

Significance and Treatment of Occult Obstructive Uropathy Complicating Crohn's Disease

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IN 1970, we reported six cases of occult, right-sided ureteral obstruction which occurred in patients suffering from fistulous complications of Crohn's disease.⁶ A ureteral abnormality coincident to Crohn's disease was first noted by Hyams, Weinberg and Alley in 1943 and has been sporadically reported during the ensuing 30 years.^{2,9,10,12,16} Despite the association of these two entities, their clinical significance and their appropriate treatment have not been elucidated.

We have encountered the entity of an occult, right-sided obstructive uropathy complicating Crohn's disease of the ileum or ascending colon in 27 patients. It is our thesis that the obstructive uropathy is caused by a cicatrix consequent to a right-sided septic retroperitonitis attributable to advanced Crohn's disease complicated by sinus, fistula, or abscess.

The demonstration of ureteral obstruction complicating Crohn's disease is an indication for operation for relief of both the advanced ileocolitis and the urinary tract obstruction. Appropriate resection of the involved bowel supplemented by ureterolysis has proved to be an effective remedy for the relief of the intestinal and urinary tract disease in all of our patients.

Material

From 1967 through 1972, 27 patients exhibiting both Crohn's disease and right ureteral obstruction were treated by resection and ureterolysis. During this period, we performed resections in 106 patients suffering from Crohn's ileocolitis primarily involving the terminal small bowel and ascending colon. This does not

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represent a true incidence of this complication as the majority of our patients were referred from other services or institutions and usually were patients with the spectrum of advanced and complicated Crohn's disease.

Seventeen patients were male and ten were female. There were 24 Caucasians and three Negroes. The youngest patient was 17 years of age and the oldest was 59. The average age at the time of operation was 25.5 years. At the time of operation for obstructive uropathy, the average duration of known granulomatous disease was 3.9 years. Two patients were unaware of the presence of Crohn's disease until they suffered urinary symptoms. Three of the 27 patients had previous operations for regional enteritis. None of our patients had prior attempts to alleviate the urinary tract obstruction.

Symptoms and Physical Findings

The 27 patients comprising this series all suffered from Crohn's disease of varying severity and localization. While some patients had granulomatous involvement of the entire colon as well as the terminal small bowel, all had one feature of the disease in common: the site of greatest severity of the disease was in the ileocecal region. The symptoms varied greatly from mild cramping and diarrhea to severe cachexia and inanition. Certain symptom complexes, as well as physical, laboratory, and roentgenographic findings were noteworthy as they defined clinically the presence of retroperitonitis and ureteral obstruction.

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Twenty-one of the 27 patients (78%) exhibited a right lower quadrant mass by abdominal, rectal, or vaginal examination. Seven patients complained primarily of right flank or CVA pain or tenderness. The right kidney of one individual was enlarged, palpable and tender. Five patients had histories of lower urinary tract symptoms such as frequency, dysuria, or suprapubic and groin pain.

Fifteen of the 27 patients had grossly abnormal urinary sediment on routine examination. Of perhaps greater significance is the fact that 12 patients had normal urinalyses.

Twenty-one patients had sterile urine cultures. The six patients with contaminated urine all demonstrated *Escherichia coli* in quantities greater than 100 thousand colonies per milliliter. One of these patients also harbored *Aerobacter aerogenes* and another was infected by *Proteus mirabilis* in quantities greater than 100 thousand per milliliter. Two patients with positive cultures suffered an entero-vesical fistula in addition to hydroureter and hydronephrosis.

Roentgenographic Findings

Gastrointestinal

Gastrointestinal contrast roentgenograms in all patients were diagnostic of Crohn's disease. The barium enema X-ray with views of the terminal ileum was particularly rewarding. In addition to delineating the extent of ileal disease, the roentgenographic findings included enterocolic and entero-vesical fistula, psoas abscess formation, entero-cutaneous fistula, etc.⁷ Of particular importance in retrospect were the two most common findings: high grade partial ileal obstruction from Crohn's disease with or without sinus tracts from the ileocecal region to abscess cavities in the retroperitoneum. This demonstration of the supposed pathogenesis of the syndrome was observed roentgenographically in 17 of the 27 patients (Fig. 1).

Cystopyelography

The most rewarding single preoperative diagnostic examination was the excretory pyelogram (IVP). Occasionally, this examination was supplemented by either cystogram or retrograde pyelography. One patient underwent emergency laparotomy and a preoperative IVP was necessarily omitted. In all other patients, ureteral obstruction with varying degrees of hydroureter and hydronephrosis were demonstrated prior to operation. Eighteen of the 26 patients undergoing preoperative excretory urograms were found to harbor occult, right-sided hydronephrosis in addition to the hydroureter. One entero-vesical fistula also was demonstrated by this means.



