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EDITORIAL

MONITORING OF NORMAL & ABNORMAL FOLLICULAR DEVELOPMENT BY COLOR DOPPLER

Menstruation is truly a weeping of a very disappointed endometrium. Cycle after cycle there takes place a symphony of vascular, stromal and glandular changes, all with the important aim of nourishing the newly arrived fertilized ovum as it floats and swims in the uterine fluid. Then with those tiny chorionic villi, it burrows through the cells of the endometrium with sheer speed and desperation to open up the waiting vessels and so to find themselves floating in oxygen and nutrients - the hemo-chorial placentation.

The micro-vascular changes that occur in the ovary within the endometrium can be studied with impunity with the Transvaginal Color Doppler technique. As the burgeoning lead follicle spurts forth into growth, areas of vascularity can be seen on the follicular rim. When the dominant

follicle reaches 10mm in dia, follicular flow velocity waveforms are usually detected. The RI is around 0.54 as ovulation approaches. A decline occurs 2 days prior to ovulation and reaches a nadir at ovulation - RI 0.44.

The marked increase in the peak systolic blood flow velocity within the follicle in presence of a relatively constant RI is an important finding which may herald impending ovulation. After ovulation, the RI shows a significant difference from preovulatory values. Shortly after ovulation the RI reaches 0.43, with a return to the earlier cycle level of 0.49. In case of a pregnancy, the RI always remains 0.50 from the 6th-12th week of gestation.

During the first trimester of pregnancy, the luteal flow is similar to the non-pregnant state in the early luteal phase. In threatened, incomplete and missed abortion, the RI and PI are significantly higher than in normal pregnancy.

Because of the angiogenesis which occurs in the follicle and the corpus luteum of the ovary and in the endometrium, endovaginal color doppler gives us a reliable and dramatic tool to study and observe the female reproductive system and vascular changes within the pelvis.

In most women, there is a small amount of end-diastolic flow in the uterine arteries in the proliferative phase. This disappears or becomes minimal during the day of ovulation and an increase in the RI and S/D ratio is found during the post-ovulatory drop in the serum oestradiol concentration. During the normal menstrual cycle, there is a sharp increase in the end-diastolic velocities between, the proliferative and secretary phase of the menstrual cycle. The lowest blood flow impedance occurs during the time of peak luteal function during which implantaion is likely to occur. In the anovulatory cycle, these changes are not present and a continuous increase in the RI is seen. In some infertile patients there is absence of end-diastolic flow in the uterine artery waveform and this may signify poor reproductive performance. In some infertile patients, the pulse doppler waveform analysis may demonstrate high velocity and high impedance flow with the pathological finding of reversal of flow.

Transvaginal Color Doppler could be used as a noninvasive assay of uterine receptivity. In IVF Programmes, if uterine conditions are adverse, this modality could enable clinicians to cryo-preserve the embryos and to reduce the number of transferred embryos where the conditions are optimal. Hence, uterine artery blood flow could be used to predict a hostile uterine environment prior to embryo transfer. If the uterine perfusion is poor, the patient could be advised that

pregnancy may be likely in the current treatment cycle and to have the embryos cryo-preserved for transfer at a later date. Also, since the probability of pregnancy is strongly related to the embryo quality and uterine receptivity, the latter should be assessed by color doppler ultrasound if the receptivity is optimal. The risk of multiple pregnancy could be obviated by single or dual embryo transfer.

OVULATION ABNORMALITIES :

Abnormal ovulatory patterns include Luteinized Unruptured Follicle Syndrome, asynchronous follicles, empty follicle syndrome and anovulation despite regular menstruation. Among these, the luteinized unruptured follicle syndrome is the one that is most extensively reported

LUTEINIZED UNRUPTURED FOLLICLE SYNDROME :

Luteinization of the unruptured follicle is seen as a progressive accumulation of strong echos predominantly located on the periphery of the cyst. For example, a mature ovarian follicle seen on day 14 of the menstrual cycle will persist for a few days without showing any signs of rupture and the flow pattern pulse doppler analysis from a prominant vessel in the wall of the follicle will reveal on increased diastolic flow and a decreased S/D ratio. However, sequential changes of the intraovarian blood flow noted in normal ovulatory cycles cannot be demonstrated by transvaginal color doppler in patients with proved luteinized unruptured follicle syndrome.

LUTEAL PHASE DEFECT

Luteal phase defect is characterised by deficient progesterone production during the luteal phase of the cycle This is a major factor for affecting nidation of an early embryo. Clinically, this defect is expressed as infertility or repeated first trimester abortion

Transvaginal sonography coupled with pulse wave doppler is an additional tool along with the hormonal profile to point towards luteal phase defect by inadequate vascularization. Studies of the luteal flow are useful in assessing corpus luteum function and these could be correlated to the hormone profile. As mentioned earlier, the luteal flow in normal early pregnancy is similar to the non-pregnant state in the early luteal phase. An increased corpus luteum RI reflects less chance for the embryo to survive.

ASSESSMENT OF OVARIAN BLOOD VESSELS DURING A STIMULATED CYCLE :

Three main changes characterize the intraovarian blood vessels in the hormone stimulated cycle .

1) The impedance to blood flow decreases during the follicular and the early luteal phase.

2) The number and size of blood vessels increase duing the follicular and early luteal phase and
3) Throughout the cycle, the blood vessels appear around the one or few leading preovulatory follicles.

It should be noted that in the hormone stimulated cycle, both ovaries are usually active and therefore both of them present clinical vascular changes. The number and size of intraovarian vessels increase during the follicular and early luteal phase and reach the maximum number and size during the formation of the corpus luteum. The corpus luteum may reveal increase vascularization.

Transvaginal Color Doppler is an important tool in monitoring the changes in impedance to blood flow in the ovarian and uterine vessels during hormone stimulated cycles in women undergoing invitro fertilization and may give us more information about the pathophysiology of infertility. Because of the application of this technique to determine optimal uterine conditions for embryo transfer, women with unfavourable condition for embryo transfer may benefit from cryo-preservation of the embryos. These embryos can be transfered, fewer in number (even single) when the conditions for embryo transfer are optimum.

DR. ADI E. DASTUR