Pediatric Nephrology (2021) 36:5–8
https://doi.org/10.1007/s00467-020-04766-2

EDITORIAL COMMENTARY

Conversations for the future in the follow-up of antenatally diagnosed renal pelvicalyceal dilatation

Aniruddh V. Deshpande[1,2,3]

Received: 16 August 2020 / Accepted: 7 September 2020 / Published online: 7 October 2020

Introduction

Antenatally detected renal pelvic dilatation and/or antenatally detected hydronephrosis is associated with a definite health burden [1]. This brief editorial, which is drafted in response to the study by Herthelius et al., looks at the results of the reported long-term follow-ups [2–5], compares between similar studies and discusses the direct and indirect future implications of such precious data on healthcare.

The authors of this index study have reported a long-term follow-up of a cohort of children diagnosed with antenatal renal pelvic dilation[4]. The median/mean follow-up is 13.5 years approximately. Such data are indeed scarce and the study is a welcome addition. Whilst the study is rigorous and well designed, it is admittedly small and discordant with its handful of peers. In my view, this study generates a few significant, guiding conversations for the paediatric nephro-urological community with perhaps, a few sub-conversations within.

Conversation 1: What is the CKD risk and safe, optimal follow-up of mild renal pelvic dilatation? (ARPD ≤ 7 mm or SFU 1)

The findings of this study perhaps argue for a limited follow-up for patients whose pelvic dilation is less than or equal to 7 mm. Similar suggestions have recently been made in other publications [6, 7]. In a study focussed on unilateral dilatation and need for surgery for pelviureteric junction obstruction (PUJO), Yang et al. confirmed that SFU grade 1 dilatations did not progress to needing intervention [2]. Nevertheless, the highlight of this study is the correlation to a lack of long-term kidney morbidity which few other studies comment on (Table 1). In perhaps the only other study to add to these data, Costa et al. also report no CKD in the low-severity cohort (SFU 1–2) in their study [5]. Clinicians should feel more reassured by this.

Conversation 2: What is the optimal management of moderate to severe renal pelvic dilatation? (ARPD ≥ 7 mm or SFU 2–4)

Sub-conversation 1: What is the risk of permanent kidney damage and CKD risk in moderate/severe dilatation (> 7 mm, SFU grades 3 and 4)?

This index study argues indirectly perhaps for a structured surveillance of the other arm (group B) mentioning a higher risk of kidney damage albeit with no reported CKD. [4] In the study, 36% cases (approximately 20% of total) in group B (>7mm RPD) had progression/new evidence of kidney damage. This is a significant finding of this study. Of note, the odds for permanent kidney damage in dilatation > 15 mm or CAKUT diagnosis are impressively high (8.9 and 14.0 respectively) and these must receive appropriate visibility and clinicians' attention. The study findings regarding CKD appear in some discordance to Costa et al., which reports a somewhat higher risk of CKD surrogates at peri-pubertal age [5] (Table 1). Although important, it is not an easy task to explain these differences; the effect of cohort size and puberty may be two important factors. Nevertheless, these differences are significant and need to be further explored.

✉ Aniruddh V. Deshpande
aniruddh.deshpande@health.nsw.gov.au

[1] Urology Unit, Department of Surgery, The Children's Hospital at Westmead (SCHN), Sydney, Australia

[2] Centre for Kidney Research, The Children's Hospital at Westmead, Sydney, Australia

[3] School of Medicine and Public Health, University of Newcastle, Newcastle, Australia

Table 1 Comparison between studies reporting long-term outcomes of antenatally detected RPD or ANH

