

delivery of the second twin did not increase the risk of perinatal mortality. Given the current level of obstetric care, intrapartum stillbirth of a second twin is now, fortunately, a rare event. However, little information has been published about the relationship between the interdelivery interval and maternal or fetal morbidity in twin gestation. The present study was therefore undertaken to test the authors' clinical impression that the second twin may be delivered safely beyond this limit if the fetus and labor continue to be monitored closely.

Materials and Methods

The perinatal outcome of all twin pregnancies ending in vaginal delivery at 34 weeks' gestation or beyond was investigated during 1981 and 1982. A review of data at four regional perinatal centers (University of Michigan, University of Cincinnati, Akron City Hospital, and University of Iowa) permitted a comparison between perinatal outcome at several institutions during the same period.

Protocols at each institution for the anticipated vaginal delivery of twins were essentially the same. Electronic fetal heart rate monitoring involved the application of an internal electrode on the first twin and an external receiver on the second. Simultaneous electronic uterine monitoring involved connecting the transducer measuring the intrauterine pressure of the first twin to the transducer of the second fetal monitor.^{20,21} Any regional anesthesia was delayed until the cervix was dilated 5 cm or more. If uterine inertia became apparent, oxytocin was used cautiously.

Two obstetricians and a neonatal care team were in attendance at delivery. A large episiotomy was usually made, and the first twin was delivered the same way as a singleton.

The second twin was often visualized ultrasonically

to monitor the heart rate and presentation. Continuous monitoring of the fetal heart rate was undertaken while watching for any excess vaginal bleeding. Halothane was used infrequently to guide the second twin into the pelvis. Oxytocin was also used if uterine contractions subsided within ten minutes after delivery of the first twin.

In all patients enrolled in the study, the gestational age was 34 weeks or more (or the birth weight of either liveborn infant was 2000 g or more if gestational age was uncertain), and the first infant was delivered vaginally from a cephalic presentation. Obstetric data gathered from chart review included any other antepartum complication, the interval between delivery of the two infants, the presentation and route of delivery of the second infant, and any maternal complication during delivery. Information collected about the newborn infants included birth weight, five-minute Apgar score, need for intensive care nursery admission, and any noteworthy neonatal complication during or shortly after delivery.

Any maternal or neonatal complications were compared with the interval between the delivery of the two infants using the χ^2 test. A *P* value less than .05 was considered statistically significant.

Results

During the two-year period, 21,420 patients were delivered at the four institutions, and 294 (1.4%) had twin gestations. Among the 186 pregnancies with liveborn twins born at or beyond 34 weeks' gestation, 117 (63%) were delivered vaginally. Two of these pregnancies were excluded from consideration because the first twin had been in a breech presentation.

The profile of the 115 study pregnancies is shown in Table 1. The maternal age, race, parity, and gestational age at delivery were similar regardless of the interde-

Table 1. Profiles of Pregnancies with Twin Gestations (*N* = 115)

	Interval between delivery of twins			Total (<i>N</i> = 115)
	≤15 min (<i>N</i> = 70)	16-30 min (<i>N</i> = 28)	>30 min (<i>N</i> = 17)	
Mean maternal age (yr) (range)	25 (15-35)	24 (17-34)	25 (17-40)	25 (15-40)
Race	48 (69%) white	19 (68%) white	9 (53%) white	76 (66%) white
Parity	23 (33%) nulliparous	9 (32%) nulliparous	5 (29%) nulliparous	37 (32%) nulliparous
Mean gestational age (wk) (range)	37 (34-40)	37 (34-43)	37 (34-40)	37 (34-43)
Antepartum complications	14 (20%)	5 (18%)	3 (18%)	22 (19%)
Cases/hospital				
Akron City	24 (34%)	7 (25%)	4 (24%)	35 (30%)
Univ. Michigan	18 (26%)	7 (25%)	4 (24%)	29 (25%)
Univ. Cincinnati	8 (11%)	9 (32%)	8 (47%)	25 (22%)
Univ. Iowa	20 (29%)	5 (18%)	1 (5%)	26 (23%)

