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# Picture of the Month

## Crystal Vue technique for imaging fetal spine and ribs

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New ways of assessing the fetus are now possible owing to the introduction of three-dimensional (3D) ultrasound over a decade ago[1]. 3D ultrasound has been used as an easy-to-perform and accurate technique to image the fetal skeleton[1–6]. Garjian *et al.* demonstrated that 3D ultrasound can provide more information than does conventional two-dimensional (2D) imaging in the diagnosis of skeletal abnormalities, both in multiplanar and volume-rendered methods. This is particularly true when assessing short ribs and chest hypoplasias as the entire body region can be visualized and offline volume reconstruction can be performed[3]. Classical 2D ultrasound examination of long bones, ribs and vertebrae frequently gives insufficiently detailed images for assessment of bone contour, thickness and mineralization.

Crystal Vue is a new technique based on image-contrast enhancement that can be used for processing and rendering of acquired 3D volumes. Our recent experience with Crystal Vue, specifically when imaging the bone/soft tissue interface, has led us to believe that it may offer new opportunities for prenatal imaging, particularly of the skeletal system but also of the face and brain. Here we present and compare images of the spine and ribs in a third-trimester normal fetus and those in a fetus with suspected skeletal dysplasia, examined using a Samsung WS80 Elite system (Samsung Medison Co. Ltd., Seoul, South Korea) with Crystal Vue and Realistic Vue software applications.

A 39-year-old pregnant woman who had five previous healthy pregnancies was followed up at 20 weeks' gestation after spontaneous resolution of pleural effusion and echogenic bowel. Amniotic fluid-polymerase chain reaction and array were negative as was TORCH and cystic fibrosis testing. Ultrasound examination was performed at 29 + 4 weeks' gestation (Figure 1). On 2D imaging, the spine and ribs appeared normal with normal fetal movements and amniotic fluid. Using Crystal Vue postprocessing on a saved 3D volume, the rib/vertebral interface was seen clearly and rib mineralization appeared normal; we were able to identify 12 ribs.

The second patient examined was a 20-year-old nulliparous woman at 33 + 4 weeks' gestation who was referred for short and abnormally shaped long bones. The mother was affected by skeletal dysplasia presumed to be achondroplasia. She declined first-trimester combined screening and genetic investigation as she planned to continue the pregnancy no matter what such tests would reveal. On 2D ultrasound examination, fetal measurements identified all long bones as being below the 5$^{th}$ percentile but with normal mineralization and no obvious fractures. The femur and humerus were bowed but the skull was normal with no evidence of frontal bossing on either 2D or 3D imaging of the face. The thorax/abdomen ratio was on the 50$^{th}$ percentile, and the ribs were visualized clearly by Crystal Vue 3D reconstruction (Figure 2).

Rib evaluation during the fetal anomaly scan is not performed routinely. However, in cases such as this it can yield important clues in the work-up for prenatal diagnosis of skeletal dysplasia as well as other chromosomal and genetic aberrations[2]. We noted abnormally short ribs, though normally mineralized and with no fractures evident. The wide spacing of the ribs and their relative slimness (Figure 2) are in contrast to those in the normal case (Figure 1). Although the maternal diagnosis has recently been confirmed with genetic testing and the finding of an FGFR3 mutation, the features of the rib spacing and slimness are not typical of achondroplasia.

Achiron *et al.* described 3D findings in two cases of genetically confirmed thanatophoric dysplasia and concluded that the highest accuracy for assessing the fetal skeleton can be achieved using 3D maximum transparent mode[1]. This is what can be attained by Crystal Vue and we were able to obtain highly detailed images that gave particular information on the contour of the ribs and enabled inference on mineralization.

In 2004, a case series of six fetuses affected by skeletal dysplasias demonstrated that 3D ultrasound was a cost-effective and safe technique for the assessment of the fetal skeleton when compared to conventional 2D and

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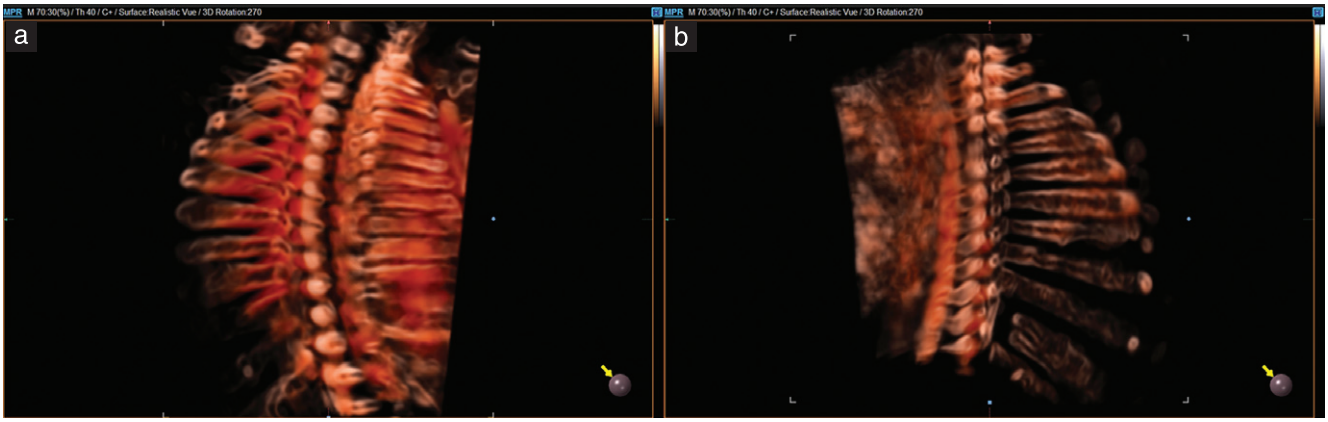


