3D & 4D ULTRASONOGRAPHY IN ABNORMALITIES OF FETAL ABDOMEN

Essay

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By

Doaa Ahmed Abd el Aziz Mohamed

Supervised by

Prof.Dr. Hassan Ali Hassan Elkiky

Professor of Radio-Diagnosis

Faculty of Medicine- Cairo University

Dr. Noha Hosam Eldin Ibrahim Behairy

Lecturer of Radio-diagnosis

Faculty of Medicine -Cairo University

Faculty of Medicine

Cairo University

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Abstract

Three-dimensional ultrasonography provides several tools (e.g., multiplaner imaging, surface rendering, volume rendering, and color power Doppler imaging). Also it can be used for studying the fetal circulation and surrounding anatomic structures (Lee et al., 2003).

Post-processing techniques of 3D ultrasound has greatly enhanced our knowledge of fetal abdominal anomalies and contributed to our understanding of how these affect pregnancy outcome (Simona et al., 2002).

The advantages of 3DUS and 4DUS in certain areas are obvious. Its use in assessment of fetal abdominal anomalies is already implemented by most centers. The use of this tool in applying color Doppler, in guiding needles for puncture procedures, as well as in assessing the fetal circulations, are under close research evaluation (Kurjak et al., 2007).

Key words : 3d & 4d ultrasonography in abnormalities of fetal abdomen

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List of Abbreviations

AC	Abdominal circumference.
AP	Antero-posterior.
APDK	Adult polycystic kidney disease.
ARA	Ano-rectal atresia.
AVI	Audio-vido interleave.
CDH	Congenital diaphragmatic hernia.
CNS	Central nervous system.
CVS	Cardio-vascular system.
2D	Two dimensions.
3D	Three dimensions.
4D	Four dimensions.
3DPD	Three dimensional power Doppler.
2 DUS	Two dimensional ultrasound.
3DUS	Three dimensional ultrasound.
4DUS	Four dimensional ultrasound.
GIT	Gastro-intestinal tract.
IPCK	Infantile polycystic kidney disease.
IUGR	Intra-uterine growth retardation.
MCDK	Multicystic dysplastic kidney disease.
MSAFP	Maternal serum Alpha feto-protein.
OEIS	Omphalocele, Exttrophy, Imperforate anus, Spinal defect.
PUJO	Pelvi-ureteric junction obstruction.
ROI	Region of interest.
RPD	Renal pelvic dilatation.
SD	Stander deviation.

SGA	Small for gestational age.
TRAP	Twin reversed arterial perfusion syndrome.
TVS	Trans-vaginal ultrasound.
UPJ	Uretro-pelvic junction.
UPR	Urine production rate.
US	Ultra-sound.
UVVF	Umbilical venous volume flow.
VACTERL	Vertebral segmentation, anorectal atresia, Tracheo-oesophageal fistulas, and Renal anomalies.
VOCAL	Virtual organ computer-aided analysis mode.

INTRODUCTION

For more than 40 years, ultrasound has been extensively used in medical imaging, which has proved helpful for the diagnosis and staging of many diseases (Goncalaves et al., 2005 & Kurjak & Chervenak, 2004).

Three-dimensional ultrasound (3DUS) was first introduced during the 1980s and has gained increasing acceptance in obstetrics as technological improvement accelerated (Yagel et al., 2009).

Three dimensional ultrasound has become an important part of prenatal diagnosis. 2D images provide a series of planer images that the operator must mentaly reconstruct to represent 3D anatomy. In cases with structural malformation, this may be doubly diffecult for even the most experienced examinar (Sciaky-Tamir et al., 2006).

The complete abdominal surface is invisble by conventional 2D technology, with the only means of abdominal surface survey involving serial tomographic sections in sagittal and trasverse planes. Using the 3D surface mode, we are able to visulaze the complete abdominal surface and umlilical cord insertion in a single image depicting their natural appearance (Benoit et al., 2000).

Post-processing offers the possibility of surface imaging of intra-abdominal structures. It is possible to construct any slice nearly parrallel to the mothers abdominal wall, thus making it possible to observe the esophageal gastric junction, pylorus and any other pathology (Candiani, 1998).

Three-dimensional ultrasuond confirms a suspected multicystic dysplastic kideny as well as renal agenesis, and the pelvi-ureteric junction and uretero-vesical junction are easily observable (Candiani, 1998).

Three-dimensional & four-dimensional ultrasonography provides accurate and quick detection of many fetal abnormalities (Merz et al., 1997 and 1998).

AIM OF WORK

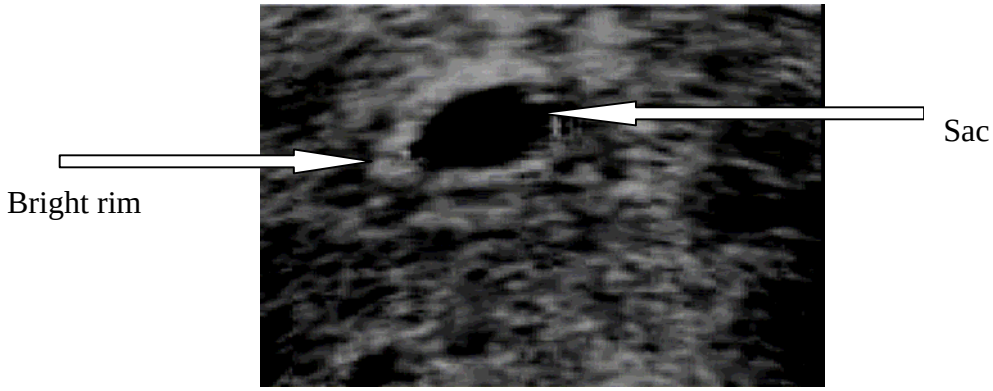
The aim of work is to review the role of 3D and 4D ultrasound in diagnosis of fetal abdominal anomalies.

NORMAL ULTRASONIC DEVELOPMENT OF FETAL ABDOMEN

The gestation sac

The earliest ultrasonic confirmation of a normal intrauterine pregnancy is the demonstration of gestation sac within the uterus, thickening of the endometrium might be recognized prior to this cannot be taken as diagnostic sign of pregnancy (Lindsay et al., 1992 &Grisolia et al., 1993).

The gestation sac is usually visualized from 31 days or 4^{+3} weeks of gestation (fig.1) using the transvaginal method, when it measures 2-3 mm in diameter. It can de identified about a week later using the abdominal route (Lindsay et al., 1992 &Grisolia et al., 1993).



(Fig. 1) A normal intrauterine pregnancy at 4 weeks' gestation imaged using the trans-vaginal method. The gestational sac measures 3 mm. The yolk sac and embryo are not visible at this early stage. Note the echogenic appearance and the thickness of the wall of the sac (Quoted from Chudleigh and Thilaganathan, 2005).