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Children's National™
Fetal Medicine Institute
Part of the Children's National Health System

Fetal Connections

Dear Colleagues,

We hope the beginning of 2018 has been good to you, and that you have been able to stay warm!

In this next edition of Fetal Connections, we are highlighting our Fetal Orthopaedic Program. This program highlights our mission of providing prenatal pediatrics and continuity of specialty care to your patients. If you have any questions about this specialty program, please reach out us via email at: fetalmedicine@childrensnational.org.

Our case study for this issue focuses on a congenital clubfoot case, including diagnosis, delivery, and post-natal care.

We would also like to remind you of our monthly CME Topics in Fetal Medicine series, and remind you of our new 12:30pm time slots, incorporated following your feedback about later time options for this series. As always, we would love to hear any feedback or recommendations for future topics!

Best wishes,

Adré J. du Plessis, MBChB, MPH
Director, Fetal Medicine Institute
Director, Fetal Brain Program
Division Chief, Fetal and Transitional Medicine

Our Fetal Orthopaedic Program

Our orthopaedic-fetal consult team is made up of a group of clinical orthopaedists who treat a wide range of orthopedic conditions. We arrange consults based on fetal sonogram findings to match up with the clinical interests and skills of the clinician, as this allows the most robust consult session, allowing families to ask a wide range of questions about conditions diagnosed, treatment options, and post-natal patient function.

Key Points about our Fetal Orthopaedic Program:

- Our fetal imaging team has broad experience in fetal musculoskeletal diagnoses based on advanced fetal ultrasound and MRI techniques
- We consult and review in detail imaging studies with our fetal imaging team before counseling the pregnant family
- We work closely with care coordinators that help to coordinate the management plan during the pregnancy and after the baby is born
- By becoming involved with families prior to delivery we are able to engage them, answer their questions and support them during this stressful time, and reassure them that the best possible plan will be developed for their baby after birth. In so doing families are better able to approach the delivery with the confidence that a plan is in place for their baby

Case Study: Congenital Clubfoot

A 31 year old G1, P0 mother was referred to the Fetal Medicine Institute for evaluation of a recently diagnosed fetus with bilateral clubfoot (talipes equinovarus) seen on routine fetal anatomy ultrasound (US) at 22 weeks gestation. Both the mother and father reported a negative family history for clubfoot or other musculoskeletal anomalies.

Follow-up fetal US confirmed the diagnosis of isolated, bilateral clubfoot as evaluation of the spine, brain, and long bone growth and development appeared normal for gestational age, and evaluation of the fetal movement was normal. The plan for vaginal delivery was confirmed with the parents and referring obstetrician, and no changes in the plan were recommended based on the fetal imaging findings.

The delivery proceeded uneventfully and upon routine neonatal exam the infant was noted to have bilateral clubfeet.

Idiopathic clubfoot is known to affect approximately 1-4 out of every 1000 live births. Approximately 50% of cases are bilateral with more males affected then females. While this gender difference is recognized, there is no current consensus whether gender plays a role in severity of cases.[1]

The etiology of idiopathic clubfoot is likely multifactorial with some genetic and environmental aspects affecting its development. Recent work has demonstrated some effect of single nucleotide polymorphisms in the promoter regions of HOXA9, TPM1, and TPM2 that alter in utero muscle development and function and may lead to clubfoot.[2] Some environmental issues may also have an effect on clubfoot development with maternal smoking and oligohydramnios being associated with this condition in the fetus.[1]

Fetal diagnosis of clubfoot can be categorized as isolated or complex. Isolated clubfoot is a diagnosis of exclusion when no other abnormalities of the fetus are seen on US. Complex clubfoot is the term used when another abnormality of the fetus is found during screening US. Underlying chromosomal abnormality has been reported in 3-30% of those fetuses with clubfoot screened at tertiary medical centers, but all of these involved cases of complex clubfoot. Due to the low incidence of chromosomal abnormality in cases of isolated clubfoot, further fetal genetic evaluation is not routinely recommended.[3]

One week after birth the child was evaluated in the Orthopaedic Surgery and Sports Medicine Clinic at Children's National Health System, and the diagnosis of severe idiopathic clubfoot was confirmed. (Fig 1)

(Continued on page 3)

Meet the Team: Fetal Orthopaedic Program

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Orthopaedic Surgeon

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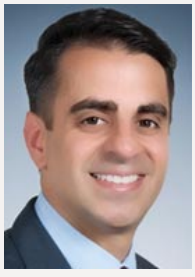

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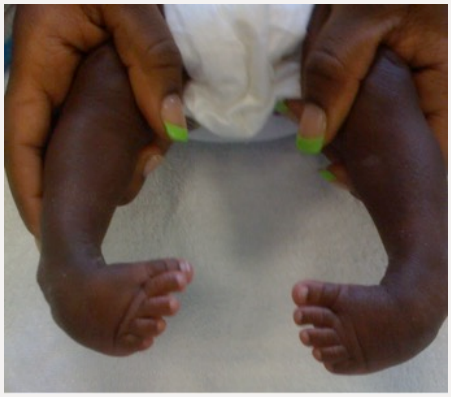
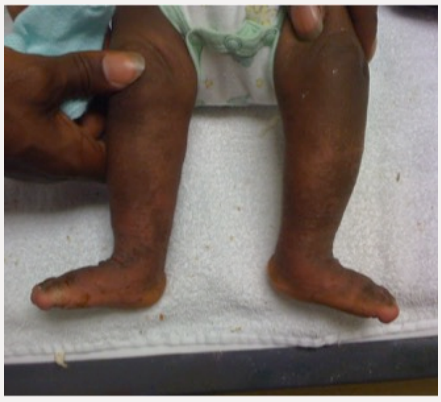


