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URINARY REFLUX -- THE PHYSICIAN'S DILEMMA

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Urinary reflux - more specifically vesicoureteral regurgitation of urine into the renal pelvis and calyces, is still a controversial subject. Clarity is undoubtedly hampered by the fact that obstruction at the bladder outlet is not always demonstrable even though vesicoureteral reflux is present. Clouding the issue still further is the occurrence of reflux when bladder infection is present. When infection is cleared, reflux disappears. Nonetheless, for purposes of this review, urinary reflux is an abnormal occurrence.

Historical Review

A valve-like action of the ureter at the ureterovesical junction was suggested by Disse¹, Lucas² and others in the 19th century. The intramural, oblique course of the ureter strongly supported the concept of a one-way valvular action.

In 1812 Charles Bell³ described several anatomic structures at the ureterovesical junction. Studies had indicated that the embryological origin of the trigone was separate from the rest of the bladder, and the proposed dynamics seemed to support this concept. Bell stated that these mechanical structures descended from the ureteral orifices toward the bladder neck where they united and ran toward the prostatic gland. He stated that the use of specific muscles in this region to assist in bladder contraction, while at the same time closing and supporting the lower aspects of the ureterovesical junction, seemed to be important.

The recent contribution of Paquin⁴ is worth mentioning. He emphasized that ureterovesical valve length alone did not determine whether reflux would occur. Paquin stated that reflux depended on the ratio of the length of this junctional valve to its width. Included in the measurement is length

of the ureterovesical valve and intramural ureter. The normal ratio in humans is approximately 6:1, and if this ratio is reduced below 3:1, reflux is more likely to occur. However, additional factors probably are important in contributing to reflux; they include decreased elasticity of the intramural ureter, fixation of the ureter to the trigone, and a disturbance in ureteral peristalsis.

The anatomic dissections of Hutch⁵ provide a clearer understanding of the ureterovesical junction. Waldeyer's sheath, a longitudinal muscular layer encasing the lower 3 cm of ureter blends with the middle muscular layer of the trigone. Apparently, its function is to increase the obliquity of the intramural ureter. Hutch has also suggested a lengthening of the intravesical ureter from 0.5 cm at birth to 1.3 cm in adulthood. Reflux varies inversely with increasing length, perhaps explaining the more common occurrence of reflux in the pediatric age group.

General Considerations

The presence of urinary regurgitation is important to the clinician in several ways. First, reflux is the means by which infected urine can reach the pelvis and medulla; this is undoubtedly the major cause of ascending pyelonephritis. Second, the presence of reflux should set in motion an organized search for the presence of some type of bladder outlet obstruction. In the majority of instances one can suspect a concentric bladder neck obstruction; one's efforts, however, should not be discontinued until a mechanical cause is carefully ruled out. Third, it is a fact that both bladder and ureters decompensate with time. When decompensation occurs, detrusor tone for micturition decreases. Ultimately, the classical signs

of cellule formation with diverticuli further disrupt bladder efficiency. After a hypertrophic phase, the bladder decompensates by becoming thin-walled and atonic. The ureters decompensate by dilation. Finally the ureters become tortuous and kink because lengthening is the only pathologic response available to the ureter. Increased urinary pressure is ultimately placed on the renal pelvis and calyces. Hydronephrosis is the final result culminating in renal insufficiency.

Technics to Demonstrate Reflux

✓ Murphy and his co-workers⁶ emphasized the importance of intravesical pressure monitoring before and during micturition. Intravesical pressures greater than 30 cm. of water are seen in clinical cases associated with urinary reflux. His group emphasized the importance of searching for lower urinary tract obstruction as the underlying cause of reflux. Physiological data are obtained, during micturition, by placing special catheters into the bladder and connecting these outflow tubes to pressure recording systems.

✓ Improved radiographic technics are available to demonstrate reflux. In 1948 Stewart⁷ described the delayed cystogram, one of the better techniques to demonstrate reflux. Stewart stated that bladder distension is not necessary, because volume is not felt to be a critical factor. He later suggested the voiding cystourethrogram as the most important maneuver during radiographic study. The voiding cystogram is now advocated by most urologists.

✓ The need for a standardized radiographic method is proposed by Lattimer and his group⁸; in their proposal the cystogram consists principally of filling the bladder at a given rate from some standard height above the

symphysis pubis. Pre-voiding and post-voiding films are obtained as well as the trapping film devised to demonstrate obstruction below the ureter, thus permitting reflux.

