Thai Journal of Obstetrics and Gynaecology
March 2000, Vol. 12, pp. 15-20

OBSTETRICS

Sonographic Features, Epidemiological Aspects and Neonatal Outcome of Fetuses with Gastroschisis.

Saifon Chawanpaiboon MD,*
Anna Cockell MRCOG,*
Joseph Iskaros MD,*
Agostino Pierro FRCS,**
Charles Rodeck FRCOG.*

* *Department of Obstetrics and Gynaecology, University College London, Medical School, London, UK.*
** *Paediatric Surgery, Institute of Child Health, London, UK.*

ABSTRACT

Objective To identify epidemiological and prenatal sonographic factors in cases of fetal gastroschisis.

Design An observational study of 71 consecutive fetuses with antenatally diagnosed gastroschisis.

Setting The Fetal Medicine Unit (FMU) at University College Hospital of London (UCLH)

Sample Seventy one fetuses with antanatally diagnosed gastroschisis referred to the FMU.

Main Outcome Measures Perinatal outcome including type of surgical repair and duration of infants' hospital stay.

Results The median maternal age in pregnancies complicated by gastroschisis was 24.8 years (range 17-36), The occurrence of vaginal delivery were 37 cases (66%), emergency caesarean section were 13 cases (23%), elective caesarean section were 6 cases (11%) and spontaneous preterm vaginal delivery were 11 cases (100%). Eighteen cases (26.9%) were of socio-economic class V, 22 (32.8%) were class IV, 23 (34.3%) were class III, 3 (4.5%) were class II and 1 (1.5%) was class I. Neonatal outcome was classified according to the complexity of the surgical repair and the length of hospital stay into good, fair and poor (Table 1). The presence of bowel dilatation > 15 mm on antanatal ultrasound scan (n= 35) was more likely to be associated with poor outcome ($P < 0.005$). The median duration of hospital stay was 44 days (range 1-124). Lower socio-economic status and younger maternal age were also associated with poor neonatal outcome ($P < 0.005$).

Conclusion Ultrasound findings and epidemiological factors such as the socio-economic status, maternal age and BMI should be taken into consideration in assessing the prognosis in cases of gastroschisis.

Key words: epidemiology, prenatal ultrasound and outcome of gastroschisis

Gastroschisis has been considered a rare malformation, in contrast with exomphalos,[1] although the incidence of gastroschisis has been apparently increase in recent years[2-6] without a corresponding

change in the number of neonates with exomphalos.[3-7]

Gastroschisis (Fig. 1, 2) is a fetal malformation characterized by a full thickness defect of abdominal wall, usually to the right of the umbilical cord insertion through which there is herniation of intraabdominal structures, principally bowels. Exomphalos is characterized by the eviscerated bowel, covered by a membrane, whereas the bowel is unprotected in gastroschisis. A high incidence of karyotypic and associated structural abnormalities are found in exomphalos. The basis of achieving prenatal diagnosis by ultrasound can detect the free-floating herniated bowel from the late first trimester scan.

The cause of gastroschisis is unknown but a possible mechanism has been suggested by vascular disruption during early embryonic development affecting the omphalomesenteric artery.[8] Many studies have suggested an association between gastroschisis and environmental factors such as illicit drug usage,[9] tobacco,5 alcohol,[10,11] conception while taking the oral contraceptive pill,[9,11] influenza or its treatments.[5-11]

The majority of cases have been diagnosed antenatally due to the improvement in ultrasound technology and practically routine anomaly scan.[12] Decreasing perinatal mortality was resulted from better neonatal intensive care, new surgical techniques, ventilatory assistance and advances in total parenteral nutrition.[13] Sepsis, prolonged mechanical ventilations and the need of total parenteral feeding lead to high morbidity and long duration of hospital stay.[14] We have an impression that the conclusions of many studies have been very variable. Therefore, the epidemiological and sonographic findings of all cases of fetal gastroschisis seen in our Fetal Medicine Unit over 6 years have been reviewed to assess the prognosis contribution of a variety of parameters to postnatal outcome.

Methods

The diagnosis of pregnancy with gastroschisis were identified from computerised data base over 6-year period (February 1992-December 1998). All pregnancies were seen in the Fetal Medicine Unit (FMU) at University College London Hospitals. Detailed fetal anomaly scan, serial ultrasounds scans and umbilical artery Doppler pulsatility index were performed throughout the pregnancy. Information of epidemiological factors (age, parity, socio-economic status and cigarette smoking), antenatal sonographic findings, delivery, postnatal surgery and outcome were obtained from the case records and the FMU computerised database.

Socio-economic status was classified by the Office of Population Censuses and Surveys (OPCS) classification of occupation 1980.[15] The body mass index (BMI) was calculated using the formula {BMI = weight in kilograms/(Height in meters)$^{(2)}$}.