FIG. 1. Barium contrast roentgenogram of the ileo-cecal region demonstrating sinus tracts into the retroperitoneum. The origin of the sinus is proximal to a partial bowel obstruction. The proximal bowel is dilated. This patient suffered retroperitonitis with an anterior retroperitoneal abscess.

In three patients, serial pyelograms prior to operation demonstrated the *sudden* development of right hydroureter and hydronephrosis coincident to clinical worsening of the intestinal disease.

In one patient in whom a double collecting system was present on the right side, both ureters were obstructed.

Pre-voiding views of the bladder observed at the time of pyelography uniformly revealed a defect attributable to Crohn's disease. In those patients with severe ileal disease, the right posterior dome of the bladder was persistently indented. This deformity corresponded to the outline of the inflamed and thickened small bowel. It did not represent either primary or secondary vesicle disease, as cystoscopy did not dis-



FIGS. 2, 3 and 4. Representative views of sequential excretory urograms. The first pyelogram in 1969 (Fig. 2) shows normal renal architecture. Figure 3 is a pyelogram taken in 1972 during an episode of severe exacerbation of the ileitis. There is obvious hydroureter and hydronephrosis. Following intestinal resection and ureterolysis (Fig. 4), the pyelogram has returned to normal.

close mucosal changes and the outline of the bladder returned to normal after resection of the offending segment of bowel. This finding has not been previously emphasized, but has proved to be a reliable index of advanced Crohn's disease for us. Despite scrupulous investigation, none of our patients was found to have renal or ureteral calculous disease to account for their dilated ureter (Fig. 6).

Operative Findings

At operation, all patients were found to harbor active Crohn's disease and the individual findings varied according to the extent of visceral disease, degree of obstruction, site of fistulae, etc. Each of the patients had certain features of Crohn's disease in common. These were severe Crohn's disease in the right lower quadrant penetrating through the visceral peritoneum and the posterior parietal peritoneum with resultant retroperitonitis. The area of penetration and retroperitonitis corresponded to the previously palpated mass in the 21 patients so recorded. Twenty-four (89%) of the patients exhibited a fistula or sinus tract from the involved ileocecum to the retroperitoneum. Eleven patients (41%) had frank abscesses of the anterior retroperitoneal compartment. In one patient, this abscess involved all compartments of both the anterior and posterior retroperitoneal spaces.

In all patients with hydroureter, the right ureter was

found to be encased in the cicatrix of retroperitoneal fibrosis. Two patients had ureteral obstruction above the level of the pelvic brim: one at the site of recurrent bowel disease and another in the retroperitoneum from residual fibrosis 3 years after bowel resection without ureterolysis.

The degree and extent of fibrosis varied greatly from patient to patient. In a few patients, the fibrosis was moderate and was easily dissected from the ureter. In the majority, the fibrosis was dense, thick and intimately encased the ureter from the pelvic brim to the trigone of the bladder. In these patients, dissection to completely free the ureter from the cicatrix was excruciatingly difficult. The ureteral obstruction occasionally produced huge proximal dilatation of such a degree that the ureter approximated the diameter of the small bowel. The obstructed distal segment of ureter gradually tapered into a dense cicatrix. The ureter at this point frequently was compressed to only a few millimeters in diameter. The involved ureter appeared ectatic and, in addition to dilatation and secondary inflammation, the walls of the ureter were thickened. No ureteral biopsies were taken.

During the early portion of the series, biopsy specimens were obtained from the retroperitoneal cicatrix. These were reported as showing nonspecific inflammation with stellate cell formation, collagen deposition, fibrosis and diffuse edema.⁶

