

Diagnostic value of 3D XI ultrasound in detection of uterine anomalies

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Before the introduction of 3D ultrasound, diagnosis of congenital uterine anomalies required few diagnostic procedures such as gynecological examination, ultrasound, hysterosalpingography and laparoscopy. The application of 3D ultrasound in the last decade of the 20th century and the analysis of uterine morphology in coronal plane were very helpful in detecting uterine anomalies. Previous research of Kurjak^{1,2}, Jurkovic^{3,4} and Baba⁵ confirmed that the 3D ultrasound is reproducible and reliable noninvasive diagnostic procedure for the diagnosis of congenital uterine anomalies.

In 2004, Samsung Medison introduced a new three-dimensional technology named 3D XI, that is comprised of Multi-Slice View and Oblique View modes. Multi-Slice View represents sequential sectional scans in A, B and C plans of the scanned 3D volume, similar to CT and MRI like technologies.

Slice interval can vary according to the area of interest and depends on the volume size. Scanned volume can be freely rotated in all planes and slice interval can be changed in order to obtain the best plane for morphological analysis. In all planes, precise 2D and 3D calculations and measurements can be performed for measuring the size and volume of desired object. Normal uterus in reconstructed coronal plane in Multi-Slice View is presented in the Figure 1.

OBJECTIVE

The aim of this study was to evaluate Multi-Slice View technology in detection of congenital uterine anomalies.

METHODS

In this study, 88 patients with congenital uterine anomalies were included. Ultrasound examinations were performed on the Accuvix XQ, Samsung Medison, Korea, with transabdominal 3D4-7EK and transvaginal 3D5-8EK probes. For each case, volume data were acquired from the sagittal and transversal plane of the uterus. Scanned volumes were evaluated in multiplanar 3D and Multi-Slice View mode, with slice interval of 0.4-0.5 mm. Off-line analysis of uterine morphology and endometrial cavity was performed in reconstructed coronal plane. Uterine structure, especially contour of the uterine fundus and muscular thickness of the fundus or septum length were analysed in every patient.

The structure and shape of the uterine cavity were assessed at the level of internal tubal orifices. Congenital uterine anomalies were classified according to the American Fertility Society classification.

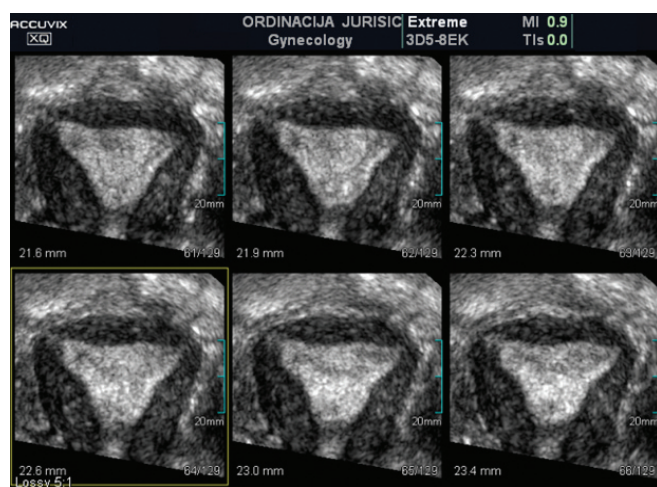


FIGURE 1. Multi-Slice View of normal uterus in the coronal plane (3 x 2, slice interval 0.4 mm)

RESULTS

Mean patients' age in our study was 32 ± 10 years. Classification and incidence of detected anomalies are presented in the Figure 2.

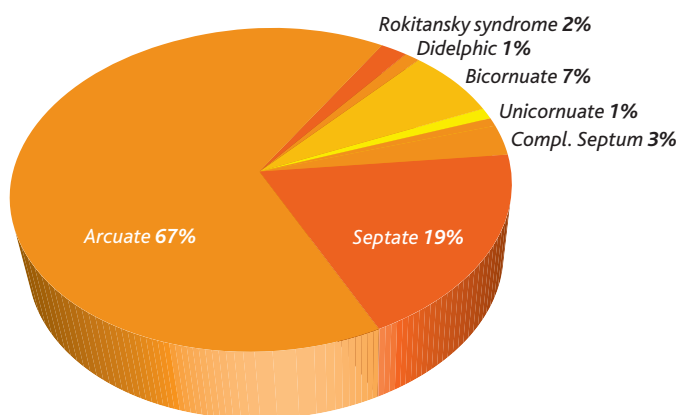


FIGURE 2. Classification and incidence of congenital uterine anomalies

Rokitansky syndrome was found in 2 (2%) patients. Didelphic uterus was detected in one (1%) patient.

