# BLOOD VESSELS OF THE TWIN PLACENTA IN RELATION TO ZYGOSITY

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*The anatomical characteristics of the arteries, veins and arteriovenous relationships, velamentous vessels, and vascular communications in 148 placentae from multiple pregnancies were studied. All features were found to show discordance of varying degrees, irrespective of the twins' zygosity. Singular involvement of one component of the twin placenta by hydramnios or congenital defects, incidence of vascular communications and the anatomical characteristics of the vessels in conjoined twins, acardiac monsters and triplets, and a chromosomal discordance in a MZ pair, lend additional support to the initial surmise of anatomical characteristics of fetal blood vessels of the placenta being determined by functional demands. It is suggested that the inequalities of prenatal environment be assessed by an examination of the fetal blood vessels of the placenta before drawing homologies in the twin concordance studies.*

## INTRODUCTION

Significance of the examination of the twin placenta has been stressed in recent years on account of its importance in determination of zygosity (Benirschke 1961), assessment of prenatal development by examination of its blood vessels (Bhargava and Raja 1971) and for detection of twin transfusion syndrome (Bleisch 1965, Rausen et al. 1965).

In earlier reports (Bhargava 1969, Barghava and Raja 1971) I stressed that the examination of fetal blood vessels of the placenta for their anatomical characteristics and interrelationships may be used as parameters of stress during prenatal development in single and multiple pregnancy. I have also shown that the incidence of marginal vessels in monochorial placentae is almost invariably associated with direct vascular anastomosis between the two components (Bhargava et al. 1974).

The pattern of branching of these blood vessels can be described as disperse or magistral, each type having almost equal incidence. It has been shown to be the same in all the children born of the same mother, and consequently to be determined genetically (Schordania 1929, Bascich and Crawford 1960). In a previous research (Bhargava and Raja 1970) we have found it to represent a key factor, linking various anatomical characteristics. On basis of our findings of discordance of the anatomical characteristics, including pattern of branching between different components of the placentae from multiple pregnancies (Bhargava and Chakravarty 1974), we have stated that these characteristics, including the pattern, are determined largely in response to functional demands.

The present communication is directed towards a plea that before the application of the twin concordance method, the inequalities of the prenatal environment be assessed by an examination of the placental vessels.

## MATERIALS AND METHODS

The material consisted of 148 sets of placentae from multiple pregnancies (including 3 triplets and 2 conjoined twins) subdivided as followed: dichorial diamniotic, separate, 72; dichorial diamniotic, fused, 48; monochorial diamniotic, 18; monochorial monoamniotic, 10.

The fetal blood vessels of the placenta were visualised by making accurate tubular injection corrosion preparations with cellulose acetate buterite in acetone, with pressure within physiological limits (Bhargava and

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Raja 1969). The general anatomical features, including the pattern of branching and incidence, level of occurrence and degree of severity of tortuosity of arteries and veins, arteriovenous dissociation and reversed arteriovenous crossings, were assessed quantitatively according to the procedure reported earlier (Bhargava and Raja 1970). Presence of velamentous vessels and vascular communications were looked for, and incidence of hydramnios and congenital anomalies in relation to the placental component involved was also recorded. Comparisons in relation to the concordance and discordance of these features in different components of the placenta were made and the data thus collected were subjected to statistical analysis by the chi-square test with Yate's correction.

## OBSERVATIONS

Absence of one umbilical artery has been observed in 12 out of 148 placentae. The pattern of branching of arteries and veins is similar in all the placentae. In monochorial ones, the pattern of branching of arteries and veins is the same in either component in the dichorial ones, it is similar in 76 and different in 44 placentae.

A comparison of other characteristics of the arteries (Table 1), veins (Table 2), and other arteriovenous relationships (Table 3), in either component of the placentae in relation to zygosity, also shows varying degrees of discordance.

Velamentous vessels and consequently direct vascular anastomoses have been observed in nearly all the monochorial placentae.

Table 1. *Comparison of anatomical features of arteries of the two components of 148 twin placentae*

| Feature | Monochorial (N = 28) | | | | Dichorial (N = 120) | | | | Significance ($\chi^2$ test) |
|---|---|---|---|---|---|---|---|---|---|
| | Concordant | | Discordant | | Concordant | | Discordant | | |
| | n | % | n | % | n | % | n | % | |
| Number | 23 | 82.14 | 5 | 17.86 | 92 | 76.67 | 28 | 23.33 | ns |
| Communication | 13 | 46.57 | 15 | 53.43 | 50 | 41.66 | 70 | 58.34 | ns |
| Pattern | 28 | 100.00 | 0 | 0.00 | 76 | 63.33 | 44 | 36.67 | 0.001 |
| Number of primary divisions | 10 | 35.71 | 18 | 64.29 | 44 | 36.67 | 76 | 63.33 | ns |
| Tortuosity level | 12 | 42.86 | 16 | 57.14 | 57 | 47.50 | 63 | 52.50 | ns |
| Tortuosity degree | 10 | 35.71 | 18 | 64.29 | 51 | 42.50 | 69 | 57.50 | ns |

