



Statement on the safe use of Doppler  
in fetal second and third trimester ultrasound examinations.

Following the implementation of Saving Babies' Lives Care Bundle version 2 (SBLCB v2) and other national programs aimed at reducing stillbirth and avoidable perinatal harm, some Ultrasound Departments and Fetal Medicine Units may see an increase in the use of pulsed Doppler (colour flow and spectral imaging) to assess fetal condition in the second and third trimesters of pregnancy.

These guidelines recommend that pulsed Doppler examinations of the umbilical, middle cerebral arteries and/or ductus venosus form a routine part of the assessment of fetuses with growth restriction or recurrent reduced fetal movements. These are both conditions linked to an elevated risk of stillbirth, perinatal morbidity or mortality. The benefit of adding pulsed Doppler to fetal biometry in high risk pregnancies has been shown in multiple studies [1-4]. Safety concerns regarding use of pulsed Doppler should be considered while performing these examinations, but should not present a bar to collection of the recommended set of images required to complete the diagnostic study.

Pulsed Doppler applications use an increased output power (compared to B mode imaging) and therefore the displayed safety index, Thermal Index (TI), is typically higher. This increase in output power represents an increase in thermal hazard within fetal tissues.

Absorption of ultrasound by different tissues (and therefore the degree of heating) varies greatly, fully calcified bone absorbing the most. The increase in temperature of the bone will also have a heating effect on the adjacent tissues. Some tissues, such as the brain, are more sensitive to thermal damage, therefore care must be taken when using pulsed Doppler in the fetal brain especially as the cranial bone is nearer to the transducer and becomes more calcified in later pregnancy. Careful attention should be paid to Thermal Index in Bone (TIB) and exposure time when using pulsed Doppler for middle cerebral artery assessment.

The guidelines also recommend Doppler assessment of the Uterine Arteries, this does not present an increased thermal hazard to the fetus as the fetus does not lie in the path of the pulsed Doppler beam.

To reduce the possible risk of thermal effects on fetal tissues, practice the ALARA principle (As Low As Reasonably Achievable) by reducing the TIB as low as possible and limiting exposure time, whilst still obtaining a diagnostic image. Particular care must be taken when using pulsed Doppler for research, teaching or training purposes as scanning times are likely to be longer than for diagnostic examinations.

Please review the table below which details the advised TIB levels and recommended safety limits for Obstetric scans more than 10 weeks gestational age.

| <b>TIB</b> | <b>Recommended scanning time</b>                    |
|------------|---|
| 0.7-1.0    | Restrict time to 60 mins                            |
| 1.0> -1.5  | Restrict time to 30 mins                            |
| 1.5> - 2.0 | Restrict time to 15 mins                            |
| 2.0> - 2.5 | Restrict time to 4 mins                             |
| 2.5> -3.0  | Restrict time to 1 min                              |
| Over 3.0   | Scanning of fetus not recommended, however briefly. |

Please review the Safety Guidelines prepared by BMUS for more detailed recommended safety indices levels and scan times.

<https://www.bmus.org/static/uploads/resources/BMUS-Safety-Guidelines-2009-revision-FINAL-Nov-2009.pdf>

1. Lees CC, Marlow N, van Wassenaer-Leemhuis A et al. 2 year neurodevelopmental and intermediate perinatal outcomes in infants with very preterm fetal growth restriction (TRUFFLE): a randomised trial. Lancet 2015. doi:10.1016/s0140-6736(14)62049-3
2. Alfirevic Z, Stampalija T, Dowswell T. Fetal and umbilical Doppler ultrasound in high-risk pregnancies. Cochrane Database Syst Rev 2017; 6: CD007529. doi:10.1002/14651858.CD007529.pub4
3. Flood K, Unterscheider J, Daly S et al. The role of brain sparing in the prediction of adverse outcomes in intrauterine growth restriction: results of the multicenter PORTO Study. Am J Obstet Gynecol 2014; 211: 288.e281-285. doi:10.1016/j.ajog.2014.05.008
4. Norman JE, Heazell AEP, Rodriguez A et al. Awareness of fetal movements and care package to reduce fetal mortality (AFFIRM): a stepped wedge, cluster-randomised trial. Lancet 2018; 392: 1629-1638. doi:10.1016/S0140-6736(18)31543-5

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