



# Center For Advanced Fetal Care Newsletter

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## INSIDE THIS ISSUE

The Brains Behind It All	1
Brainstem Angles	1
Guidelines to the Fetal CNS	2
Virtual Flipped Classroom	3
ISUOG Outreach Workshop	3
Update SANA Medical NGO	3
ISUOG Trainee Program	3
SMFM Pre-Congress Courses	3
Closed Spina Bifida	3
A Myelomeningocele Case	4
Upcoming Courses	4

## The Brains Behind It All...

Undoubtedly, the most challenging organ to comprehend, let alone image, is the human brain... It is under perpetual evolution and development, controls every aspect of our being, biologic or psychologic, drives us in our quest at maintaining our supremacy over all other living creatures, and propels us in never settling at being 'second best'. And it is that master mind that is behind the brilliance of Jobs whose vision revolutionized our digital world as we have come to know it, having minimized, organized and compartmentalized its integral aspects into the "apps of our lives", and behind Kurzweil's "Singularity" theory which has at its essence creating superhuman intelligence enabling future virtual eternal existence through scanning individual consciousnesses into computers ([www.time.com/time/magazine/article/0,9171,2048299,00.html](http://www.time.com/time/magazine/article/0,9171,2048299,00.html)). And with his "Singularity" theory, Kurzweil predicts human immortality by the year 2045... We thus dedicate this issue to "the brains behind it all" and to all the "brains" whose work is referred to in this newsletter for having served as the true inspiration behind this issue... We bring you guidelines to imaging the fetal brain in the first and second trimesters of pregnancy. We introduce the brainstem tentorium and brainstem vermis angles, new modalities to be used in evaluating posterior fossa abnormalities. We address the importance of ascertaining the absence of a tethered cord in ruling out closed spina bifida, we recommend to you a virtual "flipped classroom" for your sonographic educational needs, in addition to our usual features. We hope that this may aid us as we workup the brains of our future generation, and that this may assist us in further unraveling the mysteries of the human brain, that which constantly motivates us to never settle at being 'second best', constantly seeking to broaden limitless horizons in our infinite pursuit of mental immortality...



Credit: Jonathan Mak Long



[www.rickysmedicalblog.files.wordpress.com/2010/08/brain-1.jpg](http://www.rickysmedicalblog.files.wordpress.com/2010/08/brain-1.jpg)

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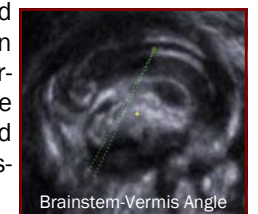
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## Brainstem Tentorium and Brainstem Vermis Angles

Posterior fossa abnormalities remain a challenging diagnosis where many a time, fetal MRI is utilized to assist in ascertaining the diagnosis in order to provide better counseling and guide the parents in their management options. This becomes important in differentiating a Blake's pouch cyst from a megacisterna magna, two entities that may seem quite similar sonographically, yet with very different prognosis, the Blake's pouch cyst having the more favorable outcome. Professor Pilu's team had 2 presentations at the 21st World Congress of ISUOG led by E. Contro on this matter, OP 03.01 and OC 16.02, Ultrasound Obstet Gynecol 2011; 38 (S1). The team carried out a prospective observational study in order to standardize the evaluation of the insertion of the tentorium as well as the rotation of the cerebellar vermis over the brainstem. From eighty 3D volume datasets starting with the trans-cerebellar views, they generated a sagittal view in which they measured the angle between the brainstem and the insertion of the tentorium, brainstem-tentorium (BT) angle, and between the brainstem and the lower edge of the vermis, brainstem-vermis (BV) angle. The average values were  $30.05 \pm 5.00$  degrees for the BT angle and  $10.12 \pm 3.46$  degrees for the BS angle. Subsequently, the team carried out a retrospective study on 80 control cases and 31 abnormal cases: 12 with Blake's pouch cyst (BPC), 12 with Dandy Walker malformation (DWM) and 7 with cerebellar vermis hypoplasia (CVI) in which the BT and BV angles were measured. In the abnormal cases, the angles were significantly increased. The BV angle was significantly increased in the DWM versus the BPC and in the CVI versus the BPC. In addition the BT angle was increased in the DWM but not in the CVI versus the BPC. The BV angle was  $\geq 45$  degrees in all DWM and  $\leq 30$  degrees in all BPC. As a consequence, the authors conclude that the BV angle can be used to differentiate sonographically similarly appearing posterior abnormalities that carry very different prognosis.



