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Fetal Chromosome Abnormalities : Sonography in Obstetrics and Gynaecology

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Introduction

The history of sonography in obstetrics and gynaecology may be traced back to Ian Donald and his Glasgow colleagues' landmark 1958 Lancet publication. It is inconceivable to imagine practising Obstetrics and Gynecology without one of the several types of ultrasonography accessible now, fifty years later. Clinical researchers have seized technological advances such as solid state circuitry, real-time imaging, colour and power Doppler, transvaginal sonography, and 3/4D imaging to improve the investigation and management of patients in areas as diverse as foetal growth and wellbeing, screening for foetal anomalies, prediction of pre-eclampsia and preterm birth, detection of ectopic gestation, evaluation of pelvic masses, screening for ovarian cancer, and more. Ultrasound-guided techniques are becoming standard practise in foetal therapy and IVF. This succinct history is written by someone who has witnessed each of these advancements over the course of the ultrasound era and can put them into context. It's often impossible to tell when most medical breakthroughs actually begin. They have a tendency to evolve, and many people will take credit for being the first to achieve success. There is no such doubt with ultrasonography in obstetrics and gynecology, as it had a very clear beginning in 1958 with Ian Donald, John Vicar, and Tom Brown's classic Lancet publication "The study of abdominal tumors by pulsed ultrasound" (Donald et al., 1958). This is a bad title since it obscures the true significance of the publication, which was exclusively devoted to ultrasound research in clinical obstetrics and gynecology and included the first ultrasound images of the fetus as well as gynecological masses. The other distinguishing feature. This landmark work is the starting point for all developments in ultrasound diagnosis (or Sonographer) in Obstetrics and Gynecology, and this brief history provides a personal assessment of the ensuing timeline of key events and breakthroughs up to the present. It would be remiss of me not to name some of the great scientists of the nineteenth and twentieth centuries whose conceptual breakthroughs opened the path for the current ultrasound machine. Although Thomas Young first defined "phase shifting" in reference to light waves in 1801, it is now employed in ultrasound phased array systems to manage interference patterns and to create 3D images. The "Doppler effect" was first described in 1842 by Christian Doppler in reference to the motion of stars, but it is currently employed as the foundation for blood flow investigations in pelvic veins and the fetus. In 1880, Pierre Curie described the piezoelectric effect, in which mechanical distortion of ceramic crystals causes an electric current to flow through them. In 1949, George Ludwig at MIT and John Julian Wild at the Technical Research Institute in Minnesota employed the first primitive A-scan metal defect detectors and variations of this equipment to identify gallstones and breast masses, respectively. Lund University's Inge Elder and Carl Hertz used a metal defect detector to get M-mode recordings from the adult heart in 1953. The first 2D images were published in 1952 by Wild and his engineer John Read, but their efforts were focused on tissue characterization, particularly of breast tumors, and the credit for producing the first tomographic images of human anatomy must go to Douglass Howry in Denver, who published his landmark paper (Howry, 1952) in the same year. The Hoary method, which relied on immersing the body portion to be investigated in degassed water (called water delay scanning) to eliminate art factual echoes from surface structures, had a severe flaw. The equipment was inelegant and uncomfortable for the patient, as shown in Figure 1, and it seems unlikely that ultrasound diagnosis would have made the breakthrough into becoming the most widely used imaging modality in clinical practice if it hadn't been for Donald and Brown's development of the compound contact scanner in the late 1950s. He was a compassionate and conscientious guy who was refused honours in his own county because of his anti-abortion position. He worked furiously, partially because he was a workaholic, but mostly because he had serious rheumatic heart disease (he'd had three mitral valve procedures), and every second was valuable to him. Donald was fortunate in that he knew little about the work being done in Denver, so armed with some radar technology learned in the air force, he teamed up with a brilliant engineer named Tom Brown and, with the help of a local engineering firm, developed the Diasonograph, the world's first contact compound 2D ultrasound scanning machine. He was a caring and thoughtful man who was denied honours in his own county due to his anti-abortion stance. He worked tirelessly, partly because he was a workaholic, but largely because he was suffering from severe rheumatic heart disease (he'd had three mitral valve surgeries), and every second

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