Defining the Spatial Relationships Between 8 Anatomic Planes in the 11+6-13+6 Week Fetus: A Pilot Study

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OBJECTIVE

Objective

Our study aims at investigating the spatial relationships between 8 anatomic planes in the 11+6 - 13+6 week fetus.

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Sept. 2012; 32: 875-882

METHODS

Methods

- **Retrospective pilot study on 63 fetuses**
- **8 anatomic planes retrieved from 3D/4D volume data**
- **Started from the mid-sagittal plane of the fetus**
- **Standardized and utilized the mid-sagittal volume (MSV) technique**
- **Spatial relationships between 8 anatomic planes were established**
- **The median and the range were calculated for each of the planes, and they were evaluated as a function of the fetal crown rump length.**
- **Linear regression and step-wise multiple regression analsis were utilized.**
- **P < 0.05 was considered statistically significant**

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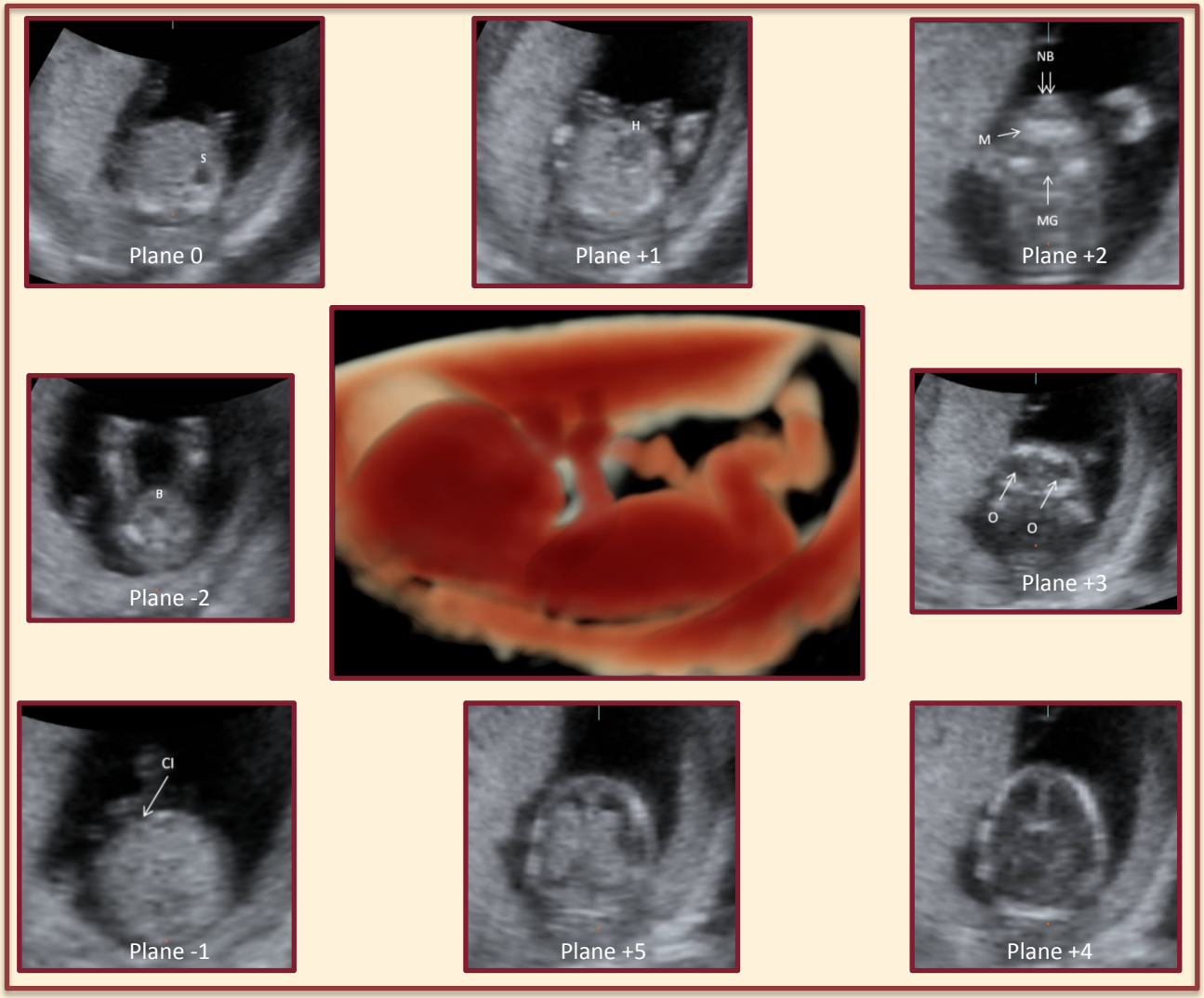
METHODS:
8 ANATOMIC BIOMETRIC PLANES



