National Practice Patterns for Prenatal Monitoring in Gastroschisis: Gastroschisis Outcomes of Delivery (GOOD) Provider Survey

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Abstract
Background: Gastroschisis is an abdominal wall defect with increasing incidence. Given the lack of surveillance guidelines among maternal-fetal medicine (MFM) specialists, this study describes current practices in gastroschisis management.

Materials and Methods: An online survey was administered to MFM specialists from institutions affiliated with the North American Fetal Therapy Network (NAFTNet). Questions focused on surveillance timing, testing, findings that changed clinical management, and delivery plan.

Results: Responses were obtained from 29/29 (100%) NAFTNet centers, comprising 143/371 (39%) providers. The majority had a regimen for antenatal surveillance in patients with stable gastroschisis (94%; 134/141). Antenatal testing began at 32 weeks for 68% (89/131) of MFM specialists. The nonstress test (55%; 72/129), biophysical profile (50%; 63/126), and amniotic fluid index (64%; 84/131) were used weekly. Estimated fetal weight (EFW) was performed monthly by 79% (103/131) of providers. At 28 weeks, abnormal EFW (77%; 97/126) and Doppler ultrasound (78%; 99/127) most frequently altered management. In stable gastroschisis, 43% (60/140) of providers delivered at 37 weeks, and 29% (40/140) at 39 weeks.

Discussion: Gastroschisis management differs among NAFTNet centers, although the majority initiate surveillance at 32 weeks. Timing of delivery still requires consensus. Prospective studies are necessary to further optimize practice guidelines and patient care.

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mise, which is seven times higher in gastroschisis than in uncomplicated pregnancies [1]. However, without these complications, morbidity is low and the survival rate is >95% [2]. There are currently no standardized guidelines for either fetal monitoring or timing of delivery in these patients. With rising incidence and increased prevalence worldwide [2–4], there is a need for a consensus in management.

Over 90% of gastroschisis cases are diagnosed by fetal ultrasound in the second trimester, prompting further antenatal surveillance [5]. Monitoring often begins with monthly ultrasounds until 30–32 weeks of gestation, after which time the frequency of testing increases to either weekly or even biweekly [6–9]. The main forms of testing include Doppler ultrasound of the umbilical artery, biophysical profile (BPP), and nonstress test (NST) [10]. Fetal growth, amniotic fluid index (AFI), bowel dilation, and bowel status or appearance are all closely followed by ultrasound [6–8, 11–16]. There is significant variation described in terms of the type of test used, the frequency of testing, and findings that would alter the surveillance regimen within institutions as well as providers.

In addition to antenatal surveillance, both method and timing of delivery are important aspects of prenatal management. There was a shift in practice from elective cesarean to vaginal delivery in the 1990s–2000s [3, 17]. This transition is attributable to a number of studies that failed to show any benefit in cesarean delivery in these patients [17–20]. The optimal timing of delivery, however, remains largely unknown. Two prospective trials were conducted, but both were underpowered and yielded inconclusive results [20, 21]. It remains unclear whether the risk of fetal death and bowel injury that can occur later in pregnancy is greater than the risk of iatrogenic preterm delivery.

The purpose of this study was to survey maternal-fetal medicine (MFM) specialists within the North American Fetal Therapy Network (NAFTNet) on their antenatal practices in caring for patients with gastroschisis. The survey information was used to define current provider and institutional practices that may help establish minimal safety guidelines for further prospective studies related to the care and delivery of patients with gastroschisis.

Materials and Methods

An online survey was created by the lead investigators of the MFM committee for the Gastroschisis Outcomes of Delivery (GOOD) study. The questions focused on the gestational age at which surveillance begins, tests used for monitoring, tests with abnormal findings that would change clinical management, tests with abnormal findings that would lead to delivery, and the recommendations for the timing and route of delivery. The survey consisted of nine questions, and there was no requirement to answer each question. Participants were identified by the number of years practiced beyond MFM fellowship, and the type of location in which they practiced (academic, private, or military). The survey was distributed via Survey Monkey to all 373 MFM specialists of the 29 NAFTNet centers. Responses were collected over a 4-week period. Results were reviewed and analyzed using descriptive and exploratory statistics.

Results

Responses were obtained from 29/29 (100%) of NAFTNet centers, comprising 143/371 (39%) individual MFM providers. Eighty-seven percent of providers were affiliated with an academic medical practice, while 10% were in private practice. Twenty-two percent of the MFM specialists had 0–5 years of experience, 15% had 6–10 years, 17% had 11–15 years, 14% had 16–20 years, and 31% of providers had >20 years of experience beyond completion of their MFM fellowship. The majority of MFM specialists (94%; 134/141) acknowledged having a regimen for antenatal surveillance in patients with stable gastroschisis.