Table 2. Relationship Between Perinatal Events in the Second Twin and the Delivery Interval Between Twins

Event	Interval			P value		
	≤15 min (N = 70)	16-30 min (N = 28)	>30 min (N = 17)	<15 min vs >15 min	<30 min vs >30 min	≤15 min vs 16-30 min vs >30 min
Breech presentation of second twin	31 (44%)	7 (25%)	7 (41%)	.21 (1 df)	.75 (1 df)	.10 (2 df)
Vaginal-abdominal delivery	2 (3%)	5 (18%)	3 (17%)	.02 (1 df)	.34 (1 df)	.02 (2 df)
5-minute Apgar score <7	2 (3%)	3 (11%)	0	.61 (1 df)	.76 (1 df)	.14 (2 df)
Birth weight						
< first twin	13 (19%)	9 (32%)	5 (29%)	.28 (2 df)	.82 (2 df)	.63 (4 df)
= first twin	39 (55%)	12 (43%)	8 (48%)	.19 (1 df)	.75 (1 df)	.30 (2 df)
> first twin	18 (26%)	7 (25%)	4 (23%)	.95 (1 df)	.86 (1 df)	.98 (2 df)
Intensive care nursery admission	8 (12%)	6 (21%)	4 (23%)	.20 (1 df)	.54 (1 df)	.29 (2 df)

livery interval. Antepartum complications occurred in approximately one fifth of the pregnancies, with pregnancy-induced hypertension being the most frequent complication. Types of anesthesia used in delivering the 105 patients transvaginally included pudendal or local (71), epidural (26), and general (eight) anesthesia. Epidural anesthesia was not used more frequently when there was a delay in delivery of the second twin. A breech presentation in 45 of the second twin fetuses was not more common if the delivery of that twin occurred after the first 15 minutes (Table 2).

The interval between vaginal delivery of the first and second twins averaged 21 minutes (range one to 134 minutes). The distribution of intervals in the 115 cases is shown in Figure 1. The elapsed interval was within 15 minutes in 70 (61%) cases, within 16 to 30 minutes in 28 (24%) cases, and more than 30 minutes in 17 (15%) cases. Oxytocin infusion for augmenting or inducing uterine contractions after a 15-minute interdelivery interval was necessary in 19 (42%) of the 45 cases.

The mode of delivery of the second twin is compared with the interval between vaginal delivery of the first and second twins in Table 3. Most cephalically present-

ing second fetuses were delivered spontaneously or by outlet forceps regardless of the interval. The 11 total breech extractions occurred within the first 15 minutes, in contrast to spontaneous or assisted extraction of the other 34 breech fetuses, which often occurred in a less hurried manner.

Extensive lacerations of the cervix or vagina, halothane anesthesia for delivery of the second twin, retained placental fragments requiring reexploration, and postpartum anemia requiring transfusion were uncommon and not more frequent in patients delivering the second twin vaginally after the initial 15 minutes. Combined vaginal-abdominal delivery in ten of the 115 (9%) cases was significantly more common after the initial 15 minutes (eight of 45 versus two of 70, $P < .02$). Indications for cesarean section included failed version and extraction of a fetus with a transverse or oblique lie (five), prolapsed umbilical cord (four), and failure to progress with fetal distress (one).

All the infants survived. No second infant had an obvious major malformation or sign of excess trauma at birth. Apgar scores of the second twin were generally high regardless of the interval between deliveries,

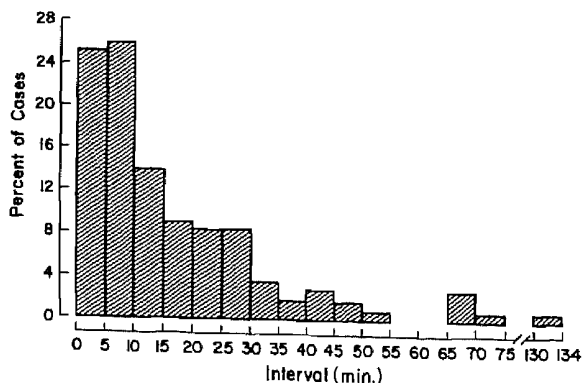


Figure 1. Percentage distribution of intervals between delivery of the first and second twins in 115 pregnancies.

