

Antireflux Surgery in Children

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A rationale for, and the results of, antireflux surgery in 58 children are reported. Suitability of the patient with primary reflux for this type of surgical correction is emphasized. Conversely, it is pointed out that the child with neurogenic reflux is usually unsuitable for this type of management. Allusion is made to a probable relationship between juvenile reflux and chronic pyelonephritis in young women. Primary importance is placed on differentiation of the obstructed from the unobstructed causation of reflux. Relief of the obstructing lesion is of primary importance in the former, whereas preliminary intensive medical management in the latter is emphasized. Discontinuation of reflux was noted in somewhat over half of the primary type with adequate medical management. Results of antireflux surgery were considered excellent in 41, no change in 12, and poor in 4.

The role of surgery in the correction of vesicoureteral reflux is still controversial. Confusion exists, in part, because of failure to correlate results of antireflux surgery with the type of reflux involved. That this surgical procedure may benefit many children with recurrent urinary infections or obstructions or both seems well established.¹⁻⁴ The purpose of this report is to further elucidate the indications for, and results of, such surgical intervention. We have been favorably impressed over the past several years with the decrease in upper urinary-tract infection rates in certain children with recurrent pyelonephritis associated with reflux who have had antireflux procedures.

Etiology of Reflux

Intelligent management of vesicoureteral reflux must be based upon an attempt to understand its causation. Individual patient investigation will usually allow categorization in terms of primary or secondary reflux. Primary reflux results from a defective or immature ureterotrigoal musculature.⁵⁻⁷ Ureteral reduplication or ectopia or both, when associated with reflux, might be considered primary in category. In such instances reflux may well precede pyelonephritis. Occasional vesical bacillary contaminations may thus be repetitively trans-

ported to the upper urinary tract to establish infection. Further, the refluxing bladder contents, constituting residual urine, play a significant role in bacterial propagation. On the other hand, reflux must be categorized as "secondary" when infravesical obstruction (vesical neck, prostatic valve, stricture), neurogenic dysfunction, an iatrogenic factor, or antecedent chronic cystitis is responsible.

Indications for Antireflux Surgery

A successful antireflux operation protects the upper urinary tract from fluctuations of intravesical pressure and retrograde urogenous contamination, but does not produce obstruction consequent to the procedure. When to perform such surgery varies with the etiological background and is considerably influenced by the functional integrity of the upper urinary tracts, ureteral dilatation, and peristaltic vigor. One should be exceedingly reluctant to reimplant large, dilated ureters incapable of competent peristalsis. In such instances subsequent obstruction is not uncommon. When reflux is the result of obstruction at or below the vesical neck, it is obvious that the obstructing lesion takes therapeutic precedence. Where the retrograde regurgitation is mild and the ureterovesical junction has been little altered by back pressure, reflux may be expected to cease on provision of good free drainage. If the ureteral orifices are gapping, and ureteral dilatation is minimal, an antireflux procedure is justifiable at the time of vesical-neck revision.

Where reflux is primary, indications for antireflux surgery are somewhat different. Failure to eliminate recurrent pyelonephritis by prolonged appropriate antibacterial drugs and repeat voidings constitutes one of the commonest indications for this type of surgical intervention. Constant drug therapy for a period of six months to one year should be carried out prior to surgical consideration. Progressive upper urinary-tract changes attributable to infection may shorten medical management. *Reflux is not corrected on its own merit.* Vesicoureteral regurgitation has been observed over a period of several years without infection or upper urinary-tract deterioration. Long-term drug therapy can be expected to allow spontaneous correction in somewhat over half of the children with primary reflux. This is not usually true of duplicated or ectopic ureters. The vesical neck is not routinely revised when no obstruction can be found

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(primary reflux). We are of the firm opinion that primary reflux exists in a major portion of female patients with recurrent pyelonephritis.