METHODS:
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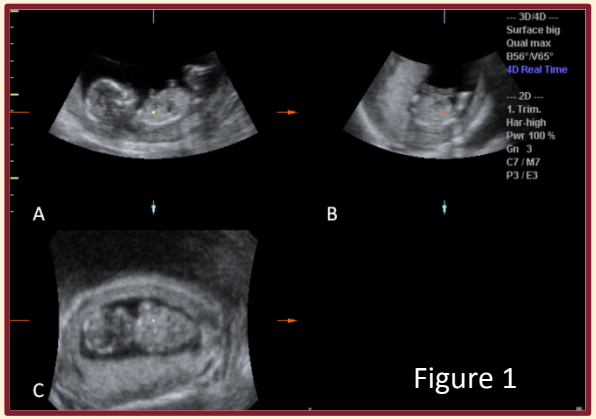

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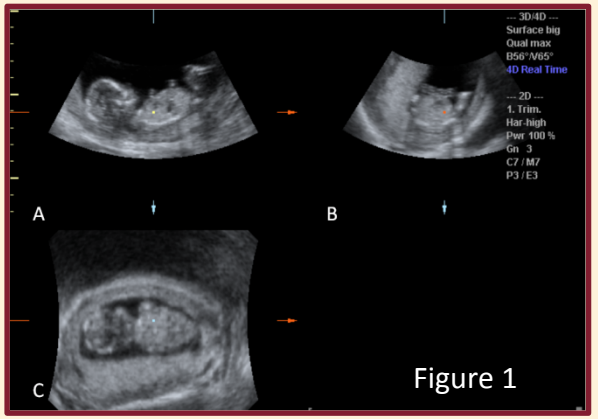

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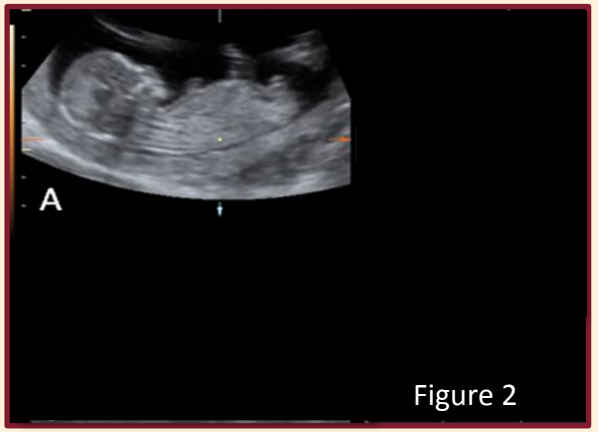

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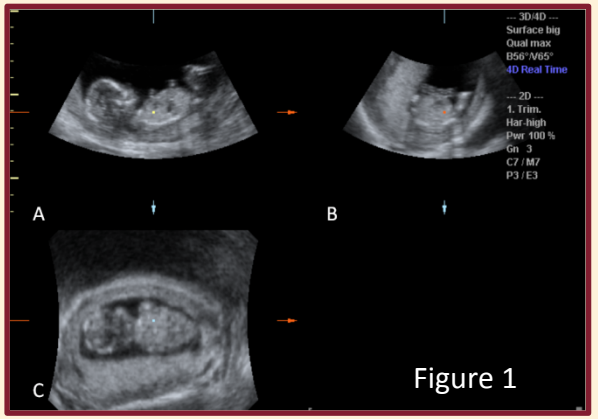

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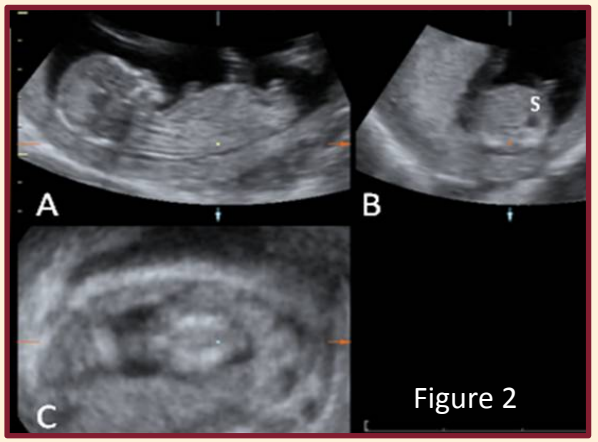

