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Hydronephrosis: Comparison of extrinsic vessel versus intrinsic ureteropelvic junction obstruction groups and a plea against the vascular hitch procedure

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Summary

Introduction
Pediatric ureteropelvic junction obstruction (UPJO) due to an extrinsic crossing vessel (CV) is rare and often remains undiagnosed preoperatively. Vascular hitch procedures are often performed as associated intrinsic obstruction is not expected. We compared data and intravenous urography (IVU) findings of patients with aberrant CV versus those with intrinsic UPJO, all undergoing open dismembered pyeloplasty.

Objective
Primary objective: Is accurate pre-operative diagnosis of aberrant CV causing extrinsic UPJO possible?

Secondary objective: To assess differences in the demographic, clinical, radiological, intra-operative features and postoperative improvement after pyeloplasty between patients with a CV and those with only intrinsic UPJO.

Patients and methods
Prospective study of all children below 12 years with UPJO presenting to a tertiary referral centre and who underwent open Anderson – Hynes dismembered pyeloplasty between 2003 and 2013 was conducted. Pre-operative investigations included serial ultrasonography, renal dynamic [ethylene dicysteine (EC)] scan and IVU. These were repeated 3 months after pyeloplasty. Pre-operative IVUs of children with CV were compared with the IVUs of an equal number of similar aged children, randomly selected from the intrinsic obstruction group.

Results
Pyeloplasty was performed in 643 children during the study period. Data of 33 children with aberrant CVs (mean age 6.99 years) were compared with the remaining 610 children (mean age 3.27 years) with only intrinsic obstruction. Highly significant associations of those with CV included age above 2 years, female gender, associated anomalies, abdominal pain in those above 2 years and poor preoperative function on IVU. Specific IVU features which were statistically highly significant in favor of presence of CV were small, intrarenal and globular flat bottomed pelvis. (Figure) Calyceal dilatation was also more prominent in the CV group. A funnel shaped, extrarenal pelvis was highly significant in favor of intrinsic obstruction. There was associated intrinsic obstruction in addition to CV obstruction in 8 children. All children symptomatically improved after pyeloplasty and did well on long term follow up. The majority showed improvement or stabilization of function on EC scan.

Discussion
With the advent of antenatal ultrasonography, most children with UPJO are detected early. Children with CV tend to present later. This is often detected during surgery. Color Doppler is useful but is operator dependant and not performed routinely. In this study, IVU showed the presence of obstruction and loss of function unlike color Doppler, but also revealed specific diagnostic features not previously reported in literature. This can help in accurate preoperative prediction and avoid endopyelotomy, or a dorsal lumbotomy/retroperitoneal approach. Renal function in CVs is expected to be good as the obstruction is thought to be intermittent. However, we noted delayed contrast uptake on IVU in 60.6% and differential renal function on EC scan below 40% in 17 patients (56.6%). These indicate the effect of the obstruction on the renal parenchyma and the importance of early detection. Higher association with other anomalies and higher incidence in females has also not been emphasized in the literature so far.

We noted associated intrinsic obstruction in 24.24% patients which is highly significant.

This category of patients is likely to be missed and inappropriately treated if a "vascular hitch procedure" is performed. None of our patients had postoperative complications.

Conclusions
Characteristic features were seen on IVU helping in preoperative diagnosis which can be extrapolated to magnetic resonance urography. There is a higher association of CV in age above 2 years, females, associated congenital anomalies, delayed uptake on IVU and differential renal function below 40% compared to intrinsic obstruction. Associated intrinsic obstruction in 24% with no postoperative complications indicates the superiority of dismembered pyeloplasty over vasculopexy procedures.

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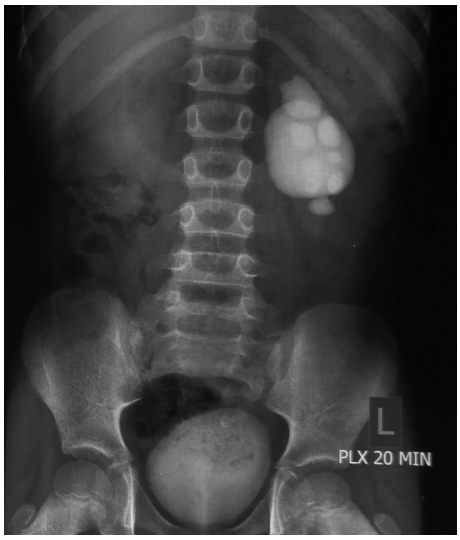

Figure Intravenous urography film showing globular intrarenal pelvis and prominent calyceal dilatation in ureteropelvic junction obstruction due to crossing vessels.

