Fetal Hydronephrosis: Optimal Renal Pelvic Measurement to Increase Detection Rate for Renal Pathology

Abstract:

J Leader 1, J Letshwiti 3, B Stuart 2, MJ Turner 2, M White 4, M Kennedy 5

1 UCD, Belfield, Dublin 4
2 Letterkenny General Hospital, Letterkenny, Co Donegal
3 Coombe Women & Infants University Hospital, Crumlin, Dublin 12
4 Nenagh General Hospital, Nenagh, Co Tipperary
5 Centre for Policy Studies, UCC, Western Rd, Cork

We reviewed the outcome of fetal hydronephrosis with a renal pelvic dilatation (RPD) of 4-7 mm to assess whether a RPD >7 mm had a higher predictive value for renal pathology. 373 fetuses were diagnosed with hydronephrosis giving an incidence of 2.2%. The male: female ratio was 1.8:1. 51 (34.3%) fetuses with antenatal hydronephrosis were diagnosed with Down Syndrome. 299 (91.7%) fetuses with an RPD of 4-7 mm had resolved by 34 weeks gestation with 10 (3.1%) incidence of 2.2%. The resolution rate for RPD > 7 mm was 60.7%(17) with 11 fetuses (39.3%) requiring long term follow up.

Introduction

Antenatal ultrasound offers many benefits including detection of fetal abnormalities which may benefit from timely management. A potential limitation is the false positive rate associated with the use of this modality and the parental anxiety they cause. Fetal hydronephrosis, a common finding in obstetric ultrasound is one such condition. In our unit, fetal hydronephrosis is defined as an anterior-posterior renal pelvic diameter (RPD) of 4-6mm before 28 weeks gestation and 8mm after 28 weeks gestation. The antenatal course is highly unpredictable, but is most commonly physiological and in the majority of cases resolves spontaneously. However, there are cases which underlie certain pathological entities including vesico-ureteric reflux as well as pelvi-ureteric junction and vesico-ureteric junction obstruction. Ultrasound is the diagnostic modality of choice and hydronephrosis is detected in up to 5.5% of all scans. Certain markers are associated with an increased risk of postnatal consequences. These include, an increased severity of renal pelvic dilation, oligohydramnios, megacystis and megareter. Studies have also shown that there is an increased incidence in those with chromosomal abnormalities with emphasis being placed on Down syndrome.

Despite this knowledge, there is a lack of consensus among fetal medicine specialists or robust data to clarify the cut-off measurement of RPD for continuing antenatal and postnatal monitoring in cases of isolated hydronephrosis (no associated renal abnormalities or extra renal abnormalities). The cut-off value should be one with a high diagnostic rate for an underlying renal abnormality and a low false positive rate. This helps to minimise parental anxiety, reduces the number of unnecessary investigations both pre and postnatally, and provides a cost efficient and effective service without missing any significant renal pathology. There is also a lack of agreement on which RPD measurement warrants karyotyping and the postnatal consequences of the antenatal measurements. The aims of this study were to review the outcome of the hydronephrosis cases raised during antenatal scans and to assess whether a RPD >7 mm had a higher positive predictive value for renal pathology. We also evaluated the incidence of chromosomal abnormalities in this group as a secondary outcome.

Methods

Ultrasound scans preformed between 2008 and 2009 in a tertiary referral ultrasound and fetal medicine unit in a large university teaching hospital were reviewed retrospectively. The Coombe Women and Infants University Hospital is a tertiary referral unit with an annual delivery rate of approximately 9,110 births. Cases with RPD were detected at routine ultrasound for anatomical review at 20-22 weeks or co-incidentally at a growth scan in the third trimester. These scans were carried out by midwife sonographers and consultants in the ultrasound and fetal medicine department on 2D ultrasound scanners. Over the two year period, all cases diagnosed were either unilateral or bilateral isolated fetal hydronephrosis which was defined as an anterior- posterior pelvic diameter with respect to gestation (Figure 1). Cases with multiple abnormal renal abnormalities such as multicystic dysplastic kidney, hydroureter, calyceal clubbing, anechoic fluid or bladder abnormalities were not included in this study. Fetuses with multiple extra-renal abnormalities were also removed from the study. The inclusion criteria for the study was a renal pelvic dilatation of 4mm detected before 28 weeks gestation or 8mm dilatation after 28 weeks. An anterior-posterior diameter of 10mm was considered pathological and was reviewed by a consultant in fetal medicine at the time of detection. The unit policy for follow up was to review these patients at 34 weeks gestation with the following diagnostic criteria: Mild hydronephrosis 6mm-9mm; moderate hydronephrosis 10-14mm and severe hydronephrosis >15mm. A follow up scan was requested and the measurement on the diagnostic report was given for diagnosis and any associated findings.