Antenatal testing began at 32 weeks for 68% (89/131) of MFM specialists (Fig. 1). Another 12% (16/131) began at 28 weeks, and 8% (10/131) began at 34 weeks. Three tests were used on a weekly basis – the NST (55%; 72/129), BPP (50%; 63/126), and ultrasound measuring AFI (64%; 84/131). Ultrasound for estimated fetal weight (EFW) was performed monthly by 79% (103/131) of providers (Fig. 2). Ultrasound of the bowel diameter was used weekly by 22% (28/129) of providers, every other week by 10% (13/129) of providers, and monthly by 29% (37/129) of providers. Bowel wall thickness was not measured by 48% (63/131) of MFM specialists. Doppler ultrasounds of the mesenteric and umbilical artery were rarely used in patients with stable gastroschisis. However, for patients with fetal growth lag (FGL), weekly Doppler ultrasound of the umbilical artery was commonly performed (79%; 104/131), whereas Doppler ultrasound of the mesenteric artery was not (20%; 25/125). Per open comments, some MFM specialists increased surveillance measures to twice weekly if FGL or abnormal Doppler ultrasound of the umbilical artery was identified.

At 28 weeks of gestational age, abnormalities in EFW (77%; 97/126) and Doppler ultrasound of the umbilical artery (78%; 99/127) most frequently altered clinical
management. A change in clinical management was defined as a change in either testing method or frequency that was outside of normal practice for the respective provider. Abnormal NST (80%; 102/126) and BPP (82%; 105/128) at 28 or 32 weeks or later also led to changes in clinical management with increasing surveillance.

Elective premature delivery was not common practice given any abnormal findings. An abnormal BPP led to early delivery by 28% of providers between 28 and 31+6 weeks, and by 36% of providers between 32 and 36+6 weeks. If there was evidence of abnormal EFW, 71% (89/125) of providers delivered at ≥37 weeks with continuation of expectant management and monitoring. In stable gastroschisis, 43% (60/140) of providers delivered at 37 weeks, and 29% (40/140) delivered at 39 weeks. Only 6% (9/140) recommended delivery prior to 37 weeks in a stable gastroschisis patient. Lastly, only 2/135 MFM specialists recommended cesarean section solely based on the presence of fetal gastroschisis.

There were also several differences in management practices between providers within a single institution. At one center, an MFM provider recommended delivery in a stable gastroschisis patient at 37 weeks, while another from the same center recommended delivery at 39 weeks. Nine MFM providers from six centers denied having an antenatal regimen for following stable gastroschisis, citing insufficient evidence to support that surveillance improves outcomes. However, at least one other respondent from the same center reported having a regimen for antenatal testing. Finally, two MFM providers recommended delivery by cesarean section in stable gastroschisis, which was not in accordance with the other members of their respective centers.

Discussion

There is significant variation in gastroschisis surveillance and delivery management among MFM providers as well as within individual NAFTNet centers. Despite these differences, there is consensus in some aspects of surveillance, including the gestational age to begin testing, forms of testing, and tests that change clinical management. Aspects of monitoring that still require consensus include the method of antenatal surveillance testing and the recommended gestational age of delivery.

The literature demonstrates a variety of practices that guide antenatal surveillance and timing of delivery. In addition to improving the prenatal diagnosis rate of gastroschisis [22], a standardized practice of surveillance and delivery can allow for unified guidelines to be used in large-scale studies to improve long-term outcomes. A recent study examining the impact of an antenatal surveillance protocol on intrauterine death rates in gastroschisis patients found that a surveillance strategy helped reduce intrauterine demise rates from 5.5 to 2.2%, leading to a 58% overall reduction [23]. In our study, 94% of providers
stated that they followed an antenatal monitoring regimen in these patients.

The majority of MFM specialists in our study began testing at 32 weeks (68%; 89/131), which is consistent with retrospective reviews in the literature [6–9]. This timing may be secondary to minimal change noted in the bowel until 30–32 weeks, after which time more rapid changes can be seen [20]. The types of testing performed were also consistent with the recommendations in the literature, although the significance of each test remains controversial. The NST (55%; 72/129) and BPP (50%; 63/126) were two of the more consistently utilized surveillance tests in our study, similar to a number of studies reported in the literature [7, 24–26]. While ultrasound for EFW was performed weekly by the majority of providers (79%; 104/131), at least two other studies disagreed on its ability to accurately predict adverse outcomes [27, 28]. There is also debate in the literature regarding the value of measuring bowel wall diameter and its relationship to outcomes, which may further explain the wide range of practices seen in our survey [6, 13, 15, 16, 29, 30].

