



Advancements in stereotactic and functional neurosurgery

In the coming years, nano-technology can utilise this principle in treating many neurological conditions

BY DR NK VENKATARAMANA

Neurosurgery has grown as one of the finest specialities over the century. The main reason for such progression is the understanding of the brain, technology adoption and imaging. Stereotactic surgery

is one such specialised surgical procedure which has evolved with technology. "Stereotaxy" is a Greek word, where 'Stereo' means three dimensional space and 'Taxis' means reaching the point. When the access to the deep seated brain region became a



challenge, several physicists, mathematicians and neurosurgeons have brought in this principle and adopted to neurosurgery. It is based on the fact that in a three dimensional space any specific point can be reached accurately by having XY and Z axis measurements. Either an accurate distance in three planes or a combination of distance and an angle can facilitate this.

Knowing this Spiezel and Wycis have devised an instrument which sits on the head and helps in calculating these measurements manually. Over the years the instruments got modified several times towards more sophistication. Coupling this technology to the computers after the advent of computerised tomography scan (CT Scan) has made this calculation accurate

and quick. The computer itself provides the calculation to avoid all manual errors. These Stereotactic frames were further advanced to adopt to the CT Scanners with a built in software program. The advent of MRI has added a 3 dimensional imaging of the brain. Now the 3rd generation Stereotactic frames became MRI compatible so that the target can be visualised in all the three planes (Axial, Coronal and Sagittal).

Now a neurosurgeon has an opportunity to directly see and select the target directly in the brain through MRI imaging. Greater precision and an accuracy of 1mm was complimented by such advancement. Later, the image fusion software has taken the entire process to the next level of accuracy and visualisation, in relation to the bony landmarks of the skull by fusing the images obtained from CT as well as MRI of brain. This has boosted the confidence of neurosurgeons, with an additional virtual reality facility where in one can plan the entire surgical procedure on a computer before the actual procedure.

Today, neurosurgeons can choose any specific point as target in the brain depending upon clinical situation, select the point of entry at the skull and can also visualise the entire trajectory in the brain to avoid damage to the important structures with certainty.

With the advent of stereotactic system, the era of key-hole surgery took its origin. Over the years the hardware has become more and more sleek and sophisticated with a lot of additional gadgets to suit the clinical applications. Similarly the software also has made a phenomenal progress in terms of speed, safety and accuracy.

The need for such stereotactic system came into neurosurgery to obtain biopsy and to establish the diagnosis of tumors located deep inside the brain. But over the years, it became a much needed tool to evacuate blood clots in brain, to drain cysts and abscess in the brain and the clinical and research applications expanded rapidly.

Eventually, it has helped the evolution of whole gamut of functional neurosurgery.

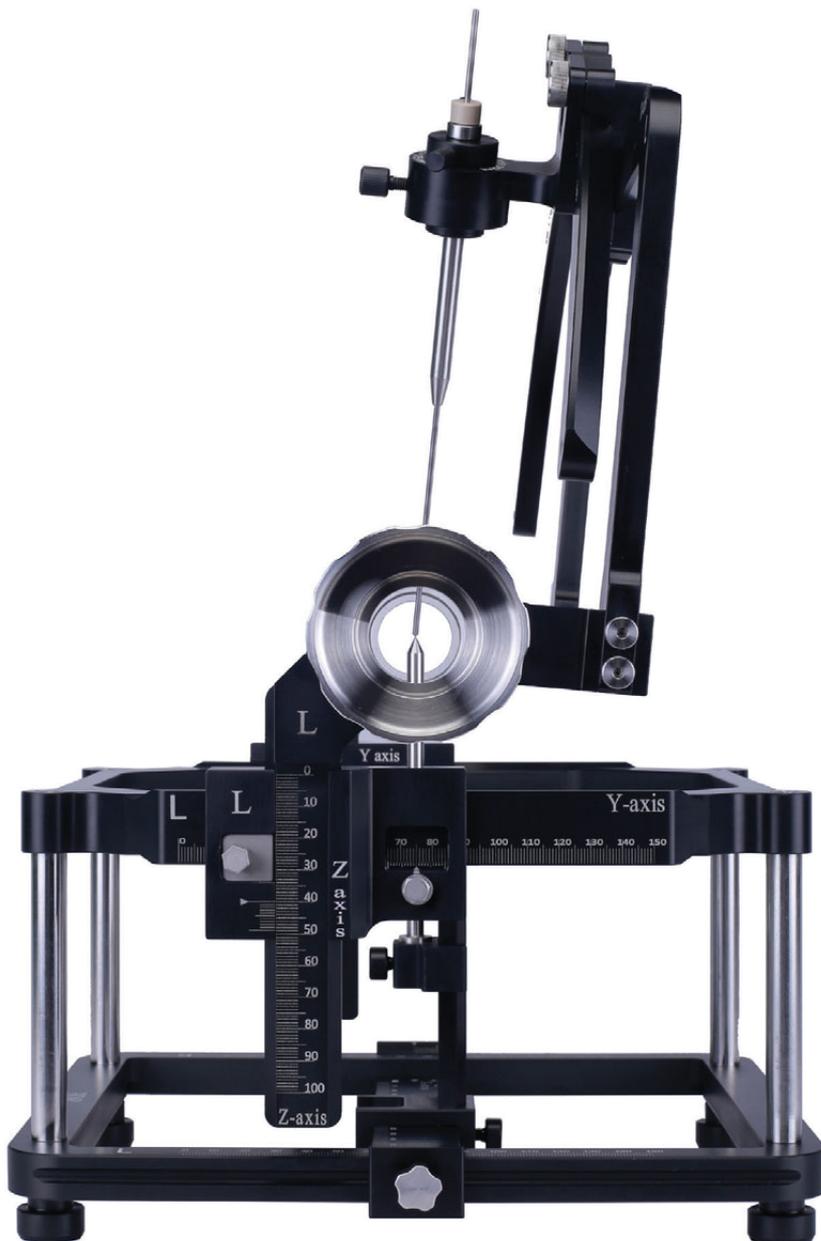
Today we can modify the course of the disease and alleviate symptoms of many complex neurological diseases with greater confidence. Deep Brain Stimulation (DBS) became the gold standard for Parkinson's disease, similarly for dystonia, chronic intractable pain, refractive epilepsy and severe depression, etc.,. In addition one can

implant a device or a drug delivery pump precisely in a specific location of the brain using this system.

In future, nano-technology can utilise this principle in treating many neurological conditions. Similarly, a serious search is on to identify different specific newer target areas in the brain that will help in modulating and modifying the human behaviour apart from illness. The scope of such futuristic implants seems to be exiting and overwhelming.

With my 25 years of experience in the stereotactic and functional neurosurgery, I have indigenously developed the 3DR Stereotactic System. The hardware and the software were built in Bengaluru by the Mahalasa Medical Technology. The vast years of learning has been incorporated into this frame to make it unique, user-friendly, error free and easy to use. The frame is versatile compatible with CT and MRI and for the whole range of clinical conditions.

In addition, this is the first Indian frame affordable to all neurosurgical departments and comes with all necessary attachments comprehensively including the software. The frame and the software is extremely user-friendly and has the ability to perform wide range of neurosurgical operations starting from Stereotaxy to Stereotactic guidance and stereo assisted neurosurgeries. Even radio-therapy can be delivered precisely to specific area of the brain using this stereotactic principle now known as stereotactic radio surgery. The single most advantage of the stereotactic surgery is the precision and the accuracy and an opportunity to preserve the integrity and functionality of the surrounding normal brain. 



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