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Disturbed Intrauterine Growth in Twins: Etiological Aspects

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Abstract. Factors presumed to influence intrauterine growth were analyzed among 192 twin pairs. Mean birthweight was considerably reduced compared to single pregnancies, and a high proportion of twins were growth retarded (12.4%). One fifth of the twin pairs presented an intrapair birthweight difference exceeding 20%. DZ twins were sligthly heavier than the MZ, while dichorionic twins had a somewhat higher birthweight than the monochorionic. The intrapair weight differences were greater in twins with fused dichorionic placentae than in those with separate ones. The umbilical cord insertion seemed to influence intrauterine growth. Fetuses with velamentously or marginally inserted cords presented more frequently retarded growth than twins with centrally inserted umbilical cords. Though a total of 13 cases of twin transfusion syndromes were observed, these were not characterized by great intrapair weight differences.

Key words: **Placental pathology, Umbilical cord, Twins, Intrauterine growth retardation**

INTRODUCTION

Both in obstetrics and pediatrics twin pregnancies represent a challenge first of all due to to a preterm uteroplacental insufficiency and other complications (e.g., hypertensive disorders of pregnancy). Growth retardation of one or both of the fetuses is a frequently encountered complication. At almost every stage of pregnancy the twin fetus has a lower weight than a singleton [6]. This tendency is, however, accentuated in the later part of pregnancy, reflecting a limited capacity in the maternal supply line.

Intrapair weight differences represent another aspect of disturbed intrauterine growth among twins. While some cases can be explained by transfusion syndromes, the causes are uncertain in the majority of cases. Differing sex [9], type of placentation [5] and localization of the placenta [3] are some factors presumed to influence growth.

An insufficient intrauterine environment may retard growth to an extreme degree. The resulting low birthweight may also possibly disturb later growth and development – both physically and psychologically.

In the present study we have tried to clarify some of the possible factors responsible for retarded intrauterine growth among twins. Special emphasis has been paid on intrapair weight differences. The perinatal and pediatric outcome will be presented in an ensuing paper.

MATERIAL AND METHODS

Twin births after the 26th week of pregnancy were registered from 1976 throughout 1983 at Kvinneklinikken, Rikshospitalet. Birthweight, length and head circumference were recorded. Ponderal index, $PI = [\text{weight (g)} \times 100] / [\text{length (cm)}]^3$, was calculated for each infant. Gestational age was calculated from the first day of the last menstrual bleeding. Birthweight was also calculated in standard deviations according to Altman and Cole's nomograms [1]. Intrauterine growth retardation (IUGR) was defined as a birthweight below mean – 2 SD.

Zygosity of same-sex pairs was established by placental examination – monochorionic placenta implying MZ twins, and/or bloodtyping of 7 polymorphic systems. Further information on the determination of zygosity is to be published later.

The placentae were examined both by a doctor or a midwife in the delivery department (with a detailed description of placentae, cord and membranes) and by a pathologist in the Department of Pathology, including a microscopic examination of the number of chorions. The placentae were categorized as monochorionic (MC, including monoamniotic) or dichorionic (DC), the latter further subdivided into fused (DCF) and separate (DCS).

Twin transfusion syndromes were diagnosed in cases of MC placentation with an intrapair difference in hemoglobin values exceeding 5 g/dl.

The pairs were subdivided into four groups based on intrapair weight differences, the groups including pairs where the smaller twins weighed:

A: 90 - 100%
B: 80 - 90%
C: 70 - 80%
D: < 70%

of the larger twin.

Chi-square and Student's t-test were used where appropriate; a P level < 0.05 was considered statistically significant.

