بسم الله الرحمن الرحيم

شبكة المعلومات الجامعية

جامعة عين شمس

التوثيق الالكتروني والميكروفيلم

قسم

نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها
علي هذه الأفلام قد أعدت دون أية تغيرات

يجب أن

تحفظ هذه الأفلام بعيدا عن الغبار

في درجة حرارة من ١٥-٢٥ مئوية ورطوبة نسبية من ٢٠-٤٠%

To be Kept away from Dust in Dry Cool place of 15-25- c and relative humidity 20-40%

بعض الوثائــــــق
الاصليـــــة تالفـــة

بالرسالة صفحات

لم ترد بالاصل

THE ROLE OF THREE-DIMENSIONAL ULTRASONOGRAPHY IN DIAGNOSIS OF THE CONGENITAL MALFORMATIONS DURING PREGNANCY

ESSAY

Submitted In Partial Fulfillment for Master Degree of

OBSTETRICS AND GYNECOLOGY

Presented By

Marwa Essam Ahmed El-Kholy

Supervised By

Prof. Medhat Mosad EL-Temamy

Professor of Obstetrics and Gynecology

Faculty of Medicine

Cairo University

Dr. Maha Yousef Soliman

Assistant Prof. Obstetrics and Gynecology
Faculty of Medicine,
Cairo University

Dr. Hassan Omar Gharieb

Lecturer of Obstetrics and Gynecology
Faculty of Medicine,
Cairo University

Faculty of Medicine
Cairo University
2003

ABSTRACT

Three-dimensional ultrasound needs the processing technology of 2D ultrasound as a basis. Beyond that it needs new competencies in transducer design and in the design of position detection systems. It needs high-level software to implement all the visualization algorithms under the constraint of execution time and it needs a great deal of system and application knowledge from the designer of such 3D ultrasound systems to make this powerful tool valuable for the user.

KEY WORDS

Normal Fetal Anatomy

Normal & Abnormal Fetal Face

ACKNOWLEDGEMENT

First of all thanks to "**ALLAH**" for giving us the ability to accomplish this work, which I hope would be of value for colleagues, who search for updated technology and perfection, and to patients who are definitely in great need for professional and qualified medical care.

I would like to express my sincere appreciation to **Prof. Medhat Mosad El-Temamy**, professor of Obstetrics and Gynecology, Faculty of Medicine, Cairo University, whom I was honored by his supervision, guidance and great concern.

My special respect, and gratitude to **Dr. Maha Yousef Soliman**, Assistant professor of Obstetrics and Gynecology, Faculty of Medicine, Cairo University, whom I was gifted with her valuable directions, guidance and encouragement and supreme patience throughout this work.

I would like to express my gratitude to **Dr. Hassan Omar Gharieb**, Lecturer of Obstetrics and Gynecology, Faculty of Medicine, Cairo University, for his efforts and advice throughout the work.

Marwa El-Kholy

Contents:

History of three-dimensional ultrasonography

Three-dimensional ultrasound comes of age. Visualization of the fetus in 3-D has always been on the minds of many investigators, including ***Tom Brown*** in the early 1970s, who had developed an elaborate Multiplanar scanner in 1973, under the Sonicaid Ltd®. With improvements in ultrasonic and computer technology, work on three-dimensional visualization began to appear in the early 1980's. Some basic computer algorithms came from the group at Stanford ***(JF Brinkley, WD Mcallum)*** and also from the ***Holm group*** at Gentofte, Denmark. Other work came from the domain of cardiologists where initial efforts were directed to ascertaining the volume of cardiac chambers. Real-time scanner probes mounted on articulated arms were often employed where positions of the probe can be accurately determined. The principle has always been to stack successive parallel image sections together with their positional information into a computer.