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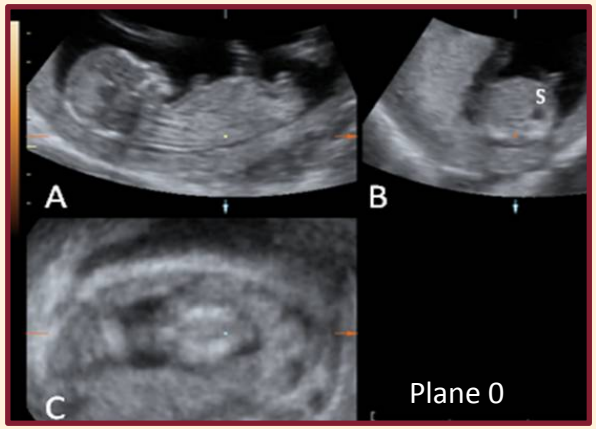

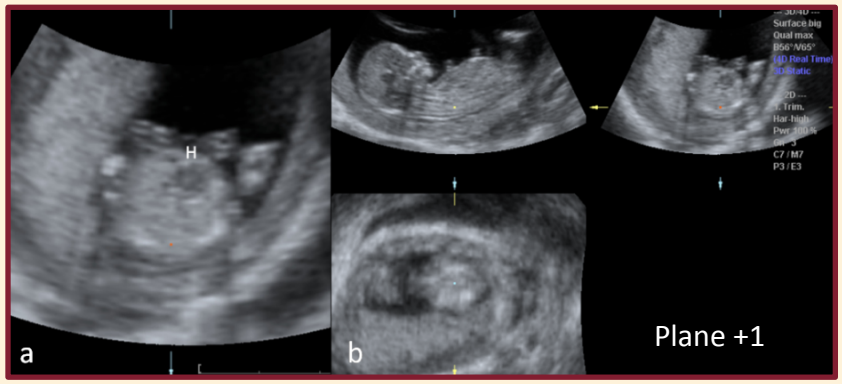

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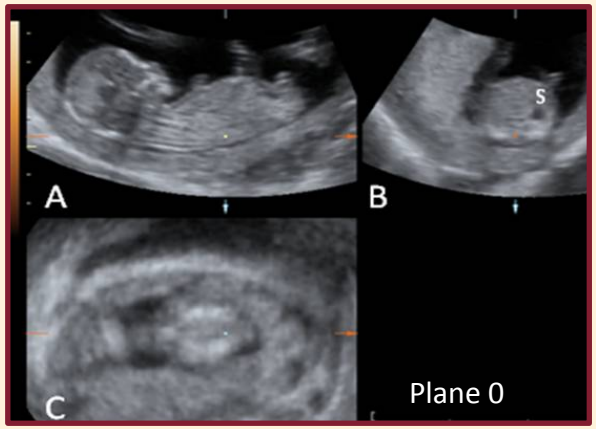