Table 1 - Distribution of Twins According to Gestational Age

Gestational age (days)	Total number	Intrauterine growth retarded (BW < mean – 2 SD)
< 231	20	6 (30.0%)
231 - 240	29	4 (13.8%)
241 - 250	50	4 (8.0%)
251 - 260	82	9 (11.0%)
261 - 270	50	5 (10.0%)
271 - 280	76	7 (9.2%)
281 - 290	55	8 (14.5%)
> 290	22	3 (13.6%)
Total	384	46 (12.0%)

Table 2 - Birthweight (BW), Ponderal Index (PI), Head Circumference (HC) and Gestational Age (GA)

Group	N	BW (g)		PI		HC (cm)		GA
		L-twin	S-twin	L-twin	S-twin	L-twin	S-twin	(days)
A	98	2675 (648)	2609^{ns} (608)	2.63 (0.28)	2.59^{ns} (0.27)	33.6 (0.20)	33.2^{ns} (2.0)	259 (25)
B	58	2504 (717)	2159** (614)	2.68 (0.34)	2.53** (0.32)	33.7 (0.17)	33.2^{ns} (1.7)	249 (24)
C	24	2699 (748)	2077** (567)	2.70 (0.28)	2.30** (0.24)	33.9 (1.9)	32.9* (1.8)	252 (24)
D	12	2485 (729)	1305** (672)	2.68 (0.28)	2.26** (0.44)	33.0 (1.4)	30.2** (1.8)	249 (26)

L and S represent larger and smaller twin (mean values with one SD).

* $P < 0.05$, ** $P < 0.01$, ns = not significant.

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RESULTS

A total of 192 twin pairs were registered, 190 males and 193 females. In one case the sex could not be confirmed due to maceration of the fetus. Forty six pairs were of differing sex, 73 were female and 72 male pairs.

The mean birthweight was 2449 g (SD = 701), sligthly higher in females than males (2471 g vs 2434 g). The mean intrapair weight difference was 322 g. The mean gestational age was 255 days (SD = 25). Forty six (12.0%) had a birthweight below mean – 2 SD related to gestational age. The distribution of these IUGR infants according to gestational age is shown in Table 1.

Table 2 shows mean birthweight (BW), head circumference (HC) and ponderal index (PI) of the smaller and larger twin in groups A, B, C and D.

Eigthy pairs were MZ, 94 DZ, and 18 of unconfirmed zygosity (Table 3). The DZ twins had a sligthly higher mean birthweight than the MZ, while the mean intrapair weight differences were almost equal (Table 4).

Fifty two of the placentae (27.1%) were monochorionic and 128 (66.7%) dichorionic, while in 12 cases the data from placental examination were unconclusive (Table 3). The mean birthweight was sligthly higher among DC than among MC twins; again, mean intrapair weight differences were only very small.

The distribution of placentation in MZ and DZ twins is shown in Table 4. DZ twins with fused placentae had a higher mean intrapair weight difference than DZ twins with separate placentae (Table 4). Among MZ twins, those with MC placentae had the highest mean intrapair weight difference, while again the DCF pairs showed greater intrapair weight variability than DCS pairs.

Both marginally (68 - 17.7%) and velamentously (50 - 13.0%) inserted cords were seen frequently. There were also a high number of centrally-velamentously inserted cords among twins with great intrapair weight differences (Table 5).

When analyzing the birthweight among pairs where the cord insertions differed (central-velamentous and marginal-velamentous), the infant with the centrally inserted cord tended to have a higher birthweight then the infant with the velamentously inserted cord (Table 5).

Thirteen cases met the criteriae for twin transfusion syndromes: 6 in group A, 4 in group B, 2 in group C, and 1 in group D.

Table 3 - Distribution of Twin Pairs by Zygosity and Placentation in the Four Weight-Difference Groups

Group	Zygosity			Placentation		
	MZ	DZ	Z?	MC	DC	C?
A	44 44.9%	43 43.9%	11	33 33.7%	58 59.2%	7
B	23 39.7%	32 55.2%	3	15 25.9%	41 70.0%	2
C	8 33.3%	13 54.2%	3	2 8.3%	20 83.3%	2
D	5 41.6%	6 50.0%	1	2 16.7%	9 75.0%	1
Total	80 41.7%	94 49.0%	18	52 27.1%	128 66.7%	12

Table 4 - Mean Birthweight by Zygosity and Placentation

	BW-T (g)	BW-L (g)	BW-S (g)	IPWD (g)
MZ twins (n = 80)	2419 (679)	2578 (653)	2261 (678)	317
MC twins (n = 52)	2389 (710)	2570 (700)	2209 (695)	361
DCF twins (n = 11)	2521 (446)	2683 (321)	2359 (472)	324
DCS twins (n = 14)	2478 (596)	2579 (632)	2370 (573)	209
DZ twins (n = 94)	2485 (710)	2652 (650)	2318 (603)	334
DCF twins (n = 34)	2487 (504)	2703 (486)	2244 (525)	459
DCS twins (n = 58)	2495 (626)	2603 (611)	2388 (645)	215
DC twins (n = 128)	2486 (698)	2652 (650)	2320 (603)	332

BW-T = birthweight of total number, BW-L = birthweight of larger twin, BW-S = birthweight of smaller twin, IPWD = intrapair weight differences – all mean values; one SD in parenthesis.