Brainstem-Tentorium Angle



Brainstem-Vermis Angle

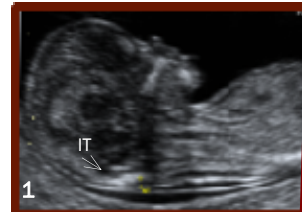
# Practical Guidelines to Examining the Fetal Central Nervous System in the First and Second Trimesters

## Introduction

The fetal central nervous system is one of the most important, yet most challenging systems to image. It is susceptible so some of the most common congenital malformations, namely neural tube defects (NTD) that affect approximately 1-2/1000 live births. It is undergoing constant development with a varied appearance depending on the fetal gestational age. Care must be taken not to mistake normal development for a congenital malformation. Prenatal detection rates are difficult to ascertain as many CNS abnormalities may escape detection and may not get detected until early adulthood, as in the case of a tethered spinal cord, presented on page 3. For this reason, a systemic basic approach to the fetal CNS is instrumental to maximize our prenatal detection rates, keeping in mind the major impact of maternal BMI as well as the resolution of the ultrasound machine being used. As such, the role of fetal MRI in the evaluation of the fetal CNS has been becoming greater and greater in recent years.

## ISUOG Recommendations

The most thorough guidelines on imaging the fetal CNS are those of ISUOG (Ultrasound Obstet Gynecol 2007; 29: 109-116), and they may be accessed free of charge at [www.isuog.org](http://www.isuog.org). With CNS abnormalities, the more severe the abnormality, the earlier the detection is, as in the case of acrania and holoprosencephaly, which may be detected in the first trimester (FT). Speulveda's butterfly sign (2010) is a FT marker reassuring against holoprosencephaly. As such in the FT, one can check the intactness of the cranium, the butterfly sign, the sagittal view of the spine with the overlying intact skin and look for Chaoui's intracerebral translucency (IT, 2009) which may reassure against open spina bifida. Early in the second (ST), with less bone ossification, imaging the brain may be clearer keeping in mind the appearance of the posterior fossa at this point as the cerebellum may not have undergone complete development. In the second trimester one must check the transventricular, transthalamic as well as the transcerebellar planes in order to ascertain the intactness of the skull, presence of the falx, cavum septum pellucidum, thalami, cerebellum, cistern magna and nuchal fold.



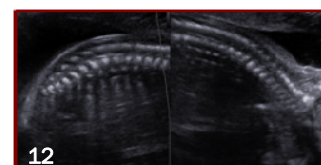
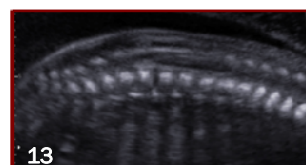
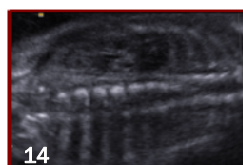
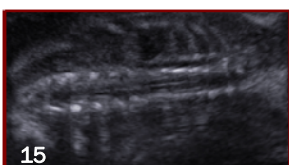
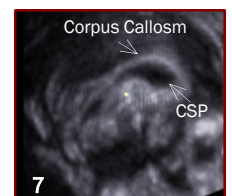
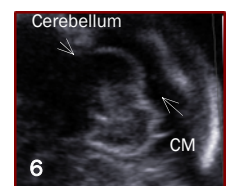
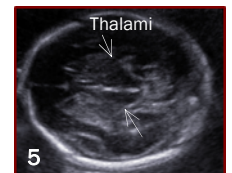
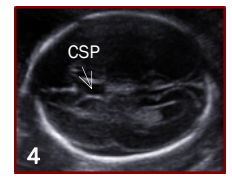
The appearance of the ventricular system should be evaluated as well. In the respective anatomic planes, the fetal biparietal diameter (BPD), occipitofrontal diameter (OFD), head circumference (HC), posterior horn of the lateral ventricle (Vp), cisterna magna (CM) and nuchal fold (NF) may be measured. Subsequently a sagittal view depicting the corpus callosum can be obtained. The fetal spine must then be imaged sagittally, axially and coronally ascertaining the intactness of the spine, the absence of second trimester markers for spina bifida, namely the banana sign (formed by an obliterated cisterna magna and a banana shaped cerebellum) and the lemon sign (formed by frontal scalloping and a lemon shaped head). In addition, the conus medullaris can be checked for 'tethering'.

