



Acta Genet Med Gemelloi 33:115-120 (1984)
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TWIN RESEARCH 4 – Part A: Biology and Obstetrics
Proceedings of the Fourth International Congress on Twin Studies (London 1983)

A Study of Twin Placentation in Tokyo

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Abstract. A total of 178 placentas of twins born in Tokyo in 1961-1982 were examined. Only just over one third were dichorionic, 110 being monochorionic and DZ twins were estimated to account for 24.7% of the pairs. The lower frequency of DZ twinning in Japan is attributed to lower gonadotropin values in Japanese women as compared to European, American, or African women. High fetal morbidity was found in monochorionic twins and this is attributed to a frequent occurrence of vascular anastomoses.

Key words: Twin placentation, Twinning rates, Gonadotropins, Vascular anastomoses, Twin transfusion syndrome, Acardius, Fetus papyraceus

INTRODUCTION

Twinning rates in Asia are known to be much lower than in Europe, the U.S. and Africa, with the monozygotic twinning rate being of about 4 per 1,000 births and the dizygotic twinning rate varying according to maternal age and parity, ethnic and environmental factors. According to the 1976 annual report of the Ministry of Health and Welfare in Japan, the overall twinning rate in Japan from 1951 to 1974 was approximately 6.2, with the DZ twinning rate as low as 2.2 per 1,000 births. However, few studies have been conducted in Japan on zygosity determination through placenta examination. This report deals with twin placentation and zygosity in relation to fetal outcome from Tokyo Medical College Hospital.

MATERIAL AND METHODS

A total of 178 placentas in twin pairs delivered at the Tokyo Medical College Hospital from February 1961 to December 1982 were examined. There having been a total of 9905 deliveries, twin deliveries were as frequent as 1:56 – an abnormally high rate probably due to the referral of many twin pregnant women from private clinics to our hospital for diagnostic procedures and deliveries. Following Benirschke [2], the placentation of twins was carefully recorded by inspecting the dividing membranes, two amnions

and one chorion meaning a monochorionic placenta, and two amnions and two chorions a dichorionic placenta, in which the placental disks are fused or not. Furthermore, it is characteristic of monochorionic placentation to have vascular anastomoses between the two fetal circulations, the presence of which can be shown by injecting air or colored chemicals into surface vessels.

RESULTS

Table 1 shows the distribution of our 178 pairs of twins by placentation and sex: 110 were monochorionic, hence MZ, and just over one third dichorionic. If one applies to the latter Weinberg's rule, then a total of 134 pairs (75.3%) may be expected to be MZ and 44 pairs (24.7%) DZ. In fact, the relationship between placentation and zygosity has been examined in different studies [1-3,5,8] and countries, and the results are summarized in Table 2. It can be seen that the frequencies of dichorionic and of DZ twins in Japan are much lower than in European, North American, and African populations.

The different rates of DZ twinning might originate from population variations in gonadotropin production, a relation between the latter and DZ twinning having been suggested [4]. As shown in the Figure, in fact, the serum levels of both the follicle-stimulating hormone (FSH) and the luteinizing hormone (LH) are much lower in Japanese women [9] than in Nigerian mothers with singletons [6] and American women [11].

Table 3 shows that the incidence of small-for-date babies, perinatal deaths, and fetal anomalies is higher in monochorionic twins (45.5%, 30.5%, and 17.3%, respectively) than in dichorionic twins (33.1%, 8.1%, and 3.7%, respectively), this being probably related not only to more frequent prematurity, but also to the vascular anastomoses of the monochorionic placenta. Therefore, the relationship between the various types of vascular communication and fetal abnormalities was considered (Table 4). Artery-to-artery anastomosis is the commonest type of vascular communication and results in a generally favorable fetal outcome, and vein-to-vein communication is unusual. In most cases for which the type of anastomosis was undetermined, one twin was blighted or became a fetus papyraceus after dying from impaired blood circulation caused by the twin transfusion syndrome in the early stage of pregnancy. In such cases, although we could not recognize any, anastomoses might have existed until a certain age.