Study author	Year published	Region	Entry year	Median follow-up (years approx.)	Number of participants	Attrition	All antenatally detected RPD/ ANH included	Exclusion	Subgroup	Subgroup outcomes				Cumulative outcomes			
										Need for surgery	CKD % (*n*)	Proteinuria % (*n*)	Hypertension % (*n*)	Need for surgery	CKD % (*n*)	Proteinuria % (*n*)	Hypertension % (*n*)
Matsui [3]	2007	Japan	1991	10	483	nr	Yes	None	SFU 1–2	1%	nr	nr	nr	19%	nr	nr	nr
									SFU 3–4	25%	nr	nr	nr				
Costa [5]	2019	Brazil	unclear	6	447	12	No	Megaureter, megacystis	SFU 1–2	nr	nr	nr	nr	28%	3.1% (1-4)	2.9% (13)	1.3% (6)
									SFU 3–4	nr	nr	nr	nr				
Yang [2]	2010	China	1989	12	910	260	No	Bilateral dilatation, megaureter, megacystis	SFU 1–2	nr	nr	nr	nr	25%	nr	nr	nr
									SFU 3–4	nr	nr	nr	nr				
Herthelius [4]	2020	Sweden	2003	13	103	32	Yes	None	< 7 mm	0%	0	0	0	8%	0	0	0
									> 7 mm	15%	0	0	0				

RPD renal pelvic dilatation, *ANH* antenatal hydronephrosis, *CKD* chronic kidney disease, *SFU* Society for Fetal Urology grading system, *nr* not reported

Sub conversation 2: Is there a long-term risk of recurrence of significant hydronephrosis after initial resolution?

One per cent of the patients in the study by Matsui develop a recurrence of severe hydronephrosis [3]. Most needed surgical correction since they had a diagnosis of PUJO in almost all cases. The authors of the current study report a 5% recurrence in group B. Whilst they have attempted to explain the difference, it is possible that there may be actually very little difference, if any. This is because 2/40 (5%) cases in the study equates to about 2% if the denominator is changed to include the entire eligible dataset which is then similar to Matsui et al. [3]. A spin-off from both these studies is that about 20% (2/10) of PUJO patients who need surgery declare themselves late despite extensive antenatal scanning support. Once again, it is reassuring that this risk is embedded almost entirely within the moderate to severe dilatation groups in both studies and should allow us to leave the counselling and follow-up of mild cases (< 7 mm or SFU 1) unaffected with confidence.

Sub conversation 3: Are we in a better position to estimate the incidence of needing surgery in antenatally detected renal pelvic dilatation or hydronephrosis?

Compared with similar studies, this study reports far reduced proportional need for surgical intervention (Table 1) [8]. Twenty to 30% children needed surgery in the other two long-term studies [2]. Whilst the reasons are not obvious, it is possible that they may be related to slightly different management paradigms and/or a selection bias (which the authors have done their best to exclude through a limited sensitivity analysis). It is therefore possible that the long-term outcomes are related to a friendlier cohort of patients compared with other studies. Furthermore, different studies have used different predictive features with some success. For example, Jung et al. reported higher predictive values of antenatal dimensions than post-natal dimensions [9]. Both these issues therefore, continue to be a space that is evolving and needs future attention.

Conversation 3: Could the cost to healthcare be reduced by less intensive screening of selected antenatal renal dilatation/hydronephrosis?

Healthcare dollars are precious and economic analyses of care models are gaining importance. With the large-scale application of antenatal scanning, the cost of healthcare is likely to go up and the policy makers may become concerned about the value it provides when applied across the board in a non-

selective manner. Markov models have been reported for antenatally diagnosed PUJO [10]. An estimated cost of 90 million USD annually on this front has been mentioned by the authors of the American consensus statement [11]. Although not directly measured or mentioned, the findings of this study have the potential of relating to the issue of the cost of healthcare in different ways. Reduced imaging tests and reduced clinical encounters are an obvious gain. Additionally, the study may provide a better insurance cover for the mild cases in some medical systems, thus affecting the utilization of the public tax dollar. These additional benefits must be systematically explored going further to show our commitment to minimizing the healthcare expenditure and cutting out the low-value encounters (healthcare waste).

Conversation 4: What thresholds/grading systems should be used? Quantitative, qualitative or others