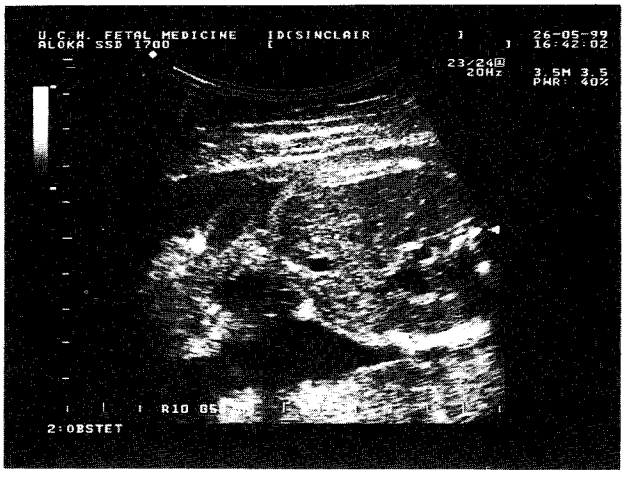


Fig. 1. Crossectional abdominal ultrasound. Gastroschisis was presented.

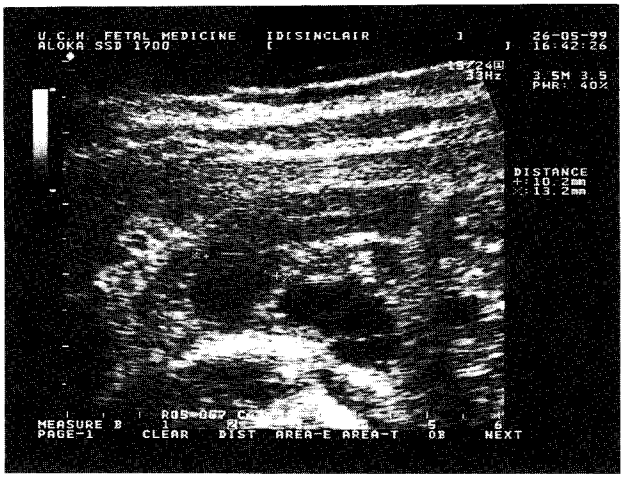


Fig. 2. Transabdominal ultrasound. The picture shows dilated bowel loop.

Type of surgical repair and the duration of hospital stay were used to assess the overall postnatal outcome which was classified as good, fair or bad (Table 1).

The mean-Whitney *U* test was used to compare the spontaneous vaginal delivery and the induction of labour (IOL) group. Logistic regression analysis was used to establish the association between fetal outcome and maternal age. The Chi-square(χ^2) test was used to test the relationship between the fetal outcome and both bowel dilatation and socio-economic status. P value < 0.05 of the outcome variables were significant.

Results

Seventy one cases of gastroschisis were collected and 2 cases were excluded due to incompleted data. From 69 cases, 2 were performed with termination of pregnancy (TOP) due to anencephaly and severe scoliosis; therefore, only 67 cases were studied.

The median maternal age at the last menstrual period for gastroschisis was 24.8 years (range 17-36). Fifty mothers (74.6%) were nulliparous. The median gestational age (GA) at delivery was 36 weeks (range 28-39). In term pregnancies, 37 cases were in spontaneous vaginal delivery (66%); 21 cases following induction of labour (IOL) and 16 cases following spontaneous onset of labour. The median gestational age (range) for the spontaneous vaginal delivery group [36 weeks (36-38)] was significantly less than the IOL group [37.5 weeks (36-39)] with P < 0.05. Of the 19 cases delivered by caesarean section, 13 (23%) were performed as an emergency, 8 due to fetal distress and 5 after IOL. Six (11%) cases were planed for elective caesarean section, 5 due to breech presentation and 1 due to twins pregnancy. All preterm pregnancies had spontaneous vaginal delivery (11 cases). The mode of delivery were neither associated with a poorer neonatal outcome nor with a poor Appar score.

Thirty seven mothers (55%) were non smokers and the median body mass index(BMI) was 22.2 (range 17.3-43). Eighteen cases (26.9%) were of socio-economic class V, 22 (32.8%) were class IV, 23 (34.3%) were class III, 3 (4.5%) were class II and 1 (1.5%) was class I.

All cases had a normal umbilical artery Doppler pulsatility index (PI). All fetuses were born alive with a median Apgar score of 8.5 (range 1-9) at 1st minute and 9 (range 4-10) at 10th minute. The median birth weight of gastroschisis infants was 2,254 grams (range 1,000-3,300). There were 35 (52%) male fetuses and 32 (48%) female fetuses. Twenty of 35 males and 24 of 32 females were below the 5th centile. Five infants (7.5%) died during the neonatal period, 3 because of sepsis and 2 cases because of extensive bowel

necrosis occuring prenatally. In addition one neonate was found to have arthrogryposis.