Kazunori Baba at the Institute of Medical Electronics, University of Tokyo, Japan, first reported on a 3-D ultrasound system in 1984 and succeeded in obtaining 3-D fetal images by processing the raw 2-D images on a mini-computer in 1986. ***Baba, with Kazuo Satoh and Shoichi Sakamoto*** described the improved equipments in 1989 in which they used a traditional real-time convex array probe from an Aloka SSD280 scanner. The images obtained were processed on elaborate computer systems. This approach successfully produced 3-D images of the fetus which were nevertheless inferior to that produced on conventional 2-D scanners. At the same time, to generate each 3-D image it took on an average some 10 minutes for data input and reconstruction making the setup impractical for routine clinical use. Baba published in 1992 the first book on ultrasonography in Obstetrics and Gynecology which contained chapters on 3-D ultrasound. In the mid 1990s, Baba collaborated with ALOKA® in the development of commercial 3-D ultrasound technology in Japan.

Another group at the Columbia University led by ***Donald King*** described in 1990 other approaches and computer algorithms for 3-D spatial registration and display of position and orientation of real-time ultrasound images. ***HC Kuo, FM Chang and CH Wu*** at the National Cheng Kung University Hospital in Taiwan, reported in 1992 3-D visualization of the fetal face, cerebellum, and cervical vertebrate using a the Combison 330 from Kretztechnik®, Zipf, Austria. The Combison 330 which appeared in 1989, was the first commercial 3-D scanner in the market. The Taiwanese group were also the first to describe 3-D visualization of the fetal heart in the same year although at that time they were only able to image static parts in 3-D.

In 1987, the Center for Emerging Cardiovascular Technologies at Duke University started a project to develop a real-time volumetric scanner for imaging the heart. In 1991 they produced a matrix array scanner that could image cardiac structures in real-time and 3-D. In 1994, ***Olaf von Ramm, Stephen Smith*** and their team produced an improved scanner that could provide good resolution down to 20 centimeters. The team developed state-of-the-art "Medical Ultrasound imaging" integrated circuits (MUsIC) that were capable of processing signals from multiple real-time phased-array images. The MUsIC 3.2, a 40MHz 1.2μ chip completed in 1994, was the basis for the beam-former in the world's first electronically steered matrix-array 3-D ultrasound imager. This became available commercially from Volumetric Medical Imaging, Inc. in 1997. The matrix-array transducer, which steered the ultrasound beam in three dimensions, contained 2,000 elements in which 512 were used for image formation. The beam-former produced 4,096 lines running at 30 frames per second. This required as much ultrasound signal processing power as eight top-end 2-D systems, running on microprocessors that execute instructions 30 times the speed of a typical 2 GHz Pentium. Due to the relatively small size of the 2-D matrix array probe, it is more suited to cardiac examination rather than for the abdomen. The apparatus is also costly to produce problem in manufacturing and in image quality due to the large amount of crystals and interconnections.

Other pioneering investigators included ***Ian Kelly and John Gardener*** at the Middlessex Hospital in London and ***the Sturla Eik-Nes*** group at Tronheim, Norway, using equipments from Vingmed®. They were able to demonstrate early gestational age fetuses with their apparatus. ***Wilfried Feichtinger*** at the University of Vienna, Austria reported images of 10 weeks embryos imaged with 3-D transvaginal transducers in 1993. Kretztechnik®. had in this year marketed their 2nd generation 3-D scanner the Voluson 530D. ***Alfred Kratochwil*** had continued his support in the development of 3-D technology at Kretztechnic® and was active in the teaching of 3-D sonography. The ***Ulrike Hamper*** group at Johns Hopkins reported images of various congenital malformations with a prototype 3-D scanner. Computation was based on a 486 computer.

In 1996, ***Nelson's*** group and the Medical Imaging group at the university College Hospital in London published independent researches on 4-D (motion 3-D) fetal echocardiography, using sonographic cardiac gating methods to remove motion artifacts, which are present with conventional (static) 3-D methods. A useful feature of 3-D display is the cine loop, in which the rendered 3-D volumes are viewed as they rotate. This capability enhances depth perception and gives a true 3-D perspective of both normal and abnormal structures.