Methods and Materials

Numerous procedures for reflux correction are at our disposal. The method best suited for the individual patient and with which the surgeon is familiar and successful should be used. For children with primary reflux, the Politano-Leadbetter⁸ tunnelling maneuver is appropriate and has been successful in our hands. Where the trigone is exceedingly large, advancement ureteroplasty may serve best. When bilateral reflux demands correction, it is undertaken at one operation. Splinting ureteral catheters, used uniformly, are brought through the urethra and anchored to a urethral Foley catheter, and the bladder is closed primarily. Meticulous care in ureteral dissection and preparation of the submucosal tunnel cannot be overemphasized.

In a period of five years (1960-1964), 1,007 new uropediatric patients were seen in the Indiana University clinics, Indianapolis. Of these, 241 (24%) primarily presented with problems of urinary infection. In each of these children reflux was either ruled in or out by cineurography. Of these, 123 (51%) refluxed. Surgical correction of this abnormality was deemed necessary in 58 patients (46%) whose ages ranged from 12 months to 18 years. The remainder were either successfully managed by antibacterial therapy or were considered unsuitable candidates for this procedure. Forty-two children with primary reflux and 16 with the secondary type were surgically corrected. A total of 96 ureters were reimplanted—51 on the left side and 45 on the right. Of these, 16 ureters were completely duplicated and one was ectopic. The preponderance of primary reflux disorders submitted to surgical correction reflects the usual integrity of the primary refluxing ureter in contrast to the obstructed or neurogenic one whose dilatation and atony often contraindicate such management. Too, the child manifesting minimal reflux with low-grade infravesical obstruction usually ceases with good drainage. In 49 children intensive antibacterial management with appropriate drugs for periods in excess of six months and as long as eight years had failed to prevent recurrence of urinary infection. This failure constituted indication for surgical correction. In many of these, upper urinary-tract changes consistent with infection or transmitted vesical back pressure also were seen. Progressive pyelographic deterioration despite good bacterial control was noted in nine children, whose disorders consequently were surgically corrected. All but two ureters were reimplanted by the Politano-Leadbetter tunnelling technique. One ureter was surgically corrected by the Bischoff technique and one by the technique described by Jewett. One ureter corrected by the tunnelling technique was supplemented by the cuff ending described by Paquin,

but subsequently lost the cuff, though not its anti-reflux capabilities. Sixteen children with obstruction had associated bladder-neck revisions at the time of, or prior to, antireflux surgery. One boy with prostatic valves persists in needing a cystostomy tube.

Results

There were no operative or subsequent deaths. One ureter, corrected by the Politano-Leadbetter technique, subsequently refluxed. All others were successfully corrected. This feature was evaluated by repeated cineradiography examinations, postoperatively, at six months to two years, where follow-up studies have proceeded this long. Four children have required surgical revision of obstructions produced at the ureterovesical junction subsequent to surgery. Three of these were neuromuscular problems associated with myelomeningocele and the ureters have since been diverted to the ileal loop or by cutaneous ureterostomy. The child with primary reflux, having obstruction, required a surgical revision and is showing satisfactory improvement at the present time.

Most gratifying is the capability of 32 apyuric children to be withdrawn from urinary antibacterial drug therapy without recurrence of infection for periods of follow-up ranging from six months to 4½ years. Seventeen children are apyuric but are still receiving medication, either because of recent surgical intervention or, consequent of the fact that renal damage is great, they require longer periods of medication before withdrawal. A few of these children have had a relapse of pyuria or bacteriuria or both from apparent cystitis, but none had symptoms or signs of pyelonephritis. Advanced renal infection in nine children necessitates continuous antibacterial medication despite successful correction of reflux.

Pyelographically, 13 patients have revealed improvement following correction. Four have worsened subsequent to corrective surgery and have had surgical revisions. Pyelography has shown no change in 41 children.