Unicornuate uterus was also detected in one (1%) patient. Multi-Slice image of unicornuate uterus with rudimentary horn is presented in the Figure 3.

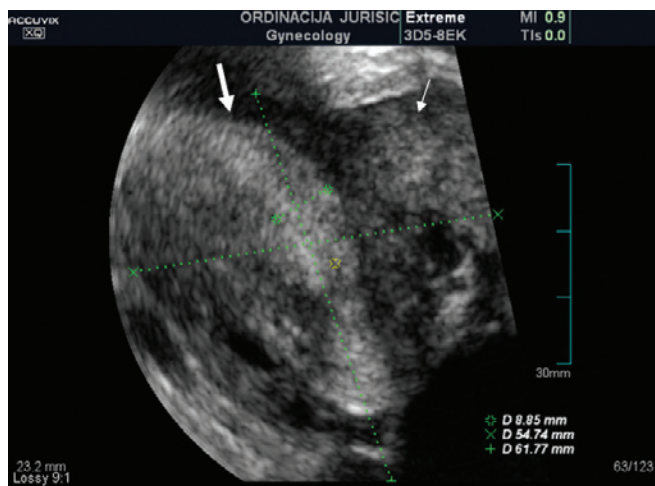


FIGURE 3. Unicornuate uterus in the coronal plane (Multi-Slice View, 1x1, slice depth 23.3 mm) with measurement of endometrial thickness and uterine size. Normal uterine cavity is shown on the left side (→) and rudimentary horn on the right side (→) of the image.

Bicornuate uterus was found in 6 (7%) patients. A case of bicornuate uterus with pregnancy is shown in the Figure 4. Early pregnancy is located in the right uterine horn and on the left side there is the empty uterine cavity with thick hyperechogenic endometrium (decidual reaction). The analysis of the shape of the uterine fundus shown two well formed cornua, with incisure between them at the level of external fundus as shown in the Figures 4 and 5.

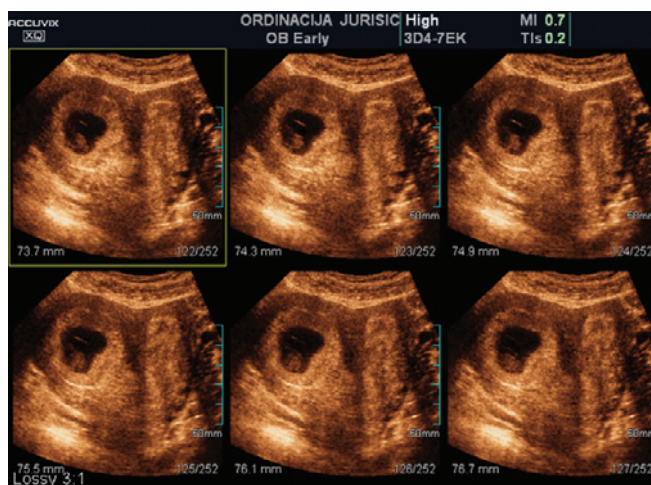


FIGURE 4. Multi-Slice View of bicornuate uterus with pregnancy in the coronal plane (2x3, slice interval 0.6 mm)

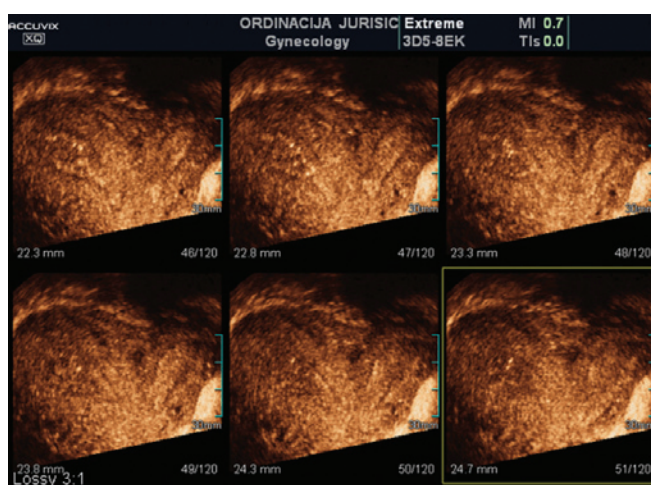


FIGURE 5. Multi-Slice View of bicornuate uterus in the coronal plane (2x3, slice interval 0.5 mm)

Septate uterus was found in 17 (19%) patients. Figure 6 represents septate uterus in 3D Multi-Slice coronal plane. It is clearly visible that there is no incisure on the uterine fundus which is presented in the cases of unicornuate (Figure 3) and bicornuate uterus (Figures 4, 5).

