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## Cardiac Output in Twin Pregnancy

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**Abstract.** No significant difference has been found in either stroke volume or cardiac output between twin pregnancies and singleton pregnancies. Cardiac output is less in pre-eclamptic twin pregnancies.

**Key words:** Cardiac output, Twin Pregnancy, Blood pressure

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### INTRODUCTION

It has been suggested that there are differences in the pattern of blood pressure change in twin pregnancies [1]. Other cardiovascular changes should be considered. Rovinski and Jaffin [6] suggested that cardiac output was slightly increased in women with twin pregnancies. However, at that time there was little awareness of the importance of the posture of the women at the time the measurements were made. Most of their measurements were made with women in the supine position which is known to cause problems in singleton pregnancies.

Transcutaneous aortic velography (TAV) measures aortic blood velocity using the Doppler shift effect from continuous ultrasound transmitted and received from the transducer in the suprasternal notch. The results obtained from this method of measurement of cardiac output also correlate well with actual pulsatile flow measured in vitro [3]. Integrating the area under the velocity time curve for each heart beat gives a measure of blood flow akin to stroke volume and hence by association with heart rate to cardiac output. This technique is independent of weight and height. Within individual subjects, TAV measured stroke distance shows close proportionality with stroke volume measured by dye dilution [5].

Preliminary observations have been made in women with twin pregnancies antenatally and postnatally both in the left lateral and supine positions. It is non-invasive and, therefore, can be repeated often throughout the pregnancy.

## METHODS

Transcutaneous aortic velograph (TAV) has been used in women with a twin pregnancy, several times antenatally and in some women in the early part of the puerperium to measure stroke distance and minute distance. The singleton data for comparison are from a group of women with normal singleton pregnancies. The non-pregnant values for women of reproductive age quoted are stroke distance 25.3 cm and minute distance 1725 cm. The women with twin pregnancies have been classified according to whether or not they developed pre-eclampsia, as defined by Nelson [4] as it has been suggested in singleton pregnancy that cardiac output is altered in women with proteinuric pre-eclampsia [2]. Arterial blood pressure was also recorded at the time of each TAV assessment.

## RESULTS

Table 1 gives range of stroke and minute distance by length of gestation in singleton pregnancies when assessed using this technique. The inter-patient variability is considerable, particularly in the latter part of pregnancy. It is not surprising, therefore, that although there are some of the women with twin pregnancies with high values (see individual values in Table 2), the majority have a stroke and minute distance within the singleton range when lying lateral. This applied also to the two pre-eclamptic twin pregnancies (Table 3).

Tables 2 and 3 show that measurements of both stroke distance and minute distance are less in the supine position again particularly in late pregnancy. The mean decrease in stroke distance in the supine position compared to the lateral measurement is 1.84 cm with a range of -6 to +13 cm. The corresponding drop in minute distance when the woman was supine was 106.5 cm (range -658 to +701).

Table 1. Singletons (in Lateral Position)

Gestation (weeks)	Number of patients	Stroke distance (cm)	Minute distance (cm)
		Mean $\pm$ SD	Mean $\pm$ SD
5	7	28.6 $\pm$ 3.2	2187 $\pm$ 231
6	10	32.6 $\pm$ 3.4	2504 $\pm$ 380
7	9	30.2 $\pm$ 2.6	2307 $\pm$ 230
8	6	32.5 $\pm$ 2.1	2445 $\pm$ 257
11	6	31.3 $\pm$ 1.3	2556 $\pm$ 255
13	5	31.2 $\pm$ 2.7	2457 $\pm$ 135
16	9	32.7 $\pm$ 4.3	2814 $\pm$ 280
20	5	34.0 $\pm$ 4.6	2948 $\pm$ 217
30	7	32.0 $\pm$ 4.6	2591 $\pm$ 428
33	5	26.6 $\pm$ 2.0	2298 $\pm$ 382
35	5	30.7 $\pm$ 3.8	2420 $\pm$ 126
36	7	28.6 $\pm$ 5.8	2427 $\pm$ 445
37	5	29.5 $\pm$ 5.6	2460 $\pm$ 165
38	9	27.8 $\pm$ 5.3	2150 $\pm$ 301
39	5	28.6 $\pm$ 7.3	2206 $\pm$ 533

