Use of MRI in diagnosis, management, and research of multiple sclerosis

This ECTRIMS Winter School is directed towards young MS clinicians and investigators with an interest in diagnosis and management of multiple sclerosis (MS), as well as MS research including MRI techniques. The immediate objective is to equip participants with the knowledge and expertise needed to (i) accurately diagnose MS, (ii) evaluate the effectiveness of drugs in MS, (iii) understand the value of non-conventional and quantitative MRI for assessing structural, metabolic and functional damage in MS, and (iv) become familiar with the different techniques used for imaging analysis.

The course will provide (i) didactic lectures from an experienced faculty and (ii) interactive (and computer assisted hands-on) workshops that actively involve attendees supported by faculty. It will focus on the following topics:

- Concepts of different MR techniques used in diagnosis and management of MS
- Standardization of brain and spinal cord MRI in the diagnosis and monitoring of MS
- Typical and atypical brain and spinal cord features in MS
- Role of MRI in the diagnostic work-up of MS
- Role of MRI in the differential diagnosis of MS
- Benefits, potential and limitations of MRI as a predictor of treatment response
- Quantitative MRI measures in clinical practice
- Role of MRI imaging in the detection of treatment related adverse effects
- MRI analysis procedures

Speakers include internationally renowned experts, who were selected based on their scientific expertise and educational skills to ensure high quality lectures and interactive case discussions.

The faculty will be asked to select papers that will be sent to the participants prior to the school along with a “reading guide”, in order for them to exercise their ability to identify in the current literature what is important and reliable. Finally, participants will actively participate in working groups and prepare MRI projects for clinical practice and research that will be discussed in a final Plenary Session.

By the end of the course, participants should be able to handle practical issues in the diagnostic process, to appreciate the potential value of conventional and non-conventional MR in predicting and assessing treatment efficacy and in monitoring disease progression, and understand basic concepts in imaging analysis procedures.

Structure of the Course:

- Didactic Lectures (25-30 minutes each incl. 10 minutes discussion)
- Workshops
- Working Groups and related Plenary Session
- Hands-on Workshops

Tuesday, 8 November 2022

08.45 - 09.00	**Welcome and Course Presentation** *M. Tintoré (Barcelona, ES), M.A. Rocca (Milan, IT), J. Sastre-Garriga (Barcelona, ES), Àlex Rovira (Barcelona, ES)*
09.00 - 09.45	**Lecture 1: The pathologic substrate of magnetic resonance imaging alterations in multiple sclerosis** *H. Lassmann (Vienna, AT)*
09.45 - 10.45	**Session 1: MRI Diagnosis 1** Chair: C. Enzinger (Graz, AT)
09.45	Typical brain and spinal cord MR features C. *Enzinger (Graz, AT)*
10.15	Atypical MRI features and MS mimics *A. Rovira (Barcelona, ES)*
10.45 - 11.15	**Coffee Break**
11.15 – 12.15	**Session 2: MRI Diagnosis 2** Chairs: A. Rovira (Barcelona, ES), M. Filippi (Milan, IT)
11.15	Paediatric MS *Y. Hacohen (London, UK)*
11.45	Neuromyelitis optica spectrum disorders *J. Palace (Oxford, UK)*
12.15 - 13.00	**Lecture 2: MRI in diagnosis and monitoring of multiple sclerosis** *M. Filippi (Milan, IT)*
13.00 - 14.15	**Lunch Break**
14.15 - 16.30	**Session 3: MRI in monitoring disease progression and treatment effect** Chairs: J. Palace (Oxford, UK), B. Stankoff (Paris, FR)
14.15	Conventional MRI in monitoring and predicting treatment response *J. Sastre-Garriga (Barcelona, ES)*

14.45	Brain/spinal cord atrophy as a predictor of disease progression *N. De Stefano (Siena, IT)*
15.15	Models to predict treatment response *C. Gasperini (Rome, IT)*
15.45	MRI in monitoring treatment related adverse effects and safety aspects concerning gadolinium *J. Hodel (Creteil, FR)*
16.15	Questions to the experts
16.30 - 17.00	**Coffee Break**
17.00 - 18.30	**Computer Assisted Hands-on Workshop** Basic Quantitative MRI analysis in MS, Part 1 – Lesion segmentation *D. Pareto (Barcelona, ES), M. Battaglini (Siena, IT)*
19.30	**Dinner at the hotel**

