The Pregnancy Foundation
2013 Garite Mini-Sabbatical Recipient

"Fetal Neuroimaging"

Steve Rad, MD
Fellow, Maternal-Fetal Medicine
Cedars-Sinai Medical Center

Mentor:
Siegfried Rotmensch, MD
Division of Maternal-Fetal Medicine
Palo Alto Medical Foundation

Recipient Statement and Summary:

Part 1: May 2014, Division of Neuroradiology, Department of Radiology, Medical University of Vienna, AKH Vienna General Hospital, Vienna, Austria.

I spent 3 weeks in the Division of Neuroradiology at AKH Vienna General Hospital with Dr. Gregor Kasprian (Chief) and Professor Daniela Prayer (Division Head). The Department is the leading institution in Europe for referrals requiring fetal MRI with expertise in fetal CNS pathology and also a major source of research, literature and international training in the field. During my rotation, I attended Department teaching conferences daily and interdisciplinary OB-radiology conference, participated in the daily work-flow of fetal MRI, which involved observing 3-4 live scans daily with reading and interpretation in the reading room, and afternoons were devoted to literature review, review of the digital archive of fetal CNS pathologies, self-study time, contribution to research projects, and preparation for presentations. I was also fortunate to have the opportunity to attend an international teaching conference that was held by my mentors on brain diffusion tensor imaging and tractography; this is a novel advanced 3D MR technique that can be used to visualize brain neuronal pathways and networks in utero, and the Vienna group is one of the leading institutions worldwide in the development and research of this technology.

I completed five main objectives during my rotation. First, I studied normal prenatal brain development including embryology, histology, and anatomy. Next, I learned about the proper technique and approach of ultrafast fetal brain MRI. This involved learning about MRI, image acquisition and optimization, sequence planning, and various MR modalities, such as T2-weighted and FLAIR sequences, spectroscopy, functional MRI, tractography, and thick-slab, echoplanar and diffusion-weighted imaging. Next, I learned how to read and interpret images of normal fetal brain MRI by gestational age. Then, I learned about abnormal brain development and CNS anomalies and how to identify and interpret these on fetal MRI. Finally, I learned how to practically apply these skills to ultrasound, prenatal diagnosis and MFM practice.

By the end of my rotation, I developed a guidebook for myself on prenatal brain development and anatomy and the technique, approach, interpretation, and reading of normal and abnormal fetal brain MRI. I also contributed to a research project on teaching image interpretation of cases of corpus callosum abnormalities. Lastly, with the guidance of my mentors, I prepared a presentation on fetal cerebral venous circulation and cerebral vascular malformations. For my presentation, we described the development of the fetal venous circulation by gestational age as can be seen with fetal MRI, which to our knowledge had not been previously described. We then described a case of a fetal cerebral vascular malformation that I had seen during my rotation and showed application of the novel MR techniques of dynamic echoplanar imaging and also tractography. As the culmination of my rotation, I gave this presentation on my last day in Vienna live online to the International Fetal Neurology Network, which is a unique international group that connects the leading experts in prenatal neuroimaging worldwide.

Part 2: September 2014, Division of Maternal-Fetal Medicine, Palo Alto Medical Foundation (PAMF), Mountain View, CA.

I spent the second 3 weeks of my mini-sabbatical in the Division of MFM at PAMF studying with my mentor, Dr. Siegfried Rotmensch, who is the founder and leader of the International Fetal Neurology Network. I focused on learning advanced neurosonography and prenatal diagnosis. My objectives were to study normal fetal brain development and anatomy which can be seen with prenatal ultrasound, learn the technique of the advanced neurosonogram, including Doppler and 3D ultrasound, and then learn about fetal CNS pathologies and their identification using advanced neurosonography, follow-up algorithms and prognostic implications. This included both hands on and theoretical study with Dr. Rotmensch, extensive literature review, review of international guidelines, review of the textbook "Ultrasonography of the Prenatal Brain" by Ilan Timor-Tritsch et al, review of the recordings of the monthly International Fetal Neurology Network videoconferences, review of digitally archived sonographic volumes of brain pathologies from members of the network, and 3D manipulation of ultrasound volumes and pathologic cases.

By the end of my rotation, I was able to understand prenatal brain development and perform, read and interpret normal and abnormal fetal neurosonograms including the use of Doppler and 3D ultrasound. We developed files and presentations on prenatal brain development and anatomy and each of the various CNS anomalies, which included relevant primary literature as well as algorithms for follow up and prognostication. Lastly, I developed a lecture presentation on prenatal brain development, anatomy and the technique of advanced neurosonography including interesting cases.

In sum, the mini-sabbatical provided me with the unique opportunity to gain a deep understanding of prenatal brain development, anatomy and pathology, advanced 2D and 3D neurosonography, fetal MRI, interdisciplinary diagnostic evaluation of fetal CNS pathologies and their prognosis. I was fortunate to study one-on-one with leading experts in the field at both institutions. The quality of mentorship at both institutions and overall by Dr. Rotmensch was superb. Upon completion of the mini-sabbatical, I was able to share what I learned and give various presentations on advanced neurosonography at my home institution, Cedars-Sinai Medical Center, including on prenatal brain development and anatomy, technique of advanced neurosonography, cortical development anomalies, posterior fossa malformations, intracranial masses, and spine anomalies. We were subsequently able to implement advanced and 3D neurosonography in cases of suspected CNS pathology in our Prenatal Diagnosis Center. As such, the mini-sabbatical not only enhanced my fellowship education but also provided me with the basis for a future academic career with a focus on prenatal neurosonography and diagnosis. As I move on after fellowship, my plan is to continue to develop and contribute my expertise in fetal neuroimaging.

I am grateful and indebted to The Pregnancy Foundation for this once in a lifetime opportunity that has changed my practice and career as an MFM.