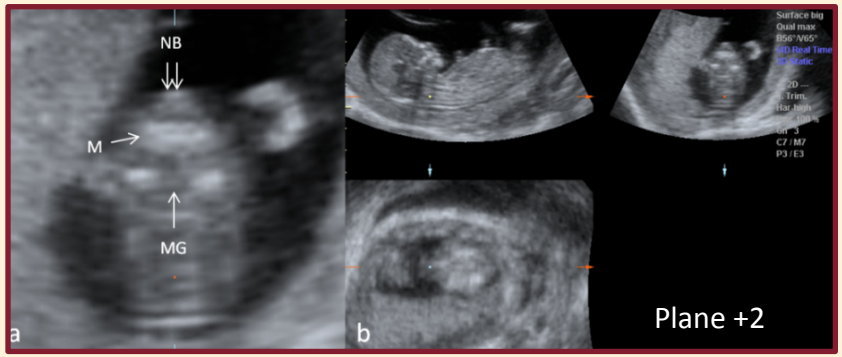

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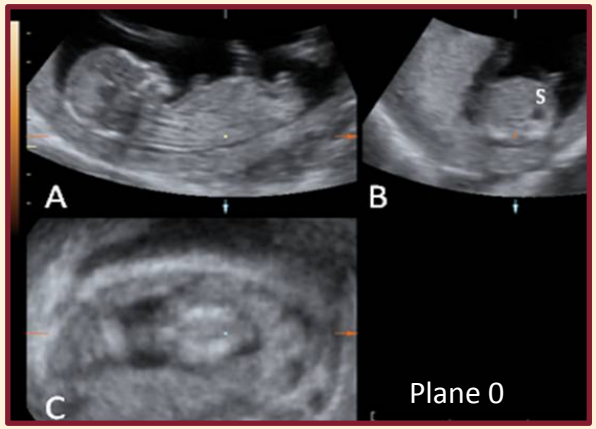

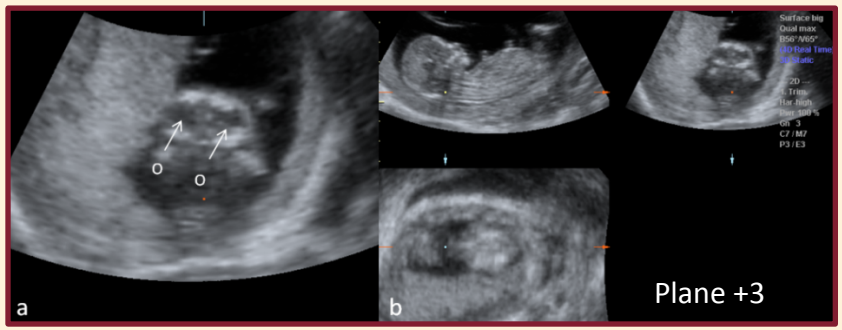

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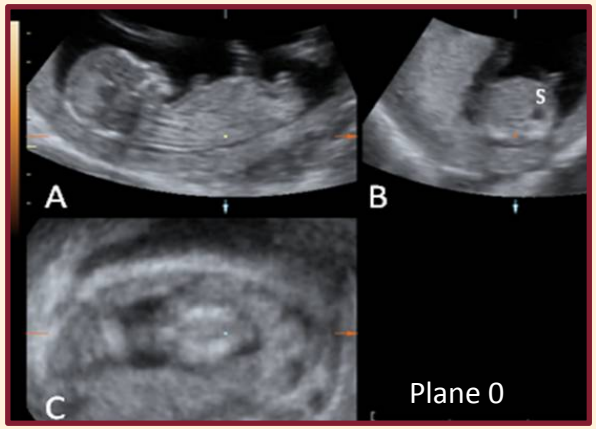

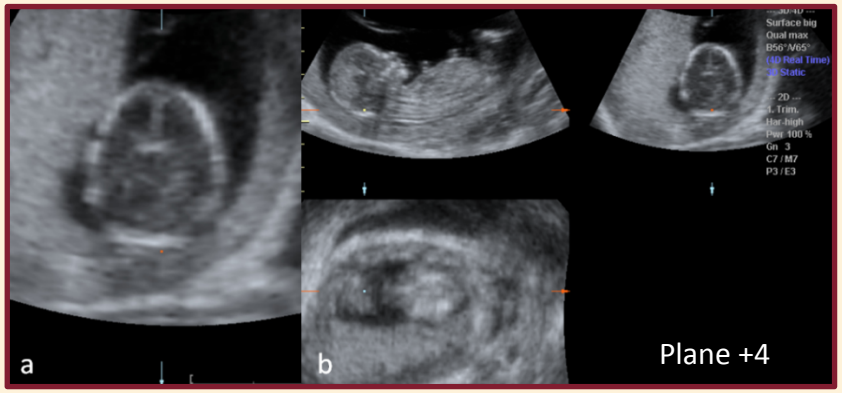

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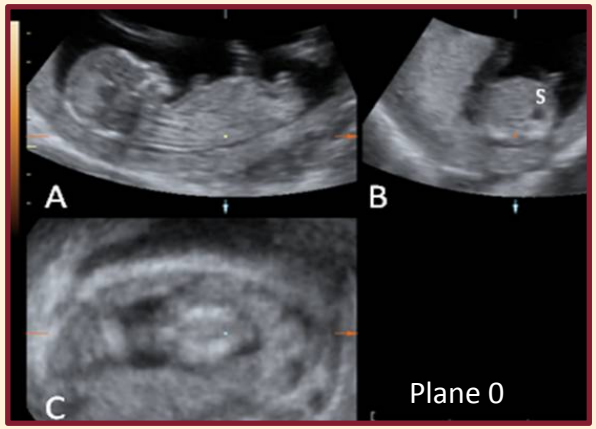

