МАТЕРИАЛЫ ОБРАЗОВАТЕЛЬНЫХ КУРСОВ WFNS

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INTRA-OPERATIVE IMAGING SOLUTIONS FOR NEUROSURGERY

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Intra-operative imaging has undergone significant improvements and has increasingly been used in the field of neurological surgery. While imaging has been deployed in the neurosurgical operating operating theatres for the last 3 to 4 decades in the form of plain x ray radiographs, ultrasonography and catheter angiographies, the last few years have seen a proliferation of other modalities in neurosurgery in the form of intra-operative CT scanning and intra-operative MRI.

The use of intra-operative CT is intuitively useful in surgery for trauma, hydrocephalus, skull base tumours, spine and neurovascular procedures in the form of CT angiography with the multislice CT's.

Intra-operative MRI's in the shape of low and high field systems have been installed increasingly in many neurosurgical units and have been useful for pituitary surgery as well as for intra-axial tumours.

More recently, the use of indigocyanine green angiography as well 5 ALA have been used as adjunctive aids to verify surgical objectives.

The integration of intra-operative imaging with surgical navigation promises to aid the neurosurgeon in potentially achieving surgical goals with hopefully minimal negative effects although more data would be necessary to verify if the increased efficacy justifies the additional infrastructural cost.

The NNI Singapore has a 5 operating suite which utilizes the imRI, iCT, is-C3D, ICG angiography for the past year integrating data processing and an IT network which aids pre-operative planning and decision making as well as influencing surgical decisions in the operating room by using imaging to evaluate the surgical microenvironment. We will attempt to share our experience with regards to the merits and demerits of the modalities described above.

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THE APPLICATION OF ICG (FLOW 800) FOR ANEURYSM AND AVM SURGERY

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Objective: To evaluate the usefulness and limitations of the intraoperative near-infrared indocyanine green videoangiography (ICG-VA) and analysis of fluorescence intensity in cerebrovascular surgery.

Methods: 48 patients received ICG videoangiography during various surgical procedures from May, 2010 to August, 2010. Included among them were 45 cases of cerebral aneurysms and 3 cases of cerebral arteriovenous malformations (AVMs). The infrared fluorescence module integrated into the surgical microscope was used to visualize fluorescent areas in the surgical field. An integrated analytical visualization tool constantly analyzed the fluorescence video sequence and generated it in the form of an intensity diagram for objective interpretation.

Results: Overall, the procedure of ICG angiography was done 158 times in 48 patients. There was no adverse effect of ICG dye. In cerebral aneurysm cases, the images obtained were of high resolution. In 4 cases, incomplete clipping was detected by ICG-VA and allowed suitable adjustment to completely obliterate the aneurysm. In 3 aneurysm cases, the intensity diagram of ICG angiography provided valuable information. ICG videoangiography identified the feeding arteries, the draining veins and nidus in all 3 AVM cases, which was confirmed by an immediate analysis of fluorescence intensity.

Conclusions: ICG video angiography provides high resolution images allowing real time assessment of the blood flow in surgical field. The intensity analysis function in addition, is a useful adjunct to improve the accuracy of the clipping and decrease the complication rates in cerebral aneurysm cases. In cerebral AVM cases, with the help of color map and intensity diagram function, the superficial feeders, drainers and nidus can be identified easily.

Key words: Indocyanine green videoangiography, Cerebral aneurysm, Cerebral arteriovenous malformation.

Prof. Dr. Keki E. Turel

DECOMPRESSION OF SPINAL STENOSIS (MIDSS)

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Lumbar canal stenosis is narrowing of the spinal canal due to structural abnormality of variable extent(Sagittal diameter < 10 mm). Lumbar canal stenosis can be due to congenital causes (Idiopathic,Achondroplasia) or acquired,which can be degenerative,combined congenital / degenerative stenosis ,Spondylotic / spondylolisthetic, Iatrogenic (post - Laminectomy,post – Fusion,post – Chemonucleosis), post traumatic or metabolic (Pagets, Fluorosis).Disc herniation adds to the pre – existing stenosis, precipitating severe neurological events.MRI is the gold standard for diagnosis of spinal stenosis.

MIDSS is an ideal procedure, which treats spinal stenosis by decompressing cauda equina and may obviate the need of instrumentation in grade-I spondylolisthesis by still maintaining architecture of the spine.MIDSS is based on the principle of internal decompression or widening the narrow canal, without laminectomy, and without disturbing the bony architecture / ligamentous supports of lumbar spine.