This study is based on a quantitative system of categorizing the imaging information using APD, ureteric dilatation etc. Discussion of management of antenatal renal pelvic dilatation includes many grading/classification systems: some qualitative, some quantitative, others semi-quantitative [12]. Although the authors of the index study have used a quantitative system consistently, it must be remembered that this is not the most popular system in current use [12]. Nevertheless, they have successfully determined 7 mm as the threshold below which the long-term risks are minimal. Comparison with the consensus document by Nguyen et al. is interesting [11]. Their inclusion criteria for this arm overlap significantly with UTDA1 and are lesser in severity than the lowest category in the postnatal group UTDP1, as has been rightly acknowledged by the authors of the index study [11]. Other authors have proposed antenatal thresholds with similar aims: 6, 8 and 10 mm of AP diameters at 20 week, 20–30 weeks and after 30 weeks [13]. Some others have tried to differentiate mild pelvic dilatation from hydronephrosis in order to improve timely detection of obstructive uropathies [14]. The use of varying thresholds and multiple grading systems is an issue in itself and is further complicated by less than ideal inter-observer agreement [15, 16]. Back et al. have recently advocated for increased consistency in reporting calyceal dilatation [16]. The question for us going forward will be: How can we influence clinical practice to assert uniformity?

Conversation 5: Is the regional variation in CKD and need for intervention real? A closer look at discordance between studies

The current study also expresses some noteworthy discordance with the long-term modelling study from Brazil [5] (Table 1). The study which includes 447 participants had a much higher incidence of obstructive nephropathy (specifically PUJO), higher modelled incidence of CKD and composite events, including proteinuria and hypertension, as has been rightly acknowledged by the authors. The cohort also had a higher incidence of UTI and this was correlated to an increased risk of kidney disease. This was all evident at a median follow-up of 6 years. The study from China appears to exclude group A patients (≤7mm RPD) and has a median follow-up of 142 months [2]. Nevertheless, they have almost a 25% incidence of PUJO in the included cohort, which is similar to group B in the index study (>7mm RPD) [4], and suggests a much higher kidney damage percentage extrapolated from the split kidney function data. They did not report data on creatinine, proteinuria and hypertension. Thus, three long-term studies appear to tell us slightly different stories, albeit with a significant overlap at the less severe end of renal pelvic dilatation. Another Scandinavian study reported about 6–7% (8/125) risk of surgical intervention at long-term follow-up [17]. These data point to some heterogeneity and the obvious (but unlikely) thought that arises is regarding the possibility of underlying geographical variations. I wonder whether synthesizing the available long-term studies into a meaningful meta-analysis with pre-specified sensitivity analyses would be a worthwhile exercise and would help clarify these variations.

Conversation 6: Innovation/research and the way forward

Data linkage and artificial intelligence

Recent studies using data linkage have added very useful information to the armamentarium of practising paediatric urologists, nephrologists and materno-fetal medicine experts [1]. They confirm a significantly higher medicalization risk for children with persistent pelvic dilatation through the pregnancy. Such studies have the potential to capture the ground realities from a slightly different angle and can further inform the debate on counselling and minimal management. Deep learning algorithms and other artificial intelligence-based approaches are entering this space too [18]. They will undoubtedly have an impact on our understanding of the problem in the future.

Do we need to do more to understand the etiopathological mechanisms?

The aim of science is to be able to explain significant phenomena. In that context, have we done enough to explain renal pelvic dilatation from an etiological perspective? Perhaps not and therefore it appears that observational studies rule the

roost. Some elegant animal studies provoked thoughts which admittedly remain difficult to pursue in human environments, such as the theory of premature urachal closure [19]. With advances in genetics, epigenetics and molecular medicine, we should perhaps advocate more for pushing further along this path.

In conclusion, the authors deserve praise for bringing these data to our attention. We owe it to them to start a few clinico-academic conversations with the hope of working towards a better, more standardized care model some time into the future.

Compliance with ethical standards

Conflict of interest The author declares no conflict of interest.

Glossary

CAKUT	congenital anomalies of the kidney and the urinary tract
CKD	chronic kidney disease
PUJO	pelviureteric junction obstruction
	RPD renal pelvic dilatation

