Proposal for ISMRM Sponsored Workshop

Mapping Functional Networks for Brain Surgery

Motto: ***All brain functions are eloquent but some are more eloquent than others***

Milan, Italy – Auditorium Sala Levi
8-9 and 10 September 2011

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OVERVIEW

Surgery near or within so-called eloquent brain structures remains a challenge particularly because of the risk of inducing a permanent neurological deficit. In order to maximizing the boundary of lesion resection and to minimizing postoperative morbidity, presurgical and intraoperative mapping of functional networks located near or within the lesion is required. In the past decade functional mapping methods such as presurgical mapping (i.e., functional and diffusion MR imaging and magnetoencephalography) and intraoperative electrophysiological cortical and subcortical monitoring have been refined and extensively used. The explosive growth of functional MR imaging and MEG in cognitive neuroscience since the early 1990s has had a major impact on their use of presurgical planning. More recently, the development of diffusion MR imaging with tractography has extended the frontier of presurgical mapping to white matter pathways and their relationship with an infiltrating neoplasm.

The objective of this workshop is to bring together in a single forum neuroscientists, MR physicists, cognitive neurologists, neuropsychologists, neurooncologists, neuroradiologists and neurosurgeons and to provide a broader view, as well as a detailed information about the current issues involving the functional mapping methods used in surgery of eloquent areas.
Other objectives of the workshop are to summarize current knowledge about localization of function in the brain; to describe results of each mapping method that have already been validated; to address the limitations, the solutions and the challenges of each mapping method.
The application of the new functional mapping methods to the surgery of eloquent areas is indeed an extraordinary opportunity for all neurospecialists to improve their understanding of how each functional network is operating during normal and pathological conditions.

AUDIENCE DESCRIPTION

- Neuroscientists, MR physicists, computer scientists, neurophysiologists, cognitive neurologists, neuropsychologists, speech therapists, neurooncologists, neuroradiologists and neurosurgeons
- All specialists interested to improve their understanding of how each functional network is operating during normal and pathological conditions.
- The level of the course is intermediate; it is designed for participants with a basic to intermediate understanding of the topics involved.
- Aim of the workshop is to draft topics for writing position papers to be published in top-rated clinical scientific journals.

Brain mapping techniques discussed in this workshop:

- Presurgical mapping:
  - Morphological MRI
  - fMRI/MEG/EEG
  - Diffusion MR Tractography
- Intraoperative mapping:
  - ESM (cortical and subcortical)
  - Ecography, optical imaging
  - MR imaging

Venue

Auditorium Sala Levi

Via Carlo Valvassori Peroni, 21 - 20133 Milan, Italy

Auditorium capacity: 300 people
Audiovisual media facilities are included in the cost of the auditorium.
Classic and modern music will be played during the intermissions in the auditorium.

The auditorium is conveniently located in downtown Milan, in the university campus of the Politecnico of the University of Milan. It is very close to the Fondazione IRCCS Istituto Neurologico Carlo Besta.

Multiple levels of **accomodations** will be available in the City of Milan. A wide selection of accomodations will be available in the range from € 80 to € 300 per night. At the time of the workshop there are no other large events scheduled in Milan that would compete for accomodation space.
The venue can be reached in 10-20 minutes from most downtown hotels with public transportations (subways, bus and tramway).

A **social program** will be organized during the workshop. This may include but it may not be limited to:

- Visit to the *Last Supper* by Leonardo da Vinci
- Visit to the *Castello Sforzesco*, a renaissance Castle in downtown Milan
- Welcome reception in the terrace of the *grattacielo Pirelli* (skyskraper)

Endorsement of the workshop will be asked to the following scientific societies:

- American Association of Neuroradiology (ASNR)
- Functional Neuroradiology section of AINR (ASFNR)
- American Association Neurosurgeons (AANS)
- European Association Neurological Surgery (EANS)
- European Socity of Neuroradiology (ESNR)
- Associazione Italiana di Neuroradiologia (AINR)
- Società Italiana di Neurochirurgia (SiNCh)
- Associazione Italiana di Risonanza Magnetica in Medicina
- Associazione Italiana Fisica Medica (AIFM)

Preliminary Scientific Program

DAY 1 - Morning

8:00 AM – Registration
8:20 AM - Welcome

8:30-10:30 AM
Session 1
What do we know about functional systems?
4 talks 30 minutes each – total 120 min
This introductory session will set the scene:

- Sensorimotor function integration
- Language production and comprehension
- Visuospatial and attention
- Memory
  Discussion