TABLE 1- Placentation and Fetal Sex in Twins

Placentation	Fetal Sex				Total (%)
	MM	FF	MF	Unknown	
Monoamnionic Monochorionic	2	5			7 (3.9)
Diamnionic Monochorionic	48	39		16	103 (57.9)
Monochorionic twins	50	44		16	110 (61.8)
Dichorionic, fused	12	11	11	1	35 (19.7)
Dichorionic, separate	15	7	11		33 (18.5)
Dichorionic twins	27	18	22	1	68 (38.2)
Total	77	62	22	17	178 (100)

Zygosity estimates: 134 MZ (75.3%) and 44 DZ (24.7%) pairs.

TABLE 2 - Twin Placentation and Zygosity in Different Studies

Study	City	Monochorionic Dichorionic	Monozygotic Dizygotic
Benirschke 1961	Boston	77 (0.45) 173	110 (0.79) 140
Potter 1963	Chicago	117 (0.27) 431	194 (0.55) 354
Cameron 1968	Birmingham	134 (0.25) 534	187 (0.39) 481
Nylander 1970	Ibadan	72 (0.053) 1364	84 (0.096) 874
Akamatsu 1981	Tokyo	36 (0.90) 40	60 (3.75) 16
Yoshida 1983	Tokyo	110 (1.61) 68	134 (3.05) 44

TABLE 3 - Small-for-Date (SFD) Babies, Perinatal Death, and Fetal Anomalies in Twins According to Placentation

Placentation	No. of infants	SFD babies (%)	Perinatal deaths (%)	Fetal anomalies (%)
Monoamnionic Monochorionic	14	10 (71.4)	7 (50.0)	4 (28.6)
Diamnionic Monochorionic	206	90 (43.7)	60 (29.1)	34 (16.5)
Monochorionic twins	220	100 (45.5)	67 (30.5)	38 (17.3)
Dichorionic, fused	70	27 (38.6)	5 (7.1)	3 (4.3)
Dichorionic, separate	66	18 (27.3)	6 (9.1)	2 (3.0)
Dichorionic twins	136	45 (33.1)	11 (8.1)	5 (3.7)
Total	356	145 (40.7)	78 (21.9)	43 (12.1)

○-----○ Nigerian mothers with singletons
 ×-----× American women
 ●-----● Japanese women

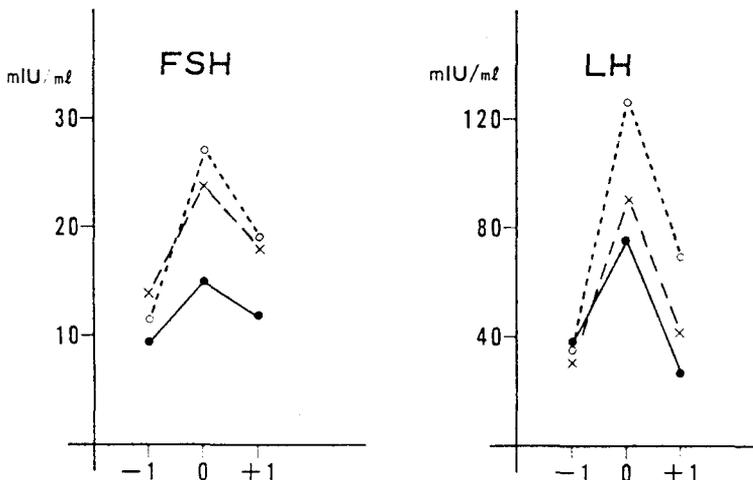


Figure - Serum levels of the follicle-stimulating hormone (FSH) and the luteinizing hormone (LH) around the time of ovulation in women of different populations (Reproduced from Soma et al 1975 [9]).

In our series, vein-to-vein or artery-to-vein anastomosis coexisting with artery-to-artery anastomosis is the most severe type of vascular communication in terms of fetal outcome. Such vascular communications may lead to an imbalance of blood supply between the twins. The various types of vascular communication presented the twin transfusion syndrome in this study are summarized in Table 5. Excluding 14 cases of unrecognized vascular communication leading to death of one twin in the early stage of pregnancy, the coexistence of vein-to-vein and artery-to-artery anastomoses resulted in the most unfavorable outcome, with 8 perinatal deaths and 7 fetal anomalies out of 10 pairs of twins. On the other hand, 6 cases of artery-to-vein anastomosis, with artery-to-artery or no coexisting anastomosis, resulted in the survival of both twins except for a case of fetus papyraceus.