Many of the MFM specialists in our study followed EFW (77%; 97/126) and used evidence of FGL as a marker to change surveillance patterns. However, there is literature that both supports and refutes the association of FGL with adverse outcomes [26, 27]. Interestingly, many of our providers also used FGL as an indicator for increased surveillance for uteroplacental insufficiency via Doppler ultrasound of the umbilical artery (78%; 99/127), despite a report that ultrasound findings are usually normal, and therefore of little use in these patients [12].

Over the last few decades there has been a shift from cesarean to vaginal delivery, which was also the method of delivery preferred by the majority of our providers (99%, 133/135). A recent meta-analysis evaluating mode of delivery and outcomes in neonates with gastroschisis suggested that the mode of delivery was not significantly associated with overall mortality, neonatal mortality, primary or secondary repair, necrotizing enterocolitis, sepsis, short gut syndrome, duration until enteral feeding, or length of hospital stay [31]. Furthermore, due to the variability of both delivery and postdelivery care within the literature, there remains insufficient evidence to advocate the use of cesarean section over vaginal delivery in these patients [31].

While vaginal delivery was the preferred method of delivery for the majority of our providers, the timing of delivery was more controversial. In stable gastroschisis, 43% (60/140) of providers delivered at 37 weeks, and 29% (40/140) delivered at 39 weeks. Two studies found that preterm delivery results in increased complications, increased incidence of sepsis, longer time on total parenteral nutrition, and increased length of hospital stay [17, 32]. Al-Kaff et al. [33] showed that planned induction at 36–37 weeks did not lead to better outcomes compared to 38 weeks or later, and Cain et al. [34] found that delivery after 37 weeks was related to improved perinatal outcomes. Two reviews also agreed that post-term delivery is related to lower medical costs [34, 35]. In contrast, another study showed that induction at 37 weeks of gestation had reduced risk of sepsis, bowel damage, and neonatal death with pregnancies managed expectantly beyond 37 weeks [25].

Despite this, only 6% of current MFM providers (9/140) will deliver prior to 37 weeks. In support, two studies showed that preterm delivery at 35 or 36 weeks did not increase morbidity and mortality in the mother or child and may lead to improved surgical outcomes [20, 36]. A randomized controlled trial from 2005 demonstrated a trend to better outcomes with shorter times to full enteral feeds and shorter hospital stays, with elective delivery at 36 weeks compared to spontaneous onset of labor [21]. A recent study by Sparks et al. [37] observed an increased stillbirth rate in babies with gastroschisis as gestational age increased, peaking at 39 weeks of gestational age. This study suggests that mortality risks for fetuses with gastroschisis may be minimized with delivery as early as 37 weeks gestation. There is no level I evidence based on prospective studies that provides adequate guidance as to the optimal timing of delivery of a fetus with gastroschisis.

As a survey, our results are limited and subjective. Our response rate of 39% may have limited the ability to identify all practice differences that exist within the NAFTNet centers. Furthermore, due to limitations in obtaining program data for all recipients of the survey, we were unable to describe and compare individuals that responded and those that did not respond. Some individuals chose not to answer all questions, which made some of our results incomplete. We did allow for open-ended comments, and many respondents stated that their answers might vary if more detailed parameters were provided within the question. Furthermore, recommendations and practice management patterns may differ both on an individual and institutional basis, and thus our results may only be applicable to the respondents of this survey. Also, given the survey format of our study, we were unable to capture combinations of testing within each center. The strengths of this study are that we were able to capture 100% of the NAFTNet centers. Also, while the majority

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of providers (87%) were affiliated with an academic institution, we did have a varying range of years of experience within the providers that were queried.

The variability in provider practices for antenatal monitoring and delivery regimens in gastroschisis is likely due to the lack of high-level evidence in the literature. For every study reporting improved neonatal outcomes with a given method of surveillance, method, or timing of delivery, there are also conflicting data to suggest otherwise. Additionally, most published data are retrospective in nature. Despite these differences, there is consensus in some aspects of surveillance among the surveyed providers. Our results suggest that minimal monitoring requirements should include initiation of testing at 32 weeks wise. Additionally, most published data are retrospective due to the lack of high-level evidence in the literature. For every study reporting improved neonatal outcomes within the providers that were queried.

Statement of Ethics

This study was approved by the Children’s Hospital of Wisconsin Institutional Review Board.

Disclosure Statement

The authors declare no conflict of interest.

References


