

## LONG-TERM OUTCOME OF ILEAL CONDUIT DIVERSION

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### ABSTRACT

**Purpose:** Ileal conduit is considered a safe procedure and the gold standard to which newer forms of urinary diversion should be compared, although few long-term results are known. We analyzed a consecutive series of patients who lived a minimum of 5 years after ileal conduit diversion.

**Materials and Methods:** A total of 412 patients underwent ileal conduit diversion between 1971 and 1995 at our institution. We analyzed all conduit related complications occurring later than 3 months after surgery in 131 long-term survivors (survival 5 years or greater).

**Results:** Median followup was 98 months (range 60 to 354). Overall 192 conduit related complications developed in 87 of 131 (66%) patients. The most frequent complications were related to kidney function/morphology in 35 patients (27%), stoma in 32 (24%), bowel in 32 (24%), symptomatic urinary tract infection (including pyelonephritis) in 30 (23%), conduit/ureteral anastomosis in 18 (14%) and urolithiasis in 12 (9%). Within the first 5 years complications developed in 45% of patients. This percentage increased to 50%, 54% and 94% in those surviving 10, 15 and longer than 15 years, respectively. In this last group 50% had upper urinary tract changes and 38% had urolithiasis, for which the respective numbers after 5 years were 12% and 17%.

**Conclusions:** This study demonstrates a high conduit related complication rate in long-term survivors and underlines the need for vigorous long-term followup. Only studies lasting more than 1 decade cover the entire morbidity spectrum.

**KEY WORDS:** urinary diversion; treatment outcome; kidney function tests; postoperative complications

The ileal conduit introduced by Seiffert and popularized by Bricker has been used for half a century, and it is still considered a standard form of urinary diversion following cystectomy for bladder cancer.<sup>1</sup> In an attempt to overcome some of its shortcomings, such as the need for external appliances, urinary leakage due to appliance problems and impaired body image, continent cutaneous diversion and orthotopic bladder substitution have been developed.<sup>2–4</sup> The latter technique is consistently replacing the ileal conduit for contemporary urinary diversion.<sup>2–4</sup> Because these procedures are not without complications, many urologists argue against these modern forms of urinary diversion and justify the continuous use of the good, old and safe standard ileal conduit. Even at our institution, where orthotopic bladder substitution was started in 1984, between 1991 and 1995, 46% and in the last 5 years 40% of all urinary diversions were ileal conduits.

Little solid long-term data on the gold standard ileal conduit are available, as many series mix patients with short and long-term followup.<sup>1,5–7</sup> To address important long-term issues, such as kidney function, stoma and bowel related problems, metabolic disorders, recurrent pyelonephritis/urinary tract infection and stone formation, we reviewed the charts of all patients who received an ileal conduit at our institution between 1971 and 1995, and who lived a minimum of 5 years after surgery.

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**Editor's Note:** This article is the fourth of 5 published in this issue for which category 1 CME credits can be earned. Instructions for obtaining credits are given with the questions on pages 1118 and 1119.

### MATERIAL AND METHODS

Files of all patients who had undergone ileal conduit diversion between March 1971 and September 1995 at our institution were retrospectively reviewed. Absolute numbers and different types of urinary diversion performed during this period are listed in table 1.

**Surgical technique.** The technique for ileal conduit diversion was more or less identical in all cases in this series as our department is a teaching institution. An ileal segment 15 to 20 cm. long was isolated 10 to 25 cm. proximal to the ileocecal valve. Ureters were split and anastomosed separately by 2 running sutures using the Nesbit technique in an open end-to-side fashion. Ureters were stented with 7 or 8Fr catheters for 5 to 8 days. The ileal segment was anastomosed to the abdominal wall in a nipple-to-stoma fashion.

**Followup.** Patients were followed according to a prospective protocol at 3 and 6 months after surgery, and at 6-month intervals thereafter for 5 years. After 5 years annual visits were performed either at our institution or by private practicing urologists. Followup investigations were in part dependent on the underlying disease (benign or malignant) and included excretory urography, ultrasonography, serum creatinine, blood urea nitrogen, electrolytes and blood gas analysis. Urine cultures were not routinely obtained. To evaluate renal function and upper urinary tract radiological changes, a comparison was made between the last preoperative and last postoperative examination. All conduit related complications observed 3 months after surgery were recorded.

### RESULTS

**Patient characteristics and followup.** Of the 412 patients who received an ileal conduit during the study period 30 (7%) were excluded from the study because of incomplete followup.

