Nonobstructing Colonic Dilatation and Colon Perforations Following Renal Transplantation

Baburao Koneru, MD; Rick Selby, MD; Daniel P. O'Hair, MD; Andreas G. Tzakis, MD; Thomas R. Hakala, MD; Thomas E. Starzl, MD, PhD

- Nonobstructing colonic dilatation has not been commonly reported following renal transplantation, and colon perforations carry a high morbidity and mortality in this population. During a 7-year period, nonobstructing colonic dilatation developed in 13 adults 1 to 13 days after renal transplantation. Twelve (92%) of the 13 had poorly functioning allografts. Five (83%) of the 6 with and 2 (29%) of the 7 without colonoscopy had resolution of nonobstructing colonic dilatation. Of the seven right-sided colon perforations during this period, six were associated with nonobstructing colonic dilatation. An additional 4 patients had diverticular perforations in the left colon. Of a total of 11 patients with colon perforation, 7 had surgery within 24 hours of the perforation and 6 (66%) of these survived. Only 1 (25%) of the 4 having surgery more than 24 hours later survived. Six of the survivors retained functioning allografts. Nonobstructive colonic dilatation seems to be a potential complication of poor graft function after renal transplantation, and colonoscopy is effective in its treatment. In patients with colon perforations, early surgery and reduced immunosuppression are essential in decreasing mortality.

(Arch Surg. 1990;125:610-613)

Mortality following renal transplantation has decreased remarkably in the last 15 years. However, colonic perforations following renal transplantation continue to have a high morbidity and mortality. In the literature, a majority of colonic complications reported are a result of diverticular disease and are in the sigmoid colon. Increased incidence of diverticular disease and increased tendency to constipation in patients with end-stage renal disease were some of the proposed reasons. Nonobstructive colonic dilatation (NCD; Ogilvie's syndrome), which occurs in association with several medical and surgical conditions, has been reported only rarely following renal transplantation. Similarly, right-sided colon perforations have formed only a small group of the overall colon perforations. A preponderance of cases with NCD and right-sided perforations among those patients in whom colon perforations developed at the University of Pittsburgh (Pa) has prompted us to review our experience with colonic perforations and NCD following renal transplantation.

SUBJECTS AND METHODS

A retrospective review of 1050 adult (>19 years) recipients of cadaveric kidneys at the Presbyterian-University Hospital, Pittsburgh, between January 1981 and December 1987 was done to identify patients with colon perforation, NCD, or both. A total of 18 patients were identified; they form the basis of this study. Charts were reviewed for age, sex, primary renal disease, graft function, duration from transplantation to the onset of complications, interval between onset of symptoms and surgery, type of intestinal surgery, and patient and graft survival. In the pretransplantation evaluation, contrast enemas were done only in patients with symptoms of acute or past colonic disease. Pretransplantation bowel cleaning was done by a sodium phosphate (Fleets), tap water, and/or milk and molasses enema.

All patients received a pretransplantation oral dose of cyclosporine of 17.5 mg/kg and an intravenous dose of 1 g of methylprednisolone sodium succinate in the operating room. After transplantation, cyclosporine was administered intravenously at 4 mg/kg per day. When oral intake was resumed, 17.5 mg/kg per day of cyclosporine was given orally to rapidly reduce doses of intravenous cyclosporine. Whole blood cyclosporine levels of 700 to 1000 ng/mL by radiimmunoassay or 200 to 300 ng/mL by high-performance liquid chromatography were sought. The dose of prednisone was tapered to 20 mg/kg the day of transplantation and the day of posttransplantation. In the later period by monoclonal antibody orthotopic renal transplantation, NCD developed soon after transplantation. Similarly, patients were identified with NCD in the later period by monoclonal antibody orthotopic renal transplantation. Two had localized abscesses. Three of the four survived with or without surgery. In the earlier period by antilymphocyte globulin, all patients had surgery. In the later period by monoclonal antibody orthotopic renal transplantation, NCD developed soon after transplantation. Two had localized abscesses. Three of the four survived with or without surgery. In the earlier period by antilymphocyte globulin, all patients had surgery. In the later period by monoclonal antibody orthotopic renal transplantation, NCD developed soon after transplantation. Two had localized abscesses. Three of the four survived with or without surgery. In the earlier period by antilymphocyte globulin, all patients had surgery. In the later period by monoclonal antibody orthotopic renal transplantation, NCD developed soon after transplantation. Two had localized abscesses. Three of the four survived with or without surgery. In the earlier period by antilymphocyte globulin, all patients had surgery. In the later period by monoclonal antibody orthotopic renal transplantation, NCD developed soon after transplantation.
Table 1.—Clinical Characteristics of Patients With Left-Sided Colon Perforations