Table 2. *Comparison of anatomical features of veins of the two components of 148 twin placentae*

| Feature | Monochorial (N = 28) | | | | Dichorial (N = 120) | | | | Significance ($\chi^2$ test) |
|---|---|---|---|---|---|---|---|---|---|
| | Concordant | | Discordant | | Concordant | | Discordant | | |
| | n | % | n | % | n | % | n | % | |
| Pattern | 28 | 100.00 | 0 | 0.00 | 76 | 63.33 | 44 | 36.67 | 0.001 |
| Number of primary divisions | 15 | 53.57 | 13 | 42.43 | 52 | 43.33 | 68 | 56.67 | ns |
| Tortuosity level | 10 | 35.71 | 18 | 64.29 | 46 | 38.33 | 74 | 61.67 | ns |
| Tortuosity degree | 13 | 42.43 | 15 | 57.57 | 39 | 32.50 | 81 | 67.50 | ns |

Table 3. *Comparison of anatomical features of the arteriovenous relationships of the two components of 148 twin placentae*

| Feature | Monochorial (N = 28) | | | | Dichorial (N = 120) | | | | Significance ($\chi^2$ test) |
|---|---|---|---|---|---|---|---|---|---|
| | Concordant | | Discordant | | Concordant | | Discordant | | |
| | n | % | n | % | n | % | n | % | |
| Primary division ratio | 10 | 35.71 | 18 | 64.29 | 46 | 38.33 | 74 | 61.67 | ns |
| AV dissoc. level | 13 | 46.57 | 15 | 53.43 | 57 | 47.50 | 63 | 52.50 | ns |
| AV dissoc. degree | 15 | 53.43 | 13 | 46.57 | 46 | 38.33 | 74 | 61.67 | ns |
| AV reversal level | 12 | 42.86 | 16 | 57.14 | 39 | 32.50 | 81 | 67.50 | ns |
| AV reversal degree | 20 | 71.43 | 8 | 28.57 | 35 | 29.16 | 85 | 70.84 | 0.001 |

Table 4. *Comparison of twin placentae in relation to incidence of abnormalities of development*

| Twin placenta | One baby abnormal | | | Both babies abnormal | | | Grand total |
|---|---|---|---|---|---|---|---|
| | Without hydramnios | With hydramnios | Total | Without hydramnios | With hydramnios | Total | |
| Monochorial | 1 | 4 | 5 | 5 | 7 | 12 | 17 |
| Dichorial | 11 | 4 | 15 | 7 | 6 | 13 | 28 |
| Total | 12 | 8 | 20 | 12 | 13 | 25 | 45 |

Table 5. *Comparison of twin placentae in relation to incidence of hydramnios*

| Placenta | One baby affected | | | Both babies affected | | | Grand total |
|---|---|---|---|---|---|---|---|
| | Without anomalies | With anomalies | Total | Without anomalies | With anomalies | Total | |
| Monochorial | 3 | 4 | 7 | 6 | 7 | 13 | 20 |
| Dichorial | 10 | 4 | 14 | 11 | 6 | 17 | 31 |
| Total | 13 | 8 | 21 | 17 | 13 | 30 | 51 |

Congenital anomalies and hydramnios involved one or both fetuses and corresponding component of the placenta, with varying incidences, the interrelationship of which is presented in Tables 4 and 5. The discordance between the incidence of the two entities in relation to unilateral or bilateral involvement is rather obvious.

In a postnatal follow-up for developmental defects, as suggested by unilateral abnormalities of blood vessels in a monochorial placenta, the suspected twin showed a chromosomal aberration - Trisomy 21, with the cotwin having a normal karyotype (Bhargava et al. 1974).

The discordance of vascular anatomy and inequalities of the components of the placenta are very well illustrated in placentae from triplets, conjoined twins, and acardiac monsters.

## COMMENTS

These observations disagree with the earlier reports that the pattern of branching is the same in placentae of all the twins and the siblings born of the same mother (Schordania 1929, Bascich and Crawford 1960). Discordance of the pattern in dichorial placentae, and other vascular characteristics in monochorial and dichorial placentae, as shown by absence of significant differences (Tables 1, 2, and 3) in most of them, in relation to the zygosity, support the contention that anatomical characteristics of fetal blood vessels differentiate in response to functional demands, rather than to genetic influences solely. It is interesting to note that the period of differentiation of these features termed as parameters of stress — the later part of the first trimester of pregnancy (Bhargava 1971) — coincides with the period of rapid growth of the fetus and the walls of the uterus. Exaggeration of these parameters to a significantly abnormal quantum, and a high incidence of absence of one umbilical artery — a potentially abnormal state (Bhargava et al. 1971) — in placentae from multiple pregnancy, further support the above contention. Additional support is given by singular involvement of twins by hydramnios or developmental defects and discordance in vascular anatomy of placentae from triplets and conjoined twins, and in chromosomal picture in a MZ twin pair (Bhargava 1974).

A routine postnatal examination of fetal blood vessels of placentae from multiple pregnancy for absence of one umbilical artery, velamentous vessels, and consequently vascular communications, especially in monochorial placentae, and for the anatomical features termed as parameters of stress, can thus be of considerable help in assessing inequalities of prenatal environment. This can easily be carried out by irrigating the cut end of the umbilical vein in the cord with water, till it stands clear in contrast to the bluish colour of umbilical arteries crossing it on the chorial surface. The incidence, level of occurrence, and degree of severity of the parameters can then be assessed in accordance with the procedure reported earlier (Bhargava and Raja 1970).

Therefore, it is suggested that the twin concordance method be supplemented with an adequate assessment of the anatomical characteristics of the placental blood vessels, which may provide a sensitive evaluation of prenatal development. Twins with a monochorial diamniotic placenta without communications should be considered ideal for twin concordance studies.

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