

Case Report

Real-Time Three Dimensional Sonographic Features of an Early Third Trimester Fetus with Achondrogenesis

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Generalized shortening of fetal long bones detected from prenatal sonographic examination usually raise a tentative diagnosis of skeletal dysplasia. Information obtained from grey-scale scan is frequently not sufficient to provide a definite diagnosis, and the images are not readily comprehensible for the parents-to-be. Lately, three-dimensional sonography has become increasingly available in obstetric practice. The authors report here a rare case of fetal achondrogenesis, which is a lethal form of skeletal dysplasia, in a 30-week-old fetus using real-time three-dimensional ultrasound. The prenatal findings of fetal achondrogenesis from this technique were thoroughly described, along with postnatal radiography and autopsy results. Sonographic features from this imaging technique allow for an accurate diagnosis and better understanding of the parents. This facilitates the genetic counseling process, as well as the parental options for further care.

Keywords: Three-dimensional sonography, Achondrogenesis, Prenatal diagnosis

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Case Report

A 21 year-old pregnant Thai lady, gravida 2, para 1, in a non-consanguineous marriage underwent an ultrasound examination at 29 weeks' gestation due to a large-for-date uterine size. All long bones of the fetus were found to be abnormally short, almost immeasurable (Fig. 1). Her first baby was apparently normal. The patient was sent to our Maternal-Fetal Medicine unit at the menstrual age of 30 weeks', where the aforementioned findings were confirmed, along with polyhydramnios and lack of fetal limb motions. The authors initially used Toshiba Aplio (Tokyo, Japan) for the two-dimensional (2D) scan. The fetus appeared to be male. Bilateral hydrocoele was also visualized. The fetal chest was small, but no rib fractures were seen. The skull ossification was unremarkable.

Three-dimensional (3D) sonography was performed to attain more details. The authors used Aloka

Prosound SSD-5500 (Tokyo, Japan) for the 3D scan, and the results concurred with the previously described 2D report. Additional findings include fetal clubfeet and clubhands were found on the real-time (4-dimensional/4D) imaging. Markedly shortened arms (rhizomelia), forearms (mesomelia), and fingers (brachy-



Fig. 1 Grey-scale imaging showing disproportionately short fetal long bones

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dactyly) were readily appreciated, as shown in Fig. 2. Shortened and deformed legs were also observed in Fig. 3. Lack of movements of fetal limbs was also noticed. Bilateral hydrocoeles are clearly shown in Fig. 4.

Amniocentesis was performed for DNA study. The DNA test to detect 80% of common mutations for thanatophoric dwarfism came back negative. The preliminary diagnosis was fetal achondrogenesis, a universally lethal skeletal dysplasia. After thorough counseling, the couple opted for continuing pregnancy. Neonatal resuscitation was discouraged at birth. The patient has been regularly followed in our unit without any signs of respiratory distress from her polyhydramnios.

The patient went into spontaneous labor at the menstrual age of 36 weeks, and delivered a 1,420-gram male fetus, with an Apgar score of 4 at 1 minute. No neonatal resuscitation was attempted. Postmortem photograph of this baby is shown in Fig. 5. Disproportion of the body compartments was noticed. The baby had a body length of 30 centimeters, with the head circumference of 31 centimeters. The placenta appeared normal and weighed 500 grams. Postmortem radiograph showed nearly total absence of ossification except for clavicles and ilia (Fig. 6). Skull calcification appeared normal. Fetal autopsy results were consistent with fetal achondrogenesis.

Discussion

The difficulties in prenatal diagnosis of lethal skeletal dysplasias result from the large number of disorders, their phenotypic variability with overlapping features, and the lack of molecular diagnosis for many disorders. It is not unusual that skeletal dysplasias are first suspected during routine sonographic examination after a shortened long bone or other abnormal skeletal findings is observed. Achondrogenesis is one of the rarest autosomal recessive lethal skeletal dysplasias, with an incidence of 1 in 40,000 to 1 in 50,000 live births⁽¹⁾. No reports of this disease were found from retrospective review of the prenatal diagnosis data at the Faculty of Medicine Siriraj Hospital for the last 10 years. This might be attributed to the complexity of this disease, as well as the unavailability of molecular genetic diagnosis in the past. Without mutation analysis, this disorder could easily be mistaken for the more common lethal skeletal dysplasia, thanatophoric dwarfism.