TABLE 1. Numbers and types of urinary diversions performed at our institution

	Urinary Diversion	Ileal Conduit	Ureterosigmoidostomy	Orthotopic Bladder Substitution	Other Types
1971-1975	128	58	31		39
1976-1980	143	109	18		16
1981-1985	111	64	8	4	35
1986-1990	151	71	5	66	9
1991-1995	237	110	4	117	6
Totals	770	412	66	187	105

Of the remaining 382 patients 131 (34%) survived 5 years or more and are included in this analysis (fig. 1). Median patient age at surgery was 62 years (range 15 to 82), and median followup was 98 months (range 60 to 354). Indications for surgery were bladder cancer in 91 patients (70%), other malignancies in 16 (12%) and nonmalignant disease in 24 (18%).

**Conduit related complications.** A total of 192 conduit related complications developed in 87 (66%) patients (mean 2.2 complications per patient, range 1 to 7). The most frequent conduit related complications observed 3 months after surgery are summarized in figure 2.

**Stoma:** Stoma related complications developed in 32 (24%) patients with the most frequent being parastomal hernia (18), stenosis (8) and recurrent bleeding/skin irritation (6). Surgical intervention was necessary in 15 patients who underwent a total of 19 surgical procedures. Median time between surgery and development of stoma related complications was 54 months (range 4 to 274). The majority of stoma related complications (25, 78%) occurred within the first 5 years after surgery (fig. 3).

**Bowel:** Bowel related complications were reported in 32 (24%) patients after a median of 36 months (range 5 to 144). Bowel obstruction developed in 16 patients, 8 of whom required surgical re-intervention after a median of 22 months (range 5 to 64) following ileal conduit diversion. An additional 8 patients reported intermittent diarrhea or bowel obstruction. Cutaneous fistula developed in 7 patients operated on before 1986 and all required surgical intervention (usually laparotomy with small bowel resection).

**Urinary Tract Infection/Pyelonephritis:** Routine urine cultures were not obtained during followup and, therefore, only clinically evident urinary tract infections requiring hospitalization were recorded. Urinary tract infections were present in 30 (23%) patients. Acute/recurrent pyelonephritis was observed in 15 patients, which was associated with postrenal

obstruction caused by anastomotic stricture, stomal stenosis or urolithiasis in 13. Recurrent urinary tract infections without clinically overt pyelonephritis were seen in 10 patients. Urosepsis occurred in 5 patients, which was associated with upper urinary tract dilatation in 4. Median time between surgery and the first episode of urinary tract infection was 48 months, and 50% of first episodes occurred in the first 5 years postoperatively (fig. 3).

**Conduit/Ureteral Anastomosis:** Complications directly related to the conduit or ureteral anastomosis developed in 18 (14%) patients. The conduit was replaced by a new ileal conduit in 1 patient, jejunal conduit in 1 and a Kock pouch in 1. Upper urinary tract obstruction developed in 13 patients due to stenosis at the ureteroileal anastomosis. Surgical re-intervention was necessary because the ileal conduit was too long in 4 cases and 3 because of fibrosis of the conduit in 3. Overall 12 procedures (including 2 endourological procedures) were required in 10 patients.

**Urolithiasis:** Urolithiasis developed in 12 (9%) patients (18 stones) during followup. Upper urinary tract pathology was present in 7 of the 12 (58%) patients, including recurrent pyelonephritis in 5, postrenal obstruction in 1 and renal failure in 1. One patient suffered from the short bowel syndrome. Urolithiasis was a late complication as median time between surgery and first occurrence was 70 months (range 25 to 232). The rate of urolithiasis was 0% within the first 2 years postoperatively, 20% within the first 5 years and 38% after 10 years (fig. 3).

**Renal Function:** Persistent hyperchloremic acidosis was observed in only 2 patients, 1 of whom had impaired renal function because of recurrent pyelonephritis. Kidney function was assessed by serum creatinine and radiological changes of the upper urinary tract. Preoperatively, kidney function/morphology was normal in 79.5% of patients and the remaining 20.5% had either an increased creatinine (greater than 150  $\mu\text{mol/L}$ ) and/or upper urinary tract pathology, such

