Opinion

The mid-pregnancy ultrasound assessment – quo vadis?

It is a sign of the pace of change in the use of ultrasound in pregnancy that we are discussing the changing shape of mid-pregnancy assessment, when the issues surrounding the original use of such an application are yet to be resolved[1,2]. Currently, given skilled staff and adequate equipment, it is possible to confirm dates, identify most major structural anomalies, and, through the use of morphological markers, achieve limited success in identifying pregnancies at increased risk of aneuploidy[3]. Ultrasonography remains one of the most operator-dependent of diagnostic technologies. The combination of skilled personnel and modern equipment can be hard to come by, and the true ability of a mid-pregnancy scan is still debated[4]. Any perceptions regarding the evolution of the second-trimester assessment must be considered in this context.

The timing of the original pregnancy scan arose because of several factors. The initial quality of early ultrasound machines made diagnosis of anomalies difficult in the early stages of pregnancy[5], although reasonably accurate dating was possible before the inception of real-time B-mode scanning[6]. With the use of amniocentesis for advanced maternal age, an ultrasound scan between 16 and 19 weeks' gestation became more valuable, as not only could dates be confirmed, but the optimal site for the introduction of the amniocentesis needle could also be identified. Biochemical screening, initially for neural tube defects[7], and later for Down's syndrome[8], relies heavily on ultrasound to provide an accurate gestational age.

The early 1980s heralded the arrival of the first capable real-time ultrasound machines. It became possible to diagnose a vast number of fetal structural anomalies, which in turn helped the prospective parent to decide about the continuation of the pregnancy, or to prepare for events after delivery[9,10]. The concept of morphological markers (banana and lemon signs[11], choroid plexus cysts[12]) for structural and chromosomal anomalies was introduced. Ultrasound-guided procedures helped to minimize the risk of such interventions, while Doppler ultrasound provided us with greater knowledge of the hemodynamic changes that take place in the uteroplacental and fetal circulations during pregnancy[13–15].

Ultrasound manufacturers have taken advantage of revolutionary developments in computer technology to produce machines and transducers with ever greater resolution, particularly at higher frequencies. These machines, whether transabdominal or transvaginal, have made routine investigation in early pregnancy a reality. Early pregnancy dating, confirmation of viability, diagnosis of multiple pregnancy and abnormality can now be attained with a 10–14-week scan. It is therefore apparent that much of what is currently achieved at the mid-pregnancy assessment can be fulfilled by the 12–14-week scan[16,17]. Earlier

diagnosis will include pregnancies that would have been lost through the process of natural wastage, but it allows women to make decisions about their pregnancy at a much earlier stage than before. Invasive prenatal diagnostic testing can also be offered at this stage, accepting the potential dangers of early chorionic villous sampling[18] and early amniocentesis[19].

Nuchal translucency is a transient finding in early pregnancy, observed at a time when dramatic changes are occurring in the uteroplacental and fetal circulations. The transient nature probably reflects the completion of these changes in uteroplacental and fetal hemodynamics. Within a few weeks, the fetal circulation adapts and the fluid typically disappears. The confirmation that increased fetal nuchal translucency is associated with an increased risk of chromosomal abnormality[20], as well as structural, particularly cardiac and genetic syndromes[21,22], raises the possibility of adapting (or applying) the early scan to meet the needs of the original mid-pregnancy assessment. Two important issues then arise; the true ability of the early pregnancy scan to achieve these objectives and the future role, if any, of the second-trimester scan.

Lively discussions take place at every scientific meeting regarding the true capability of the early pregnancy assessment. It is now generally agreed that the estimation of gestational age is best performed using ultrasound, early in the pregnancy[23]. The detection of anomalies, whether using transvaginal[16] or transabdominal probes[24], continues to improve, again through the use of better training and technology. While the best means of exploiting the relationship between increased nuchal translucency and aneuploidy in screening for fetal abnormality may be a subject of debate[25], it would be churlish to ignore the information altogether.

This evokes the question of the future of the mid-pregnancy assessment, in terms of both its timing and what is to be achieved by the investigation (if a detailed first-trimester scan has been performed). The paucity of anomalies left after first-trimester anomaly and nuchal translucency screening renders the description 'anomaly scan' at 20 weeks' gestation virtually redundant. In addition, the detailed early scan annuls the significance of 'soft markers' of aneuploidy, e.g. mild hydronephrosis[26], at the mid-pregnancy scan. It is also more difficult to justify its use for this purpose in terms of cost–benefit analysis[27]. This investigation is likely to be most useful in the prediction of complications such as preterm delivery and uteroplacental disorders that present later in the pregnancy.

Color Doppler has greatly improved access to the use of Doppler ultrasound, without necessarily resulting in a corresponding improvement in the skill of the operator; this problem can only be addressed by proper training and

meticulous attention to detail. While the reproducibility of uterine artery Doppler ultrasound screening in pregnancy varies[28–30], it is generally accepted that there is a strong relationship between elevated uterine artery resistance and perinatal complications, particularly pre-eclampsia[31]. The finding of elevated resistance in both uterine arteries (bilateral notches) at 20[32] or 24 weeks'[33] gestation identifies a cohort of women at considerable risk of early delivery as a result of uteroplacental problems. The next logical step is to find and introduce interventions that will prevent or palliate such complications; studies are currently being conducted to address the issue.

Finding suitable prophylactic therapies has proven more difficult than originally envisaged[34,35]. There remains a nagging suspicion that aspirin, given in adequate doses, can improve the outcome in certain high-risk pregnancies[36]. Other regimens may also prove useful in this regard. For example, while glyceryl trinitrate[37], a nitric oxide donor, has a limited benefit as a single treatment, it may be of use in combination therapy. Meanwhile, a paper[38], published in the previous issue of this Journal, reports a link between short cervical length and an increased risk of preterm delivery. Mid-trimester cervical cerciage may see a resurgence in popularity.

In the current issue, Yinka Oyelese and colleagues[39], Nomiyama and colleagues[40], and Fung and colleagues[41], report an improvement in the previously poor diagnostic sensitivity of screening for vasa previa. This condition, though rare, is associated with a very high fetal mortality rate (the argument proposed to justify screening). In surviving cases, fetal anemia requiring transfusion is common. Transvaginal ultrasound and color Doppler screening helped to avoid fetal losses in the three reports, but, as expected with such a rare condition, not all cases were detected and fetal deaths still occurred among the cases reported. Antenatal diagnosis of the condition is not unexpectedly associated with a good pregnancy outcome following elective delivery.

There are several risk factors for this condition, the most common ones being a low-lying placenta and multiple pregnancy. Taipale and colleagues[42] have reported a marked reduction in false-positive diagnosis of the condition using transvaginal ultrasound between 18 and 23 weeks. While it would be difficult to justify a mid-pregnancy ultrasound-based assessment solely to identify vasa previa, these reports provide another example of the potential of a mid-pregnancy scan to help to identify pregnancies at increased risk of perinatal complications. Intervention for fetal abnormalities, which are not identified until late in the second trimester, raise ethical, moral and legal issues that vary within individuals and society. The exact timing of this type of scan is, therefore, likely to vary around the world.

The practice of medicine is an art, perfected through learning and experience. New technological frontiers appear, before we have even consolidated the use of current modalities. Our challenge is to use our insight and skills to produce the scientific evidence that will clarify the best use of new technologies in our practice. The evolution of the mid-pregnancy ultrasound assessment serves as a good example of the constant need for such innovation.

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