## Anatomical Components Examined in the CNS

- FT mid-sagittal view for IT (1)
- FT sagittal view of the fetal spine (2)
- FT butterfly sign (3)
- ST axial transventricular plane (4)
- ST axial transthalamic plane (5)
- ST transcerebellar plane (6)
- ST sagittal plane, corpus callosum and CSP (7)
- ST measurement of Vp, BPD, OFD (8)
- ST measurement of cerebellum, CM, NF (9)
- ST coronal view of spine and ribs (10)
- ST sagittal view of spine, conus distance (11)
- ST sagittal view of spine (12)
- ST sagittal view of spine, conus medullaris (13)
- ST coronal view with vertebral bodies (14)
- ST coronal view with vertebral processes (15)

## Practical Tips

Aim beyond a BPD and HC. Start familiarizing yourself with the first trimester key elements. Practice evaluating the posterior fossa and the ventricular system in the second trimester. Remember that an absent cavum septum pellucidum may signify agenesis of the corpus callosum. In case of a dilated lateral ventricle and an obliterated cistern magna (banana sign) and a lemon sign, rule out an NTD. Check for the conus medullaris. In summary, always have a high index of suspicion and approach the CNS in a most systematic manner. Do not get overwhelmed by all the potential pathology. Simply recognizing a deviation from normal and referring for further assessment would have a tremendous impact.



## CFAFC's 'Virtual' Recommendation: The International Society of Ultrasound in Obstetrics and Gynecology's OnDemand Web Portal



In 2010, ISUOG introduced 'OnDemand' a webportal that gives access to all electronic posters, oral posters, oral communications and lectures presented at ISUOG's annual congresses ([isuog.conference2web.com/content/all#](http://isuog.conference2web.com/content/all#)). Currently there are 2080 items and over 3200 registrants. This invaluable portal allows one to attend lectures missed during the packed World Congress due to schedule conflicts (the online format includes the audio as well as the power point live presentations) and it allows those that were physically never there, to sit in the comfort of their homes and offices, and 'virtually' attend (and re-attend as many times as needed) all the presentations on cutting edge research in this ever evolving field. OnDemand is available free of charge to ISUOG members. There are 3 membership options starting with core membership at a cost of 50 Euros/ year. The major limitation to utilizing this portal is the speed of the internet in various part of our world. And as an accompaniment to this issue, CFAFC highly recommends the Pre-Congress Course on the Fetal CNS presented in Los Angeles Sunday September 18, as well as all the CNS-related abstracts. In addition, CFAFC would like to pay a special tribute to Professor Pilu for his unbelievable clarity in presenting some of the most challenging topics in the fetal CNS and urge each and everyone interested in comprehending, learning and improving their evaluation of the fetal CNS to watch his lectures and learn from his systemic most through clear approach. ISUOG has been a pioneer in this 'flipped classroom' type service, which is slowly revolutionizing standard classroom-based learning as we have come to know it ([www.usatoday.com/news/education/story/2011-10-06/flipped-classrooms-virtual-teaching/50681482/1](http://www.usatoday.com/news/education/story/2011-10-06/flipped-classrooms-virtual-teaching/50681482/1)). And with the super fast track that the 'virtual' is replacing the 'physical', it shall come as no surprise when the world congresses of today, as we have come to know them, become an extinct, compartmentalized, memory of the past...