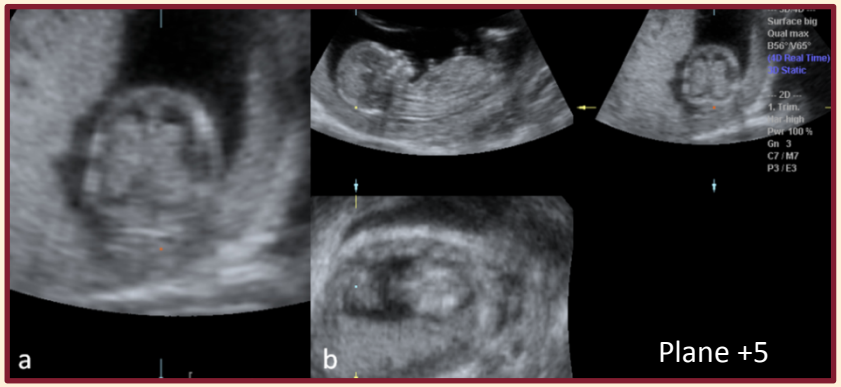

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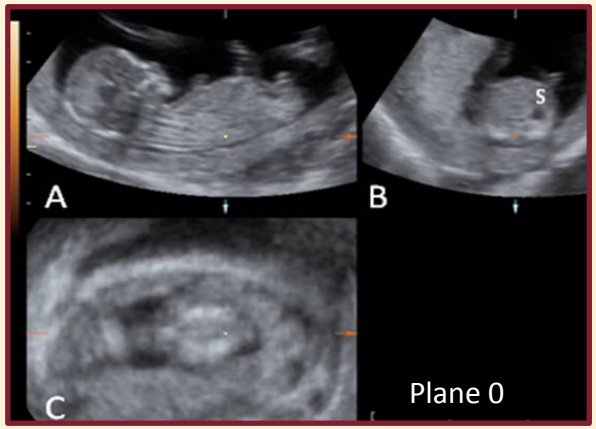

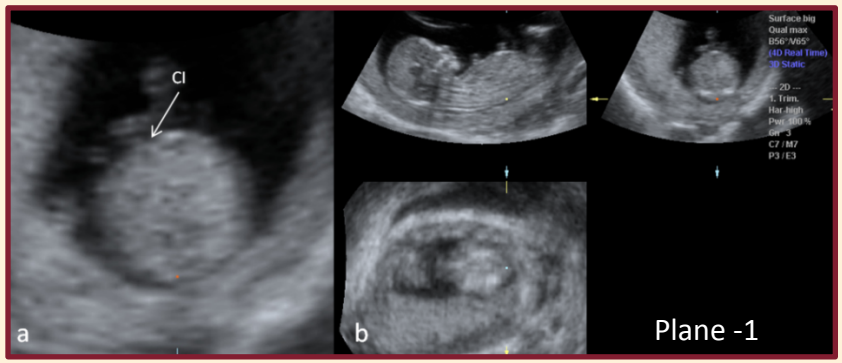

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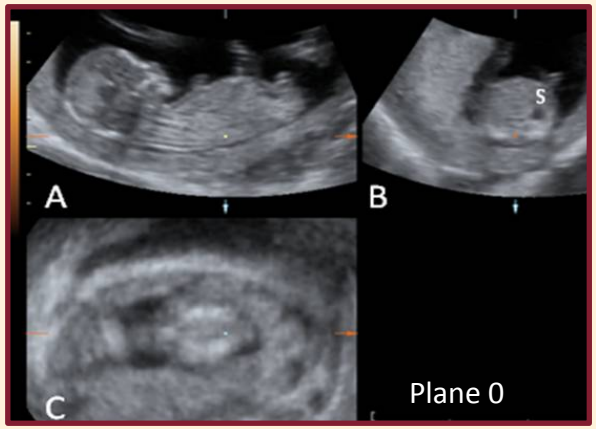