The median duration for hospital stay was 44 days (range 1-124). Four fetuses were referred to have an emergency surgical performance at other hospitals within 2 hours after delivery.

Younger maternal age was associated with a poorer postnatal outcome ($P < 0.005$) and a longer hospital stay for the infants ($P < 0.005$).

Ultrasound revealed bowel dilatation (>15 mm at the third trimester) in 35 cases (52%) antenatally. Primary surgical repair was performed in 47 cases, initial primary repair followed by a further surgical procedure in 12 and staged silastic silo repair (in cases where primary surgical repair was not possible) in 10 cases. Bowel dilatation was presented in 8/47, 7/12 amd 9/10 cases respectively. Table 2 shows the classification of neonatal outcome according to bowel dilatation in the fetus and social class. The presence of bowel dilatation in the third trimester was associated with a worse neonatal outcome ($P < 0.005$). Low socio-economic status was associated with worse outcome ($P < 0.005$).

Discussion

Gastroschisis is one of the most common abdominal wall defects which has been increased incidence from many studies.[6,16] In a recently published paper, using nationally collected data, the incidence of gastroschisis in the UK was reported to have doubled from 0.65 in 1987 to 1.39/10,000 births in 1993.[6] This is probably due to more complete assertainment as a result of improvements in prenatal management and postnatal diagnosis.[17] However, prediction of morbidity by using a prognostic indicator remains an important challenge to reduce the mortality rate for gastroschisis.[18]

Prenatal ultrasound scanning and epidemiological aspects were debated as prognostic indicators. The prognosis for infants born with gastroschisis is variable. The fact that the the prognosis may be linked to bowel condition at birth19 has been led to the suggestion that amniotic fluid exposure has a damaging effect on the fetal bowel with subsequent postnatal morbidity arising from varying degrees of bowel dysfunction. Some report found no effect of bowel dilatation to fetal outcome.[20]

Our study supported that gastroschisis is more likely to complicate pregnancies of younger women, as many reports,[21,22] with significantly worse of the overall neonatal outcome. Furthermore the babies of younger mothers tend to stay longer in the hospital due to a slow postnatal surgical progress.

Comparison between the cases in 1995 and the previous eight years presented no significant changes in the rates of illicit drug use, tobacco smoking, alcohol ingestion or pregnancy while taking the oral contraceptive pill. Some report found that first trimester drug usage, especially pseudoephredrine and aspirin, cocain, amphetamine, marijuana or LSD were found to increase the chances of gastroschisis affected in the fetuses.[11,21] The vascular disruption theory was supported for the association between these drugs and gastroschisis.[23]

Incidence of gastroschisis was found to be associated with life style, risk factors and yearly income;[21] therefore, environment factors could also be studied for these linkage. Our study supported that more than 50% of cases were of social class IV and V with a strong association between lower social class and poorer overall surgical outcome. Whereas maternal smoking, parity, maternal body mass index, mode of delivery (whether the delivery was induced or not); did not influence the neonatal outcome.

After counselling of gastroschisis pregnancies by paediatric surgical teams, none of mothers seen in our unit decided to have a termination of pregnancy (TOP) which was contrasted to high TOP (26.5%) in some report.16 A close prenatal monitoring and a plan of the delivery were led to an early postnatal surgery with good care. In our report, all of fetuses were born alive, although 5 were dead during neonatal period. These were related to bowel ischemia and long time sepsis. Two fetuses were related to extensive bowel necrosis and multiple atresia prenatally. The perinatal mortality rate of 7.5% in our study compares favourably

with other reported.[24] The long term outcome in all of fetuses following surgery after prolonged hospitalisation was also good as well as other reported.[13,20]

In summary consideration of maternal age; socio-economic status and ultrasound assessment of bowel dilatation of gastroschisis pregnancies may be used as predictors of neonatal outcome and as informations to counsel the couples for planning of delivery and postnatal care.