As hydronephrosis is associated with an increased risk of aneuploidy, this risk was calculated using previous risk of aneuploidy based on maternal age or nuchal translucency when appropriate, as background risk. If the estimated risk was higher than 1:250, an amniocentesis was offered. The postnatal follow up included ultrasound scans on day 3-5 of life on all babies with a dilatation of greater than 8mm at the 34 week scan. Further diagnostic scans were then requested depending on the ultrasound findings and at the requests of the paediatric nephrologist. If the postnatal ultrasound examination was normal, a RPD >7 mm, follow-up was discontinued. These cases were then classified as postnatal normal. In cases where the RPD was larger or additional findings were revealed, the management was individualised. In such cases, prophylactic antibiotic treatment was given to all newborns.

Results

A total of 373 fetuses out of 18,250 scans performed were diagnosed with hydronephrosis with the mean maternal age was 32.7 years and the mean gestational age at delivery was 39.2 weeks (Range 28.3 - 42.3 SD=2.1). 187 (50.1%) cases were female and 133 (35.7%) cases being female giving a male to female ratio of 1.8:1. There were 5 (1.34%) fetuses diagnosed in the antenatal or postnatal period with Down Syndrome. The male: female ratio was 1.8:1. It can, however, be associated with certain pathological entities including vesico-ureteric reflux as well as pelvi-ureteric junction and vesico-ureteric junction obstruction. Ultrasound is the diagnostic modality of choice and hydronephrosis is detected in up to 5.5% of all scans. Certain markers are associated with an increased risk of postnatal consequences. These include, an increased severity of renal pelvic dilation, oligohydramnios, megacystis and megareter. Studies have also shown that there is an increased incidence in those with chromosomal abnormalities with emphasis being placed on Down syndrome.

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Flow Chart 1: A representation of the overall breakdown of results into resolved or diagnosed renal pathology for those who had fetal hydronephrosis between 4-7mm, >7mm and those diagnosed in third trimester.

The overall results are depicted in Flow Chart 1. The resolution rate for a RPD of 4-7 mm was high with 91.7% (299 cases) of the entire group having resolved by the 34 week scan. Of those that did not resolve, Table 2 details the outcome. The mean RPD in these cases was 6.8mm. 17 fetuses had an RPD 4mm of which all resolved. Of those diagnosed at the 20-22 week scan, 7 (23.3%) had a RPD >7mm. The resolution rate was less in these, 26 (60.7%) resolving and 11 (39.3%) requiring long term follow up. Of the 19 diagnosed in the third trimester 9(47.3%) had an underlying renal abnormality. Overall an underlying abnormality/pathology was present in 29 (7.8%), 11 (37.9%) of which were female and 18 (62.1%) male. These cases included: Pelvi-ureteric junction obstruction(8), vesico-ureteric junction obstruction(5), strictures(6), duplex systems(7) and posterior urethral valves(3). These cases required going long term follow up. Table 2 details the results from the third trimester scans.

RPD: renal pelvic dilatation

Discussion

Our data highlights the natural course of isolated fetal hydronephrosis (RPD 4-7 mm) diagnosed at 20-22 weeks gestation is of resolution during the pregnancy or the neonatal period. This supports the view that they do not have a congenital origin and are related to transient obstruction of the urinary tract. This hypothesis is supported by the findings of Allen et al (4) who in their study of isolated hydronephrosis diagnosed before 34 weeks gestation, found that 80% of cases had resolved by birth.

Figure 1: Ultrasound image of fetal hydronephrosis where the renal pelvices are measured.

Flow Chart 1: A representation of the overall breakdown of results into resolved or diagnosed renal pathology for those who had fetal hydronephrosis between 4-7mm, >7mm and those diagnosed in third trimester.
necessarily need a third trimester or a postnatal scan, but 10 (3.1%) cases of possible pathology could be missed. As stated the mean RPD in these cases was 6.5 mm, which may suggest that a 6mm cut off may be more sensitive for a higher detection rate with a low false positive rate. However, the unit policy for soft markers at that point, did not include nuchal pad or humerus length, so in fact, this group may include other soft markers and hence not represent isolated hydronephrosis. Regarding the sex distribution, the male preponderance was also reflected in the resolution rate, hence this indicates that female fetuses with renal pelvic dilatation have a higher probability of non resolution and underlying pathology. In summary, this review suggests that a RPD of 6 mm is more sensitive with a lower false positive rate than 4 mm.

The 1.3% prevalence of Trisomy 21 in this group of isolated kidney dilatation, without taking maternal age or any other risk factors into account was higher than expected. However, the unit policy for soft markers at that point, did not include nuchal pad or humerus length, so in fact, this group may include other soft markers and hence not represent isolated hydronephrosis. Regarding the sex distribution, the male preponderance was also reflected in the resolution rate, hence this indicates that female fetuses with renal pelvic dilatation have a higher probability of non resolution and underlying pathology. In summary, this review suggests that a RPD of 6 mm is more sensitive with a lower false positive rate than 4 mm.

Correspondence: J Leader
Apt 1, 91 Harcourt Street, Dublin 2
Email: joyce.leader@ucdconnect.ie

References