Introduction

Ureteropelvic junction obstruction (UPJO) leading to hydronephrosis is usually associated with intrinsic narrowing. Extrinsic obstruction is rare and may be secondary to vessels, kinks, or adhesions over the ureteropelvic junction (UPJ) area [1]. In this study, we compared all available parameters in children with lower polar crossing vessels (CVs) with those of children with intrinsic UPJO who underwent pyeloplasty during the same period. We specifically compared the intravenous urography (IVU) findings to look for specific features which may help in preoperative diagnosis of a CV. The vascular hitch procedure, open or laparoscopic, is often performed in children with CVs. In this study we opened up the UPJ and upper ureter while performing dismembered pyeloplasty in all children with CVs to rule out internal narrowing [2—5].

Patients and methods

In a prospective study from October 2003 to October 2013, data of all children who underwent open Anderson—Hynes dismembered pyeloplasty were collected. Children underwent renal function tests (blood urea/serum creatinine) and ultrasonography (USG) of the kidney, ureter, and bladder (KUB) region initially. In antenatally diagnosed cases, serial USGs were performed. In the presence of increasing or significant pelvic dilatation (>20 mm), one or more renal dynamic scans (diethylene triamine pentaacetic acid [DTPA] or ethylene dicysteine [EC]) was performed. In the presence of poor drainage, an IVU was also done to confirm the diagnosis. In older children, the decision to undertake surgery was based on symptoms and an obstructive pattern on renal dynamic scan and IVU. Relative function was not a criterion for decision-making. We prefer to operate before there is deterioration in function. Moreover, we feel that there are still many fallacies in the interpretation of the relative function in the renal dynamic scan. The EC scan and IVU were repeated 3 months after removal of drainage tubes (nephrostomy in the initial part of the study and later on mostly with double J stent). Demographic and clinical features of children with CVs causing UPJO (VO group) were compared with the remaining group with intrinsic obstruction (IO group).

Preoperative IVU films of all children in the VO group were compared with the IVUs of an equal number of children of similar age, randomly selected from the IO group.

Statistical analysis was performed using commercially available software (SPSS version 15.0; SPSS Inc., Chicago, IL, USA). Continuous variables were expressed as mean and ranges and categorical variables as percentages. Comparative analysis for qualitative data was done using the chi-square test. A p-value < 0.05 was considered significant.

Results

There were 643 children who underwent pyeloplasty during this period, 33 of whom had lower polar CVs. Data of these 33 children (VO group) (mean age 6.99 years) were compared with the remaining 610 children with only intrinsic obstruction (IO group) (mean age 3.271 years) (Table 1). Overall, 226 patients had an antenatal diagnosis of hydronephrosis. In the VO group, there was only one patient with an antenatal diagnosis. He had bilateral gross hydronephrosis and underwent bilateral pyeloplasty at the age of 3 months. He was found to have a CV on the right side, which incidentally had a differential function of 28% and rim sign on IVU.

The VO group had a statistically significant higher incidence in children above the age of 2 years: 30/33 (91%) versus 294/610 (48.2%) and female gender (33% vs. 15.2%) compared with the IO group. Specific features in the VO group were as follows: symptoms of abdominal pain had started between the ages of 2 and 10 years (mean 6.21 years); associated anomalies included horseshoe kidney (3), cardiac anomaly (1), delayed milestones (1), malrotated ipsilateral kidney (2), malrotated opposite kidney (1), ectopic small opposite kidney (1) and non-visualized opposite kidney (1); percutaneous nephrostomy had to be performed in seven (21.2%) children for lump/pyonephrosis with associated uremia in one and hypertension in another; USG of the KUB showed a pelvic anteroposterior diameter ranging from 2.2 to 5 cm (mean 3.03 cm). In the VO group ($n = 30$), excluding single kidney (1) and bilateral UPJO (2, one with bilateral CV and another with unilateral CV), the differential renal function on EC scan was as follows: $< 10\%$ in four (13.33%), 11—40% in 13 (43.33%), 41—54% in 11 (33.33%), and >55% in two (6.6%) patients. In the IO group ($n = 517$), excluding a single functioning kidney (26), bilateral UPJO (64) and study not done (3), the function was as follows: $< 10\%$ in 48 (9.28%), 11—40% in 206 (39.84%), 41—54% in 219 (42.35%) and >55% in 44 (8.58%) patients. The decision to operate in the presence of <10% function was as follows: presentation with lump/good urine output on percutaneous nephrostomy and on table assessment by operating surgeon. There was no statistically significant