Table 3. Relationship Between Mode of Delivery of the Second Twin and Interval Between Vaginal Deliveries of Twins in Pregnancies (N = 105)

Mode of vaginal delivery	Interval		
	<15 min (N = 68)	16-30 min (N = 23)	>30 min (N = 14)
Cephalic			
Spontaneous	3.7 (54%)	18 (78%)	11 (79%)
Outlet forceps	2 (3%)	2 (9%)	1 (7%)
Midforceps	0	0	0
Breech			
Spontaneous	3 (4%)	1 (4%)	1 (7%)
Assisted extraction	15 (22%)	2 (9%)	1 (7%)
Total extraction	11 (16%)	0	0

and were usually similar (Apgar scores. All 17 second twins delivered within 30 minutes had five-minute Apgar scores of 7 or greater (one was remarkably lower or higher than the first twin).

Neonatal complications were uncommon regardless of the mode of delivery. Morbidity included respiratory distress but also included a need for intensive care in one infant who was delivered long after the first twin.

The longest interdelivery interval involved a 31-year-old primipara whose twin gestation was diagnosed by ultrasound at 34 weeks gestation because of mild prematurity was confirmed. Amniotomy was performed and proceeded uneventfully. The second twin was delivered by the vaginal route. The first twin was delivered by the vaginal route. The second twin was delivered by the vaginal route. When the cervix had retracted, the delivery continued. When the cervix had retracted after the next 15 minutes, delivery was begun. Uterine contraction dilated gradually. When the cervix dilated, the patient's head descended. Apgar scores of the second twin were respectively, was unremarkable.

Discussion

The authors conducted this study to determine whether the second twin was truly born during an interval of 21 minutes or not much longer. The mean interval of 17.5 minutes supports the

and were usually similar or identical to the first infant's Apgar scores. All 17 second twins delivering beyond 30 minutes had five-minute Apgar scores between 8 and 10. The birth weights of the second twins were not remarkably lower or higher (more than a 200-g difference) than the first twins if the delivery interval was greater than 15 minutes (Table 2).

Neonatal complications among the second twins were uncommon regardless of the interval or the institution. Morbid conditions related primarily to prematurity (respiratory distress, hypoglycemia, jaundice) but also included anemia and possible sepsis. The need for intensive care nursery admission was infrequent and no more common among second infants delivering long after the first (Table 2). Furthermore, admissions to the intensive care nursery were no more frequent in the second than in the first twin, regardless of the interval between deliveries.

The longest interdelivery interval (134 minutes) involved a 31-year-old black woman, gravida 2, para 1, whose twin gestation was diagnosed at 24 weeks' gestation by ultrasound examination. At 38 weeks' gestation the patient was admitted to the hospital because of mild preeclampsia. After fetal pulmonary maturity was confirmed by amniotic fluid testing, an amniotomy was performed and the induced labor proceeded uneventfully. The first infant, a 2438-g female with Apgar scores of 8 and 8 at one and five minutes, respectively, was delivered spontaneously by the vaginal route. The second infant was determined to be in cephalic presentation at minus one station, but the cervix had retracted to 6 cm. Fetal monitoring was continued. When no uterine contractions were evident after the next 15 minutes, a dilute oxytocin infusion was begun. Uterine activity resumed, and the cervix dilated gradually. Once the cervix was completely dilated, the patient was encouraged to push. The fetal head descended well, and a 2500-g male infant with Apgar scores of 8 and 9 at one and five minutes, respectively, was delivered spontaneously. The postpartum course was uncomplicated.

Discussion

The authors considered the interdelivery interval to determine whether a delay in delivery of the second twin was truly hazardous when close fetal and uterine monitoring was employed. The average interdelivery interval of 21 minutes (range, one to 134 minutes) was not much longer than that reported by Jouppila et al¹⁶ of 17.5 minutes (range, zero to 92 minutes). There were no perinatal deaths in the study population, which supports the contention by Jouppila et al¹⁶ that the

interdelivery interval does not have any significant effect on the perinatal mortality of second twins.