Ivan Ng MBBS, FRCS(Surgical Neurology)

THE FAR LATERAL APPROACH FOR TUMOURS NAD VASCULAR PATHOLOGIES AT THE CRANIOVERTEBRAL JUNCTION

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In tackling lesions of the lower third of the clivus and craniovertebral junction, the far lateral approach is an invaluable surgical approach The key steps to the procedure is the proper positioning og the patient. I prefer a park bench position with the head laterally extending and rotated to the opposite side to expose the lateral craniovertebral position in question. The operative techniques is divided into a number of steps to facilitate understanding:

1. The soft tissue disseciotn stage: this endeavours to expose the sulcus limitans on the atlas as well as the extracranial vertebral artery before it pierces the dura.

2. Bony dissection includes a lateral C1 laminectomy and if necessary resection to the lateral mass; lateral squamous occipital bone resection up to and potentiall involving part or all of the occipital condyle(extreme far lateral approach)

3. Intradural dissection: involves resecting the dentate ligament to allow the whole brainstem complex to move posteriorly; dissection and preservation of the lower cranial nerves

This approach can be used for VA, PICA and VA-basilar aneurysms, dural AV fistulas of the craniovertebral junction, extra axial tumours and even intraxial lesions.

Kazuhiro Hongo

SURGERY FOR THE CEREBRAL AVM OF THE ELOQUENT AREA

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To remove an arteriovenous malformation (AVM) more safely and accurately, we have been applying two modalities: 1) the preoperative embolization, and 2) 3-D rotational angiography as the preoperative simulation and intraoperative navigation. With these modalities with precise microsurgical techniques, even eloquent AVM can be removed when it is located superficially.

In the presentation, several illustrative cases will be presented with surgical videos as well as showing our surgical results.

Yoko Kato,M.D.,Ph.D.

MANAGEMENT OF GIANT AND COMPLEX ANEURYSMS

Chair,Education and Training Committee of the WFNS
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Aneurysm >2.5 cm is considered Giant. Apart from Size; presence of thrombus, atherosclerosed wall, perforator or branch arising from the aneurysm, dome of the aneurysm embedded in a parenchyma, partially coiled or previously clipped aneurysm are the factors which make the aneurysm complex.

In spite of the tremendous advances in imaging technology, microsurgical techniques, and endovascular modalities; Giant and complex aneurysms of anterior circulation are still a challenge for a neurosurgeon.

Strategy of management of complex and Giant aneurysm of anterior circulation is different. .Pre operative imaging includes 3D CT angiography and MR angiography, while 3 D DSA in selected cases. Selection of modality; whether endovascular, surgical or combined, is based on the detailed analysis of pre operative images and discussion with endovascular team.

We use standard pterional craniotomy for most of the cases with anterior circulation aneurysms at circle of Willis and Orbitozygomatic craniotomy in selected cases. Measures like, extradural clinoidectomy, utilization of Dolenc approach for proximal control are applied when needed.

Meticulous microsurgical dissection, wide splitting of Sylvian fissure, patient arachnoid dissection, achieving proximal and distal control and aneurysm dissection are standard practice.

Selection of proper clip and proper technique of clip application are of significance. Multiple clip techniques such as March clip technique, Tandem clip technique, neck reconstruction are essential tools. .

Endoscope assistance is of important to evaluate blind corners and confirmation of complete obliteration of aneurysm. We also use Doppler to confirm complete exclusion of aneurysm.

Alternative strategies are useful in selected cases and includes; utilization of Hypothermia and cardiac arrest which provides more time as well as slacken the aneurysm and if needed aneurysm can be opened, thrombus removed and neck reconstruction can be done. Aneurysm, which is unclippable, is wrapped.

Combined modality with endovascular treatment is also an important tool in selected cases. Options would be: proximal temporary balloon occlusion, endovascular suction decompression, surgical bypass with endovascular vessel occlusion or trapping of aneurysm and partial clipping to occlude and narrow the neck and complete obliteration by coiling.

Conclusion: Giant and complex aneurysms of anterior circulation are a challenge for a cerebrovascular surgeon. With proper selection of approach, proper application of microsurgical technique and utilization of endovascular and surgical combination modalities these aneurysms can be managed with better outcome.