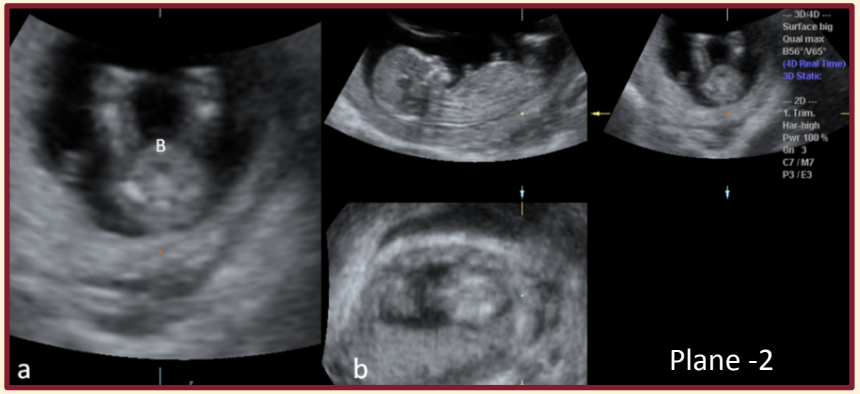

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Sept. 2012; 32: 875-882

RESULTS: USING THE MSV

Table 2 Total number of 2D planes retrieved out of the 63 volume data sets as a function of fetal CRL. Mean, minimum, maximum, and standard deviation (SD) are in millimeters. $P = 0.039$

# Planes retrieved	N	%	Mean CRL	SD	Minimum	Maximum
< 7 Planes retrieved	8	12.7%	66.1	8.6	52.4	75.5
7 Planes retrieved	19	30.2%	70.6	6.6	54.8	81.1
All 8 planes retrieved	36	57.1%	72.8	6.2	53.9	83.4
Total	63	100.0%	71.3	6.9	52.4	83.4

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Sept. 2012; 32: 875-882

RESULTS: USING THE MSV

Table 3 Percentage of successful retrieval of designated 2D planes out of the 63 stored sets, and descriptive statistics for the spatial relationships, expressed as percentage of the fetal CRL, cephalad (+) and caudad (−) from the transverse abdominal circumference plane (parallel shift) towards the seven 2D planes

Plane	Total successful retrieval (%)	5%[a]	25%[a]	Mean, mm	75%[a]	95%[a]	Standard deviation
Plane +1	62 (98.4%)	5.37	7.08	8.27	9.46	11.17	1.76
Plane +2	49 (77.8%)	21.46	27.36	31.47	35.57	41.48	6.09
Plane +3	58 (92.1%)	24.74	31.03	35.41	39.78	46.07	6.49
Plane +4	60 (95.2%)	36.14	42.41	46.77	51.13	57.41	6.47
Plane +5	60 (95.2%)	42.48	49.02	53.57	58.11	64.65	6.74
Plane −1	50 (79.4%)	−15.16	−12.40	−10.48	−8.56	−5.80	2.84
Plane −2	61 (96.8%)	−23.91	−20.84	−18.72	−16.56	−13.49	3.17

All planes' measurements and CRL were tested for normality and were found to be normally distributed with *p*-values > 0.138.

[a]On the basis of probability estimates, assuming normality and estimating the parameters (mean and standard deviation) from the data.

Plane 0: Abdominal Circumference; Plane +1: Heart; Plane +2: Facial Bones; Plane +3 Orbits; Plane +4: Biparietal Diameter; Plane +5: Butterfly; Plane; Plane -1: Cord Insertion; Plane -2: Bladder