TABLE 4 - Anastomoses in Twin Placentas and Fetal Outcome

Types of anastomosis	No. of cases	Survivors			Cases of anomalies (no. of fetuses)
		Both	One	None	
MONOCHORIONIC TWINS:					
Artery-Artery	41	35	4	2	1 (2)
Artery-artery & artery-vein	10	8	2	0	1 (1)
Artery-artery & vein-vein	19	7	5	7	8 (11)
Vein-vein & artery-vein	2	1	0	1	0 (0)
Vein-vein	3	0	1	2	1 (1)
Artery-vein	7	4	1	2	1 (1)
Unknown or none	28	8	14	6	18 (22)
Total	110	63	27	20	30 (38)
DICHORIONIC TWINS:					
None	68	59	7	7	5 (5)

TABLE 5 - Type of Vascular Communication and Fetal Outcome in the Twin Transfusion Syndrome

Anastomoses	No. of cases	Survivors			Cases of anomalies (no. of fetuses)
		Both	One	None	
Artery-artery	1	0	1	0	0
Artery-artery & artery-vein	4	3	1	0	1 (1)
Artery-artery & vein-vein	10	4	4	2	6 (7)
Vein-vein & artery-vein	0	0	0	0	0
Vein-vein	1	0	1	0	1 (1)
Artery-vein	2	2	0	0	0
Unknown or none	14	0	13	1	14 (17)
Total	32	9	20	3	22 (26)

DISCUSSION

In Europe and the USA, about 70% of twins are DZ and in Nigeria, especially in the lowest social class, the rate of DZ twins is even much higher. In Tokyo, however, only 25% of twins are DZ. Nylander [7] reported the mean FSH level in twin-prone women

to be much higher than that in non-twin-prone women in the Ibadan population and the mean FSH levels in Nigerian mothers of twins and singletons to be also significantly higher than the corresponding levels in their Aberdeen counterparts. Therefore, there may be racial variations in the gonadotropin output. Japanese women, whose DZ twinning rate is very low, may have a lower production of gonadotropin than Nigerian women. In fact FSH values in Japanese women were found to be significantly lower than in West Nigerian and North American women [9]. The hormonal treatment of subfertile women is known to frequently lead to polyovulation, and also in Japan a higher frequency of multiple births after such treatments has been reported.

Monochorionic twins are considered to be all MZ and dichorionic twins to include both zygosity types. Placentation, rather than zygosity, is likely to be the major cause of the fetal morbidity, the rates of small-for-date babies, perinatal deaths and fetal anomalies being much higher in monochorionic than dichorionic twins, with no significant differences in neonatal outcome between fused and separated twin placentas being found. In the monochorionic placenta, some type of vascular communication between the two fetal circulations almost always exists, and this is a basic determinant of the twin transfusion syndrome affecting fetal development. In our study, the commonest type of artery-to-artery anastomosis resulted in favorable fetal outcome, since it rarely led to a twin transfusion syndrome. The coexistence of vein-to-vein and artery-to-artery anastomoses gave the most unfavorable results to the twins, and vein-to-vein or artery-to-vein anastomosis coexisting with artery-to-artery anastomosis led to severe transfusion syndrome. In some cases, although the exact type of anastomosis is unknown, the fetal vessels which had communicated between the twins until a certain age were obliterated by a severe imbalance of blood distribution due to the transfusion syndrome at some later stage in development and one twin died and shrank into a fetus papyraceus. Out of 32 cases of twin transfusion syndrome in our series, 26 fetal deaths and 26 fetal anomalies were noticed. Out of these, 4 acardiac monsters were found, one case being associated with single umbilical artery and the coexistence of vein-to-vein and artery-to-artery anastomoses. In addition, the high frequency of fetal abnormalities was associated with an abnormal insertion of the umbilical cord, ie, 8 velamentous and 13 marginal insertions, in 32 cases of transfusion syndrome. Presumably, such abnormal cord insertions are related to a nutritional disturbance in twin placental growth and to impaired blood distribution.

Possible environmental factors affecting fetal development and placental growth in utero may be clarified by further examination of the twin placentas.

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