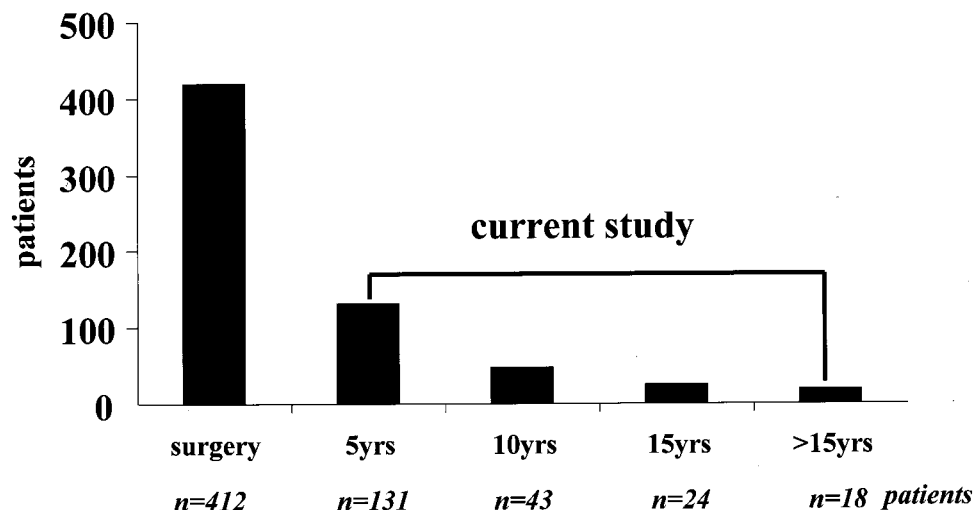


FIG. 1. Study population and followup. Only 131 patients who lived minimum of 5 years after ileal conduit diversion were included in study.

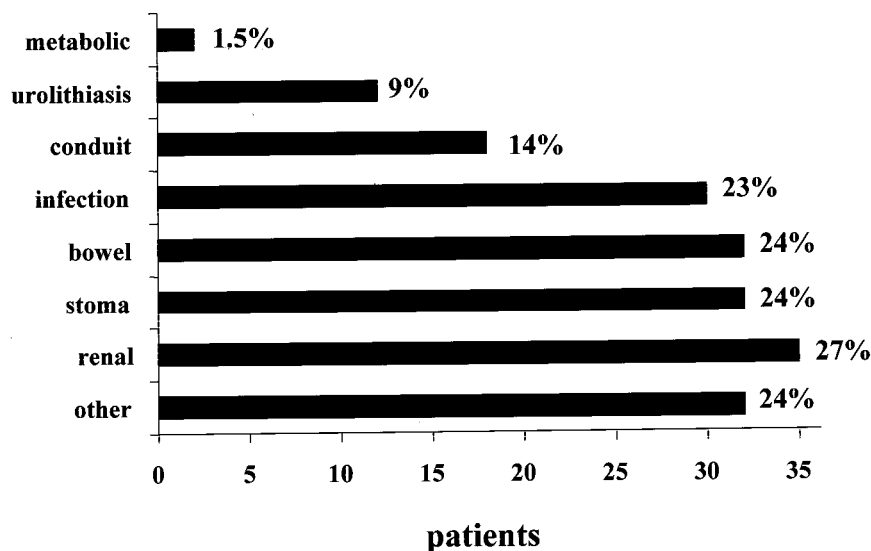


FIG. 2. Summary of ileal conduit related complications. All ileal conduit related complications recorded are listed. Several nominations per patient were possible. Percentages refer to total study population of 131 patients.