**Figure 1** Coronal (a) and pseudosagittal (b) views of normal fetal ribs and spine at 29 + 4 weeks' gestation using Crystal Vue.

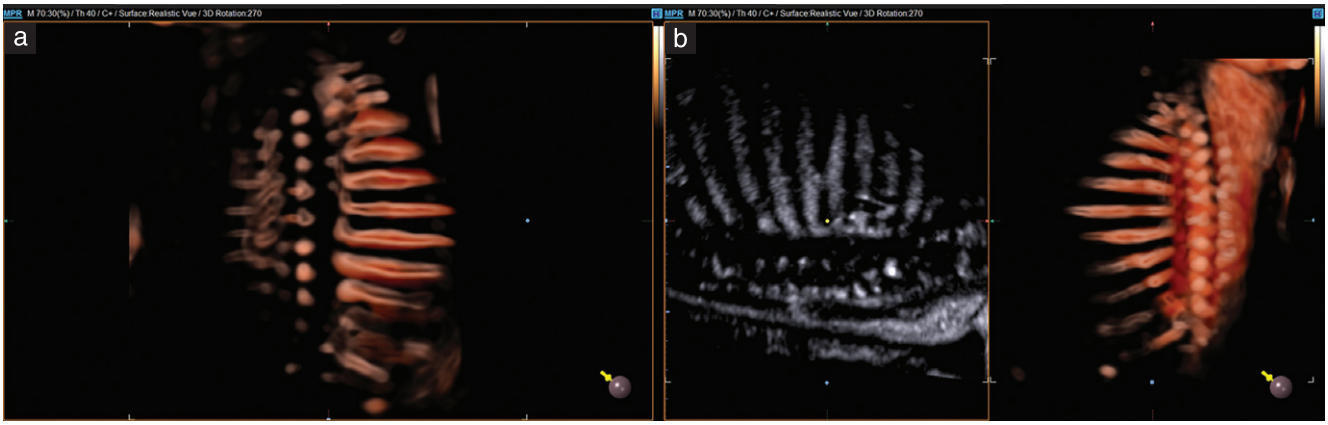


**Figure 2** Coronal (a) and pseudosagittal (b) views of fetal ribs and spine at 33 + 4 weeks' gestation using Crystal Vue, showing narrow' widely spaced, short ribs. The two-dimensional image from which the pseudosagittal Crystal Vue image was constructed is shown in the left panel of (b).

3D helical computed tomography[4]. In 2015, we would argue that, with Crystal Vue, a step forward has been taken in the improvement of antenatal skeletal imaging.

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## References

1. Achiron R, Gindes L, Zalel Y, Lipitz S, Weisz B. Three- and four-dimensional ultrasound: new methods for evaluating fetal thoracic anomalies. *Ultrasound Obstet Gynecol* 2008; **32**: 36–43.
2. Hershkovitz R. Prenatal diagnosis of isolated abnormal number of ribs. *Ultrasound Obstet Gynecol* 2008; **32**: 506–509.
3. Garjian KV, Pretorius DH, Budorick NE, Cantrell CJ, Johnson DD, Nelson TR. Fetal skeletal dysplasia: three-dimensional US--initial experience. *Radiology* 2000; **214**: 717–723.
4. Ruano R, Molho M, Roume J, Ville Y. Prenatal diagnosis of fetal skeletal dysplasias by combining two-dimensional and three-dimensional ultrasound and intrauterine three-dimensional helical computer tomography. *Ultrasound Obstet Gynecol* 2004; **24**: 134–140.
5. Krakow D, Williams J 3rd, Poehl M, Rimoin DL, Platt LD. Use of three-dimensional ultrasound imaging in the diagnosis of prenatal-onset skeletal dysplasias. *Ultrasound Obstet Gynecol* 2003; **21**: 467–472.
6. Benacerraf BR, Benson CB, Abuhamad AZ, Copel JA, Abramowicz JS, Devore GR, Doubilet PM, Lee W, Lev-Toaff AS, Merz E, Nelson TR, O'Neill MJ, Parsons AK, Platt LD, Pretorius DH, Timor-Tritsch IE. Three and 4 dimensional ultrasound in obstetrics and gynecology: proceedings of the American Institute of Ultrasound in Medicine Consensus Conference. *J Ultrasound Med* 2006; **20**: 1587–1597.