

Renal Growth Retardation in Children: Sign Suggestive of Vesicoureteral Reflux?

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Of 141 children undergoing surgery for vesicoureteral reflux detected by voiding cystourethrography, preoperative excretory urography demonstrated signs suggestive of vesicoureteral reflux in 154 (67.5%) of 228 refluxing ureters. In 48 refluxing ureters (21%) renal growth retardation was the only sign; the latter was appreciated by applying the index described by Hodson, that is, the ratio of bipolar parenchymal thickness to total renal length. It was concluded that it is important to systematically calculate this simple index from every child's excretory urogram.

In children, excretory urographic signs suggestive of vesicoureteral reflux usually mentioned in the relevant literature are pyelonephritic scarring; ureteral dilatation or hypotonia without apparent obstruction; ectopic ureteric orifice; vesicoureteric diverticula; longitudinal striations or folds of renal pelvis and/or ureters; poor opacification of the renal pelvis and ureter early in the excretory urogram with later good opacification, presumably because of reflux of urine from the good contralateral kidney by way of the bladder; and significant postvoiding urine in the bladder [1-8]. One sign not usually cited is growth retardation of the kidney.

In 1960, Hodson and Edwards [9] and, in 1963, Hutch et al. [10] described the causal relation between vesicoureteral reflux and chronic pyelonephritis; since then numerous studies have demonstrated that, given evidence of pyelonephritic scarring on a child's excretory urogram, the probability of finding vesicoureteral reflux on a voiding cystourethrogram is more than 85% [11-17].

More recently, it has been shown that vesicoureteral reflux can cause a second form of nephropathy: renal growth retardation [18-21]. Several methods of renal size measurement in children have been proposed [22-25]; however, Hodson et al. [26, 27] pointed out that a kidney affected by vesicoureteral reflux may show normal length even though there is growth retardation; they demonstrated that measuring the renal length often is not sufficient and proposed calculating the ratio of bipolar parenchymal thickness (BPT) to total renal length (TRL) (fig. 1). Using the BPT/TRL ratio, we studied a group of 141 children undergoing surgery for vesicoureteral reflux to determine the number of patients whose preoperative excretory urograms would have led to suspicion of vesicoureteral reflux and the number of patients in whom renal growth retardation was a sign suggestive of vesicoureteral reflux.

Materials and Methods

We retrospectively reviewed the preoperative excretory urograms of 141 children (35 boys, 106 girls) who had surgery between 1966 and 1978 for vesicoureteral reflux in the Department of Pediatric Surgery at the University of Lausanne Hospital Center. These children were selected according to several criteria: under 10 years of age at the time of surgery; vesicoureteral reflux resulting from a primary anomaly of the ureteric orifice; and availability of good-quality preoperative and 2- and 5-year postoperative complete radiologic studies (the

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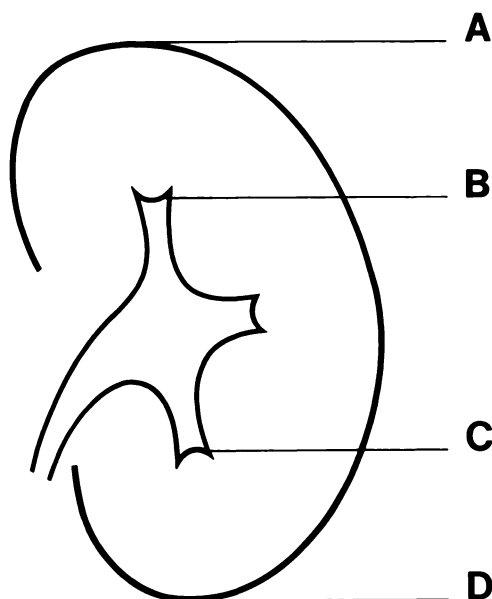


Fig. 1.—Method of calculating renal size developed by Hodson et al. [26, 27]: $BPT/TRL \text{ ratio} = (AB + CD)/AD$.

last criterion was for another study on the postoperative evolution of renal morphology). Included in the preoperative assessment were a voiding cystourethrogram, an excretory urogram, and cystoscopy; the standard excretory urogram consisted of a supine view of the abdomen 5 min after intravenous injection of contrast material (2 ml Urografin 76%/kg body weight), a prone view 15 min after injection, and, only when necessary, later views including spot films with compression and tomograms.