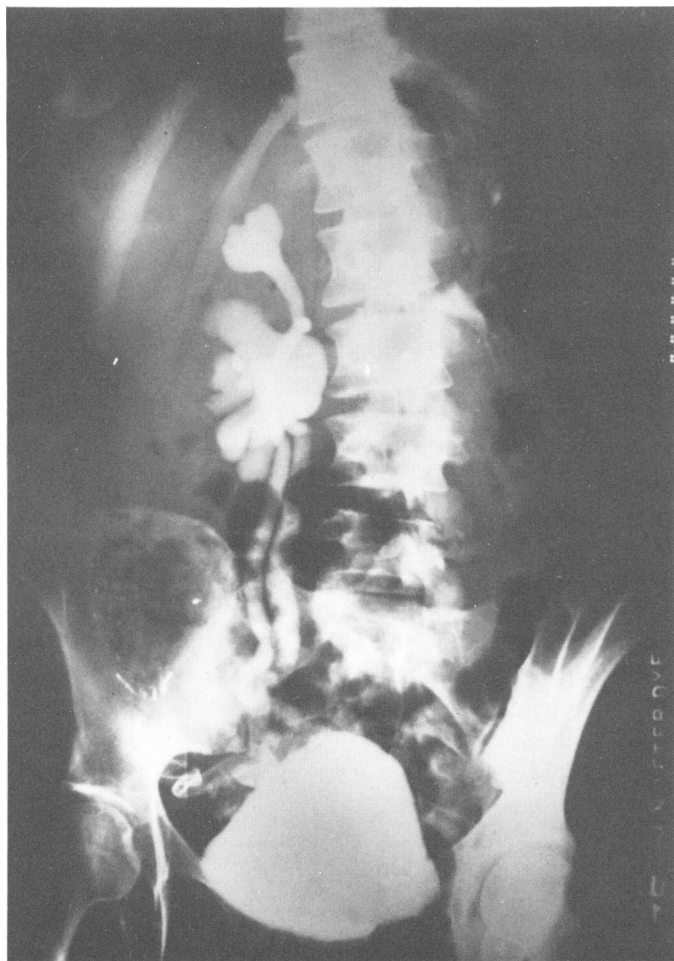


FIG. 5. Hydroureter and hydronephrosis in a patient with a right-sided double collecting system. After ureterolysis, the hydroureter and hydronephrosis resolved.

Operative Procedures

A variety of operative procedures were performed upon the patients in this series. Although varied in exact nature, all operations conformed to our basic thesis: resection of the area of bowel harboring the mechanical complication, complete ureterolysis of the involved ureter, and drainage of retroperitoneal abscesses when encountered. No intestinal bypass procedures were employed for treatment of the Crohn's disease.

One patient underwent ureterolysis only, as the Crohn's disease was resected 3 years prior to diagnosis of ureteric obstruction. Two patients underwent total colectomy, and the remaining 24 patients underwent appropriate small and large bowel resections. Fecal continuity was reestablished primarily in 23 of these patients, but one patient had a temporary ileostomy and mucous fistula. An ileo-ascending anastomosis was constructed in six patients, ileotransverse in 16, and an ileosigmoid anastomosis in one patient.

Our technic of ureterolysis is to circumferentially free the ureter from its encasing cicatrix and to resect the anterior portion of the fibrotic sheath. Following ureterolysis the freed ureter lies in a wide bed of extraperitoneal connective tissue. No attempt is made to transpose the affected ureter nor to wrap it in omentum.

Morbidity and Mortality

There were no operative nor postoperative deaths in this series of patients. There were no complications either directly or indirectly related to the ureterolysis. There was no postoperative ureteral stricture, persistent obstruction, urinary extravasation, etc.

There were seven major and two minor complications. All complications were related to the intestinal component of the disease or its concomitant sepsis. All major complications were successfully treated. These included one instance each of partial intestinal obstruction, stress ulceration, and subphrenic abscess, and four instances of inadequately drained retroperitoneal abscess. Despite the use of delayed primary closure, two patients developed wound abscesses subsequent to premature closure.

Results

The period of follow-up observation was from 2 months to 5½ years. The one individual who was followed for only 2 months died during the third postoperative month from amyloidosis complicating long-standing Crohn's disease. For all the other patients the shortest follow-up period was 6 months and the average was 26 months. Twenty-four patients have been followed for more than 1 year.

The postoperative pyelograms in all patients have

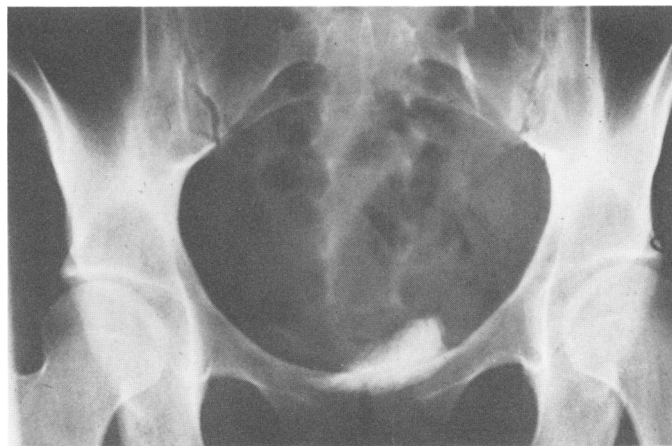


FIG. 6. Bladder deformity demonstrated by excretory pyelography. The right superior dome of the bladder is indented and deformed by the adjacent inflamed small bowel.