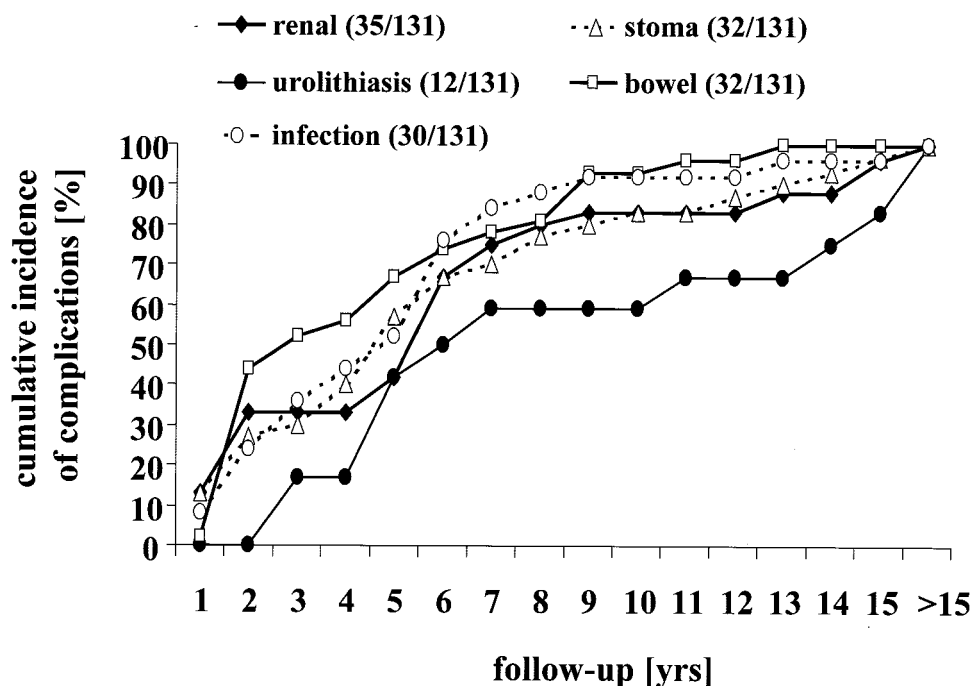


FIG. 3. Cumulative incidences of ileal conduit related complications with time. Most complications occurred within first 10 years after surgery but stone formation was late event. Percentages refer to absolute number of respective complication.

as a shrunken kidney (for example caused by vesicoureteral reflux) or hydronephrosis mostly caused by tumor infiltration. After ileal conduit diversion morphological/functional deterioration occurred or the preoperatively existing upper urinary tract pathology deteriorated in 35 (27%) patients (fig. 2). Nephrectomy was required for pyonephrosis in 2 patients and for an upper urinary tract tumor in 1. The most common upper urinary tract changes were hydronephrosis (15 cases) and shrunken kidney (9). Hemodialysis after ileal conduit diversion was required in 3 patients, 1 of whom later received a kidney transplant. These 3 patients already had impaired renal function from prior surgery. Mean time between surgery and renal changes was 60 months. The rate of renal pathology was 40% within the first 5 years after surgery and approximately 80% after 10 years (fig. 3).

*Parameters affecting long-term complications.* To evaluate

whether the year of surgery had an impact on long-term complications, we analyzed complications occurring only within the first 5 years, thus avoiding the bias of a longer followup of patients operated on earlier in this series (fig. 4). Patients operated on in more recent years had a lower conduit related morbidity within the first 5 years. Patient age at surgery was not correlated to the incidence of long-term complications, yet differences in followup periods must be considered (table 2). Median followup of patients younger than 50 years at surgery (148 months) was almost twice as long as that of patients older than 70 years at surgery (78 months).

Incidences and patterns of complications changed during followup. The typical complication early in followup was related to the bowel, and almost 50% of these complications occurred within the first 2 years. The typical late complica-

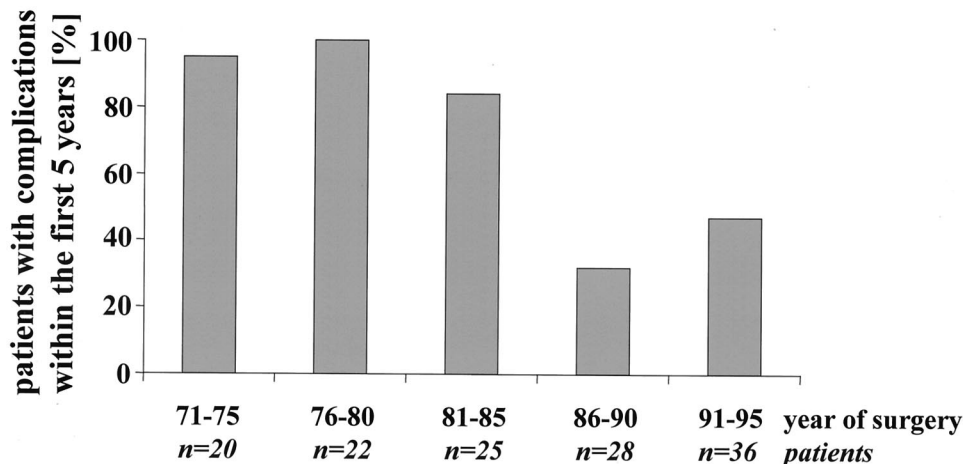


FIG. 4. Impact of year of surgery on conduit related complications. To avoid bias caused by longer followup period of those operated on earlier in this series, only complications occurring within first 5 years were calculated.

