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Intrauterine death rate in gastroschisis following the introduction of an antenatal surveillance programme: a retrospective observational study

Running Head:Intrauterine death rate in gastroschisis

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ABSTRACT

Aim: to investigate whether an antenatal surveillance protocol including ultrasound and Cardiotocograph monitoring reduces intra-uterine death (IUD) in cases of gastroschisis.Secondary outcomes included neonatal death rate, mode of delivery and rate of intervention before planned time of delivery.

Methods:this was a retrospective observational study of all women with an antenatally diagnosed gastroschisis who were managed according to our surveillance programme between 2002 and 2015 in a tertiary fetal medicine and paediatric surgical centre covering the Wessex Region of England. We reviewed and analysed data from the WANDA database as well as prospectively managed maternity, ultrasound and neonatal databases over the given time period. Case notes were reviewed when delivery was expedited.

Results: the intra-uterine death rate was 2.2%, a 58% reduction since the introduction of our surveillance protocol. Delivery was expedited in 35.4% of cases and in 86% of these, delivery was by caesarean section. In women being induced as planned at 38 weeks, the vaginal delivery rate was 88% and for those in spontaneous labour before 38 weeks it was 75%.

Conclusions: an antenatal surveillance programme appears to reduce the intra-uterine death in gastroschisis. In a third of cases, delivery was indicated before the planned date of delivery. When expedited delivery was indicated, the chance of caesarean section was high.

Key Words

Caesarean section, fetal distress, fetal monitoring, gastroschisis, stillbirth.

MAIN BODY OF TEXT

INTRAUTERINE DEATH RATEIN GASTROSCHISIS FOLLOWING THE INTRODUCTION OF AN ANTENATAL SURVEILLANCE PROGRAMME: A RETROSPECTIVE OBSERVATIONAL STUDY

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Introduction:

Gastroschisis is a congenital abdominal wall anomaly in which bowel and viscera protrude through a defect in the abdominal wall. The defect is typically to the right of a normally sited umbilicus. The prevalence of gastroschisis is increasing worldwide and is now around 4 per 10 000 total births in the UK[1, 2]. Despite the condition being associated with low birth weight, long term developmental problems and intrauterine death, there is currently no recommended or standardised guidance for antenatal monitoring and delivery [1,3,4,5]. Practice varies greatly with a wide range of antenatal monitoring regimes and delivery policies [1,3,6,7]. In some units, all babies with gastroschisis are delivered by elective Caesarean section[6].

In 1997, we reported an institutional intrauterine death rate of 5.3% and a literature review at that time showed a rate of between 9.5 and 12%[8]. In 2012, using capture-recapture analysis, Overton *et.al* reported an IUD rate of 4% in a UK-wide assessment of gastroschisis outcomes[1]. At the time of our previous publication, our unit had recently adopted a

programme of regular growth ultrasound scans (USS) at 28, 32 and 36 weeks gestation, with additional scans if there are concerns about poor fetal growth, twice weekly Cardiotocograph (CTG) monitoring from 34 weeks and planned delivery at 38 weeks [8, 9]. This practice is now well established within our centre and we wish to assess any changes in our outcomes which may be attributable to this regime. The standard practice in our unit is for induction of labour aiming for vaginal delivery unless there is another indication for Caesarean section. Prior to this programme, fetal monitoring and timing of delivery were at the discretion of individual clinicians, based on their assessments of the pregnancy.Overton *et.al* highlight the wide variation in UK-wide practice with concern to fetal monitoring programmes and this variation also applies to the studies included in our literature review of the time.[1,8]

Our primary aim was to investigate the intrauterine death rate in our unit following the introduction of our antenatal surveillance protocol. Secondary outcomes included mode of delivery, rate of intervention before planned time of delivery (by earlier induction of labour or emergency Caesarean section) and neonatal death rate. We also examined the reason for earlier intervention to assess whether the antenatal surveillance was contributing to this.

Methods:

We searched our regional congenital anomaly register, the WANDA (Wessex Antenatally Detected Anomalies) database, to identify all cases of gastroschisis. The register captures and records both antenatally and postnatally detected congenital anomalies for live births, stillbirths and terminations of pregnancy in the Wessex health region, which covers ten maternity services in central southern England and the Channel Islands. We report data for the last 13 years, encompassing births in the years 2002–2015. The data are obtained

prospectively from the single regional fetal medicine unit on a weekly basis and from the neonatologists, surgeons, cardiologists and pathologists on a monthly basis, as well as from referrals to the Genetics service. Each of these specialties covers the Wessex region and sees virtually all cases detected within this area, so ascertainment rates are high. In addition, there are regular meetings with paediatricians and those carrying out prenatal diagnosis in the regional referral hospitals, which would identify cases referred out of region for management. Ethics approval to maintain and use the data in this register has been obtained from the Trent Multicentre Research Ethics Committee (Ethics number09/H0405/48). Additional information about the pre and postnatal management and outcomes was then obtained from prospectively maintained databases (maternity database, ultrasound database, pathology reporting and the neonatal database). Patient notes were reviewed in cases where an unplanned intervention took place.