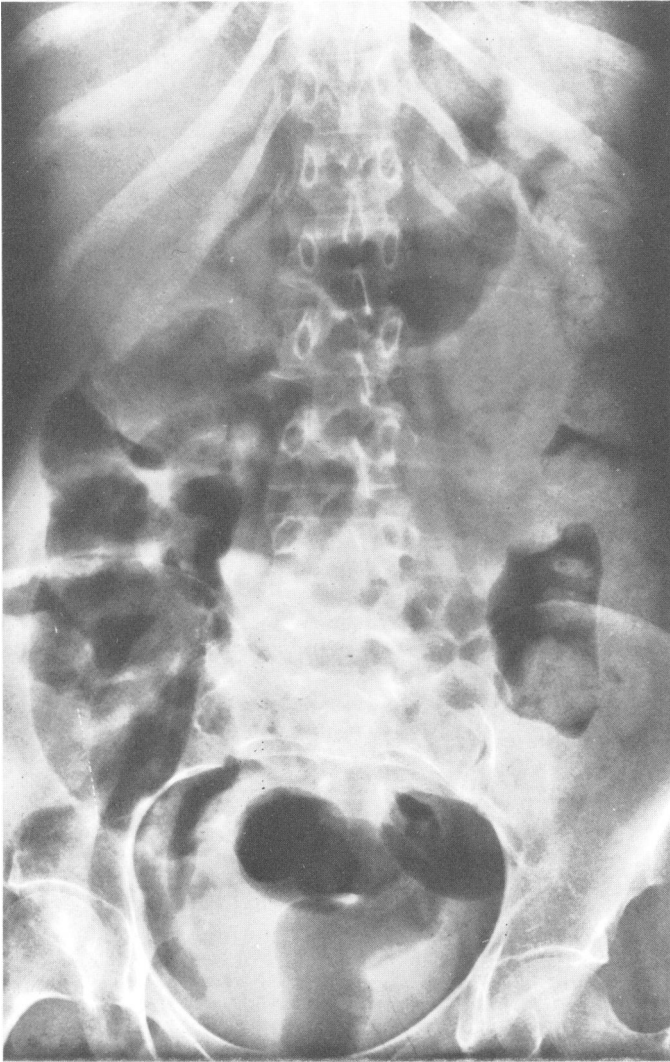


FIG. 7. Abdominal roentgenogram of patient with Crohn's disease, right ureteral obstruction and massive retroperitoneal infection. The anterior and posterior retroperitoneal space are occupied by abscesses which have also involved the subcutaneous areas of the thigh, buttocks and groin.

reverted to normal with the exception of two patients who still have minimal caliectasis without persistent ureteral dilatation. Urinary infection has resolved in all patients.

Except in those patients with vesicle fistulae, urinary bladder drainage was discontinued within 48 hours of operation. Following ureterolysis, the obstructive urinary tract infections were readily overcome by appropriate antibiotic therapy. Complete resolution of the previously documented hydroureter and hydronephrosis was evident on urography as early as 7 days following operation. Follow-up urography performed up to 42 months after operation revealed complete resolution of the obstructive uropathy in all patients.

Although it is not our purpose here to detail the

postoperative course of ileocolitis, all living patients were evaluated as to the reappearance of active Crohn's disease. Twenty-two patients are free of disease while four have had recurrence of the gastrointestinal manifestations of the disease.

Bacteriology

The offending organisms contributing to the septic retroperitonitis were cultured from the retroperitoneal abscesses, fistula tracts and urine. As expected, these infections were multimicrobial and reflected the enteric origin of the pathogens. The average patient harbored two or more organisms and from one patient six pathogens were cultured. The bacteria identified in order of frequency included: *Escherichia coli*, Enterococci, *Aerobacter aerogenes*, *Pseudomonas aeruginosa*, *Streptococcus faecalis*, non-hemolytic streptococci, and *Klebsiella* species.

The organisms varied in their antibiotic sensitivity, but most showed convenient sensitivity to common antibiotics. Chloramphenicol, Ampicillin, cephalosporin, Gentamicin and Kanamycin were commonly indicated by *in vitro* sensitivities. In most instances, the results of cultures and sensitivities were not known at the time of diagnosis, and empiric antibiotic therapy was initiated utilizing agents known to be useful in combating both aerobic and anaerobic infections. In most cases a combination of chloramphenicol with a penicillin or cephalosporin was employed. When bacteriologic *in vitro* sensitivities became available, the antibiotic agents were modified depending upon the clinical course of the patient.

In two patients, active retroperitoneal suppuration was not found and despite proven contamination from enteric organisms, antibiotic agents were not employed. These patients made an uneventful recovery. In the overwhelming majority of patients, however, appropriate antibiotic therapy was employed to supplement resection and adequate drainage.

Discussion

The necessity for resection in Crohn's disease complicated by the septic processes of abscess, sinus or fistula is well recognized. Although bypass of the involved small bowel still enjoys some popularity, the capacity for the bypassed segment to be the site of continuing or further complications is also widely appreciated.⁵ Similarly, the advisability of decompression of an obstructed ureter is well known. The long-term deleterious effects of obstruction on renal function, particularly when complicated by hemolytic *E. coli* infection, has been adequately detailed by Kass, Freid and others.^{4,20}

In 1961, Altmeier and Alexander,¹ in a classic presentation concerning retroperitoneal abscesses, classi-

fied and described the retroperitoneal spaces and stated that a majority of retroperitoneal infections were secondary to primary diseases of the contiguous abdominal organs of the gastrointestinal tract. These authors reported clinical findings similar to those present in our patients with infections of the anterior retroperitoneal space, *i.e.*, right lower quadrant mass, CVA tenderness, and an unremarkable urine examination in one-third of the cases. Two of their patients suffered anterior retroperitoneal space infections due to *regional ileitis* and one due to *radiation ileitis*.

