Outcome of neonates with gastroschisis at different gestational ages using a national database

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ABSTRACT

Background/purpose: The optimal time for delivery of neonates with a prenatal diagnosis of gastroschisis (GS) is controversial. We compared the outcomes for GS at three different gestational ages (GAs), 33–34 weeks, 35–36 weeks, and ≥ 37 weeks.
Methods: We analyze hospital discharge data of neonates with GS using the 2006, 2009 and 2012 Healthcare Cost and Utilization Project Kids' Inpatient Database (HCUPKIDS). Multivariable analysis was used to compare the association between GS outcomes and the three GAs.
Results: Significantly higher number of 33–34 week infants had coexisting morbidities like respiratory distress syndrome, bronchopulmonary dysplasia, small bowel atresia, stenosis, or stricture, large bowel atresia and/or stenosis, malrotation, and atrial septal defect. In multivariable logistic regression, 33–34 week infants had higher NEC (p value = 0.002, 95% CI1.64–10.32), small bowel resection (0.024, 1.12–5.25) and pRBCs transfusion (0.024, 1.05–2.11). No differences were found between 35–36 weeks and ≥37 weeks gest infants for NEC, malabsorption, small bowel resection, TPN cholestasis, sepsis, CLABSI, number of pRBCs transfusion, length of stay and total charges.
Conclusion: We did not show benefit for delivering early and in the absence of data, delivery at ≥37 weeks was noninferior to 35–36 weeks. We suggest that waiting for spontaneous onset of labor may be a better approach to balance the effects of prematurity and possible ongoing in utero bowel damage/stillbirth.
Levels of evidence: Level 3 (Retrospective comparative study).

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Gastroschisis (GS) is an abdominal wall defect in which the intestine and other abdominal organs protrude into the amniotic fluid through a hole in the abdominal wall, typically on the right side of the umbilicus. The average length of stay (LOS) is 46 days [1]. The average charges for the entire hospital stay of patients with GS are $250,000 [2]. Timing of delivery of patients with GS affects its outcome. There is no clear guidance on when to deliver patients with prenatal diagnosis of GS.

There are increased risks of third trimester complications including fetal heart rate abnormalities, intrauterine growth retardation, preterm labor, still births; meconium stained amniotic fluid and oligo/polyhydramnios [3]. Therefore, some studies suggested early induced delivery to prevent prolonged in utero bowel contact with amniotic fluid to decrease these complications and more importantly still birth [4–6]. However, some recent studies are recommending that we should avoid early delivery to prevent short and long term morbidity related to prematurity and to overall improve the outcome in these patients [7,8].

This study expands current understanding of GS by comparing the outcomes at three different gestational ages (GAs), 33–34 weeks, 35–36 weeks, and ≥37 weeks in a large national database. This will allow us to understand the effect of GA on GS' associated coexisting conditions, complications, LOS and total charges (TCH).

1. Methods

1.1. Database selection

An analysis was performed using the 2006, 2009 and 2012 Healthcare Cost and Utilization Project Kid's Inpatient Database (HCUP-KIDS). HCUP-KIDS is part of a family of databases available every three years that is sponsored by the Agency for Healthcare Research and Quality [9]. It contains a large sample of pediatric discharges (age 20 years or less at admission) from U.S. community hospitals enabling analysis of rare conditions, including congenital anomalies. Information collected from the database includes primary and secondary diagnoses, patient demographics (gender, race, primary payer), hospital characteristics (region of country, rural/urban, teaching status), in-hospital birth, in-hospital mortality, LOS and TCH.

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1.2. Patient selection

We identified all cases with GS using the International Classification of Diseases, 9th revision, clinical modification (ICD-9-CM) diagnosis code of 758.73. To further improve the accuracy of our identification, the ICD-9-CM GS surgical repair code of 54.71 was also used. We further narrowed the dataset to neonatal hospitalizations by using the HCUP codebook variable NEOMAT. We divided the remaining group into three GAs: 33–34 weeks (code 765.27); 35–36 weeks (code 765.28); and ≥37 weeks (code 765.29).

1.3. Data analysis

National weighted data were used to examine differences in demographics, hospital characteristics, coexisting congenital defects, complications, LOS and TCH among the three GAs. Comparisons between groups were performed using Pearson's χ^2. Among the three age groups, we used multivariable logistic regression to examine the differences of the outcome GS with each coexisting congenital defect and complication. Because of the skewed distribution, we converted LOS and TCH to their respective log (base 10). Then, we used the generalized linear model with Poisson distribution for differences of LOS and the generalized linear model with gamma distribution and log link function for differences of TCH among the three GAs.

We divided primary payer into public (Medicare, Medicaid, Self-pay and no charge) and private insurance [10]. Total charges were adjusted to 2016 dollars using the Consumer Price Index calculator [11]. Statistical analyses were conducted using STATA 14/SE (Statacorp LP, College Station, TX). Results of the descriptive analysis were presented as frequency and percentages. Summary statistics for LOS and TCH were

Table 2
Coexisting diagnosis of patients with gastroschisis at different gestational ages.