Peter M. Black, MD, PhD

NEW DEVELOPMENTS IN MENINGIOMA MANAGEMENT

Franc D. Ingraham Professor of Neurosurgery
Harvard Medical School

This presentation will discuss the changing patterns of meningioma management over the last 10 years at our hospital. These changes include:

1. Increasing importance of an aggressive phenotype in meningiomas and the potential for tumors to progress. In our experience the three-year recurrence rate was 3.5 % for Grade 1 meningiomas, 10.5 % for Grade 2 and 50 % for Grade 3.

2. Increasing need for guidelines for decision-making. The author's personal series includes over 800 meningiomas, 49.5 % convexity, 10.3 % midline, 29.8 % skull base and 10.3 % others. For convexity tumors, mortality was 0.4% and neurological morbidity 3 %. For parasagittal tumors mortality was 0 % and morbidity 2 %. We will discuss our surgical approaches to these tumors.

3. Less aggressive surgery for skull base meningiomas with fewer complex approaches and greater attention to patient quality of life postoperatively. We will review a personal experience with 200 skull base meningiomas.

4. Increasing role for radiation including both

radiosurgery and conformal radiation (intensity modulated radiation therapy or IMRT for residual meningiomas.

5. Recognition of the need for new techniques including new chemotherapies for malignant meningiomas.

Kaoru KURISU, M.D., Ph.D.

SURGERY OF THE 4TH VENTRICULAR TUMORS

Professor and Chairman
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Surgery of the 4th ventricular tumors is one of the most challenging issues for neurosurgeons because of its anatomical and functional relationship to surrounding structures. In this lecture, I will talk about precise procedures to make removal route from the 4th ventricle without resection or cutting of the cerebellar vermis in medulloblastoma and ependymoma case.

Potapov A.A.[1], Loshakov V.A.[1], Usachev D.U.[1], Kornienko V.N.[1], Pronin I.N.[1], Cherekaev V.A.[1], Gavrilov A.G.[1], Lukshin V.A.[1], Belaev A.U.[1], Kobyakov G.L.[1], Golbin D.A.[1], Shishkina L.V.[1], Kuzmin S.G.[3], Loshenov V.B.[2], Grachev P.V.[2], Saveljeva T.A.[2], Kholodtsova M.N.[2], Shurhai V.A.[1], Goraynov S.A.[1], Zelenkov P.V.[1], Ohlopkov V.A.[1]

MULTIMODAL NAVIGATION INCLUDING LASER FLUORESCENCE SPECTROSCOPY IN SURGERY OF INTRACEREBRAL TUMORS

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BACKGROUND: 5-ALA fluorescence guidance is one of established methods of intraoperative detection of malignant gliomas and metastases. Protoporphyrin IX accumulation enables simultaneous intraoperative laser spectroscopy, which may represent a useful quantitative modality for precise location of malignant tumor borders.

AIM OF THE STUDY: to evaluate the usefulness of laser fluorescence spectroscopy in 5-ALA-guided microsurgical resections of malignant brain tumors.

MATERIALS AND METHODS: since 2008, 88 patients underwent 5-ALA-guided microsurgical resection of malignant brain tumor, laser fluorescence spectroscopy was used in last 21 consequtive cases. These group included 15 cases of glioblastoma, 2 cases of oligoastrocytoma, 1 anaplastic oligodendroglioma and 3 cases with cerebral metastasis. Different modalities of intraoperative navigation were used, including endoscopic assistance, intraoperative ultrasound and neurophysiological monitoring. Laser spectroscopic measurements followed by biopsies were performed in multiple sites of tumor and surrounding tissues. Fluorescence intensity was normalized to normal brain. Biopsies morphology (n=118 from 21 patients) was compared to fluorescence ratio.

RESULTS: Normal brain tissue, tumor tissue and infiltrative zone could be identified and differentiated with laser fluorescence spectroscopy ($p<0.05$). The average fluorescence ratio in core of glioblastoma was 12.8±6.4, infiltrative zone 4.7±2.2, necrotic tissue 1.1±0.5. Average fluorescence ratio in cerebral metastasis was 10.8±2.3.

CONCLUSION: laser fluorescence spectroscopy is a useful quantitative diagnostic modality in 5-ALA-guided microsurgery of malignant brain gliomas and metastases. It may provide better understanding of tumor spread and may influence the extent of tumor removal.