We categorised outcomes of the pregnancy as the following: live birth, neonatal death, intra-uterine death (IUD (fetal loss beyond 23 weeks gestation)), miscarriage (fetal loss before 23 weeks) or termination of pregnancy. The delivery details were collated to demonstrate mode of delivery and whether this was planned, spontaneous or an intervention ahead of planned delivery for fetal concerns. This allowed us to determine the proportion of babies who needed intervention following antenatal surveillance. We further analysed this group to try and identify which element of the antenatal surveillance led to this intervention (namely reduced fetal movements, ultrasound findings or CTG findings) and documented any trends in findings. Statistical analysis was performed using 2 x 2 tables and Fisher's Exact Test.

Results:

Two hundred and twelve cases were identified. There were four cases of spontaneous miscarriage between 13 and 22 weeks gestation, thirteen terminations of pregnancy (of which eight had complex anomalies not representative of isolated gastroschisis) and three live born cases were reclassified as an exomphalos, a complex twin-twin transfusion syndrome and a baby with multiple anomalies. Six cases moved out of area and thus followed a different antenatal surveillance strategy and have been excluded. We have limited data for a further five cases where the delivery and neonatal care were transferred away from our unit, although we do know that four of these were live births. This left a total of 181 cases of gastroschisis where the pregnancy continued beyond 23 weeks gestation with adequate detail to assess (*Figure 1*).

Of these 181, there were four intrauterine deaths that occurred between 31 and 37 weeks gestation giving an overall rate of IUD of 2.2% (95% CI -0.2%-4.6%). Two of these mothers had a history of substance abuse; one is known to have consumed excessive alcohol the night before the IUD was detected and the other was a known intravenous drug user but further details of the case are not known. A third mother attended for a routine scan at 36 weeks gestation and was found to have sustained an IUD. Reduced fetal movements had been noted the day before but these had subsequently improved. The fourth mother had an IUD at 33 weeks gestation (before routine CTG monitoring started) and post-mortem revealed no abnormalities other than gastroschisis; this mother had noted reduced fetal movements for 48 hours prior to this. She had had normal scans at 29 and 31 weeks of gestation. All four cases were delivered vaginally.

Two neonatal deaths occurred (1.1%). The first was an uncertain diagnosis which may represent a possible Exomphalos without a membrane. The otherhad absent basal ganglia and fused thalami in addition to gastroschisis. The remaining infants survived the neonatal period (*Table 1*).

Of the 177 pregnancies resulting in live births, forty-nine(27.1%) patients were induced at 38 weeks gestation as planned, fifty-six (31%) went into spontaneous labour before 38 weeks gestation, eight (4.4%) had an elective Caesarean section for reasons not related to their diagnosis of gastroschisis (five for breech presentation, two for twin pregnancies and one for a failed induction at 38 weeks gestation) and sixty-four (35.4%) had delivery expedited (by Caesarean section or induction of labour) following the detection of suspected fetal compromise before their planned delivery date. These patients either attended for a routine scan or CTG or self-presented with reduced fetal movements (*Table 2*).

The trigger for earlier intervention in 64 patients was concerns at routine ultrasound in twenty-three (36%) patients, concerns at routine CTG in eighteen (28.1%) patients and presentation with reduced fetal movements in twenty-one (32.8%). In two (3.1%) cases details were unknown (*Table 3*). All of those who presented with reduced fetal movements were subsequently delivered due to having an abnormal CTG, either directly at presentation or after a short period of inpatient surveillance. Seven of these patients were also noted to have ultrasound changes of bowel dilatation or stomach herniation. There is some evidence in the literature that these findings may be associated with intrapartum and postnatal complications[10-12]. However, due to conflicting findings in the literature and a lack of large scale prospective studies, these findings were not used alone to dictate timing of delivery and instead led to increased frequency of CTG monitoring, including as inpatients in some

circumstances. In eight cases where the decision was based on ultrasound or CTG findings, reduced fetal movements were also reported and three of these patients had delayed attending with reduced fetal movements as they knew they had a planned intervention (ultrasound or CTG) soon.

In the 49 patients induced at 38 weeks gestation, thirty-nine (79.6 %) had a normal vaginal delivery (NVD), four (8.2 %) had an instrumental delivery and six (12.2 %) had an emergency Caesarean section. Two of the six Caesareans were for failure to progress in labour and the remainder were for suspected fetal compromise (*Table 4*).

