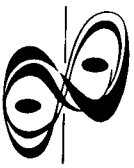

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Time Trends in Characteristics and Outcome of Twin Pregnancies

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Abstract. This study describes the evolution in fetal and neonatal mortality rates among twin pairs born in 22 hospitals located in the eastern regions of the province of Quebec in 1976-1978 (n = 776 pairs) and 1982-1985 (n = 712 pairs). It also assesses the contribution of maternal factors, obstetrical care and characteristics of twins in the variation of the risk of death over time. The fetal mortality rate did not improve from 1976-1978 (22.6 per 1000) to 1982-1985 (28.1 per 1000). However, the neonatal mortality rate declined from 44.7 to 34.7 per 1000 liveborn first twins and from 56.8 to 36.1 per 1000 liveborn second twins. For first twins as for second twins, birthweight-specific neonatal mortality rates decreased within birthweight categories under 2500 g. In the second period, 96.9% of twin pregnancies were detected before confinement compared to 59.6% in the earlier period. The proportion of twins delivered by obstetricians, the percentage of twin births occurring in ultraspecialized perinatal units and the frequency of caesarean sections increased markedly. The proportion of preterm births increased over time (34.5% vs 43.1%) whereas the percentage of low birthweight twins decreased but not significantly (54.3% 51.6%). In this study, changes in maternal age, parity, educational level, sex of pairs, qualification of the physician, and level of care available at the hospital of birth, did not account for the decrease in neonatal mortality rates among twins. The increase in the frequency of caesarean sections seemed to explain only a small proportion of the decrease in the neonatal mortality rate among second twins. In the second as well as in the first period, the neonatal mortality rate for twins was six times higher than that for singletons.

Key words: Twin pregnancy, Fetal mortality, Neonatal mortality, Caesarean section

INTRODUCTION

Twin pregnancies carry an increased risk of fetal and neonatal death when compared to singletons [8,9]. Although twin deliveries represent about 1% of all deliveries, they are responsible for approximately 11% of neonatal deaths [13]. In the province of Quebec, perinatal mortality rate among twins was 86.5 per 1000 births in 1976 [8]. The excess of mortality in twins is usually attributed to the high frequency of preterm birth and low birthweight [12,13,21]

Since the management of twin pregnancy has changed markedly over the last years, it is pertinent to assess whether these changes are associated with a reduction in mortality. Furthermore, most of the recent publications on this topic deal with twins born or treated in only one hospital [2,6,11,15,20] and therefore are more prone to selection bias than population-based studies [18] or studies including a large number of hospitals. This study compares fetal and neonatal mortality rates among twins born in the same hospitals during two different time periods. It also assesses the contribution of maternal factors, obstetrical care and characteristics of twins in the variation of the risk of death over time.

METHODS

The study is based on twin pairs born from January 1976 through December 1978 and from April 1982 through March 1985 in 22 hospitals located in the eastern regions of the province of Quebec, Canada. The participating hospitals account for approximately 90% of twin deliveries reported annually from all hospitals located in these regions. Entry into the study was restricted to pairs in which each twin weighed at least 500 g at birth.

Vital status at birth was abstracted from the mothers' hospital records. Survival status of twins at the end of the neonatal period (0-27 days) was ascertained by reviewing all stillbirth and death certificates filed at the Quebec Population Registry. All twins are included in the denominator of the stillbirth rate, whereas the denominator of the neonatal mortality rate comprises only liveborn twins.

Data on maternal characteristics, use of obstetrical ultrasonography, time of detection of twin pregnancy, fetal presentation, length of pregnancy, method of delivery, birthweight, birth order and sex of pairs, were abstracted from the mothers' and newborns' hospital records. The estimation of length of gestation was based on the date of last menstrual period. Hospitals were classified according to three levels: level I hospitals offering non-specialized perinatal services, level II catering to higher risk pregnancies, level III corresponding to regional centres with ultraspecialized perinatal services [19].

The frequencies of maternal, pregnancy and delivery characteristics were compared for the two study periods. Statistical differences were assessed by the Student's t-test for means and the Fisher's exact test or chi-square test for proportions. Relative risks (RR) were computed to estimate the risk of a specific event (eg: caesarean section, death) among twins from the second period to the risk among twins from the first period. Con-

fidence intervals (CI) for the RR were estimated according to Miettinen's test-based procedure [14].

