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Editorial

Doctor, can I hear the heart beating? When and why is most opportune to use doppler during the first scan in pregnancy

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The very first scan during the pregnancy usually represent a moment of excitation and anxiety for the woman or the couple. It is more and more common that the woman asks for an early scan, before the first trimester screening (that takes place between 11 and 13+6 weeks of gestation), to confirm the vitality of the embryo. This is for both reasons, the accuracy of the pregnancy tests to detect the pregnancy status since the very first weeks, and the increasing number of pregnancies following in vitro fertilization techniques.

An eagerly awaited moment for the couple during that scan, is of course the first auscultation of the heartbeat of the fetus. This sound encourages the parents and reassure them. Although this, an affirmative response to the request of hearing the heartrate is not always possible neither in the case of an alive embryo, for medical reasons following the living literature and the subsequent international guidelines.

Albeit to show the motion of the hearth with a transvaginal or transabdominal scan in M-mode is safe, in the case of a very early pregnancy, the use of the Power Doppler is not.

First, is important to differentiate the embryonic period, which starts from the conception to the 10+6 week of pregnancy [1], and the fetal period (that is subsequent and starts from 11 weeks or 45 mm of Crown-Rump Length). The embryonic phase is characterized by a rapid cell division together with the development of the embryonic organs. At the same time is important to highlight that the fetal–placental circulation is, during this period, not yet established [2].

Back to the scan aspects, the conformity of the ultrasound machine and the competency of the operators are of course mandatory, given the potential risk of an apparently un-harmful technique. Albeit there is no evidence that repeated exposure to scans has cumulative or detrimental effects, embryonic/fetal structures could be exposed to thermal and mechanical stress, represented by the thermal index (TI) and the mechanical index (MI).

Specifically, the TI is the ratio of the machine power output to the power required to raise the temperature of bone or soft (TIB and TIS) by 1°C. Royal College of Obstetricians and Gynecologists advise that the higher the TI, the shorter the ultrasound exposure should be [2].

On the other hand, "the MI is a parameter whose value is proportional to the peak negative pressure in the imaging pulse and inversely proportional to ultrasound frequency" [2]. An MI lower than 1.0 indicates that effects arising from acoustic cavitation are very unlikely. In obstetrics, there is usually no need to increase the energy output levels and the MI can be kept below 1.0 [2].

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The most used pre-setting in the obstetric contest is the so-called "B-mode". This represent a safe pre-set given the generated intensities that are low. Plus, the time exposure is, as it should be, very limited and rarely exceed 40 minutes.

Other setting, such as Colour Doppler and pulsed wave Doppler, more useful during the later stages of pregnancy, and anyway later than 10+6 weeks, involve greater average intensity and power outputs than the B-mode; this result in potential risk to the embryo/fetus, principally from heating.

In this contest, it's easy to understand why is important that these parameters should be adjusted by the operator in order to maintained TI less than or equal to 1.0, expecially in gestations under 10 weeks. Plus, as said, is fundamental to reduce the exposure time.

Moreover, an emerging 'problem' is the increasing request by the couple of 'souvenirs' images such as 3D or 4D. While the use of 3D ultrasound does not require higher ultrasound exposure than 2D, on the contrary, 4D ultrasound (real-time moving 3D) requires higher energy output and a documented change in TI and MI.

If B-mode ultrasound pre-set seems safe and without any harmful effects on the delicate development of embryonic structures before 11 weeks of gestation, Colour and pulsed wave Doppler involve greater average intensity and animal studies have suggest that prolonged, high intensity can be associated with permanent harmful biological effects [2].

Given this, the use of colour and pulsed wave doppler is not recommended during the embryonic period of development. If use of Doppler is clinically indicated, then the exposure time should be kept to a minimum [1].

In conclusion, patients should be aware of these aspects, in order to reduce their expectation during their first appointment and to reassure them that the hearing of their baby's heartbeat should be only postponed after 11 weeks.

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