Our identification of the syndrome of obstructive uropathy complicating Crohn's disease, and our advocated treatment are, then, a synthesis of three established surgical principles: the recognition of an anterior retroperitoneal space infection, resection of the segment of bowel initiating the complication, and the relief of the mechanical obstructive uropathy.

Pathogenesis

The pathogenesis of this lesion becomes obvious when one relates the clinical course of Crohn's disease to the operative findings and the gross and microscopic pathology.

Crohn's disease of the ileum and proximal ascending colon is notorious for the complications of perforation or penetration (sinus or fistula formation). Crohn's disease of the descending colon (granulomatous colitis) infrequently is the site of origin of fistula formation and free perforation is a clinical rarity.¹⁵ Hence, involvement of the right ureter is much more likely to occur than on the left side where the ureter is completely retrocolic throughout its pelvic course. However, two instances of left-sided ureteral stenosis complicating Crohn's disease have been documented by others.^{8,10,18}

The characteristic cleft or fissure which microscopically characterizes Crohn's disease appears to be the site of serosal penetration.¹⁷ These penetrations, in our experience, are predominantly immediately proximal to an area of luminal stenosis or obstruction. The terminal ileum and cecum are either partially retroperitoneal or in immediate juxtaposition to the posterior, lateral parietal peritoneum. Progression of the inflammatory disease through the serosa of the bowel can then easily involve the anterior retroperitoneal space in a localized phlegmon or abscess via a gross or microscopic communication. The inflammatory reaction in this region results in a retroperitoneal cicatrix that is particularly fibrous. The entrapment and obstruction of the underlying right ureter at or below the pelvic brim completes the lesion. Similar observations have been made in some cases of bilateral "idiopathic retroperitoneal fibrosis." A number of patients diag-

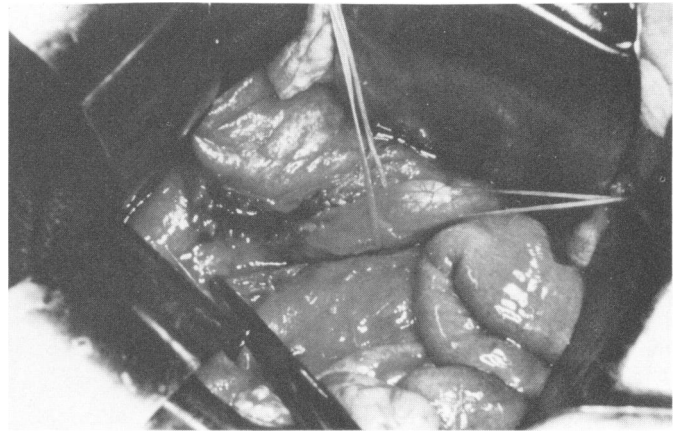


FIG. 8. Photograph taken during operation of a dilated right ureter. The ureter is isolated between umbilical tapes and disappears into the cicatrix of retroperitonitis.

nosed as having "idiopathic" retroperitoneal fibrosis had events in their history capable of producing a retroperitoneal insult leading to fibrosis: sigmoid diverticulitis, inflammatory processes of the lower extremity, cholecystitis, etc.^{1,19}

Our theory of pathogenesis is attractive, easy to demonstrate and, in the end stage, can be proven by demonstration of the sinus tract to the retroperitoneum, retroperitonitis, and ureteral obstruction.