Logistic regression was carried out in order to investigate the contribution of specific factors in the evolution of neonatal mortality rates between the two periods. In these analyses, the measure of association is the odds ratio (OR), obtained from the regression coefficient of the variable representing the study period. This OR provides a good estimate of the relative risk since the outcome is relatively rare [14]. The crude OR was compared to the adjusted OR obtained from a model including as independent variables the factors under investigation and the study period. The change in the OR indicates the contribution of a factor in the evolution of the risk of mortality. A factor or set of factors that would yield an adjusted OR equal to unity would be responsible for all the change in mortality observed between the two periods.

RESULTS

Evolution in Twin Fetal and Neonatal Mortality

Our study includes 776 twin pairs born in 1976-1978, and 712 born in 1982-1985. A total of 112 fetal and neonatal deaths were recorded in the first period compared to 89 in the second. These figures include five deaths attributed to major congenital anomalies in the first period and eight in the second. The proportion of pairs in which both twins died decreased from 4.8% in 1976-1978 to 3.9% in 1982-1985, whereas the percentage of pairs including only one fetal or neonatal death changed little over time (4.9% in 1976-1978 vs 4.6% in 1982-1985).

Fetal and neonatal mortality rates are given in Table 1. Fetal mortality rate was slightly, but not significantly, higher in 1982-1985 than in 1976-1978. In contrast, the neonatal mortality rate was 30% lower in 1982-1985 than in 1976-1978. This diminution was of borderline statistical significance. The reduction in neonatal mortality was more pronounced for second twins (RR = 0.64) than for first twins (RR = 0.78). Whereas in the first period the neonatal mortality rates for second twins exceeded that of first twins by 12.1 deaths per 1000, this difference was of only 1.4 death per 1000 in the second period.

Maternal Characteristics

From the first period to the second, the proportion of mothers under 20 years of age tended to decrease (from 3.6% to 3.1%, $p = 0.68$) whereas that of women aged 30 years or more increased (26.9 vs 30.9%, $p = 0.10$). Nulliparae constituted 41.9% of the mothers in the first period and 42.7% in the second. However, the proportion of mothers of high parity (3 or more) decreased slightly (8.1% vs 5.6%, $p = 0.07$). Finally, the percentange of mothers with less than 10 years of education in the more recent period (10.7%) was much lower than that reported in the first period (24.7%, $p < 10^{-6}$).

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Table 1 - Fetal and neonatal mortality rates in twins according to birth order by study period

	1976-1978		1982-1985		Relative risk[a]	95% Confidence interval
	No. of twins	Mortality rate ‰	No. of twins	Mortality rate ‰		
Fetal deaths						
Twin I	776	20.6	712	28.1	1.36	0.71–2.60
Twin II	776	24.5	712	28.1	1.15	0.62–2.13
All twins	1552	22.6	1424	28.1	1.25	0.80–1.95
Neonatal deaths						
Twin I	760	44.7	692	34.7	0.78	0.47–1.29
Twin II	757	56.8	692	36.1	0.64	0.39–1.03
All twins	1517	50.8	1384	35.4	0.70	0.49–0.99
Fetal and neonatal deaths						
Twin I	776	64.4	712	61.8	0.96	0.65–1.42
Twin II	776	79.9	712	63.2	0.79	0.55–1.14
All twins	1552	72.2	1424	62.5	0.87	0.64–1.22

[a] Risk of death in 1982-1985 vs 1976-1978.

Time of Diagnosis and Use of Ultrasonography

The management of twin pregnancies changed markedly from one period to the other (Table 2). The percentage of mothers having undergone at least one obstetrical ultrasound examination during pregnancy rose from 20.7% to 91.3% ($p < 10^{-6}$). In the most recent period, 96.9% of twin pregnancies were diagnosed before hospitalization for delivery, whereas the corresponding figure was 59.6% in the first period ($p < 10^{-6}$). The use of ultrasonography was strongly related to the probability for a twin pregnancy to be diagnosed before hospitalization. In 1982-1985, the percentage of twin pregnancies still undiagnosed at the time of mother's entrance to the hospital was 1.5% among those who had received an ultrasound examination, compared to 20.0% among those who did not have such an examination ($p < 10^{-8}$).