Winters⁹ recently suggested the use of radioisotopes in the diagnosis of ureteral reflux. In his report he instills a solution containing radioactive iodine into the bladder. By placing gamma scintillation counters over the region of each kidney, activity is obtained in this location whenever reflux occurs. Winters believes that one significant advantage of this method is the minimal amount of radiation to the patient.

More recently, the cine-radiograph (movie films made at the time of fluoroscopy during a voiding cystogram) has come into favor. Such methods overcome the disadvantages inherent in a single exposure, and these films are able to demonstrate the dynamics of voiding with a demonstration of regurgitation when it is present. In addition, these films, when properly obtained, reduce the overall exposure to radiation.

The Probable Pathogenesis of Urinary Reflux

The most frequent cause of urinary reflux is the presence of bladder outlet obstruction. From a review of several clinical series with reflux, bladder neck obstruction accounts for about 75 percent of cases in the pediatric age group. This occurrence is congenital in origin, and the majority of patients with reflux will be in the first decade. Bladder outlet obstruction in the male is a concentric fibromuscular ring which is stenotic and obstructs normal urine flow during micturition. In the female, a concentric fibromuscular ring may also be present. A recent report by Lyon and Smith¹⁰ has emphasized the occurrence of distal urethral stenosis

in the female child. Again the fibromuscular ring is of importance at this more distal location, and this entity can best be treated in a manner similar to early bladder neck stenosis.

Another less common mechanical defect is the posterior urethral valve. This may occur in the prostatic urethra in the male child; in the female a not uncommon defect is the fibromuscular, stenotic mid-urethral ring distal to the bladder neck sphincter.

When bladder outlet obstruction is present, the bladder responds by attempting to empty itself against this type of outflow resistance. Bladder muscle hypertrophies with time to overcome resistance at the bladder outlet. If prolonged, the intravesical dynamics encourage the development of trabeculations (muscular hypertrophy). Because weakened interstices between the bladder musculature, outpocketings of the bladder mucosa may result; cellule formation and diverticuli herald the onset of progressive bladder decompensation.

Patho-Physiological Grouping of Patients with Reflux

Class I. High Intravesical Pressure

Patients in this group reflux urine only at pressures greater than 80-100 cm of water. If left untreated, constant stretching and pressure at the ureteral orifice prior to urination encourages development of a patulous orifice. Since urinary stasis is encouraged in this situation, bladder infection may supervene. Edema and rigidity of the intramural ureter will also intensify ureterovesical reflux.

Unfortunately, this group of patients are not seen by the urologist unless a recurrent history of urinary tract infection is elicited. In

children, the presenting history is a failure to thrive or develop normally. Reflux, if left untreated, progresses to a more serious and nearly irreversible stage.

✓ Class II. Patients with Reflux at Low Intravesical Pressures but High Urinary Volumes.

In this group the patients reflux at intravesical pressure of 5-25 cm of water (9-30 mm Hg), but only after large urinary volumes have accumulated.

Stephens¹¹ has suggested that these ureterovesical junctions have a partial muscular deficiency in the intravesical ureter. Consequently, the ability to resist reflux is only partially retained. In a chronic state tortuosity and dilatation of the affected ureter is present. The intravesical pressure becomes reduced as the ureters dilate since bladder urine is quite easily displaced into this refluxing ureter.

✓ Class III. Patients with Reflux at Low Intravesical Pressures and Low Volumes.

The worst prognosis will be found in these patients. In the typical patient the ureterovesical junction is no longer able to resist reflux. The ureters are widely dilated and kink. Ureteral peristalsis is impaired. Consequently, urine see-saws from the bladder to the upper tracts in haphazard fashion. These patients display severely deranged upper urinary tracts because of chronicity. Renal insufficiency is a more serious problem in these patients.

SYNOPSIS

Urinary reflux needs careful evaluation and prompt treatment. Presenting complaints include failure to thrive, and/or recurrence of a urinary tract infection. If bladder outlet obstruction is present, then surgical intervention is necessary. Bladder neck revision combined with an anti-reflux operation is a decision reserved for the urologist. Certain types of bladder inflammation affect the ureterovesical junction even though bladder neck obstruction cannot be demonstrated. Vigorous antibacterial treatment will abolish urinary reflux. A neurogenic bladder disorder is present in 10 to 15 percent of all cases with reflux. One should separate mechanical causes from physiological factors affecting bladder function since the neurogenic bladder is handled differently.

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