TABLE 2. Impact of age at surgery on the rate of long-term complications after ileal conduit

Age at Surgery	No. Pts.	Median Followup (mos.)	No. Pts. With Complications (%)
50 or Younger	24	148	19 (79)
51-60	28	101	19 (68)
61-70	59	89	37 (63)
Older than 70	20	78	12 (60)
Overall	131	98	87 (66)

tion was urolithiasis. Kidney and stoma related complications such as urinary infection occurred between these 2 extremes (fig. 3). Overall number of incidences and types of complications in different followup groups increased with time after surgery (fig. 5). Complications developed in 45% of patients within the first 5 years and in 94% of those who lived longer than 15 years with the conduit (fig. 5).

DISCUSSION

This study demonstrates a high conduit related morbidity and, probably most importantly, that complications occurred

up to 1 to 2 decades after surgery. Thus, the true picture regarding this issue can only be obtained by studies with followup length similar to that of this study. It is noteworthy that all patients in this series had a minimum followup of 5 years. In contrast to other studies, our data were not diluted with short-term survivors. Long-term followup cases carry the risk that surgical techniques during the study period do not necessarily reflect current surgical practice. For instance small bowel fistula occurred in this series only when double layer anastomosis with interrupted silk and chromic catgut was used. Bowel fistulas were not observed with a single seromuscular end-to-end anastomotic technique used after 1986. Although we performed a retrospective study of more than 25 years, 49% of patients analyzed were operated on after 1985, representing a more contemporary surgical experience.

Despite the fact that intraoperative and postoperative mortality, and survival following ileal conduit improved during the last 3 decades, incidences of delayed complications did not decrease in parallel.<sup>1,8</sup> Long-term morbidity of newer forms of urinary diversion must be compared to that of the old gold standard ileum conduit,<sup>9-12</sup> as several issues, such as stomal problems, appliance malfunction/incontinence,

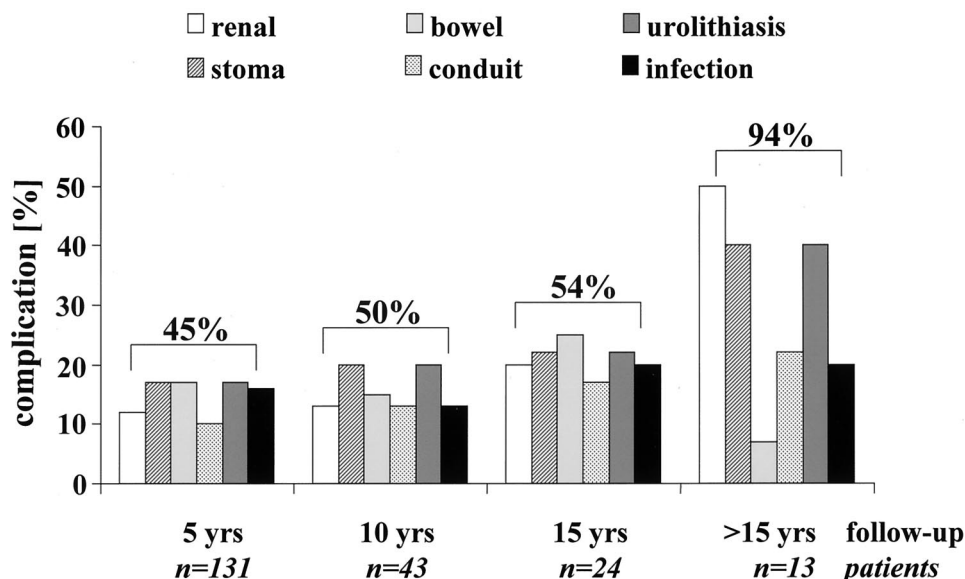


FIG. 5. Patients with ileal conduit related complications as function of followup. Within first 5 years 45% of patients had complications. This percentage increased to 50%, 54% and 94% of those living 10 years, 15 years or longer, respectively, with conduit.

metabolic complications, urinary tract infection and upper urinary tract changes, become apparent.