<table>
<thead>
<tr>
<th>Age, y/Sex</th>
<th>Cause of Renal Failure</th>
<th>Days After Transplantation</th>
<th>Interval From Perforation to Surgery, h</th>
<th>Surgical Treatment</th>
<th>Patient and Graft Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>42/F</td>
<td>Chronic glomerulonephritis</td>
<td>283</td>
<td>24</td>
<td>Perforation exteriorized with colostomy</td>
<td>Alive; graft lost to chronic rejection 4 y later</td>
</tr>
<tr>
<td>50/F</td>
<td>Polycystic kidneys</td>
<td>31</td>
<td>24</td>
<td>Sigmoid resection, colostomy, and mucous fistula</td>
<td>Alive; creatinine level, 160 μmol/L</td>
</tr>
<tr>
<td>62/F</td>
<td>Hypertension</td>
<td>7</td>
<td>24</td>
<td>Sigmoid resection, Hartman's procedure, and colostomy</td>
<td>Alive; creatinine level, 110 μmol/L</td>
</tr>
<tr>
<td>69/M</td>
<td>Unknown</td>
<td>14</td>
<td>48</td>
<td>L-sided colon resection, Hartman's procedure, and colostomy</td>
<td>Died 6 wk after transplantation</td>
</tr>
</tbody>
</table>

Table 2.—Clinical Features of 13 Patients With NCD Following Renal Transplantation