The relation between time of diagnosis and risk of neonatal death is shown in Table 3. The risk of neonatal death was higher when the diagnosis of twin pregnancy was made only after the mother's admission to hospital. After adjustment for length of pregnancy, twin pregnancies undiagnosed before confinement still carried a two- to three-fold higher risk of neonatal death. Finally, twin pregnancies diagnosed after confinement in the second period carried a higher risk of mortality than in the first period.

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Table 2 - Twin pregnancy characteristics related to obstetrical management

Characteristic	Pregnancies 1976-1978		Pregnancies 1982-1985	
	N	%	N	%
At least one obstetrical ultrasound	774	20.7	712	91.3
Diagnosis of twin pregnancy before hospitalization for delivery	763	59.6	703	96.9
Delivery by obstetrician-gynaecologist	774	55.6	712	79.2
Delivery in level III hospital by length of gestation (weeks)				
<34	97	13.4	116	25.9
34-36	171	8.2	191	13.1
⩾37	508	9.8	405	9.4
Total	776	9.9	712	13.1

Differences between totals are explained by missing values.

Hospital of Birth and Caesarean Sections

Access to specialized perinatal services has improved since 1976 (Table 2). Obstetrician-gynecologists were involved in a statistically higher proportion of twin deliveries in 1982-1985 (79.2%) than in 1976-1978 (55.6%). Moreover, the percentage of twins delivered in a level III hospital climbed from 9.9% to 13.1% (RR = 1.32, 95% CI: 0.99-1.75). This increase was more pronounced for twins born before 34 weeks of gestation (13.4% vs 25.9%, RR = 1.93, 95% CI: 1.09-3.42). However, 60.4% of all twins and 46.6% of those born before 34 weeks were still delivered in level I hospitals in 1982-1985.

Fourty-three percent of the mothers were delivered by caesarean section in the second period compared to 16.9% in the first (RR = 2.55, 95% CI: 2.16-3.01) (Table 4). This rise in the frequency of caesarean sections was observed in all gestational age groups, but was particularly pronounced among pregnancies of less than 34 weeks (RR = 5.57, 95% CI.: 2.84-10.95). Stratification according to twin presentations indicates that, in 1982-1985, the frequency of abdominal delivery reached 41% in vertex-nonvertex pairs and nearly 85% when the first twin had a nonvertex presentation.

Length of Gestation and Birthweight

The proportion of twin pairs born before 37 completed weeks of gestation was higher in the second period (43.1%) than in the first (34.5%) (p = 0.0008). Pregnancies of less than 34 weeks were also more frequent in 1982-1985 (16.3%) than in 1976-1978 (12.5%) (p = 0.04), whereas the proportion of post-term pregnancies (42 weeks or more) was slightly lower in the second period (0.3%) than in the first (1.4%).

Table 3 - Neonatal mortality rates and risk of death in twins diagnosed after admission vs twins diagnosed before admission, by birth order and study period

Time of diagnosis	1976-1978				1982-1985			
	No. of twins	Mortality rate ‰	RR	(95% CI)	No. of twins	Mortality rate ‰	RR	(95% CI)
Twin I								
Diagnosis before admission	445	20.2	1.00	–	667	27.0	1.00	–
Diagnosis after admission	302	76.2	3.77[a]	(1.87-7.60)	22	181.8	6.74[b]	(2.68-16.92)
Twin II								
Diagnosis before admission	445	33.7	1.00	–	668	31.4	1.00	–
Diagnosis after admission	299	87.0	2.58[a]	(1.42-4.68)	21	142.9	4.54[b]	(1.54-13.42)

Thirteen twins I and twins II in the first period and 3 twins I and twins II in the second period are excluded because of missing information on time of diagnosis relative to admission.

[a] Relative risk (RR) and 95% CI adjusted for length of gestation are 2.57 (1.34-4.92) for twins I and 1.85 (1.07-3.21) for twins II.

[b] RR and 95% CI adjusted for length of gestation are 3.77 (1.46-9.75) for twins I and 2.35 (0.79-6.95) for twins II.