Complications

Ureterovesical obstruction in four children has followed antireflux correction. Three required diversion of the ureters to the ileal loop or cutaneous ureterostomy. The child with primary reflux showing obstruction at the ureteroplasty site was afebrile and apyuric. However, hydroureter and hydronephrosis progressive over a period of two years necessitated revision of the operation with subsequent improvement. Two other children encountered some degree of significant febrile illness during the immediate postoperative period attributable to pyelonephritis. One of these suffered dislodgement of the ureteral catheter terminating splinting and drainage following surgery. Both subsequently responded satisfactorily to antibiotic medication. Postoperative pneumonitis, probably

associated with some degree of atelectasis, was noted in three. All recovered uneventfully. Wound infections were seen in two children, one infection attributable to *Staphylococcus aureus*. Subvesical hematoma resulting from an uncontrolled bleeder at the time of surgery produced temporary obstruction at the ureterovesical junction, which required prolonged catheter splinting on that side. Subsequently, the hematoma reabsorbed and drainage from this kidney is quite satisfactory.

Comment

Where persistent or recurrent pyelonephritis is associated with reflux, serious consideration of surgical correction not only is justifiable, but clearly indicated in the child with primary reflux pyelonephritis refractive to prolonged intensive medical treatment. Antireflux surgery with the neuromuscular vesical dysfunction of myelodysplasia and its attendant inflammatory and obstructive renal consequences is disappointing in our experience. Of the four upper urinary-tract obstructions following reflux correction, three were in children with myelomeningocele. Diversion appears to be the operative preference in such problems. Preoperative control or eradication of urinary infection is the sine qua non of the successful result. This is usually not difficult in primary reflux, but may be exceedingly laborious in the secondary type. Postoperatively, instillation of a few cubic centimeters of 2% neomycin sulfate solution into the splinting ureteral catheters several times each day seems to be a good prophylactic practice. Early postoperative excretory urograms will show stasis in over half of the units reimplanted, which at three months will no longer be present.

Postoperative administration of antibacterial medication will always be necessary for several weeks and often for months. Careful withdrawal of medication should be followed by frequent clean-catch urinalyses and periodic culture for bacteria. The present series seems to affirm the efficacy of the Politano-Leadbetter tunnelling procedure

in preventing further reflux, failing only once in 96 units reimplanted. While we have always re-investigated postoperatively for reflux by cinecystourethrography, it is probably unnecessary in the face of normal findings from an excretory urography, apyuria, and a sterile culture. It is indeed surprising how many children with distinct pyelographic stigmata of chronic renal infection can be rendered apyuric with withdrawal of all antibacterial medication by reflux correction. This leads us to strongly suspect repetitious urogenous renal contamination is responsible for many advanced chronic infections in youth and adulthood, especially in women, where reflux can be demonstrated. While intensive antibacterial medication can be expected to eliminate recurrent infection and favor discontinuation of reflux in many children, excessively long periods of medication with its attendant complications and the possibility of renal deterioration cannot be disregarded. Irreversible changes can be avoided by carefully elected surgery after adequate medical trial. Thorough search for obstructive lesions responsible for reflux must precede any consideration of an antireflux procedure.

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THE RESOURCEFUL DR. LISTON!—As an example of the readiness with which he encountered difficulties, we may relate the following incident, communicated to us by one who was present. He had amputated a leg for extensive necrosis and chronic disease of its bones. The patient was feeble, and yet, after securing many vessels, hemorrhage was still abundant from the cut surfaces. More vessels were secured, but the bleeding continued, and Professor Russell, who was assisting him, became alarmed lest the patient should sink on the table. At this moment it was discovered that the blood oozed from an enlarged vessel in the substance of the bone. There was a panic of a few seconds, and every one whispered, what was to be done? Liston immediately sliced off a piece of wood from the operating table with his large amputating knife, and rapidly formed it into a plug, which he thrust into the mouth of the bleeding vessel. The hemorrhage ceased immediately, and the patient recovered.—Anonymous: Liston and Diffenbach, *Monthly J Med Sci* 8:548, 1848.