	Preterm 33–34 weeks	Late Preterm 35–36 weeks	Term >/=37 weeks	P value
Small intestinal atresia				0.000
No	905 (91)	2151 (95)	471 (96)	
Yes	87 (9)	109 (5)	17 (4)	
Large intestinal atresia				0.000
No	954 (96)	2219 (98)	481 (99)	
Yes	38 (4)	42 (2)	-	
BPD				0.000
No	978 (98)	2249 (99)	482 (99)	
Yes	14 (2)	11 (1)	-	
RDS				0.000
No	843 (85)	2081 (92)	453 (93)	
Yes	149 (15)	180 (8)	35 (7)	
ASD				0.017
No	345 (87)	561 (90)	112 (88)	
Yes	573 (13)	867 (10)	190 (12)	
Malrotation				0.051
No	933 (94)	2167 (96)	468 (96)	
Yes	59 (6)	94 (4)	20 (4)	
PDA				0.000
No	891 (90)	2107 (93)	452 (93)	
Yes	102 (10)	154 (7)	37 (7)	
Undescended Testes[a]				0.000
No	492 (96)	1078 (90)	442 (90)	
Yes	20 (4)	119 (10)	23 (10)	

Note: Per HCUP guidelines, data were suppressed for ≥37 weeks' Large intestinal atresia (Yes) and BPD (Yes) because cells contained ≤10 observations.

[a] Undescended testes denominator equals male infants.

Table 1
Demographics of patients with gastroschisis at different gestational ages.

	Preterm 33–34 weeks n = 922	Late Preterm 35–36 weeks n = 2261	Term >/=37 weeks n = 488	P value
Sex				0.386
Male	512 (52)	1197 (53)	234 (48)	
Female	479 (48)	1064 (47)	254 (52)	
Race				0.050
White	425 (51)	1044 (55)	247 (59)	
Black	74 (9)	171 (9)	36 (9)	
Hispanic	225 (27)	487 (26)	100 (24)	
Asian/Pacific Islander	15 (2)	52 (3)	_	
Native American	12 (2)	30 (2)	_	
Other	78 (9)	119 (6)	26 (6)	
Geographic region				0.154
Northeast	93 (9)	221 (10)	53 (11)	
Midwest	235 (24)	561 (25)	112 (23)	
South	401 (40)	867 (38)	190 (39)	
West	262 (26)	612 (27)	133 (27)	
Insurance				0.032
Private	207 (22)	432 (20)	69 (15)	
Public	731 (78)	1699 (80)	383 (85)	
In Hospital Birth				0.099
Out born	326 (33)	684 (30)	161 (33)	
Inborn	666 (67)	1576 (70)	327 (67)	
In Hospital Mortality				0.000
Survived	949 (96)	2217 (98)	478 (98)	
Died	43 (4)	42 (2)	-	
Hospital Location/Teaching				0.440
Rural	11 (1)	26 (1)	15 (3)	
Urban Non-Teaching	119 (13)	257 (12)	55 (12)	
Urban Teaching	819 (86)	1875 (87)	399 (85)	

Note: Per HCUP guidelines, data were suppressed for ≥37 weeks Asian/Pacific islander, American Indian and In hospital mortality because cells contained ≤10 observations.

Table 3
Complications of patients with gastroschisis at different gestational ages.

	Preterm 33–34 weeks	Late Preterm 35–36 weeks	Term >/=37 weeks	P value
NEC				0.000
No	924 (93)	2163 (96)	468 (96)	
Yes	68 (7)	98 (4)	21 (4)	
Malabsorption				0.000
No	907 (91)	2185 (97)	472 (97)	
Yes	84 (9)	76 (3)	16 (3)	
Perforation				0.165
No	895 (99)	2250 (99)	487 (99)	
Yes	-	11 (<1)	15 (<1)	
Volvulus				0.076
No	959 (97)	2202 (97)	477 (98)	
Yes	33 (3)	59 (3)	12 (2)	
Small Bowel resection				0.000
No	858 (86)	2105 (93)	465 (95)	
Yes	134 (14)	156 (7)	24 (5)	
TPN Cholestasis				0.000
No	925 (93)	2131 (94)	459 (94)	
Yes	67 (7)	130 (6)	29 (6)	
Sepsis				0.000
No	942 (95)	2189 (97)	470 (96)	
Yes	50 (5)	71 (3)	18 (4)	
CLABSI				0.472
No	971 (98)	2223 (98)	483 (99)	
Yes	21 (2)	38 (2)	-	
Cellulitis				0.168
No	912 (92)	2125 (94)	457 (93)	
Yes	80 (8)	136 (6)	32 (7)	
Transfusion pRBCs				0.000
No	738 (74)	1850 (82)	402 (82)	
Yes	254 (26)	411 (18)	86 (1)	

Note: Per HCUP guidelines, data were suppressed for 33–34 weeks Perforation (Yes) and ≥37 weeks CLABSI (Yes) because cells contained ≤10 observations.