Appropriate timing of performing abdominal ultrasonography and termination of follow-up observation for antenatal grade 1 or 2 hydrenephrosis

CURRENT STATUS: UNDER REVIEW

Akihiro Nakane
Nagoya Shiritsu Daigaku
ORCiD: https://orcid.org/0000-0003-4922-6978

Kentaro Mizuno
kmizuno@med.nagoya-cu.ac.jp Corresponding Author
ORCiD: https://orcid.org/0000-0002-9624-2009

Taiki Kato
Nagoya Shiritsu Daigaku

Hidenori Nishio
Nagoya Shiritsu Daigaku

Hideyuki Kamisawa
Nagoya Shiritsu Daigaku

Satoshi Kurokawa
Nagoya Shiritsu Daigaku

Tetsuji Maruyama
Nagoya Shiritsu Daigaku

Takahiro Yasui
Nagoya Shiritsu Daigaku

Yutaro Hayashi
Nagoya Shiritsu Daigaku

DOI:
10.21203/rs.2.22206/v1

SUBJECT AREAS
Urology & Nephrology
KEYWORDS
antenatal hydronephrosis, ultrasonography, continuous follow-up period
Abstract

Background

Most cases of antenatal the Society of Fetal Urology (SFU) grade 1 or 2 hydronephrosis improve or resolve spontaneously with conservative treatment. However, there is no consensus on the duration of follow-up for cases of grade 1 or 2 hydronephrosis. The aim of this study was to determine the need for continuous follow-up period and new management of children with antenatal grade 1 or 2 hydronephrosis.

Methods

Subjects underwent ultrasonographic assessment for hydronephrosis according to the SFU classification. We retrospectively evaluated 112 patients with postnatal grade 1 hydronephrosis and 69 with grade 2 hydronephrosis using abdominal ultrasonography between January 2010 and December 2017. We examined the change in hydronephrosis grade on repeat ultrasonography.

Results

The mean follow-up duration was 44.9 months. Initial grade 1 hydronephrosis disappeared in 44.8% of cases at 12 months, 66.4% at 24 months and 73.2% at 48 months. Initial grade 2 hydronephrosis showed improvement in grade in 70.0% of cases at 12 months, 88.3% at 24 months and 89.5% at 48 months. However, 13.4% of grade 1 and 2.9% of grade 2 cases increased in grade and 99.3% of these cases worsened within the first 6 months. No cases with increased grade required pyeloplasty. Initial disappearance and later reappearance of hydronephrosis occurred in 13.4% of grade 1 cases and 2.9% of grade 2 cases. The mean duration of later reappearance of hydronephrosis was 6.9 months. No cases showed reappearance of hydronephrosis after more than 1 year.

Conclusions

Ultrasonography within the first 6 months was necessary for management of children with antenatal grade 1 or 2 hydronephrosis, because some patients showed worsening. Most cases of grade 1 or 2 hydronephrosis resolved spontaneously, however a few cases reappeared within 1 year. Therefore, ultrasonography after 1 year was necessary in children with hydronephrosis that spontaneously
disappeared. The appropriate time to end the follow-up was considered to have been after one year or more has passed since the disappearance was confirmed.

Background
Fetal hydronephrosis is the most common anomaly detected on antenatal ultrasonography, with an estimated prevalence of approximately 2–5.5% [1–3]. In most cases, hydronephrosis is diagnosed in the absence of urinary tract obstruction, when the anteroposterior diameter of the renal pelvis is just above the normal range for gestational age [4]. Studies have shown that most cases of antenatal hydronephrosis improve or resolve spontaneously with conservative treatment [2,3]. The cases of 98–100% in the Society of Fetal Urology (SFU) grade 1 or 2 hydronephrosis improve or resolve [5,6]. However, some patients do not show improvement or increase grade of hydronephrosis, and a few cases need operation [7,8]. The detection and postnatal follow-up of persistent antenatal hydronephrosis is believed to help in the early recognition and prevention of progressive renal damage [3,9–11]. There is no consensus on the duration of follow-up for cases of grade 1 or 2 hydronephrosis [12]. The present study aimed to determine the need for continuous follow-up period and new management of children with antenatal grade 1 or 2 hydronephrosis.