Most conduit related long-term morbidity centers around the stoma, affecting up to a third of patients (24%) in our series.<sup>1,8</sup> Stomal stenosis is seen in 2% to 19% of cases and the 6% rate in our series is within this range.<sup>1,8</sup> Parastomal hernias develop in 10% to 15% of patients, and the majority require surgical revision. The occurrence of parastomal hernias can be avoided by placing the stoma through the rectus muscle, and fixing the conduit to the anterior and posterior rectus sheath. Vascular insufficiency and/or scarring caused by chronic infection has been suspected of being the pathomechanism causing "pipe stem" deformities of the conduit.<sup>1</sup>

A driving force in the search for alternative urinary diversions is avoidance of stoma related problems. Newer forms of diversion overcome these shortcomings by creating continence mechanisms (continent cutaneous reservoirs) or by using the native sphincter (orthotopic bladder substitution). Long-term continence data in men after orthotopic bladder substitution are now available.<sup>2-4,13,14</sup> We reported on 83 men living a minimum of 5 years with an orthotopic bladder substitute. Daytime continence rates averaged about 90% at 5 years, nighttime continence rates were about 10% lower and severe forms of urinary incontinence were rare.<sup>13</sup> Similar data have been reported by others.<sup>4,14</sup> Hypercontinence requiring intermittent catheterization is rare in men, usually occurring in less than 5%, provided that a funnel-shaped outlet prone to kinking is avoided. Avoidance of stoma related morbidity and favorable long-term continence data following orthotopic bladder substitution (particularly in men) are strong arguments for this type of diversion.<sup>13</sup>

The ileal conduit is a low pressure reservoir as long as outflow is unobstructed, which requires the shortest length of bowel and exposes the mucosa to urine for a shorter time than continent diversions. In the presence of normal kidney function long-term metabolic complications are usually absent, yet bicarbonate is lost in the early postoperative period. This finding is emphasized in our series as hyperchloremic acidosis was observed only twice. Resection of an ileal segment less than 60 cm. is thought to be without malabsorption for patients with a normal terminal ileum, an intact ileocecal valve and normal kidney function.<sup>2,15</sup>

The most concerning issue following ileal conduit diversion is upper urinary tract changes, which are found consistently in long-term studies.<sup>1,7,8,16,17</sup> Neal reported upper tract changes in 47% and renal deterioration in 16% of patients with a mean followup of 10 years.<sup>16</sup> Pernet and Jonas evaluated results of 110 renal units 10 years postoperatively and observed deterioration in about a third.<sup>7</sup> More recently Singh et al reported upper urinary tract dilatation in 34% of patients after a mean followup of 5 years.<sup>17</sup> Renal functional/morphological alterations developed in more than 35% of our patients, and this percentage increased to 50% of those surviving longer than 15 years. What are the mechanisms causing these alterations? Reflux and chronic infection are most frequently quoted. However, the role of reflux is challenged by 2 studies from Sweden, which revealed no change in the glomerular filtration rate following a refluxing or nonrefluxing ileal conduit, and renal scarring was less frequent in patients with an antirefluxing ureteral anastomosis.<sup>18,19</sup> However, reflux is only avoided as long as there is no outlet obstruction. If a high pressure system develops reflux is inevitable.

These high incidences of upper urinary tract changes are in clear contrast to the low incidence following orthotopic bladder substitution using a tubular isoperistaltic ileal segment similar to an ileal conduit but connected to an orthotopic low pressure reservoir.<sup>20</sup> Of 76 long-term survivors with this form of urinary diversion upper urinary tracts were preserved in 95%.<sup>20</sup> In the few cases in which upper urinary tract changes were observed postoperatively they were in-

variably associated with preexisting pathology or de novo obstruction.<sup>20</sup> The usually sterile urine in the bladder substitute (in contrast to ileal conduit) may have contributed to these favorable results.<sup>20</sup>

The high incidence (9%) of urolithiasis in our series also reflects these upper urinary tract changes, as obstruction, recurrent urinary tract infection and pyelonephritis were frequently present in patients with urolithiasis, and similar percentages have been reported by others.<sup>7,21</sup> The stone rate was 20% at 10 years and 38% at greater than 15 years after the ileal conduit (figs. 3 and 5). This high incidence again is in contrast to data after orthotopic bladder substitution. In a consecutive series of 98 patients with a minimum followup of 5 years urolithiasis did not develop in any patients.

#### CONCLUSIONS

Complications directly related to the ileal conduit developed in 2 of 3 patients in the long term and almost 40% required surgical re-intervention. The fact that these complications occurred up to 20 years after surgery emphasizes the need for more long-term studies lasting more than a decade to determine the entire morbidity spectrum. This fact must be considered particularly in regard to newer forms of urinary diversion. One might even raise the provocative question of whether the gold standard is really so golden, safe and simple.

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