In the 56 patients who presented in spontaneous labour prior to their induction date, thirty-eight (67.9%) had a normal vaginal delivery, one (1.8%) had a vaginal breech delivery, three (5.4%) had an instrumental delivery and fourteen (25%) had an emergency Caesarean section (six due to breech presentation and eight for suspected fetal compromise).

Regarding the group of patients where a decision was made to expedite delivery,induction of labour was attempted in twelve (18.8%) patients. Of these, tenachieved a vaginal delivery and twohad an emergency Caesarean section. In the remaining fifty-two patients, induction was not attempted and they had a Caesarean section.

Discussion:

Main Findings

Our results demonstrate that our intrauterine death rate has fallen from 5.3% to 2.2% of pregnancies continuing beyond 23 weeks (p=0.36). This compares favourably with the 4% national figure generated by the BAPSCASS survey in 2012 (*Overton et al*[1]) for pregnancies surviving to the third trimester. Our IUD rate is lower, though there is not a statistically significant difference from the unadjusted 2.9% figure of their raw data (p=0.77). During this time there has been a slight reduction in the background IUD rate (from 5.3 per 1000 in 1997 to 4.7 per 1000 in 2013)[13]. The 58% reduction in IUD we have shown suggests that our protocol has been successful in lowering IUD rates for fetuses with gastroschisis. This trend gives us encouragement to continue our current practice of surveillance and elective induction at 38 weeks.

The antenatal surveillance strategy we employ has several components, namely serial USS scans, twice weekly CTG and increased maternal awareness of potential complications with heightened awareness of reduced fetal movements. This strategy led to expedited deliveries in 35.4% of cases. Each aspect of the surveillance programme led to a significant fraction of these deliveries, demonstrating the importance of each component of the surveillance strategy.

Our results suggest that careful antenatal surveillance is of value and may reduce the intrauterine death rate amongst fetuses with gastroschisis. They also emphasise the importance of maternal awareness, namely informing pregnant women to present early if they have concerns over fetal movements, despite the fact they are having regular monitoring.

The emergency Caesarean section rate was 41%, which is similar to that reported by this unit in 1997[8]. In the group where delivery was expedited, 84% of patients had an emergency

Caesarean Section, making up the majority of cases. However, patients undergoing induction at 38 weeks gestation achieved a vaginal delivery rate of 88% and in those that went into spontaneous labour prior to 38 weeks gestation, the vaginal delivery rate was 75%. This is an important observation as vaginal delivery has benefits for both mother and fetus over Caesarean section and the concerns regarding subsequent pregnancies are particularly relevant in this population who are often young and primiparous[14-19]. Our findings suggest that by having a policy of induction of labour at 38 weeks gestation, we are not disadvantaging women, as the rates of successful vaginal delivery are high. However, women should be counselled that in 35% of cases, delivery will be sooner than planned, and in this situation, there is a high chance of having a Caesarean Section.

A recent meta-analysis by South et.al suggested avoiding delivery before 37 weeks gestation in stable fetuses to avoid the risks associated with prematurity and that there may be benefit in increased monitoring from 36 weeks gestation[7]. This is in keeping with our current policy.

Our study benefits from the robust way in which cases are collected by WANDA which means that our ascertainment rate is high and very few cases are lost to follow up (except where they moved out of region). Additionally, in the majority of the cases where the baby was delivered out of area due to limited local cot capacity, we were still able to identify the birth outcome (as a minimum) with information from the maternity and neonatal databases.

Our findings support the notion that an antenatal surveillance protocol reduces the occurrence of intra-uterine death in fetuses with gastroschisis and leads to earlier delivery than planned when clinically indicated. A policy of aiming for vaginal delivery following

induction of labour at 38 weeks gestation does not appear to disadvantage women as the success rates are high and this may result in benefits to both the mother and baby. Our results show that 1 in 3 pregnancies with gastroschisis require delivery to be expedited because of concerns about fetal wellbeing and in these cases there is an 84% chance of having a Caesarean section. This information regarding mode of delivery should be included in prenatal counselling. Advising women about the importance of reporting reduced fetal movements at any gestation should be a key message when counselling them about gastroschisis as our study found that 100% of those presenting with reduced fetal movements also had CTG or ultrasound abnormalities that led to their delivery being expedited.

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Disclosure of Interests

None declared

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Figure Legends

>23/40 = pregnancy continuing beyond 23 weeks of gestation

Livebirth = birth of a live baby at or above 23 weeks gestation

Intrauterine death = death of a fetus before birth at or above 23 weeks gestation

Neonatal Death = death of a baby in the first 28 days of life

Miscarriage = spontaneous abortion of pregnancy at less than 23 weeks of gestation

Termination = medical or surgical abortion of pregnancy

Misclassified = pregnancy incorrectly coded as gastroschisis so excluded from analysis

Insufficient data = too little detail available to interpret outcomes

Moved during pregnancy = patient moved out of area and therefore no information available