In addition to improvements in 2D ultrasound, new and rapidly available advances have been made in 3D imaging. Several authors have advocated the value



Fig. 2 Real-time three-dimensional imaging showing markedly shortened fetal arm and forearm holding with the elbow and wrist in fixed flexing position. Short digits are also noted



Fig. 3 Real-time three-dimensional imaging showing markedly shortened fetal legs and feet in fixed flexing position

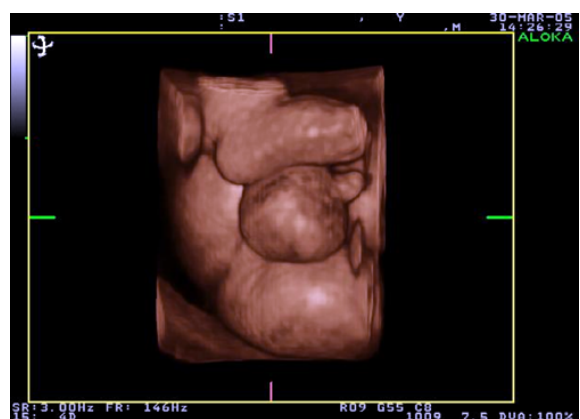


Fig. 4 Bilateral hydrocoeles



Fig. 5 Postmortem photograph showing a markedly short limbs and disproportionately large head. Note: the resemblance in appearance from this picture and the 3D images



Fig. 6 Postmortem radiograph shows nearly total absence of calcifications

of 3D imaging in assessing the fetal skeleton, cranium, and facies in both normal and abnormal gestations^(2,3). Using 3D imaging technology, the authors are not only able to improve our diagnostic accuracy, but, by using surface-rendering mode, the parents can easily understand the condition of their baby. Due to the late detection of the presented case, the benefit of 3D imaging was mainly for the intrapartum and postnatal management. More acceptances of the parents were gained for the plan of non-resuscitation at birth. Findings from

3D scan are in agreement with postmortem examination in the presented case, and this could facilitate the prenatal counseling process regarding the appropriate management of the fetus. The pathology and radiographic appearances of achondrogenesis have been described elsewhere⁽⁴⁾.

Future recurrence also needs to be discussed. Given that this couple was not consanguineous, the authors believe that this fetus was affected by *de novo* dominant mutation of the collagen synthesis gene. If the mutations are identified, then prenatal diagnosis by chorionic villous sampling could be an option in subsequent pregnancies for earlier diagnosis. However, because *de novo* mutation yields a low risk of recurrence, the costly genomic DNA analysis from the fetal tissue was not performed in the presented case. Alternatively, discussions have been made that ultrasound examination could be done as early as in the first trimester of pregnancy, when many suggestive signs for achondrogenesis, e.g. lack of limb buds movement, nuchal edema, grossly shortened upper and lower extremities that are held in an abnormal and fixed position, have been reported⁽⁵⁾. Abnormal bone formation could also be noted this early using transvaginal ultrasound⁽⁶⁾. If the abnormalities are detected, then the pregnancy could be determined earlier to reduce the morbidity to the mother.

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ลักษณะการตรวจพบทางคลื่นเสียงความถี่สูงสามมิติของทารกในครรภ์ที่เป็นโรคกระดูกอะคอนไดรเจเนซิส

ดวงสิทธิ์ วัฒนาราร, อนุวัฒน์ สุตันทวีบูลย์, ชนินทร์ ลิ้มวงศ์

การวินิจฉัยโรคในกลุ่มกระดูกเจริญผิดปกติแต่กำเนิด ของทารกในครรภ์นั้นมักจะได้จากการตรวจพบกระดูกแขนขาสั้นจากการตรวจด้วยคลื่นเสียงความถี่สูง บ่อยครั้งที่ข้อมูลที่ได้จากการตรวจด้วยคลื่นเสียงความถี่สูงตามมาตรฐานที่ปฏิบัติกันนั้นไม่เพียงพอที่จะให้การวินิจฉัยจำเพาะถึงชนิดของภาวะกระดูกเจริญผิดปกติแต่กำเนิดได้ นอกจากนี้ ภาพที่ได้จากการตรวจยังเข้าใจได้ยากสำหรับคู่สมรสที่กำลังตั้งครรภ์ทารกที่มีความผิดปกติดังกล่าว เหตุผลเหล่านี้ทำให้การวินิจฉัยการให้คำปรึกษาแนะนำทางพันธุศาสตร์ และทางเลือกของการตั้งครรภ์นั้นทำได้ไม่ง่ายนัก ในรายงานฉบับนี้ คณะผู้ประพันธ์นำเสนอถึงการใช้เทคนิคคลื่นเสียงความถี่สูงสามมิติเพื่อช่วยในการวินิจฉัยโรค achondrogenesis ของทารกในครรภ์ที่อายุครรภ์ 30 สัปดาห์ ลักษณะการตรวจพบด้วยวิธีดังกล่าวได้ถูกบรรยายอย่างละเอียด เปรียบเทียบกับการตรวจภาพรังสีและการผ่าพิสูจน์ทารกหลังคลอด เนื่องจากโรคนี้เป็นโรคที่พบได้ไม่บ่อย และทารกในครรภ์จะเสียชีวิตทุกราย ข้อมูลที่ได้จากการตรวจด้วยคลื่นเสียงความถี่สูงสามมิติจะทำให้การวินิจฉัยทำได้อย่างแม่นยำมากขึ้น ความสามารถในการสร้างภาพเสมือนจริงยังทำให้คู่สมรสมีความเข้าใจที่ถูกต้องเกี่ยวกับสภาพของทารกในครรภ์ และช่วยเสริมความกระจ่างในการให้คำปรึกษาแนะนำถึงแนวทางการดูแลขณะตั้งครรภ์และหลังคลอดของทั้งมารดาและทารก