Wednesday, 9 November 2022

08.45 - 10.00	**Computer Assisted Hands-on Workshop** Basic Quantitative MRI analysis in MS, Part 2 – Brain atrophy *M. Battaglini (Siena, IT), E. Pagani (Milan, IT)*
10.00 - 11.30	**Workshops 1-3: How and when should brain and spinal cord MRI be performed in the diagnostic and monitoring process?** (3 groups, 30 minutes each) Workshop 1: Assessing brain lesions *M. Wattjes (Hannover, Germany), B. Moraal (Amsterdam, NL)* Workshop 2: Assessing spinal cord lesions *L. Cacciaguerra (Milan, IT), A. Rovira (Barcelona, ES)* Workshop 3: Assessing brain and spinal cord volumes *L. Storelli (Milan, IT), A. Eshaghi (London, UK)*
11.30 - 12.00	**Coffee Break**

12.00 - 13.00	**Session 4: MRI: advanced techniques. Their value in clinical practice and research** Chairs: MA. Rocca (Milan, IT), C. Tur (Barcelona, ES)
12.00	Advanced techniques for assessing focal lesions *P. Preziosa (Milan, IT)*
12.30	Advanced techniques for assessing diffuse damage *C. Granziera (Basel, CH)*
13.00 - 14.00	**Lunch Break**
14.00 - 15.30	**Session 4 : MRI advanced techniques. Their value in clinical practice and research (cont'd)** Chairs: B. Stankoff (Paris, FR), N. de Stefano (Siena, IT)
14.00	Grey matter imaging *M.A. Rocca (Milan, IT)*
14.30	Optic nerve imaging *A. Toosy (London, UK)*
15.00	Spinal cord imaging *C. Lukas (Bochum, DE)*
15.30 - 17.00	**Workshops 4-6: Advanced MRI techniques** (3 groups, 30 minutes each)
	Workshop 4: Microstructural and molecular measures *R. Cortese (Siena, IT), B. Bodini (Paris, FR)*
	Workshop 5: fMRI: task related, resting state *P. Valsasina (Milan, IT), D. Pareto (Barcelona, ES)*
	Workshop 6: Susceptibility-weighted MRI *J. Wuerfel (Basel, CH), N.* Evangelou *(Nottingham, UK)*
17.00 - 17.15	**Coffee Break**

17.15 - 18.15 **Computer Assisted Hands-on Workshop**
Basic Quantitative MRI analysis in MS, Part 3 – Spinal cord atrophy
P. Valsasina (Milan, IT), R. Schlaeger (Basel, CH)

19.30 **Winter School Dinner**

Thursday, 10 November 2022

08.45 - 10.30 **Working Groups - (3 working groups)**

Participants will work in 3 working groups (A, B, C) and prepare 3 MRI projects for clinical practice and / or research. The projects should consider MRI techniques, timing, and measures. Participants will receive feedback from three senior investigators (facilitators).

Working Group A: MS Diagnosis
Facilitators: A. Rovira (Barcelona, ES), C. Enzinger (Graz, AT)

Working Group B: MRI in monitoring and predicting treatment response (relapsing remitting MS)
Facilitators: C. Granziera (Basel, CH), J. Sastre-Garriga (Barcelona, ES), C. Gasperini (Roma, IT)

Working Group C: MRI in monitoring disease progression (progressive MS)
Facilitators: N. De Stefano (Siena, IT), M. A. Rocca (Milan, IT)

10.30 - 11.00 **Coffee Break**

11.00 - 12.00 **Plenary Session**
(3 working groups, 20 minutes each)

Participants' presentations of their acquired knowledge.
Participants will make proposals of MRI projects for clinical practice and research. Each project will be presented by WG coordinators and discussed. The session will be led by 3 facilitators.

12.00 - 12.30 **Panel Discussion**
Mara Rocca (Milan, IT), Jaume Sastre-Garriga (Barcelona, ES) & Àlex Rovira (Barcelona, ES)

12.30 - 13.00 **Wrap-up & Adjournement**
M. Tintoré (Barcelona, ES), M.A. Rocca (Milan, IT), J. Sastre-Garriga (Barcelona, ES), Àlex Rovira (Barcelona, ES)

13.00 - 14.30 **Lunch and individual departure**