(Fig. 1)

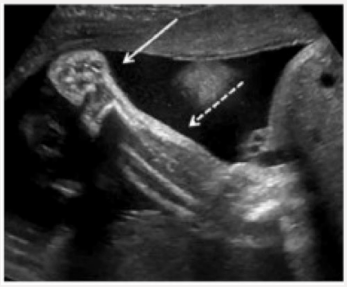


(Fig. 2)

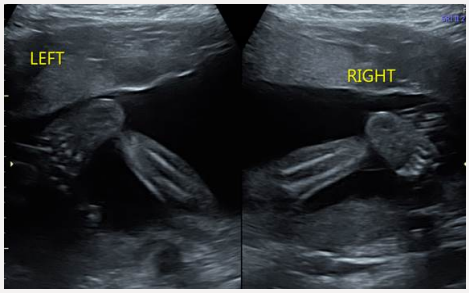
Treatment was begun at that initial clinical visit using the Ponseti Method. This is a non-invasive technique, currently accepted as the standard of care, in which the feet are gently stretched and manipulated weekly. The patient underwent a six-week course of treatment in which the feet were stretched, corrected, and held with a long-leg cast each week. Over the course of six weeks this child's foot was corrected to a more normal position. (Fig. 2) With the foot deformity corrected, a percutaneous heel cord tenotomy was performed in the office, to correct the shortened heel cord and a final cast was placed for three weeks to allow the tendons to heal. After this final correction special braces were fitted to maintain the corrected foot position. These braces were worn for 23 hours each day for four months, then switched to nighttime only wear until the child was four years old. At the completion of the brace wear, the patient had an excellent clinical outcome with fully corrected feet, which were flexible and in a plantigrade position without residual abnormal motor findings.

[1] O'Shea RM, Sabatini CS. What is new in idiopathic clubfoot? Curr Rev Musculoskelet Med. 2016 Dec;9(4):470-477.
[2] Basit S, Khoshhal KI. Genetics of clubfoot; recent progress and future perspectives. Eur J Med Genet. 2017 Sep 14. [Epub ahead of print]
[3] Oetgen ME, Kelly SM, Sellier LS, Du Plessis A. Prenatal diagnosis of musculoskeletal conditions. J Am Acad Orthop Surg. 2015 Apr;23(4):213-21.

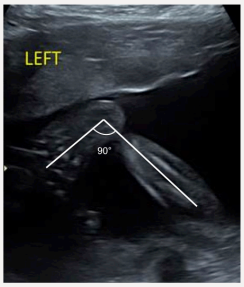
Key Clinical Findings



(Fig. 3) Fetal US of a normally aligned lower limb. As the long axis of the foot and tibia are in different planes they can not been seen in the same image. The tibia (dotted arrow) is seen along its axis and the foot (solid arrow) is seen down its axis.



(Fig. 4) Fetal US of the patient with clubfeet. As can been seen both the tibia and foot are seen along their long axis in the same image indicating presence clubfoot deformity on both feet.



(Fig. 5) Assessment of the prenatal severity of the clubfoot deformity. The angle of the long axis of the tibia and foot is measured to be 90%, consistent with a severe deformity.

- Fetal US showed bilateral clubfoot. (*Fig. 3*) In normal alignment, the long axis of the foot and the tibia are in different planes. (*Fig. 1*) In the presence of clubfoot deformity, the rotation of the foot puts the long axis of the foot and tibia in the same plane allowing simultaneous viewing of both of these structures. (*Fig. 4*)
- A prenatal classification of clubfoot deformity has been developed based on the angle subtended by the long axis of the foot and the tibia. (*Fig. 5*) If the angle is <80° the deformity is considered mild with an angle >80° considered indicative of a severe deformity. A 7% rate of false positive diagnosis was found with this definition of deformity, but no correlation between prenatal severity and post-natal severity has been shown.

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Upcoming Topics in Fetal Medicine CME Webinar Series:

This innovative series, featuring fetal medicine subject experts, occurs every third Tuesday of the month.
To sign up for updates or view past sessions, visit ChildrensNational.org/Topics-FetalMed.

Prenatal Diagnosis of Skeletal Dysplasia
March 20, 7:30am

Indicators for Counseling concerning Fetal Abnormalities, Fetal Loss, Miscarriage and Stillbirth
April 17, 12:30pm

Pre-natal Diagnosis of Micrognathia: How it Affects Post-natal Management
May 15, 7:30am

Send recommendations and feedback to swohlers2@childrensnational.org

Fetal Connections

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Submit your 2018 abstract submission!

Abstracts should be focused on the fetus or the preterm baby, particularly on brain development and/or the nervous system. Abstract topics may include, but are not limited to, neuroimaging, non-invasive monitoring, dysmorphology, genetics and/or counseling, congenital infections, fetal interventions, placenta, fetal/neonatal outcome, ethics, and fetal program development/quality improvement.

Visit **fetalbrainsymposium.com** to submit your abstract by June 8th!