Table 4 - Percentage of caesarean section (CS) deliveries in twin pairs according to length of gestation and fetal presentation by study period

	Twin pairs 1976-1978[a]		Twin pairs 1982-1985		Relative risk[b]	95% confidence interval
	N	CS%	N	CS%		
Length of gestation (weeks)						
<34	97	6.2	116	34.5	5.57	2.84-10.95
34-36	171	15.2	191	44.5	2.93	2.06- 4.15
37-38	261	19.5	247	47.8	2.44	1.89- 3.17
⩾39	245	19.6	158	40.5	2.07	1.51- 2.82
Fetal presentation						
V-V	327	8.0	332	26.8	3.37	2.32- 4.90
V-NV	246	9.4	236	41.5	4.44	3.10- 6.36
NV-V	54	24.1	62	82.3	3.42	2.33- 5.02
NV-NV	71	38.0	75	84.0	2.21	1.68- 2.90
Unknown	76	55.3	7	85.7	1.55	0.89- 2.70
Total	774	16.9	712	43.1	2.55	2.16- 3.01

V = vertex, NV = nonvertex.
[a] Two pairs with unknown method of delivery are excluded in 1976-1978.
[b] Risk of caesarean section delivery in 1982-1985 vs 1976-1978.

The distribution of twins according to birthweight did not change substantially. There was only a slight and nonsignificant decrease in the proportion of low birthweight twins (less than 2500 g) between the two periods (54.3% vs 51.6%, $p=0.15$). The same nonsignificant diminution was observed for very low birthweight twins (less than 1500 g) (9.2% vs 8.8%, $p=0.73$).

Birthweight-specific neonatal mortality rates are shown in Table 5. Very low birthweight twins accounted for 79% and 88% of neonatal deaths recorded respectively in the first and the second period. Mortality rates within birthweight strata were lower in the second period than in the first except in the 2500+ g category.

Table 5 - Birthweight-specific neonatal mortality rates in twins by birth order and study period

Birthweight (g)	1976-1978		1982-1985	
	No. of twins	Mortality rate/1000	No. of twins	Mortality rate/1000
Twin I				
500-999	22	863.6	23	739.1
1000-1499	38	236.8	27	111.1
1500-1999	99	30.3	85	23.5
2000-2499	232	12.9	210	9.5
2500+	369	0.0	347	0.0
Total	760	44.7	692	34.7
Twin II				
500-999	22	1000.0	22	727.3
1000-1499	40	300.0	33	212.1
1500-1999	114	35.1	100	0.0
2000-2499	243	12.4	201	0.0
2500+	338	5.9	336	6.0
Total	757	56.8	692	36.1

Sex of Pairs

The two study groups are comparable regarding the sex of pairs. Overall, 75.6% of the twin pairs were of like-sex in the first period (39.4% MM and 36.2% FF) comparatively to 73.6% in the second period (35.1% MM and 38.5% FF).

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Factors Associated with the Improvement in the Neonatal Mortality Rates

Logistic regression analysis was carried out in order to identify the factors contributing to the improvement in neonatal mortality. The regressions included only liveborn twins. Twins I and twins II were considered separately. The crude ORs comparing the risk of neonatal death in the second vs the first period were 0.74 and 0.62 for first and second twins, respectively. Simultaneous adjustment for age, parity and educational level did not change these ORs, suggesting non contribution of these maternal characteristics in the improvement of mortality. Similarly, controlling for sex of pairs (like vs unlike) had no effect on the estimates. When variables related to the management of the pregnancy and delivery were considered, neither the qualification of the physician (obstetrician or not) nor the type of delivery hospital (level I, II or III) had an effect on the evolution of mortality. However, adjustment for the mode of delivery yielded adjusted ORs equal to 0.84 for twins I and 0.70 for twins II. These results suggest that the increase in the frequency of caesarean sections explained 38% and 21% of the decline in neonatal mortality observed in first and second twins, respectively.

DISCUSSION

In this study, the fetal mortality rate among twins did not decline from 1976-1978 to 1982-1985. However, there was a 30% reduction in the risk of neonatal death, and this reduction was more marked for second twins than for first twins. The proportion of twin pregnancies diagnosed after admission into hospital has decreased markedly. The probability for twin pregnancies of being detected before confinement was strongly related to the use of ultrasonography. This observation is in agreement with randomized trials of ultrasonographic screening, which indicate that ultrasonography leads to earlier detection of twin pregnancies [1,7,23,26].