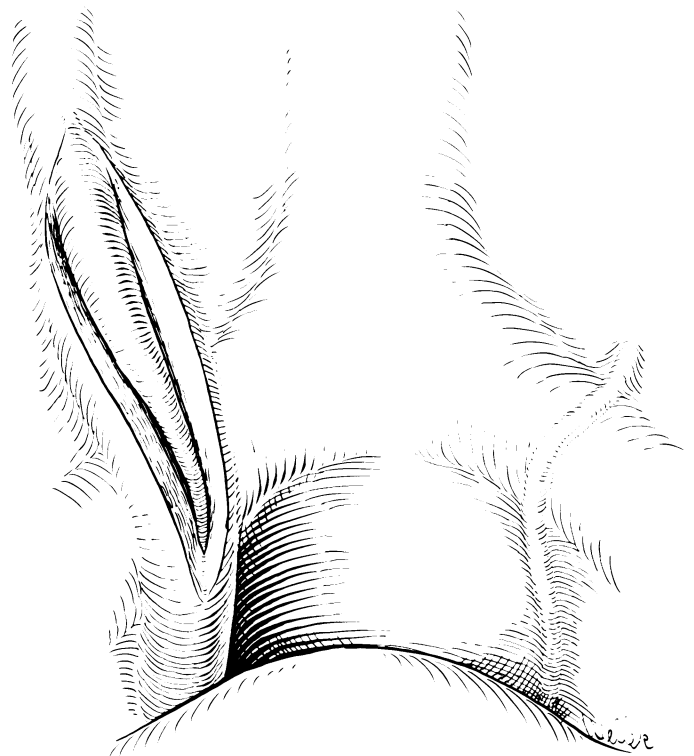
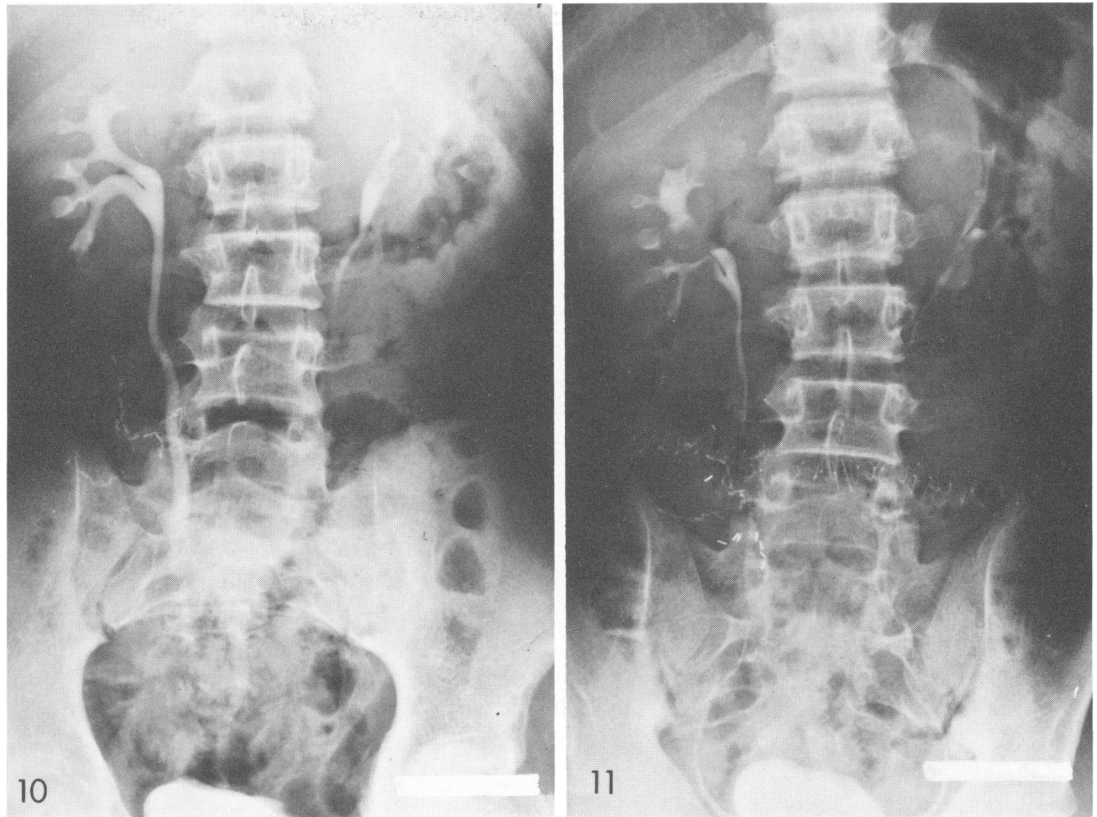


FIG. 9. Technic of ureterolysis. The ureter is circumferentially freed from the encasing cicatrix, and the anterior portion of the fibrotic sheath is resected.

Figs. 10 and 11. Excretory pyelogram (Fig. 10) of patient J. M. 3 years after intestinal resection for Crohn's disease. Hydroureter is present. Following ureterolysis (Fig. 11), the hydroureter has resolved. There was no residual Crohn's disease found at the time of ureterolysis.



Treatment

Our advocacy of ureterolysis as a necessary supplement to intestinal resection for relief of obstructive uropathy relies upon three categories of proof: our uniform success following ureterolysis; a review of others' failures to achieve renal decompression when ureterolysis was not employed; and a presentation of the clinical course of three patients known to us in whom obstructive uropathy remained despite medical management, intestinal bypass, or resection alone. One of these patients was eventually relieved by ureterolysis.

