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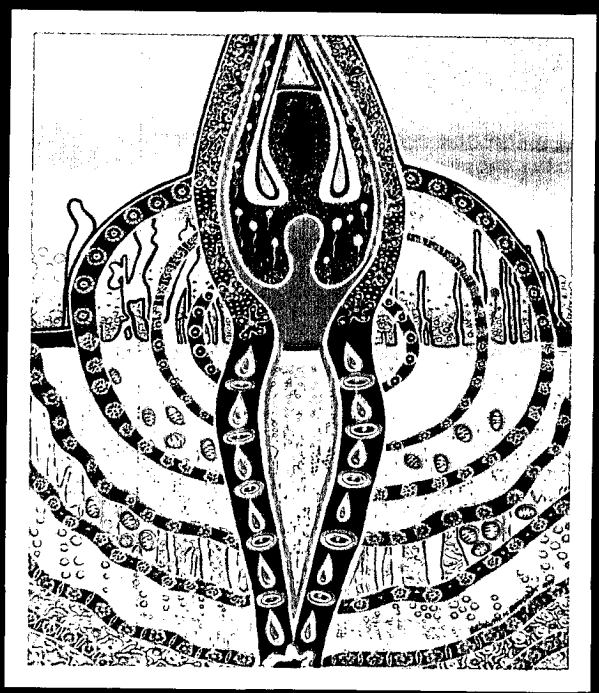

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Uterine Artery Vascular Impedance Measured by Doppler Sonography Throughout an IVF Cycle with Ovarian Stimulation Does Not Correlate with Pregnancy Outcome

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Summary

There have been conflicting reports on the relationship of vascular impedance of the uterine artery measured mid-cycle and pregnancy outcome in in vitro fertilization-embryo transfer (IVF-ET). The objective of this study was to compare uterine artery vascular impedance throughout the IVF cycle by pregnancy outcome. Measurements of the pulsatility (PI) and resistance indices (RI) were performed at baseline, day of oocyte retrieval, and mid-luteal (3 days post-ET). Patients were stratified by stimulation protocol and IVF outcome. Within each stimulation protocol, there was no difference between the PI or RI by pregnancy outcome at any time in the IVF cycle. The vascular impedance indices were lower in the luteal phase for all groups. Measurements of vascular impedance of the uterine arteries was not found to be associated with outcome of IVF-ET.

Introduction

Many studies have been reported focusing on the use of color Doppler imaging to measure vascular impedance of the uterine arteries, to predict the success of in vitro fertilization-embryo transfer (IVF-ET) cycles. Some researchers have found that increased resistance to uterine artery blood

flow, as measured by pulsatility (PI) and resistance indices (RI), negatively correlates with IVF outcome. Some studies have evaluated these parameters on different days of the cycle, i.e., the day of human chorionic gonadotropin (hCG) injection (1-3), the day of oocyte retrieval (4,5) or day of ET (6,7). The maximum acceptable PI has been reported to vary, in some reports it is 3.0 (1,2,4,5), while in others it has been reported as high as 3.3 (3,6). The same variation has also been reported with respect to the RI (4,7). Other studies have been unable to support these findings (8). The object of the study presented herein was to determine if these changes exist in an IVF cycle with controlled ovarian hyperstimulation (COH) and to determine if there is any time of the cycle that provides us with a higher degree of prediction of pregnancy.

Materials and Methods

A total of 253 IVF-ET oocyte retrieval cycles were evaluated from the Cooper Center for IVF from December, 1996 to September, 1998. To be included in the study, patients must have had color Doppler imaging, performed in our center, at three times during the cycle: 1) baseline (day 2 of the cycle or when down-regulation was achieved, 2) day of oocyte retrieval, and 3) mid-luteal phase (3 days post-ET). Patients were stratified by COH protocol. The protocol used in group 1 (n=97) was luteal phase leuprolide acetate (LA) starting day 22 of the cycle with gonadotropins added when down-regulation was achieved; group 2 (n=99) follicular phase LA/gonadotropins; and group 3 (n=57) diluted follicular phase LA/gonadotropins.

Color Doppler imagining was performed using a multifrequency endovaginal probe with color and pulsed Doppler capabilities (GE Logic 400, General Electric Medical Systems, Milwaukee, WI, USA). Color Doppler signals were obtained from the right and left ascending branches of the uterine arteries at the level of the internal os. A pulsed Doppler range gate was placed over each uterine artery to obtain velocity waveforms. Measurements of the PI and RI were obtained by electronically tracing the waveform and applying the following equations: PI = (A-B)/FD and RI = (A-B)/A where A is the maximum systolic velocity, B is the end diastolic velocity, and FD is frequency shift. Recordings of each artery were considered satisfactory when multiple waveforms of equal intensity were obtained. The average of the right and left uterine artery was used in the analysis. All calculations were performed by one sonographer.