The presence of possible renal growth retardation was estimated according to the normal curves established by Hodson et al. [26, 27]: We assumed that renal growth retardation existed when the BPT/TRL ratio was found to be more than 2.5 SD below normal values in the absence of pyelonephritic scarring (fig. 2).

Results

We found 228 refluxing ureters on voiding cystourethrograms. In 154 (67.5%) of these, one or several of the signs suggestive of vesicoureteral reflux were present on excretory urograms. Renal growth retardation (i.e., BPT/TRL ratio more than 2.5 SD below normal value in the absence of pyelonephritic scarring) was found in 65 kidneys (28.5%); more important, in 48 cases (21%), renal growth retardation was the only sign suggestive of vesicoureteral reflux.

The probability of renal growth retardation depends on the seriousness of the vesicoureteral reflux. Among the five kidneys without scars that were affected by vesicoureteral reflux that dilated the pyelocaliceal system to a large degree, four (80%) had growth renal retardation; this percentage dropped to 31.3% in the kidneys affected by a vesicoureteral reflux that dilated the pyelocaliceal system to a moderate degree and to 24.8% in the kidneys affected by a vesicoureteral reflux in which there was no dilatation of the pyelocaliceal system.

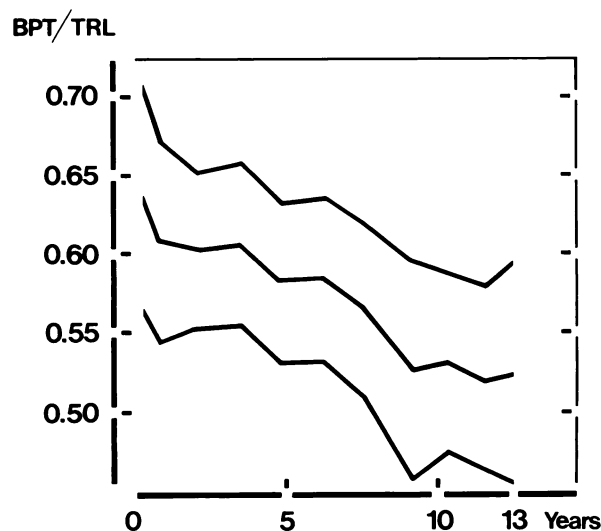


Fig. 2.—Normal values (mean \pm 2.5 SD) of BPT/TRL ratio as function of age. (Reprinted from [27].)

Discussion

The high rate (67.5%) of excretory urographic signs suggestive of vesicoureteral reflux found in our sample of 228 refluxing ureters may be explained by the nature of our sample, which was composed exclusively of children undergoing surgery either because of severe vesicoureteral reflux or because of relatively moderate vesicoureteral reflux and a severe anomaly of the ureteric orifice on cystoscopy, significant renal scarring, or recurrent urinary tract infections refractory to conservative therapy.

Renal growth retardation appears to be a sensitive sign suggestive of vesicoureteral reflux: It was the only excretory urographic sign to lead to the suspicion of reflux in 21% of refluxing ureters. It is evident that renal growth retardation may result from causes other than vesicoureteral reflux, such as ischemia or congenital hypoplasia. Nevertheless, we believe that any renal growth retardation detected on a child's excretory urogram should lead to voiding cystourethrography to search for possible vesicoureteral reflux. Calculation of the BPT/TRL ratio of Hodson et al. [26, 27] constitutes a simple and sensitive method of systematically determining renal growth from any child's excretory urogram.

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