### THIS AND THAT

#### ISUOG Outreach Workshop

A most successful workshop was carried out at ISUOG's 21st World Congress entitled "Training the Trainers" led by Professor Abuhamad with presentations by various members of the dedicated Outreach team. The workshop highlighted the Outreach Program's 3 year experience and presented their future plans for standardizing the approach used in the training (a manual is being put together to be made available online) as well as the methods used in evaluating the trainees. The Outreach team is seeking volunteers for their future missions. For more information visit [www.isuog.org/EducationAndTraining/Outreach+Program/](http://www.isuog.org/EducationAndTraining/Outreach+Program/)

#### Update on SANA Medical NGO

It has been a busy few months for SANA since the last CFAFC newsletter posted. SANA Medical NGO participated in ISUOG's Outreach Workshop. This further intensified our determination and commitment in making our services available to the underserved areas of Lebanon. Several outreach trips have been carried out and contact has been made with various local NGO's and local organizations for future planning and execution of outreach missions. To follow SANA, visit [www.sanango.org](http://www.sanango.org)

#### ISUOG Trainee Program

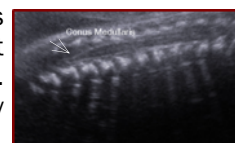
Education is one of ISUOG's primary objectives. As such, the ISUOG Trainee Program has been launched and has recruited key adoptive world-wide societies and organizations. The program provides all trainees (residents) free 2 year membership to ISUOG with access to all web and "OnDemand" content in addition to several other benefits. There must be an adoptive society in each country with which the residents can register and provide proof of their status. That adoptive body then gets ISUOG approval and gets listed on ISUOG's website to make this most valued educational opportunity available to its trainees. Trainees, the future of our specialty, anywhere in the world, may contact their societies in order to make this available to them. The Trainee Program has already been successfully established in Denmark, Hong Kong, Italy, Malaysia, Norway, Singapore and Switzerland. We aspire to have it available to our trainees in Lebanon as well as in various parts of the Middle East. For further information, you may visit [www.isuog.org/Membership/Trainees/default.htm](http://www.isuog.org/Membership/Trainees/default.htm)

#### SMFM's Pre-Congress Sessions

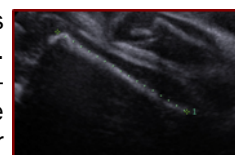
The annual meeting of the Society of Maternal Fetal Medicine is scheduled for February 6-11, 2012 in Dallas, Texas. Several interesting pre-congress courses are planned on fetal echocardiography, critical care, genetics in clinical practice, ultrasound controversies as well as an NICHD/SMFM Workshop on preventing first cesarean delivery, in addition to several others. For details visit: [www.smfm.org/Annual%20Meeting%20Page.cfm?ht=me](http://www.smfm.org/Annual%20Meeting%20Page.cfm?ht=me)

#### Visualization of the Conus Medullaris in the Prenatal Detection of Tethered Spinal Cord

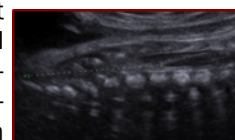
Tethered spinal cord (also referred to as closed spina bifida) is a challenging, yet important prenatal diagnosis to make. Here, unlike open spina bifida, the bony defect of the posterior vertebral arches, herniated meninges and the neural tissue are all covered with skin. This oftentimes goes undetected into early adulthood. Due to stretching of the usually free spinal cord, progressive neuronal damage may ensue leading to sensory and motor dysfunction and progressive loss of control of other bodily function. At the 21st World Congress of ISUOG, Kagan et al were awarded "best abstract presentation" for their abstract OP 03.05, Ultrasound Obstet Gynecol 2011; 38 (S1), on the conus distance. In their retrospective study of 300 fetuses, 16 weeks to term, Kagan et al describe a sonographic technique to ascertain the absence of a tethered cord. They measured the distance between the conus medullaris and the last vertebral body in a midsagittal plane: the conus distance CD. In this study, the normal relationship for the conus distance is established as follows:  $CD \text{ in mm} = FL \text{ in mm} - 8$ . In 5 cases of prenatally detected skin covered spinal dysraphism, the CD was < 5th centile. The authors conclude that measuring the CD is feasible and a promising parameter for the prenatal diagnosis of a tethered spinal cord.