Other variables included serum hormone levels of estradiol and progesterone, age, number of oocytes retrieved, and number of embryos transferred.

Within each stimulation group, the mean PI and RI were compared by phase of the cycle and pregnancy outcome using analysis of variance for

repeated measures. The association between serum hormone levels and vascular impedance were assessed using Pearson correlation coefficients.

Results

For patients in groups 1 and 3, there was no difference in age of the patients by conception outcome nor was there any difference in the median number of oocytes retrieved, fertilization rate or number of ET. In group 2, the fertilization rate and number of ET was higher in the women who conceived (Table 1).

The comparison of RI by conception is summarized in Tables 2 and 3. Within each stimulation protocol, there was no difference between the mean PI and RI by conception outcome at any time in the IVF cycle (p=NS, ANOVA). The vascular impedance indices were lower in the luteal phase for all groups (p<.05, ANOVA).

There was no association found between serum estradiol and progesterone levels and the PI and RI at any time during the cycle (p=NS, Pearson correlation coefficients).

Conclusions

Measurements of vascular impedance of the uterine arteries was not found to be associated with outcome of IVF-ET. The highest PI and RI on the day of oocyte retrieval where a pregnancy was achieved were 5.15 and .955, respectively. In the luteal phase, conception occurred when the PI was

Table 1 - Comparison of IVF characteristics by conception outcome[a]

Stimulation protocol	Age (years)	# oocytes retrieved	Fertilization rate (%)	# embryos transferred
Group 1				
Pregnant (n=59)	33 (24-39)	12 (3-38)	61 (20-100)	3 (2-5)
Not preg. (n=38)	35 (27-42)	13.5 (3-34)	55 (15-100)	3 (1-5)
Group 2				
Pregnant (n=36)	37 (24-43)	10 (3-24)	65.5 (32-100)[b]	4 (3-7)[b]
Not preg. (n=63)	37 (22-44)	9 (2-31)	50.0 (15-100)[b]	3 (1-6)[b]
Group 3				
Pregnant (n=15)	39 (32-44)	7 (3-20)	56 (14-80)	4 (1-5)
Not preg. (N=42	39 (26-46)	6.5 (2-21)	58.5 (14-100)	3 (1-5)

[a]Data presented as median (range)
[b]p<.05

Table 2 - Comparison of PI levels by conception outcome and phase of the cycle (Data presented as mean ± standard deviation)

	Phase of Cycle [b]		
IVF outcome [a]	Baseline	Day of oocyte retrieval	Luteal phase PI
Group 1			
Pregnant (n=59)	2.62±.78	2.64±.54	2.22±.49
Not pregnant (n=38)	2.65±.53	2.67±.43	2.24±.53
Group 2			
Pregnant (n=36)	2.91±.95	2.75±.56	2.53±.59
Not pregnant (n=63)	2.74±.69	2.65±.55	2.35±.51
Group 3			
Pregnant (n=15)	2.52±.67	2.71±.62	2.38±.64
Not pregnant (n=42)	2.51±.72	2.65±.57	2.33±.57

[a]p=NS by conception outcome (ANOVA)

[b]p<.05 comparing luteal phase levels to other phases of cycle (ANOVA)

Table 3 - Comparison of RI levels by conception outcome and phase of the cycle (Data presented as mean ± standard deviation)

	Phase of Cycle[b]		
IVF outcome[a]	Baseline	Day of oocyte retrieval	Luteal phase
Group 1			
Pregnant (n=59)	.87±.06	.88±.04	.83±.06
Not pregnant (n=38)	.88±.05	.89±.05	.83±.06
Group 2			
Pregnant (n=36)	.89±.05	.89±.04	.87±.05
Not pregnant (n=63)	.88±.06	.89±.04	.85±.06
Group 3			
Pregnant (n=15)	.87±.06	.89±.07	.86±.06
Not pregnant (n=42)	.86±.06	.89±.05	.84±.07

[a]p=NS by conception outcome (ANOVA)

[b]p<.05 comparing luteal phase levels to other phases of cycle (ANOVA)

4.15 and the RI was .955. There was no significant change from the baseline to day of oocyte retrieval with respect to measurements of resistance to uterine artery blood flow. Vascular impedance was lower in the luteal phase of all cycles, regardless of stimulation protocol.

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