Methods
Patient characteristics
We retrospectively evaluated 112 antenatally-detected hydronephrosis patients with grade 1 unilateral hydronephrosis and 69 with grade 2 unilateral hydronephrosis using abdominal ultrasonography at our institutions between January 2010 and December 2017. All patients visited our institutions within 1 month of age. Patients who had repeated febrile urinary tract infections or abdominal mass, or pain and those who were diagnosed with vesicoureteral reflux on voiding cystourethrography were excluded.

Follow-up surveillance
The patients were followed up according to the grade of hydronephrosis, and ultrasonography was performed once every 1–3 months. Ultrasonographic assessments were performed according to the SFU classification [13]. The term “resolved” indicated a change in the SFU grade to grade 0;
“improved” indicated a decrease in the SFU grade by one or more levels, and this included resolved cases; “no change” indicated no change in the initial SFU grade; and “worsened” indicated an increase in the SFU grade. In the further follow-ups, repeat ultrasonography was performed for low SFU grade hydronephrosis, while renal nuclear medicine studies using dynamic scanning modes were performed for hydronephrosis that progressed to a high grade.

All these procedures were performed after obtaining informed consent form the parents. Additionally, the procedures were performed as a clinical trial at our institution after obtaining institutional review board approval (approved by Ethical Committee of the Gamagori City Hospital, approval no. Gamabyo 500-4). All statistical analyses were performed using SPSS Statistics Ver. 22 (IBM, Armonk, NY, USA).

Results
The mean follow-up duration was 44.9 months. The rate of time to resolution or improvement in grade 1 or 2 were determined using Kaplan-Meier method (Figure 1). Initial grade 1 hydronephrosis resolved in 44.8% of cases at 12 months, 66.4% at 24 months and 73.2% at 48 months. The median of time to resolution was 14 months (95% confidence interval (CI) 9.49–18.51). Initial grade 2 hydronephrosis showed improvement in grade in 70.0% of cases at 12 months, 88.3% at 24 months and 89.5% at 48 months. The median of time to resolution was 14 months (95% CI 6.15–7.85). However, 13.4% of grade 1 and 2.9% of grade 2 cases increased in grade. Then, 99.3% of these cases worsened within the first 6 months, only one case of grade 1 worsened at the 13 months. The rate of time to worsening in grade 1 or 2 were determined using Kaplan-Meier method (Figure 2). In worsened cases that underwent pyeloplasty, deterioration of renal function was not noted. We followed up on 42 cases that hydronephrosis resolved. Initial disappearance and later reappearance of hydronephrosis occurred in 40.5% cases. The mean duration of later reappearance of hydronephrosis was 6.9 months. The rate of time to reappearance of hydronephrosis was determined using Kaplan-Meier method (Figure 3). No cases showed reappearance of hydronephrosis after more than 1 year.

Discussion
Most cases of antenatal hydronephrosis improve or resolve spontaneously with conservative treatment [2,3]. However, some patients do not show improvement without treatment. No consensus
currently exists regarding the optimal schedule and duration of follow-up with grade 1 or 2 hydronephrosis. It is unclear which neonates require postnatal evaluation, when postnatal evaluation for hydronephrosis should be performed, how long follow-up should be continued, how long an examination should be performed [12].

The timing of postnatal resolution of hydronephrosis is quite variable, occurring over the first few years of life. Despite variabilities in the underlying diagnoses, mild grades of hydronephrosis generally show early resolution, with most cases of SFU grade 1–2 hydronephrosis resolving within 12–18 months of age [14–16]. In our study, most cases of SFU grade 1–2 hydronephrosis showed natural improvement or disappearance within 4 years of age. However, few cases showed worsening of grade 1 hydronephrosis to grade 2 hydronephrosis, and this worsening was mainly noted within 6 months of age. In a previous report, of 225 kidneys with grade 2 hydronephrosis, 3 showed worsening of hydronephrosis to a severe grade [15]. We believe that patients with grade 1 or 2 hydronephrosis who are less than 6 months of age need to undergo ultrasonography. SFU grade 1–2 hydronephrosis tends to resolve with time and usually requires only ultrasonography surveillance. A previous study reported the need for surgical intervention in a small percentage of cases of mild-grade hydronephrosis [17]. In our study, operative repair was not required in all cases.