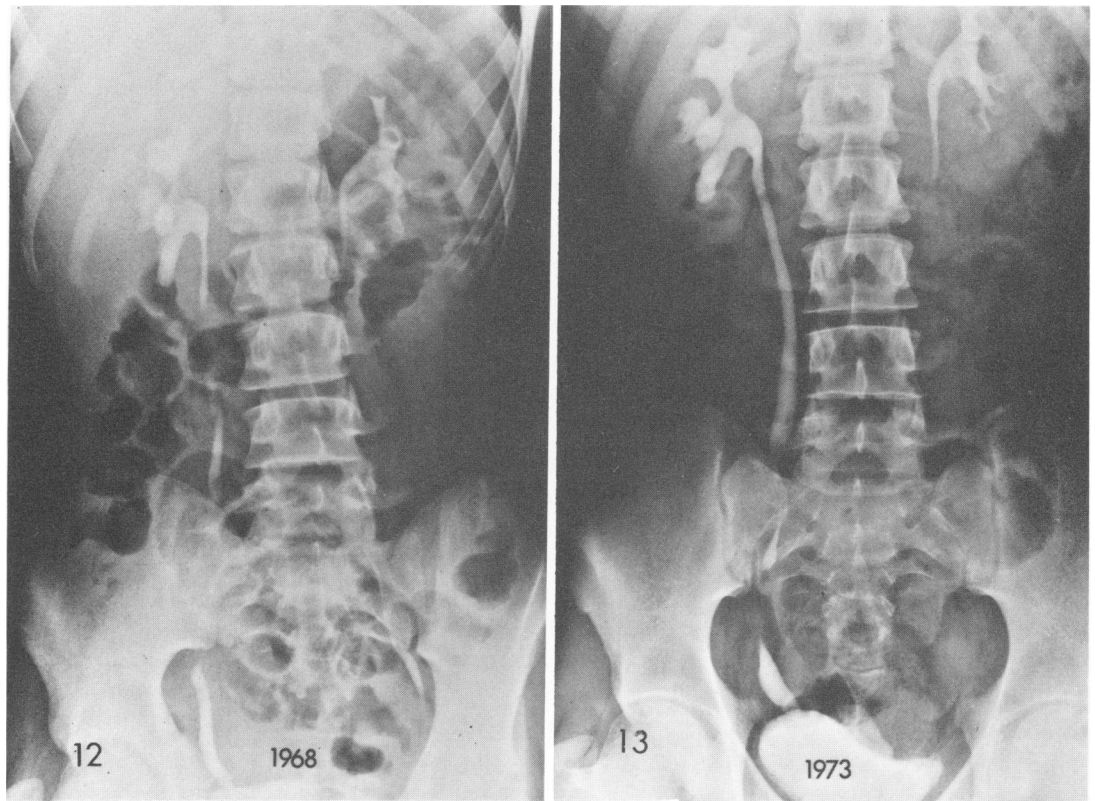
In 27 patients the septic complications of Crohn's disease, as well as the right-sided ureteral obstruction have been uniformly relieved by resection and ureterolysis. This fact, in our opinion, is the most persuasive proof of the correctness of our position. That this result was achieved without operative mortality or urinary complication further reinforces our thesis. The absence of renal calculi in our group of patients and their maintenance of a normal collecting system up to 5½ years after operation is additional argument in favor of the necessity of ureterolysis. Monge¹⁴ and Cerny³ have both reported success in supplementing bowel resection with ureterolysis.

A review of the results of others in their management of ureteral obstruction with Crohn's disease

lends further support to our advocated treatment. From 1943 to 1970, 22 cases of insidious right-sided periureteric fibrosis developing as a consequence of regional enteritis have been reported by others.⁶ Prior to 1970, the operative treatment for the ureteral complication has primarily centered around control of the intestinal disease alone. The failure to supplement intestinal resection with ureterolysis has resulted in a continuing morbidity with a concomitant needless loss of renal function.

Hyams *et al.*, considered the origin of periureteric fibrosis to be the transport of intestinal-mesenteric inflammation to the retroperitoneum via communicating lymphatics.¹² Since their report, the spectrum of this complication has been reported to vary from minimal periureteric fibrosis with associated ureteral dilatation, to stenosis and constriction of the distal right ureter with proximal hydronephrosis. Ureterolysis for the relief of this syndrome was originally shunned because of the early unsuccessful experience encountered in ureteral decompression. Harlin and Hamm¹¹ warned that "intervention in the form of some surgical procedure on the urinary system is usually unnecessary and may lead to further complications." This warning was seemingly well-heeded, and the *laissez faire* attitude has resulted in a high degree of unnecessary morbidity. The failure to perform appropriate

Figs. 12 and 13. Pyelogram of patient P.G. (Fig. 12) in 1968 demonstrating moderate occult hydroureter. There is worsening of the hydroureter and hydronephrosis in 1973 (Fig. 13). During this interval the patient was treated medically without operation.



ureteral decompression has been directly responsible for the loss of the right kidney in two patients.¹¹

An objective assessment of the treatment afforded by Present, Rabinowitz and Banks¹⁶ is not possible, as they did not record the nature of the operative treatment provided to each of the ten patients reported. Of the 12 other cases reported prior to 1969, the average patient was subjected to over two operations with one-third of the patients requiring three operations or more. Only one patient was treated by ureterolysis.¹⁸ In this patient, as in our series, complete urinary decompression was achieved.