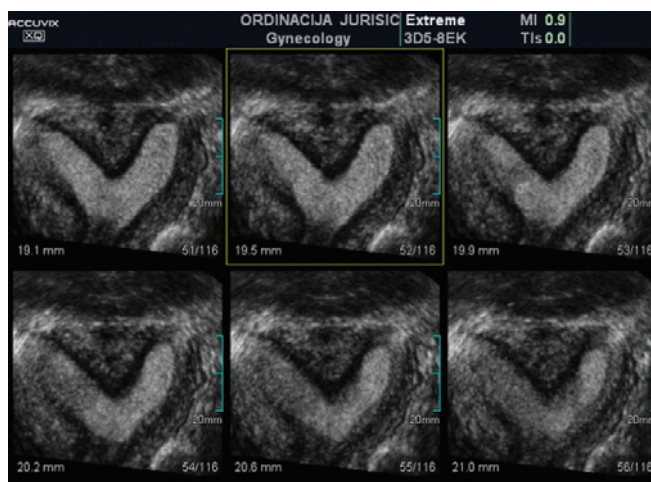


FIGURE 6. Multi-Slice View of septate uterus in the coronal plane (2x3, slice interval 0.4 mm)

Three patients (3%) had complete uterine septum with duplication of cervix and vaginal septum. It was confirmed in Multi-Slice View in the coronal plane that there is one uterine body without incisure on uterine fundus and there are two uterine cavities going parallel to the cervical orifice (Figure 7).

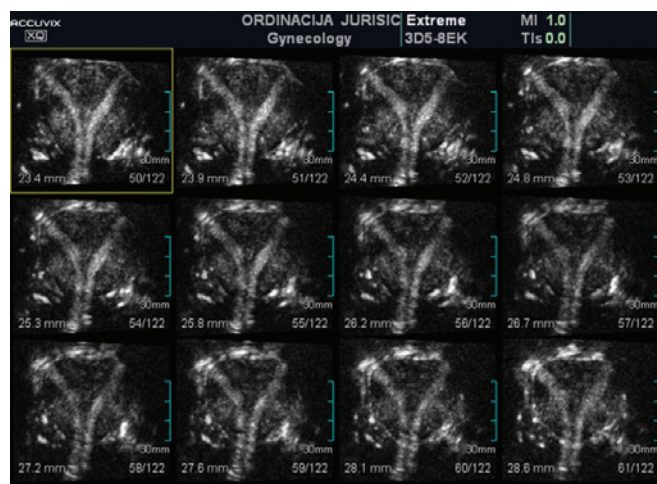


FIGURE 7. Multi-Slice View of septate uterus with complete septum and duplication of the cervix in the coronal plane (3x4, slice interval 0.5 mm)

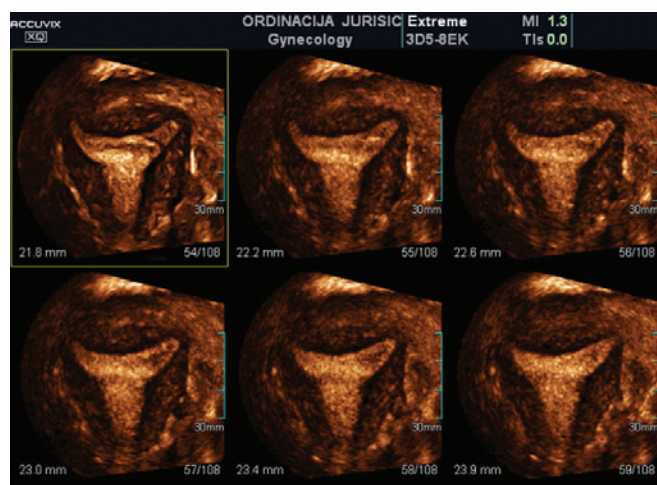


FIGURE 8. Multi-Slice View of arcuate uterus in the coronal plane (2x3, slice interval 0.4 mm)