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Sept. 2012; 32: 875-882

RESULTS

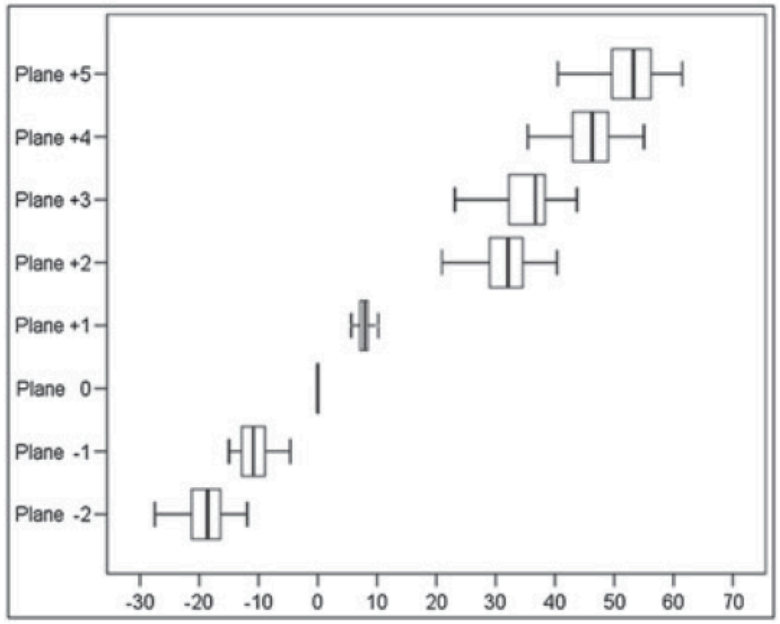
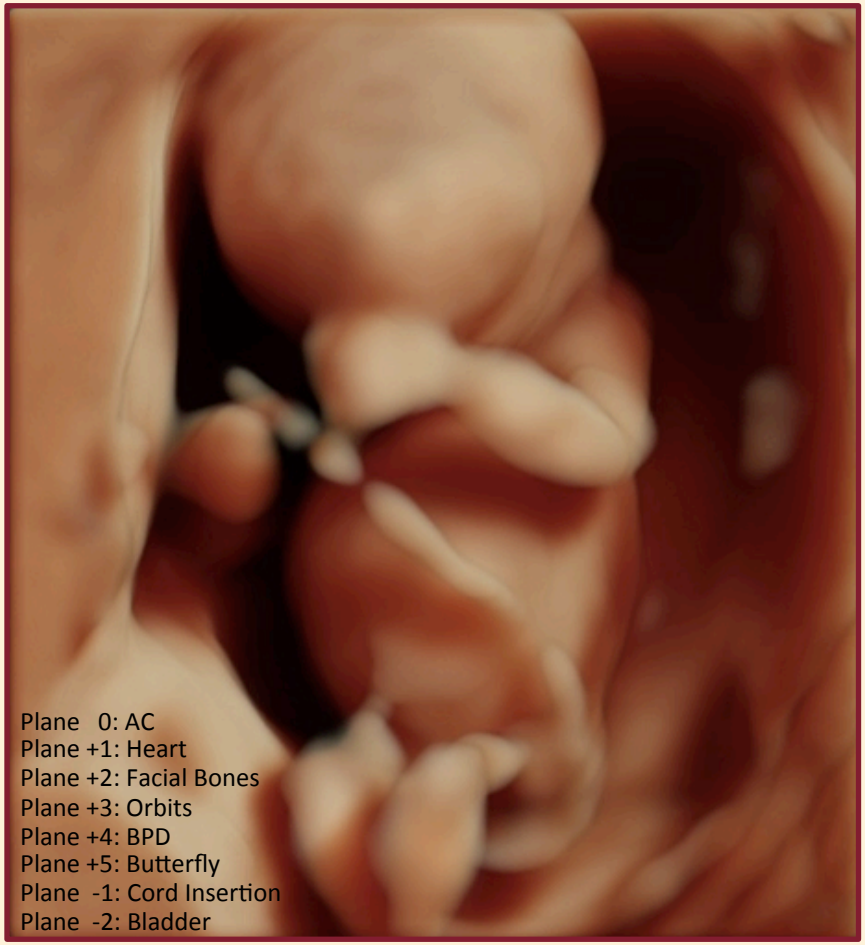


Figure 6 Figure 6 is a box plot representation for the parallel shift (in millimeters expressed as a percentage of each fetus' CRL) from plane 0 to all seven 2D planes. The line inside each box represents the 50th centile for CRL (median). The left and right edges of each box correspond to the 25th and 75th centiles, respectively. The end points of the left and right whiskers correspond to the minimum and maximum values



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CONSLUSION

Limitations

- Sample size
- Retrospective nature
- Need larger prospective studies to validate

Conclusion

- To our knowledge, this is the first study to describe the possible spatial relationships between 8 two-dimensional anatomic planes in the 11+6 - 13+6 week fetus, utilizing a standardized approach, MSV
- The 8 anatomic planes were found to adhere to normal distribution curves
- Most of the planes are in a definable relationship to each other with statistically significant correlations
- Defining these spatial relationships may serve as the first step for the potential future development of automation software for fetal anatomic assessment at 11+6 - 13+6 weeks

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