10:40-11:00 AM Break

11:00-11:30 AM
Keynote lecture
Exploring columnar organization with fMRI at ultrahigh field
Kamil Ugurbil, Minneapolis, MN

11:30 AM -1:15 PM
Session 2
Presurgical mapping with functional MR and MEG/EEG: *challenges, solutions and limitations*

3 talks 30 minutes each – total 90 min. This methodological imaging session will address the following functional systems:

- Sensori-motor functional and dysfunctional anatomy
- Hemispheric dominance for language: comparison between results obtained with different methods: fMRI -> MEG -> IAP - TBA
- Attention and memory
  Discussion

1:15-2:30 PM Lunch break

DAY 1 - Afternoon

2:30-3:30 PM

Case study discussion (Interactive Medical Learning)

3:30-3:45 PM Break

3:45-4:15 PM

Keynote lecture

Surgery of eloquent areas: the insula
Ugur Ture – Istambul, Turkey

4:15-6:30 PM

Session 3

Intraoperative mapping of cortical areas: *challenges, solutions and limitations*
4 talks 30 minutes each – total 120 min
Surgeons will address methodological and practical issues. To which extent a particular functional network should be explorated with intraoperative methods will also be addressed.

- Sensorimotor system
- Vision and attention
- Pre, intra and post-surgical neuropsychological assessments
- Language production and comprehension
  Discussion

6:30-7:30 PM

Session 4

Oral communications (8+2 min each)

8:30- 10:00 PM

Poster and wine & cheese reception

We'll consider to have this section organized in a different location to make it a social event if necessary funds will be available. Otherwise it will be organized in a separate room adjacent to the auditorium.

DAY 2 - Morning

8:00-9:00 AM
Oral communications (8+2 min each)

9:00-10:40 AM
Session 5
Diffusion MR tractography: *challenges, solutions and limitations*
3 talks 30 minutes each – total 90 min

- Patterns of white matter invasion by neoplasm
- Challenges and limitations of quantifying white matter pathways in vivo
- Reproducibility, precision and accuracy
  Discussion

10:40-11:00 AM Break

11:00-11:30 AM
Keynote lecture
The Human Connectome
David Van Essen – University of Washington, St. Louis, MO

11:30AM-1:15 PM
Session 6
Presurgical mapping with diffusion MR tractography
4 talks 20 minutes each – total 90 min

- Sensori-motor system
- Verbal language
- Pathways of the visual and spatial network
- Callosal fibers
  Discussion

1:15-2:30 PM Lunch break

DAY 2 - Afternoon

2:30-3:40 PM

Session 7

Intraoperative mapping of white matter connections: *challenges, solutions and limitations*

3 talks 30 minutes each – total 90 min. Surgeons will address methodological issues and to which extent a particular functional network should be explorated with intraoperative methods

- Corticospinal tract and SMA-related tracts
- Exploring verbal language pathways
- Pathways of the visuo-spatial network
  Discussion

3:40-4:00 Break

4:00-5:00 PM

Keynote lectures

What we have learned so far about localization of function in the brain
Marsel Mesulam – Chicago

Analysing the brain as a network
C.J. Stam - Amsterdam (suggested by Duffau)

5:00-6:15 PM

Session 8

Validation of mapping methods

3 talks 20 minutes each – total 90 min

- Intraoperative cortical and subcortical mapping
- Functional MRI, MEG and EEG
- Diffusion MR Tractography
  Discussion

6:30-7:30 PM

Session 9

Oral communications (8+2 min each)

DAY 3 - Morning

9:00-10:30 AM

Session 9

Neurosurgical interventions that modify dysphunctional networks

3 talks 30 minutes each – total 90 min

- Movement disorders
- Epilepsy (Mesial temporal sclerosis and split brain)
- Obsessive-compulsive disorders (OCD) and depression

  Discussion

10:40-11:00 AM Break

11:00-11:30 AM

Keynote lecture (Rehabilitation and plasticity)

Suggested topic: Mirror neurons circuits may be important to recognize and to be exploited for speeding up rehabilitation

11:30 AM -1:00 PM

Session 10

Quality of life and outcome: evidence from risk benefit assessment

4 talks 20 minutes each – total 90 min

- Outcome from neuropsychological language evaluation – *Costanza Papagno*, Milan
- Outcome results from presurgical mapping – *John Ulmer*, Milwaukee, WI
- Outcome results from intra-operative mapping – *Mitch Berger*, San Francisco
- Do we need to redefine "eloquence"?

  Discussion

1:00 PM

Panel discussion

1:30 PM

Summary and conclusions