In the present authors' experience, perinatal morbidity was lowest with expectant therapy and subsequent spontaneous delivery, regardless of the fetal presentation. The availability of portable real-time ultrasonography during labor and delivery has afforded the obstetrician a means of rapid determination of fetal presentation and of monitoring the fetal heart rate and localizing the umbilical cord of the second twin. Accumulated experience with electronic monitoring now facilitates the assessment of fetal status and uterine activity. Placental separation while awaiting delivery of the second twin is a theoretic concern because of the rapid reduction of volume in the intrauterine contents. Although excessive vaginal bleeding is uncommon, a search must be undertaken after delivery of the first twin. Unless labor has resumed within ten minutes, oxytocin augmentation of labor is recommended as the fetal heart rate is monitored electronically.²² An initial 5- to 10-mU/minute dose has been used if mild or infrequent contractions are present. Once the presenting fetal part is in the pelvic inlet, amniotomy is recommended while the presenting part is guided further into the pelvis.

Vaginal delivery of the first twin does not guarantee a safe vaginal delivery of the second twin. Occasionally, delivery of the second twin by cesarean section may become necessary because of the complications described here and in prior studies. The frequency of vaginal-abdominal deliveries varied at each institution in the study, but the overall rate (9%) was higher than the 0.001 to 2% reported elsewhere.^{5,23,24} An explanation for this discrepancy may involve changes in attitudes toward fetal monitoring and neonatal care and limitations or experiences of the attending physicians.

Although there is an increased incidence of malpresentation among second twins, which requires more operative deliveries, the authors' impressions are the same as those of Acker et al²⁵ that vaginal delivery may be considered when the second twin is in a breech presentation. An immediate breech extraction or cesarean section does not need to be performed routinely for the delivery of the second twin if it is in a transverse, oblique, or high breech presentation. Instead, minimal interference during close monitoring and selective cesarean section for a malpresenting second twin may lead to a more favorable outcome for the mother and fetus.²⁶ Any intrauterine manipulation or external version of a breech fetus is optimal when assisted by real-time ultrasonography to visualize the operator's hand in relation to the fetal extremities.²⁷

The overall favorable outcome of the second twins in the study may be attributed to the care provided to this

select pregnant population. The first twin in each case was in a cephalic presentation and delivered late in gestation at a regional perinatal center with a well-equipped and well-staffed intensive care nursery. Low Apgar scores were not more common among second twins than among first twins. This finding is to be expected if the fetuses are monitored closely as gestational age advances.²⁰ The usual neonatal disorders in the second twin did not differ significantly from those occurring in the first twin and were not found to be influenced by the interval between delivery of the infants. Cautious observation of twin infants born after 33 weeks' gestation remains necessary, as infection, hemorrhage, hypoglycemia, malformation, and hemolytic disease are seen frequently in preterm twin newborn infants.¹⁹