Conus Medullaris



FL 58.8 mm



Conus Distance 50.7 mm



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CFAFC would like to thank Dr. Hanady Maaliky for her contribution to this issue. In addition, a special thank you to all the “brains” whose work is referred to in this newsletter for having served as the true inspiration behind this issue...



For any interesting case reports, comments, suggestions or announcements to be included in our newsletter, please send an e-mail to [rar@cfafc.org](mailto:rar@cfafc.org). Since the beginning of 2011, CFAFC's website has had over 1576 visitors from 81 countries, with the newsletter being the primary target. A special thank you to all of our supporters...

## Myelomeningocele: Presentation and Localization Reem S. Abu-Rustum MD, Hanady Maaliky MD

A 27 yo G3 P1011 had had prenatal care up until 16 weeks. She was then lost to follow up for 10 weeks. At 26 weeks she represented and the fetus was found to have microcephaly. She was then referred for more detailed evaluation. At 26w2d the female fetus was in breech presentation, weighing 878 grams (43.3 %). Several concerning findings were present. There was microcephaly, a cerebellar banana sign (Figure 1), ventriculomegaly with a lateral ventricle of 14 mm (Figure 2). In addition a myelomeningocele in the lumbosacral area was present measuring 47 mm (Figure 3). There was minimal motion of the lower extremities and bilateral club feet were noted (Figure 4). On 3D evaluation, the lesion was found to extend over 5 vertebrates and was localized to approximately L3-S2 (Figures 5,6). All options were discussed with the family and they consulted with a neurosurgeon at a tertiary care center where they delivered at term. Findings were confirmed at birth and the baby girl underwent surgical correction and is still undergoing physiotherapy.

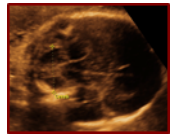


Figure 1



Figure 2



Figure 3



Figure 4



Figure 5

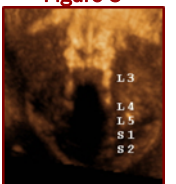


Figure 6

## Upcoming Congresses

COURSE TITLE	DATES	LOCATION	WEBSITE ADDRESS
National Conference on Ob/Gyn Ultrasound	November 4-6, 2011	Chicago, Illinois	<a href="https://iame.com/conferences/ob14/">https://iame.com/conferences/ob14/</a>
Advanced Course in Fetal Cardiology	November 10-11, 2011	London, UK	<a href="http://www.sites.google.com/site/evelinacardiologycourses/fetal-cardiology">www.sites.google.com/site/evelinacardiologycourses/fetal-cardiology</a>
Annual Meeting of the Lebanese Society of Obstetrics & Gynecology	November 17-19, 2011	Beirut, Lebanon	<a href="http://www.lsog.org.lb">www.lsog.org.lb</a>
14th Mid-Atlantic Ultrasound Symposium	November 18-19, 2011	Virginia Beach, Virginia	<a href="http://www.evms.edu/continuing-medical-education/continuing-medical-education.html">www.evms.edu/continuing-medical-education/continuing-medical-education.html</a>
Fetal Medicine Foundation's Advanced Ultrasound Course	November 19-20, 2011	London, UK	<a href="http://www.fetalmedicine.com/fmf/">www.fetalmedicine.com/fmf/</a>
20th Annual Ob/Gyn Update for Clinical Practice	December 8-11, 2011	Ft Lauderdale, Florida	<a href="http://www.cmebyplaza.com/Registrants/GoHo1a/About.aspx">www.cmebyplaza.com/Registrants/GoHo1a/About.aspx</a>
31st Annual Meeting of the Society of Maternal Fetal Medicine	February 6-11, 2011	Dallas, Texas	<a href="http://www.smfm.org/Annual%20Meeting%20Page.cfm?ht=me">www.smfm.org/Annual%20Meeting%20Page.cfm?ht=me</a>
Fetal Anomalies & Echocardiography: Advanced Sonographic Techniques	February 17-18, 2011	Paris, France	<a href="http://www.isuog.org/FutureMeetingsAndCourses/ISUOG+Organize+courses/2012+Anomalies.htm">www.isuog.org/FutureMeetingsAndCourses/ISUOG+Organize+courses/2012+Anomalies.htm</a>