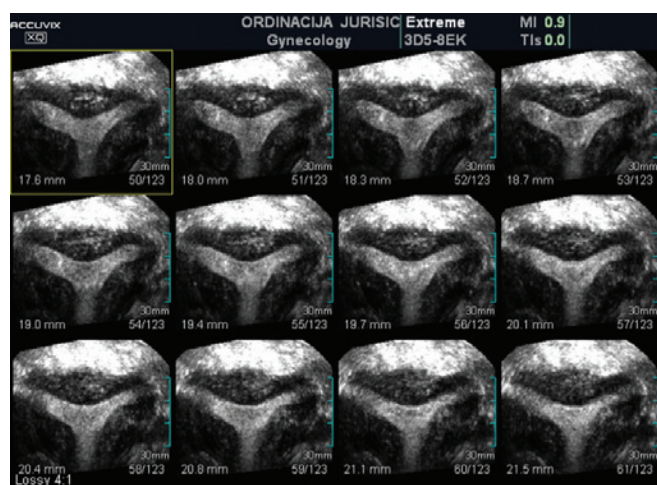


FIGURE 9. Multi-Slice View of arcuate (T-shaped) uterus in the coronal plane (3x4, slice interval 0.4 mm)

The remaining 58 (67%) patients had uterus arcuate anomaly (Figures 8, 9). Patients were classified into septate or arcuate groups after off-line analysis of uterine morphology and endometrial cavity shape.

Three off-line measurements in the coronal plane of the uterus were taken in each case: Line A – connecting line between the two uterine horns, which simulates triangular normal uterine cavity; Line B – muscular thickness of the uterus, which was measured from the fundus to the top of the septum; and Line C – septum length, that defines as a distance between midpoints of the line connected uterine horns (Line A) to the top of septum (Figures 10,11).



FIGURE 10. Septum uterus. Measurements of septum length in the coronal plane (Line A – connecting between the uterine horns, Line B – muscular thickness, Line C – septum length) are illustrated

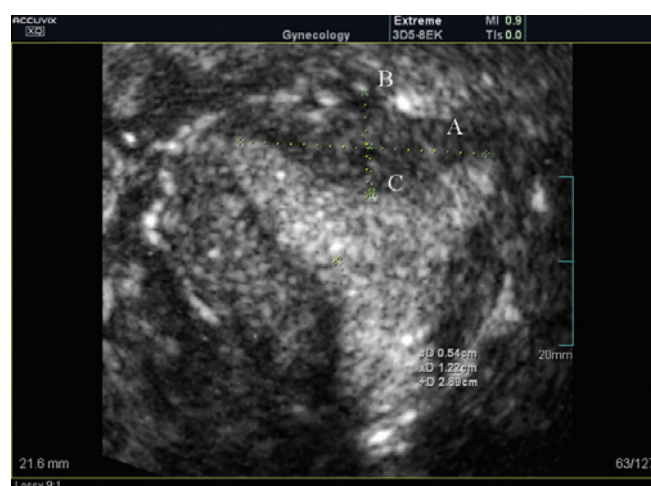


FIGURE 11. Uterus arcuate. Measurements in the coronal plane (Line A – connecting between the uterine horns, Line B – muscular thickness, Line C – septum length) are illustrated

In the case when the length of septum (Line C) exceeds 1/2 values of muscular thickness (Line B), anomaly was classified as a uterine septum (Figure 10). If the septum length was shorter

than 1/2 values of muscular thickness, congenital uterine abnormality was considered as an arcuate uterus (Figure 11).

Diagnoses of Rokitansky syndrome and unicornuate uterus with rudimentary horn were additionally confirmed on laparoscopy.

CONCLUSIONS

Multi-Slice View is reliable diagnostic method for detection of congenital uterine anomalies. It enables the analysis of uterine structure such as uterine fundus, septum length and the shape of the uterine cavity in only one volume scan. Sequential sectional scans in three-dimensional Multi-Slice View mode of the uterus in all three planes can give sufficient information for diagnosis of uterine anomalies. Multi-Slice View should be in the future the gold standard for noninvasive diagnosis of the uterine anomalies.

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