

## Maternal blood flow to the placenta

In the late 1940's, Beker (*J Obstet Gynaecol Brit Emp* 1948;55:756-65) and Bastiaanse and Mastboom (*Ned Tijdschr Geneesk* 1949;93, 2609-18) hypothesized that placental hypoxia could be the trigger of pre-eclampsia. However, no reliable technique existed at that time to assess maternal blood flow to the placenta. In 1953, McClure Brown and Veall from the Hammersmith Hospital in London described a technique to measure maternal blood flow to the placenta in normotensive and hypertensive pregnancies (*J Obstet Gynaecol Brit Emp* 1953;60:141-7): they blindly inserted a 18G needle infusing procain until they could tap blood from the choriodecidual space; at that point, saline marked with radioactive sodium was rapidly injected with a specially designed tool (Figure), and the radioactive decay curve over the placenta was drawn with a Geiger counter. The radioactive sodium washout was thought to be correlated with maternal blood flow, and was slower in hypertensive women, suggesting a 60% reduction in blood flow compared to controls.

The Doppler principle was first described over 100 years ago by Christian Andreas Doppler in Austria in 1842. Medical applications of the ultrasonic Doppler techniques were first implemented by Shigeo Satomura and Yasuhara Nimura at the Institute of Scientific and Industrial Research in Osaka, Japan in 1955 for the study of cardiac valvular motion and pulsations of peripheral blood vessels (*Ultrasound Med Biol* 1986;12:187-95). The Satomura team which also included Ziro Kaneko, pioneered transcutaneous Doppler flow measurements in 1959, several years ahead of similar work at the University of Washington in Seattle. It has also become known from the work of Ziro Kaneko and Kanemasa Kato in Satomura's laboratory in 1962 that blood flow can be detected by the ultrasonic Doppler method largely because blood itself consists of a suspension of "uncorrelated point back-scatterers" (the red cells) with varying density and compressibility, and not because of turbulence in the flow stream as was previously thought. In 1966, Kato and Izumi pioneered the directional flow-meter using the local oscillation method where flow directions were detected and displayed. This was a breakthrough in Doppler instrumentation as reverse flow in blood vessels could then be documented.

Stuart Campbell and David Griffin at the King's College Hospital in London suggested in

1983 that the shape of the arterial flow velocity waveforms would be more useful in fetal assessment. In the same year Campbell also reported on the usefulness of uterine and placental arcuate arterial waveforms (*Lancet* 1983;1:675-7). A few years later, Trudinger and colleagues confirmed that uteroplacental blood flow is reduced in pregnancies complicated by fetal growth restriction or pre-eclampsia (*Br J Obstet Gynaecol* 1985;92:39-45). This paved the way for non-invasive assessment of uteroplacental blood flow, and for studies on the early prediction of pre-eclampsia such as the one published by Sovio and Smith in this issue of BJOG (reference).

Word count: 463

BJOG Perspectives on 2017-OG-20268R1

### **Disclosure of interests**

The authors declare no conflicts of interest.

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**Legend to the figure:** The injection apparatus used by McClure Brown and Veall (*J Obstet Gynaecol Brit Emp* 153;60:141).