Table 2. Normotensive Twin Pregnancies

	Week	Stroke distance (cm)		Minute distance (cm)	
		Lateral	Supine	Lateral	Supine
V.S.	4	31	33	1956	2238
	6	30	31	2052	2110
	8	32	35	2276	2242
	9	33	35	2253	2372
	12	35	39	2585	2909
	16	34	38	2722	3007
	22	37	40	2740	3398
A.L.	16	26.9	30.8	1545	1765
I.H.	17	28.1	29.4	2720	2626
L.J.	19	27.2	26.2	2089	2032
M.A.	20	35.4	34.4	2710	2726
	24	35	29	2714	2433
	27	37.5	26	2993	2312
	29	33	25	2894	2644
	33	37	24	3242	2541
F.C.	24	42	41	3312	3141
	26	33	32	3074	3038
S.M.	28	28.3	27.3	3120	2849
F.A.	33	26	26	2520	2400
	35	24	17	2400	1920
	36	24	19	2220	2160
	37	25	21	2400	2040
	38	27	25	2340	2340
	pp day 2	31	32	3240	2700
	3	31	31	3300	3240
4	32	36	2940	3060	
50	32	33	1965	2068	

Table 3. Pre-Eclamptic Twin Pregnancies

	Week	Stroke distance (cm)		Minute distance (cm)	
		Lateral	Supine	Lateral	Supine
A.R.	24	27	27	2688	2323
	28	25	18	2074	1737
	29	24	23	2002	1718
	31	25	17	2003	1569
	32	26.5	23.3	2262	2008
	33	24	17.5	2272	1722
D.B.	35	36	41	2147	2515
	36	38	38	2491	2678

The average minute distance with simultaneous arterial blood pressure recordings for antenatal twin pregnancies, normotensive and pre-eclamptic, are shown in Table 4. The minute distance is less in the pre-eclamptic twin pregnancies. The inter-relationships between these variables (Table 5) show in both categories the expected high correlation between systolic, diastolic and mean arterial pressure. Only in the normotensive group, however, is there an inverse association between minute distance and arterial blood pressure.

**Table 4. Minute Distance (cm) Systolic, Diastolic and Mean Arterial Pressure (mmHg) in Normotensive and Pre-Eclamptic Twin Pregnancies (Mean  $\pm$  SD)**

Normotensive (N = 19)		Pre-eclamptic (N = 6)	
2687.9 $\pm$ 353.3	Minute distance	2216.8 $\pm$ 260.5	
120.8 $\pm$ 13.1	Systolic B.P.	147.7 $\pm$ 12.7	
72.0 $\pm$ 9.7	Diastolic B.P.	96.7 $\pm$ 8.2	
88.6 $\pm$ 10.9	M.A.P.	113.7 $\pm$ 9.4	

**Table 5. Correlation Matrix (r) in Normotensive and Pre-Eclamptic Twin Pregnancies**

	Normotensive (N = 19)			Pre-eclamptic (N = 6)			
	Minute dist.	SBP	DBP	Minute dist.	SBP	DBP	
SBP	-0.38			SBP	0.14		
DBP	-0.35	0.73		DBP	-0.06	0.88	
MAP	-0.39	0.92	0.94	MAP	0.03	0.96	0.98

## DISCUSSION

In this early and preliminary study we have been unable to demonstrate significant differences in either stroke distance or minute distance, ie, stroke volume or cardiac output between twin and singleton pregnancies using TAV, although the expected differences with changing posture have been found. Both stroke volume and cardiac output in the left lateral position tend to be higher than those from the same women when lying supine. As in the non-pregnant, there is a tendency for cardiac output to decrease as arterial blood pressure increases, but only in normotensive women. Presumably the pre-eclamptic process leads to changes both in cardiac output and arterial pressure by a different mechanism from the normal control.

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