available research on the latest drugs, treatments and alternative therapies. Healthcare Video On Demand from hundreds of certified medical and Health Care Providers are freely available. Neurosurgeons who do not consider using social networks risk being run over on the super-highway of health information sharing. 33% of Americans who go online to research their health, use social networks to find fellow patients. Amyotrophic Lateral Sclerosis patients organized their own clinical trial on PatientsLikeMe.

**Conclusion:** The only thing that is constant in the universe is change. Many of us are afraid of the future and clinging desperately to the present, not realising that we are already the past. The famous science fiction writer Arthur Clarke once said, “Advanced Technology will eventually be indistinguishable from magic.” To face this magic, what we require, in the coming decade, is a mature head on young shoulders - not to get carried away by gadgets. A technology in search of an application has a limited life span. We should never forget that we have the unique privilege of trouble shooting and repairing the greatest supercomputer of all time, the human brain. Science without compassion is blind, compassion without science is lame. In our anxiety to keep up with the Joneses let us never forget that we are healers first and technologists later. A combination of the surgical skills of Sushrutha, the compassion of Mother Theresa, the scientific acumen of Albert Einstein, the pragmatic “Karma Yoga” philosophy of Lord Krishna and the innovation, shrewdness and IT skills exemplified by Steve Jobs will produce Superman, which is what the neurosurgeon of 2020 needs to be!!