References

1. Kauppila A, Jouppila P, Koivisto M, et al: Twin pregnancy: A clinical study of 335 cases. *Acta Obstet Gynecol Scand (Suppl)* 54:5, 1975
2. Ferguson WF: Perinatal mortality in multiple gestations: A review of perinatal deaths from 1609 multiple gestations. *Obstet Gynecol* 23:861, 1964
3. Farooqui MO, Grossman JH, Shannon RA: A review of twin pregnancy and perinatal mortality. *Obstet Gynecol Surv* 28:144, 1973
4. Ware HH: The second twin. *Am J Obstet Gynecol* 110:865, 1971
5. Guttmacher AF, Kohl SG: Cesarean section in twin pregnancy. *Am J Obstet Gynecol* 83:866, 1962
6. Collea JV: Twins, Protocols for High-Risk Pregnancies. Edited by JT Queenan, JC Hobbins. Oradell, NJ, Medical Economics, 1982, pp 284-285
7. Barrett JM, Staggs SM, VanHooydonk JE, et al: The effect of type of delivery upon neonatal outcome in premature twins. *Am J Obstet Gynecol* 143:360, 1982
8. Quilligan EJ, Zuspan FP: Douglas-Stromme Operative Obstetrics. Fourth edition. New York, Appleton-Century-Crofts, 1982, pp 667-668
9. Medearis AL, Jonas HS, Stockbauer JW, et al: Perinatal deaths in twin pregnancy: A five-year analysis of statewide statistics in Missouri. *Am J Obstet Gynecol* 134:413, 1979
10. McCarthy BJ, Sachs BP, Layde PM, et al: The epidemiology of neonatal deaths in twins. *Am J Obstet Gynecol* 141:252, 1981
11. Spurway JH: The fate and management of the second twin. *Am J Obstet Gynecol* 83:1377, 1962
12. Langer H: Perinatale Mortalität der Zwillingsgeburt. *Zentralbl Gynaekol* 94:1288, 1972
13. Ellis JW: Multiple Gestation, A Clinical Manual of Obstetrics. Edited by JW Ellis, CRB Beckman. Norwalk, CT, Appleton-Century-Crofts, 1983, p 572
14. Falkner F, Hendricks CH: Clinical aspects of twinning. *Fetal and Maternal Medicine*. Edited by EJ Quilligan, N Kretcher. New York, Wiley 1980, p 432
15. Oxorn H: Human Birth and Labor. New York, Appleton-Century-Crofts, 1980, pp 284-285
16. Jouppila P, Kauppila A, Koivisto M, et al: Twin pregnancy: The role of active management during pregnancy and delivery. *Acta Obstet Gynecol Scand (Suppl)* 54:13, 1975
17. Koivisto M, Jouppila P, Kauppila A, et al: Twin pregnancy: Neonatal morbidity and mortality. *Acta Obstet Gynecol Scand (Suppl)* 54:21, 1975
18. Pettersson F, Smedby B, Lindmark G: Outcome of twin birth: Review of 1636 children born in twin birth. *Acta Paediatr Scand* 65:473, 1976
19. Ho SK, Wu PYK: Perinatal factors and neonatal morbidity in twin pregnancy. *Am J Obstet Gynecol* 122:979, 1975
20. Cetrulo CL, Ingardia CJ, Sbarra AJ: Management of multiple gestation. *Clin Obstet Gynecol* 23:533, 1980
21. Read JA, Miller FC: Technique of simultaneous direct intrauterine pressure recording for electronic monitoring of twin gestation in labor. *Am J Obstet Gynecol* 129:228, 1977
22. Pritchard JA, MacDonald PC: Williams Obstetrics. 16th edition. New York, Appleton-Century-Crofts, 1980, pp 660-661
23. Evrard JR, Gold EM: Cesarean section for delivery of the second twin. *Obstet Gynecol* 57:581, 1981
24. Kizer S, Aguero O: Cesarean en segundo gemelar. *Rev Obstet Ginecol Venez* 37:167, 1977
25. Acker D, Lieberman M, Holbrook RH, et al: Delivery of the second twin. *Obstet Gynecol* 59:710, 1982
26. Kelsick F, Minkoff H: Management of the breech second twin. *Am J Obstet Gynecol* 144:783, 1982
27. Chervenak FA, Johnson RE, Berkowitz RL, et al: Intrapartum external version of the second twin. *Obstet Gynecol* 66:120, 1983

Address reprint requests to:
 William F. Rayburn, MD
 Department of Obstetrics and Gynecology
 Women's Hospital
 The University of Michigan
 Ann Arbor, MI 48109

Submitted for publication July 11, 1983.

Revised September 26, 1983.

Accepted for publication September 30, 1983.

Copyright © 1984 by The American College of Obstetricians and Gynecologists.

Maternal Estradiol in Early

RUTH FREE
 HAROLD SO

During the 16th (mean) level of estradiol, 2.1 ng/ml. Amn estrone, 234.1 ng/ml. Amn estradiol, 2633.5 ng/ml. Late with placenta correlate significantly of estradiol and relationship to decidua. *Obstet Gynecol* 1

Maternal progressively estradiol (E) progressively different source normal probable quant changes t concentration seen in m

The antagonistic prolactin levels.^{2,3} materna Amniotic. Cl correlat prolati that br

From the
 Albert E.
 Montefiore
 York.