In spite of a large increase in the use of ultrasonography as well as a marked change in the time of diagnosis of twin pregnancies, there was little or no improvement in the birthweight distribution. Length of gestation was even shorter in the second period than in the first. There are, however, two possible explanations for this last observation. First, interventions to terminate the pregnancy may have been more frequent in the most recent period. Unfortunately, information on this variable was not collected. Second, the comparison of length of gestation between the two periods may be biased, since ultrasound was much more frequently available in the second period as compared to the first. Although our estimation of length of gestation was based on the date of last menstrual period, this date may have been revised by the attending physician following an early ultrasonographic examination. Goldenberg et al [10] reported that the recent increasing use of ultrasonographic findings for estimating gestational age in their institution was related to a shift towards shorter reported gestational ages and higher frequency of preterm births. This may have also occurred in our study.

Whether earlier diagnosis through routine ultrasound screening can result in improvement in length of gestation and birthweight is still a controversial issue. In the two Norwegian trials of routine ultrasound screening, twins in the screened group were on average 420 g [7] and 606 g [1] heavier than those in the unscreened group. In one of

these trials, screening was also associated with a longer mean length of twin gestation [1]. In contrast, in two other randomized trials [23,26], routine one-stage ultrasound screening had no beneficial effect on birthweight or length of gestation in twin pregnancies. Smith and Campbell [25] suggested than ultrasound screening could hardly improve birthweight and length of gestation since prophylactic bed rest [24] and use of tocolytic agents [16] have not been shown to be beneficial in twins pregnancies.

Our results indicate that the time of diagnosis of twin pregnancies is strongly related to the risk of neonatal mortality. Interestingly, in a recent randomized trial [23], twin babies in ultrasound-screened pregnancies had a lower perinatal mortality rate (27.8 per 1000) than twin babies from the control group (65.8 per 1000). Early detection of twin pregnancies allows both better antepartum and intrapartum monitoring of fetal well-being and permits more appropriate timing for delivery. These could reduce the risk of fetal asphyxia and lead to lower birthweight-specific mortality rates. Although improved neonatal care could also have a role in the decline of birthweight-specific mortality rates, this factor was not considered in our study.

Twin pregnancies diagnosed only after confinement carried a higher risk of neonatal death in the later period than in the previous one. In the first period, ultrasound screening was only available in a few large hospitals whereas, in the second period, it was offered to all pregnant women. Some observations suggest that the few women who did not undergo an ultrasound examination in 1982-1985 probably shared some high-risk characteristics. For example, they were on average younger, less educated, and more often delivered by a family physician in a level-I hospital after a shorter length of gestation.

In our study, the proportion of twin pairs delivered by caesarean section has increased markedly, especially among pregnancies shorter than 34 weeks and in vertex-nonvertex presentations. The four-fold increase in caesarean section rates for vertex-nonvertex pairs resulted in a caesarean section frequency of 40% in this group. This proportion is higher than that of 28.8% reported by Chervenak et al [5]. Several authors do not advocate routine caesarean section for term vertex-nonvertex pairs [3,4,17]. Results of a randomized trial on 60 vertex-nonvertex pairs also suggest that there is no difference in the neonatal outcome for the second twin according to the type of delivery [22]. Bell et al [2] also suggested that the increase in the frequency of caesarean section did not improve the condition of twins at birth. In the present study, the more liberal use of caesarean section in the second period seems to have contributed weakly to the improvement in the risk of neonatal death.

In spite of the improvement in the neonatal outcome for twins, their neonatal mortality rate remains much higher than that of singletons. The neonatal mortality rates for twins born in 1976-1978 and 1982-1985 were respectively 6.1 and 6.2 times those reported for all births in corresponding regions of the province of Quebec. Furthermore, the relative contribution of twins to neonatal deaths has not changed over time, twins being responsible for 8.7% of all neonatal deaths reported in the first period and 9.3% in the second period. Clearly, further progress still needs to be made and efforts should be directed towards prevention of preterm delivery.

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