Prof. Dr. Keki E. Turel

MANAGEMENT OF LOW GRADE GLIOMAS

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Low-grade gliomas (LGGs) are a heterogeneous group of relatively slow-growing primary tumors of astrocytic and/or oligodendroglial origin. Peak incidence occurs in the second and third decade of life. Many patients will present with easily controlled seizures and will remain stable for many years, whereas others may progress rapidly, with increasing neurological symptoms, to a higher-grade tumor. Although morphologically indistinguishable at diagnosis, the time interval to progression varies considerably from a few months to several years. Oligodendroglioma with specific molecular changes (allelic loss on chromosomes 1p and 19q) have been recognized over the last decade to be a distinct subgroup with a better prognosis and a particular sensitivity to chemotherapy.

Management of LGG remains a challenging task. More precise definition of tumor entities, including also specific molecular markers, is necessary to identify patients in need of a more aggressive treatment strategy. Evaluation of the known prognostic factors by an experienced multidisciplinary team is the basis for any treatment recommendation or for watchful waiting. The role of chemotherapy and new biological agents currently in development needs to be established in well-designed clinical trials. Long-term toxicity is of concern in a disease where patients may live for many years.

The goals of treatment for patients with LGGs include prolonging overall and progression-free survival and minimizing morbidity. This requires preventing tumor enlargement and transformation into high-grade gliomas (HGGs) and minimizing treatment-related complications. Radical or total resection is the surgical procedure of choice for all forms of glioma, because in many of the patients with these tumors complete removal of the lesion can result in cure. On occasion, cortical mapping or awake surgery may be helpful in allowing complete resection to be accomplished without producing unacceptable neurological deficits.

Peter M. Black, MD, PhD

ROLE OF SURGERY IN GLIOMA MANAGEMENT

President, World Federation of Neurosurgical Societies
Franc D. Ingraham Professor of Neurosurgery
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Low-grade Gliomas

Surgery has an important role in low-grade glioma management. It is useful to:

1) Establish a correct diagnosis. This may require an attempt at major resection, since there may be islands of anaplasia in these tumors and sampling error can be a serious problem. The need for diagnosis mandates at least a biopsy, however, since MR imaging is not accurate.

2) Decrease seizure frequency—often seizures are a major manifestation of these tumors, and resection can diminish seizure frequency.

3) Relieve mass effect—if the tumor is large, symptoms from its size alone can be ameliorated by major surgery.

4) Improve survival—this is a controversial aspect of resection but one that seems to have increasing class 2 evidence to support it.

5) Avoid radiation therapy, a modality which has little demonstrated efficacy in increasing survival—resection may be followed by observation alone if one knows the grade of the tumor accurately.

6) Avoid chemotherapy, (again which has little demonstrated efficacy).

Our present attitude is to do as aggressive a removal as possible for low-grade gliomas and then observe them without radiation or chemotherapy. Techniques of surgery including brain mapping, navigation, and intraoperative imaging are important.

High-grade Gliomas

The role of aggressive surgery for anaplastic gliomas and glioblastomas is more controversial. How-

ever, there are a number of reasons for considering major resection for these tumors:

1) Making the diagnosis accurately—the ability to establish unequivocally the presence of higher grade tumor, of oligodendroglial components, and making a specific diagnosis of tumor type is important for protocols and outcome analyses

2) Setting up further therapy—mass effect and cerebral swelling can be serious side effects of both surgery and radiation if a large mass is left after a procedure. Major resection avoids this.

3) Improving survival-- there are no class one data that demonstrate in a prospective randomized way that major debulking increases survival from these tumors. However, there is increasing class-2 evidence.

Recurrent Gliomas

Surgery can be an important part of managing recurrent gliomas. In previously low-grade tumors it can assess progression to a higher grade. In higher grade gliomas, it is often a good start to management of recurrence.

Kaoru Kurisu, Atsushi Tominaga, Yasuyuki Kinoshita, Satoshi Usui, Tetsuhiko Sakoguchi and Kazuhiko Sugiyama

SURGICAL TREATMENT OF CRANIOPHARYNGIOMA VIA TRANSSPHENOIDAL ROUTE WITH SPECIAL EMPHASIS OF ENDOSCOPE ASSISTANCE

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We have no objection to the doctrine that micro-neurosurgery under operating microscope is crucial to the basis of neurosurgery. But in recent years, endoscopic micro-neurosurgery has been spreading dramatically and very speedily. Especially in the field of skull base surgery, transnasal endoscopic approach could be applied from anterior frontal base to craniocervical junction in the most advanced state. We also have steadily expanded the indication of endoscopic approach with microscope in safe and accurate fashion. In this presentation, we will show our present status of microscopic and endoscopic removal of pituitary adenoma and craniopharyngioma via transnasal and/or transcranial route. And also we would like to emphasize the benefit of combined use.