In our study, 66.1% of grade 1 cases and 86.3% of grade 2 hydronephrosis cases showed improvement during the study period. We believe that cases of SFU grade 1 or 2 hydronephrosis should undergo initial ultrasonography within 6 months of age, and then cases without an increase in grade undergo follow-up with ultrasonography to improve hydronephrosis. In our study, Once hydronephrosis disappeared for more than 1 year, no case had recurrence of hydronephrosis. Chertin et al. reported that 50% of cases requiring surgical intervention undergo surgery within the first 2 years and almost all cases undergo surgery within the first 4 years [18]. These authors recommended evaluation every 3–6 months during the abovementioned period [18]. Some authors have proposed that further evaluation is unnecessary for grade 1 or 2 of hydronephrosis [19, 20]. Others have advised serial US until decrease or resolution of hydronephrosis, or until patients are old enough to communicate symptoms of renal colic [21, 22]. Taken together the above results, we thought that
cases disappeared hydronephrosis over 1 year, over 4 years old, then we might be able to decide termination of follow-up observation for grade 1 or 2 hydronephrosis.

Our study had some limitations. This was a retrospective study. Additionally, follow-up indications were not standardized across the participating physicians. The evaluation grade of hydronephrosis was SFU classification only, anterior-posterior diameter measurement [23] and UTD classification [24] are not performed. Further studies are needed to overcome these limitations and confirm the findings of the present study.

Conclusions
Ultrasonography within the first 6 months was necessary for management of children with antenatal grade 1 or 2 hydronephrosis, because some patients showed worsening. Most cases of perinatal grade 1 or 2 hydronephrosis resolved spontaneously with conservative treatment. However, a few cases reappeared within 1 year. Therefore, ultrasonography after 1 year was necessary in children with hydronephrosis that spontaneously disappeared. The appropriate time to end the follow-up was considered to have been after one year or more has passed since the disappearance was confirmed.

List Of Abbreviations
CI: confidence interval
SFU: the Society of Fetal Urology

Declarations

Ethics approval and consent to participate: All patients were fully informed of the disease, examinations and complications, and were required to sign a written informed consent form before undergoing any procedures. All study protocols were approved by Ethical Committee of the Gamagori City Hospital (approval no. Gamabyo 500-4). The requirement for research consent was waived due to the study’s retrospective nature.

Availability of data and material: The datasets used and/or analysed during the current study are available from the first author or the corresponding author on reasonable request.

Competing interests: The authors declare that they have no competing interests.

Funding: None

Authors’ contributions: Conception and design: AN and YH; enrollment of patients and acquisition
of data: AN, KM, and HN; drafting of the manuscript: AN, KM, and YH; statistical analysis: AN and HK; analysis and interpretation of data: TK, SK, and TM; supervision: TY. We confirm that all authors read and approved the final manuscript.

Acknowledgements: None

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Figures
Rate of time to resolution or improvement of hydronephrosis in grade 1 or 2. There were 44.8% of cases at 12 months, 66.4% at 24 months and 73.2% at 48 months disappeared hydronephrosis in initial grade 1. There were 70.0% of cases at 12 months, 88.3% at 24 months and 89.5% at 48 months improved hydronephrosis in initial grade 2.
Figure 2

Rate of time to worsening of hydroureteronephrosis in grade 1 or 2.

Rate of time to worsening of hydroureteronephrosis in grade 1 or 2. There were 13.4% of grade 1 and 2.9% of grade 2 cases increased in grade. Then, 99.3% of these cases worsened within the first 6 months, only one case of grade 1 worsened at the 13 months over the study period.
Rate of time to reappearance of hydronephrosis. No cases showed reappearance of hydronephrosis after more than 1 year.