References

1. Hurt L, Wright M, Demmler J, VanDerVoort J, Morris S, Brook F, Ucker D, Chapman M, Francis NA, Daniel R, Fone D, Brophy S, Paranjothy S (2019) Mild-to-moderate renal pelvis dilatation identified during pregnancy and hospital admissions in childhood: an electronic birth cohort study in Wales, UK. PLoS Med 16: e1002859
2. Yang Y, Hou Y, Niu ZB, Wang CL (2010) Long-term follow-up and management of prenatally detected, isolated hydronephrosis. J Pediatr Surg 45:1701–1706
3. Matsui F, Shimada K, Matsumoto F, Takano S (2008) Late recurrence of symptomatic hydronephrosis in patients with prenatally detected hydronephrosis and spontaneous improvement. J Urol 180:322–325 discussion 5
4. Herthelius M, Axelsson R, Lidefelt KJ (2020) Antenatally detected urinary tract dilatation: a 12-15-year follow-up. Pediatr Nephrol. https://doi.org/10.1007/s00467-020-04659-4
5. Costa FP, Simões e Silva AC, Mak RH, Ix JH, Vasconcelos MA, Dias CS, Fonseca CC, Oliveira MCL, Oliveira EA (2019) A clinical predictive model of renal injury in children with isolated antenatal hydronephrosis. Clin Kidney J. https://doi.org/10.1093/ckj/sfz102
6. Hothi DK, Wade AS, Gilbert R, Winyard PJ (2009) Mild fetal renal pelvis dilatation: much ado about nothing? Clin J Am Soc Nephrol 4:168–177
7. Elmaci AM, Dönmez M (2019) Time to resolution of isolated antenatal hydronephrosis with anteroposterior diameter ≤ 20 mm. Eur J Pediatr 178:823–828
8. Dos Santos J, Parekh RS, Piscione TD, Hassouna T, Figueroa V, Gonima P, Vargas I, Farhat W, Rosenblum ND (2015) A new grading system for the management of antenatal hydronephrosis. Clin J Am Soc Nephrol 10:1783–1790
9. Jung J, Lee JH, Kim KS, Park YS (2020) Utility of the Society for Fetal Urology and Anteroposterior Pelvic Diameter Grading Systems for estimating the time to resolution of isolated hydronephrosis: a single-center study. J Urol 2020: 101097ju0000000000001140
10. Hsieh MH, Meng MV, Baskin LS (2008) Outcomes and cost analysis of pyeloplasty for antenatally diagnosed ureteropelvic junction obstruction using Markov models. Urology 72:794–799
11. Nguyen HT, Herndon CD, Cooper C, Gatti J, Kirsch A, Kokorowski P, Lee R, Perez-Brayfield M, Metcalfe P, Yerkes E, Cendron M, Campbell JB (2010) The Society for Fetal Urology consensus statement on the evaluation and management of antenatal hydronephrosis. J Pediatr Urol 6:212–231
12. Sidhu G, Beyene J, Rosenblum ND (2006) Outcome of isolated antenatal hydronephrosis: a systematic review and meta-analysis. Pediatr Nephrol 21:218–224
13. Siemens DR, Prouse KA, MacNeily AE, Sauerbrei EE (1998) Antenatal hydronephrosis: thresholds of renal pelvic diameter to predict insignificant postnatal pelviectasis. Tech Urol 4:198–201
14. Bassanese G, Travan L, D'Ottavio G, Monasta L, Ventura A, Pennesi M (2013) Prenatal anteroposterior pelvic diameter cutoffs for postnatal referral for isolated pyelectasis and hydronephrosis: more is not always better. J Urol 190:1858–1863
15. Keays MA, Guerra LA, Mihill J, Raju G, Al-Asheeri N, Geier P, Gaboury I, Matzinger M, Pike J, Leonard MP (2008) Reliability assessment of Society for Fetal Urology ultrasound grading system for hydronephrosis. J Urol 180(4 Suppl):1680–1682 discussion 2-3
16. Back SJ, Christopher Edgar J, Weiss DA, Oliver ER, Bellah RD, Darge K (2018) Rater reliability of postnatal urinary tract dilation consensus classification. Pediatr Radiol 48:1606–1611
17. de Kort EH, Bambang Oetomo S, Zegers SH (2008) The long-term outcome of antenatal hydronephrosis up to 15 millimetres justifies a noninvasive postnatal follow-up. Acta Paediatr 97:708–713
18. Smail LC, Dhindsa K, Braga LH, Becker S, Sonnadara RR (2020) Using deep learning algorithms to grade hydronephrosis severity: toward a clinical adjunct. Front Pediatr 8:1
19. Gobet R, Bleakley J, Peters CA (1998) Premature urachal closure induces hydroureteronephrosis in male fetuses. J Urol 160:1463–1467