Of the 21 cases reported prior to 1970 which were not treated by ureterolysis, ureteral obstruction was eventually relieved in only 11. Two of the failures required nephrectomy.¹¹ Despite the fact that ureteral decompression was achieved in 50 per cent of patients without ureterolysis, it was achieved at the cost of at least two operative procedures per patient. It is noteworthy that of the six cases reported prior to 1969 in which there was resolution of ureteric obstruction without ureterolysis, bowel resection was employed for four patients. We may postulate that if the ureteral obstruction was above the pelvic brim, the surgeon may perforce perform an incidental ureterolysis while mobilizing the ileo-ascending colon in order to identify and spare the right ureter.

That ureterolysis is both an effective and safe procedure for definitive ureteral decompression is corroborated by the operative experience in periureteric fibrosis unrelated to Crohn's disease. This has been reported previously by Vest and Barelare¹⁹ and Kerr, Suby and Vickery.¹³

The sequence of events occurring in two of our patients is further evidence that ureterolysis is a necessary supplement to bowel resection in order to relieve the obstructive component of this syndrome. Medical management, intestinal bypass, and intestinal resection without ureterolysis have all failed to achieve urinary decompression as witnessed by the following case studies.

Case Reports

Case 1. J. M. (969513), a 14-year-old male underwent resection of the terminal ileum and cecum for Crohn's disease complicated by right lower quadrant and retroperitoneal sinus and abscess. A primary anastomosis was accomplished and the patient made an uneventful recovery. Three years after operation the patient complained of right CVA pain. Investigation revealed extraluminal obstruction of the right ureter with hydroureter and mild hydronephrosis. At reoperation, no residual Crohn's disease was found, but the right ureter was obstructed by periureteric fibrosis. Ureterolysis resulted in prompt relief of symptoms and the pyelogram reverted to normal in less than 1 month and has remained normal for over 2 years (Figs. 10 & 11).

Case 2. P. G. (978363), a 19-year-old man was admitted to the gastroenterology service of the University of Chicago in 1968

with weight loss, inanition, and recurrent urinary tract infections. A diagnosis of Crohn's disease was confirmed and the patient was treated by an effective medical regimen. Excretory urography at the time of hospitalization demonstrated right-sided hydronephrosis and hydronephrosis with obstruction at the level of the pelvic brim. Operation was not advised by the primary physicians. The patient's condition regarding the intestinal disease improved, and under strict medical therapy the patient gained 50 pounds. Despite occasional episodes of partial intestinal obstruction the patient has managed reasonably well over the past 5 years. Intravenous pyelography performed in April of 1973 to evaluate the evolution of the urinary obstruction revealed persistent marked ureteral obstruction with worsening of the hydronephrosis since 1968. There have been no urinary symptoms (Figs. 12 & 13).

Conclusions

A specific and identifiable clinical entity of advanced and complicated Crohn's disease is presented. This entity consists of Crohn's disease involving at least the terminal ileum and/or ascending colon which has progressed to involve the retroperitoneum by a microscopic or gross sinus, fistula or abscess. This retroperitonitis results in a cicatricial periureteric fibrosis that, in turn, causes ureteral obstruction. This clinical entity has been observed in 27 of our patients. The urinary obstruction may be encountered in patients known to have Crohn's disease, may occur as an indication of worsening of the enteritis, or may be the first indication of previously undiagnosed Crohn's disease. Appropriate bowel resection supplemented by ureterolysis has resulted in the relief of the ureteral obstruction in all of our patients.

On the basis of our experience and observations we conclude that:

1) Routine and periodic excretory pyelograms are an essential part of the evaluation of the patient with Crohn's disease.

2) Obstructive uropathy complicating Crohn's disease is an indication for operation both for the bowel disease *per se* and for the relief of the ureteral obstruction. Obstructive uropathy indicates the presence of a classic complication of Crohn's disease: sinus, fistula or abscess.

3) Appropriate bowel resection supplemented by ureterolysis is the recommended treatment for this syndrome.

4) Ureterolysis has not resulted in any urinary tract complications nor injury to other retroperitoneal structures.

Acknowledgments

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DISCUSSION

DR. ALEXANDER J. WALT (Detroit): As a new member, I felt flattered when invited by my old sparring partner, George Block, to read his manuscript and to discuss his paper. My sense of

pleasure was rapidly dulled, however, when I discovered that the penalty I would have to pay for this distinction would be public exposure of my ignorance! In a reasonable experience with Crohn's disease, I have personally seen only one patient with the full blown picture described by Dr. Block and in this patient,