Table 1. Overall neonatal outcome based on the type of surgical repair and the duration of hospital stay

Overall neonatal outcome	Definition	N
Good	primary surgical repair alone and duration of hospital stay < 30 days	36
Fair	primary surgical repair alone and duration of hospital stay > 60 days or primary initial repair with further procedure and hospital stay < 90 days or staged silastic silo repair and < 60 days in hospital	16
Bad	primary initial repair with further procedure and > 90 days in hospital or staged silastic silo repair and hospital duration of > 60 days or death of the infant	15
Total		**67**

Table 2. Overall neonatal outcome according to bowel dilatation and social class

	Bowel dilatation		Social class				
Fetal outcome	**>15 mm**	**<15 mm**	**V**	**IV**	**III**	**II**	**I**
Good	7	17	3	2	15	2	1
Fair	13	12	6	12	4	1	0
Bad	15	3	9	8	4	0	0
Total	35	32	18	22	23	3	1

References

1. Moore TH. Gastroschisis with antenatal evisceration of the intestine and urinarybladder. Ann Surg 1963; 158: 263-9.
2. Lindham S. Omphalocele and gastroschisis in Sweden 1965-1976. Acta Paediar Scand 1981; 70: 55-60.
3. Martinez Friaz ML, Salvador J, Prieto L, Zaplana J. Epidemiological study of gastroschisis and omphalocoele in Spain. Teratology 1983; 29: 377-82.
4. Torfs C, Curry C, Roeper P. Gastroschisis. J paediatr 1990; 116: 1-6.
5. Goldbaum G, Daling J, Milham S. Risk factors for gastroschisis. Teratology 1990; 42: 397-403.
6. Tan KH, Kilby MD, Whittle MJ, Beattie BR, Booth IW, Botting BJ. Congenital anterior wall defects in England and Wales: 1987-1993: retrospective analysis of OPCS data. BMJ 1996; 313: 903-6.
7. Roper PJ, Harris J, Lee G, Neutra R. Secular rates and correlates for gastroschisis in California (1968-1977). Am J Obstet Gynecol 1987; 35: 203-10.
8. de Vries PA. The pathogenesis of gastroschisis and omphalocele. J Pediatr Surg 1980; 15: 245-51.
9. Drongowski RA, Kendall Smith R, Coran AG, Klein MD: Contribution of demographic and environmental factors to the etiology of gastroschisis: a hypothesis. Fetal Diagn Ther 1991; 6: 14-27.
10. Werler MM, Mitchell AA, Shapiro S. Demographic reproductive, medical and environmental factors in relation to gastroschisis. Teratology 1992; 45: 353-360.
11. Werler MM, Mitchell AA, Shapiro S. First trimester maternal medication use in relation to Gastroschisis. Teratology 1992; 45: 361-7.
12. Chitty LS. Ultrasound screening for fetal abnormalities. Prenat Diag 1995; 15: 1241-57.
13. Eurenius K, Axelsson O. Outcome for fetuses with abdominal wall defects detected by routine second trimester ultrasound. Acta Obstetricia et Gynecologica Scandinavica 1994; 73: 29-9.
14. Novotny DA, Klein RL, Boekman CR. Gastroschisis : an 18-year review. J paed Surg 1993; 28: 650-2.
15. OPCS. Occupational mortality. London: HMSO. 1987.
16. Calzolari E, Bianchi F, Dolk H, Milan M. Omphalocele and gastroschisis in Europe : a survey of 3 million births 1980-1990. EUROCAT Working Group. Am J Med Genet 1995; 58: 187-94.
17. Torfs CP, Curry CJR. Familial cases of gastroschisis in a population-based registry. Am J Med Genetics 1993; 45: 465-7.
18. Tunell WP, Puffinbarger NK, Tuggle DW, Taylor DV, Mantor PC. Abdominal wall defects in infants. Survival and implications for adult life. Ann Surg 1995; 221: 525-8.
19. Langer JC, Bell JG, Castill RO. I. Etiology of intestinal damage in gastroschisis, II. Timing and reversibility of histological changes, mucosal infection and contractility. J Pediatr Surg 1990; 25: 1122-6.
20. Alsulyman OM, Monteiro H, Ouzouian JG, Barton L, Songster GS, Kovacs BW. Clinical significance of prenatal ultrasonographic intestinal dilatation in fetuses with gastroschisis. Am J Obstet Gynecol 1996; 175: 982-4.
21. Torfs CP, Velie EM, Oechsli FW, Bateson TF, Curry JA. A population based study of gastroschisis: demographic, pregnancy, and lifestyle risk factors. Teratology 1994: 50: 44-53.
22. Hemminki K, Saloniemi I, Kyronnen P, Kekomaki M. Gastroschisis and omphalocele in Finland in the 1970S. Prevalence at birth and its correlates. J Epidemiol Com Health 1982; 36: 289-93.
23. Hume RF Jr, Gingras JL, Martin LS, Hertzberg BS, O' Donnellk Killam AP. Ultrasound diagnosis of fetal anomalies associated with in utero cocaine exposure: further support for cocaine induced vascular disruption teratogenesis. Fetal Diagnos Ther 1994; 9: 239-45.
24. Drun M, Griggnon A, Guibaud L, Garel L, Saint-Vil D. Gastroschisis; are prenatal ultrasonographic findings useful for assessing the prognosis? Ped Radiol 1996; 26: 723-6.