Table 5 - Distribution of Twin Pairs with Intrapair Differences in Cord Insertion

Group	CM BW-C 2473 g * BW-M 2193 g	CV BW-C 2529 g ** BW-V 2063 g	MV BW-M 1955 g ns BW-V 1864 g
A	16 16.3%	7 7.1%	5 5.1%
B	6 10.3%	10 17.3%	–
C	4 16.7%	5 20.8%	–
D	2 16.7%	6 50.0%	1 8.3%

C = central, M = marginal, V = velamentous cord insertion. BW = mean birthweight of the twins with the given cord insertion.

* $P < 0.05$, ** $P < 0.01$, ns = not significant.

DISCUSSION

The intrauterine growth of twins represents an interesting model for evaluating factors affecting growth in this essential period. The present study shows great differences in intrauterine growth among the two fetuses in a twin pair. Almost one-fifth of the twin pairs had an intrapair weight difference exceeding 20%.

The ponderal index reflects the duration of retarded intrauterine growth [10]. A relatively acute insufficiency in the maternal supply line or placental function will cause loss of subcutaneous fatty tissue, resulting in a lowered PI. The intrapair differences in groups C and D are almost equal, while it would have been expected that the intrapair differences in PI should have been greater in group D due to larger birghweight differences. This may indicate that the growth retardation of one of the twins in group C is of a more acute nature than that in group D.

The differences in head circumference are smaller as the brain is less affected than other organ systems in such growth disturbances.

A high proportion of infants were found to be growth retarded, similarly to previous reports [7]. These infants were, however, almost equally distributed according to gestational age. This may indicate that growth retardation in twins may start at a relatively early stage in pregnancy. Similarly, there did not seem to be increased intrapair weight differences with reduced gestational age as observed by Naeye et al [8]. Our results are here concordant with those of Corey et al [4].

The apparent excess of MZ pairs may be partly due to the fact that only seven polymorphic systems were tested: a minor part (< 5%) of the pairs diagnosed as MZ may therefore be DZ. As this represents less than 5 pairs out of a total of 80, this uncertainty should not affect the results too much.

The finding of a somewhat higher mean birthweight in DZ than MZ twins agrees with earlier observations [3]. It is of greater interest that the DZ and MZ pairs were almost equal as to intrapair weight difference: in earlier reports [8], MZ twins have been claimed to be much more prone to unequal intrauterine growth, resulting in differing birthweight.

The proportion of MC and DC placentae agrees with previous observations [4]. No obvious pattern as to the distribution in groups A, B, C and D appeared. In agreement with previous reports [4], we observed a higher mean birthweight among DC than MC twins. It is also interesting that the fused dichorionic placentae seemed to give more intrapair growth differences than the separate ones. Though the differences are small, this pattern was observable among both MZ and DZ pairs. Possibly, the DCS placenta offer a more equal distribution of the maternal blood flow than the DCF placenta.

Both marginal and velamentous insertion of the umbilical cord have been reported with increased frequency in twin pregnancies [2], and this is confirmed from our study. Of more interest is the fact that the infant with velamentous or marginal insertion had a significantly lower birthweight than the cotwin with a centrally inserted cord.

Both marginally and velamentously inserted cords have been associated with disturbed placental circulation and thereby affected intrauterine growth. Though such considerations are somewhat speculative, they may explain the observed weight differences in some twin pairs.

A relatively high number of cases were diagnosed as twin transfusion syndromes. The number found may, however, still represent an underestimate due to failure to register cases without great intrapair differences in hemoglobin values. Interestingly, these cases were almost equally distributed in the four groups, and not concentrated in groups C and D as might have been expected.

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