<table>
<thead>
<tr>
<th>Age, y/Sex</th>
<th>Cause of Renal Failure</th>
<th>Onset of NCD Following Transplantation, d/ Maximum Cecal Diameter, cm</th>
<th>Coloscopy</th>
<th>Course of NCD†</th>
<th>Patient and Graft Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>40/M</td>
<td>Unknown</td>
<td>1/12</td>
<td>No</td>
<td>Resolved</td>
<td>Alive; graft lost to renal artery stenosis, 4 mo</td>
</tr>
<tr>
<td>51/M</td>
<td>Buerger's disease</td>
<td>2/11</td>
<td>No</td>
<td>Resolved</td>
<td>Alive; creatinine level, 310 μmol/L</td>
</tr>
<tr>
<td>44/F</td>
<td>Hypertension</td>
<td>13/12</td>
<td>Yes</td>
<td>Resolved</td>
<td>Alive; graft lost to rejection, 3 wk</td>
</tr>
<tr>
<td>64/M</td>
<td>Glomerulonephritis</td>
<td>3/9</td>
<td>Yes</td>
<td>Resolved</td>
<td>Alive; creatinine level, 210 μmol/L</td>
</tr>
<tr>
<td>42/M</td>
<td>Polycystic kidneys</td>
<td>1/14</td>
<td>Yes</td>
<td>Resolved</td>
<td>Alive; graft lost to hyperacute rejection, 3 d</td>
</tr>
<tr>
<td>45/F</td>
<td>Interstitial nephritis</td>
<td>2/6</td>
<td>No</td>
<td>Resolved</td>
<td>Alive; creatinine level, 220 μmol/L</td>
</tr>
<tr>
<td>51/F</td>
<td>Polycystic kidneys</td>
<td>5/12</td>
<td>Yes</td>
<td>Resolved</td>
<td>Alive; kidney lost to chronic rejection, 64 mo</td>
</tr>
<tr>
<td>53/M</td>
<td>Hypertension</td>
<td>3/12</td>
<td>No</td>
<td>R-sided colon perforation (4 d)</td>
<td>Died</td>
</tr>
<tr>
<td>37/M</td>
<td>Hypertension</td>
<td>2/12</td>
<td>No</td>
<td>R-sided colon perforation (36 h)</td>
<td>Alive; graft lost to chronic rejection 18 mo later</td>
</tr>
<tr>
<td>60/M</td>
<td>Unknown</td>
<td>2/11</td>
<td>No</td>
<td>R-sided colon perforation (24 h)</td>
<td>Died</td>
</tr>
<tr>
<td>54/M</td>
<td>Hypertension</td>
<td>2/11</td>
<td>Yes</td>
<td>R-sided colon perforation (24 h)</td>
<td>Alive; creatinine level, 250 μmol/L</td>
</tr>
<tr>
<td>34/M</td>
<td>IgA nephropathy</td>
<td>2/9</td>
<td>No</td>
<td>R-sided colon perforation (24 h)</td>
<td>Alive; creatinine level, 220 μmol/L</td>
</tr>
<tr>
<td>52/M</td>
<td>Lupus nephritis</td>
<td>2/14</td>
<td>No</td>
<td>R-sided colon perforation (24 h)</td>
<td>Alive; graft lost to rejection 1 mo later</td>
</tr>
</tbody>
</table>

*NCD indicates nonobstructing colonic dilation.
†Duration in parentheses refers to the interval between the onset of perforation and right-sided colon resection.
hemodialysis. The indications for surgery were any one or a combination of the following: increasing abdominal tenderness, presence of intramural colonic gas, free peritoneal air, and presence of systemic gram-negative sepsis. All had right-sided colon resections, ileostomy, and a colonic mucous fistula (except one with primary anastomosis) from less than 1 day to 4 days after the onset of features of perforation.

The resected specimens showed thin-walled and dilated colon with areas of ulceration and ischemic necrosis as well as single or multiple perforations. The specimen in the seventh patient without NCD revealed a perforation in the indurated posterior wall of the cecum with several ulcers surrounding it. Histological examination was nonspecific. Three of the seven patients who suffered right-sided colon perforation died.

Sepsis with multiple organ failure was the cause of the 4 deaths in the 11 patients with colon perforation. Three of the 4 patients who died had surgery more than 24 hours after the apparent onset of features of perforation. Clinical confusion with rejection, ileus, and perigraft hematoma led to delay in operating on these patients. In comparison, 6 of the 7 patients who had surgery within 24 hours survived. Immunosuppression therapy was stopped in 8 of the 11 patients in whom colon perforation developed and was not resumed for periods varying from 7 to 85 days. This suspension of immunosuppression did not seem to affect allograft function adversely. Six of the 7 survivors went on to have fully functioning allografts. One survivor lost his graft 1 month after transplantation secondary to rejection. However, 2 patients subsequently lost their allografts to chronic rejection 18 and 38 months later.

**COMMENT**

The majority of the colon perforations following renal transplantation that were reported in the literature were on the left side, the leading cause being diverticulitis.\(^1\) Higher incidence of diverticulosis and onset of its symptoms at an earlier age have been reported in patients with end-stage renal disease, especially those with polycystic kidney disease.\(^4\) However, in our patients diverticular perforations accounted for only 36% of all colon perforations. The interval from transplantation to perforation was highly variable in our patients (7 to 283 days), as was the experience reported by the others.\(^1\) Steroids have been postulated to cause lymphoid atrophy with thinning of the bowel wall,\(^5\) decreased rate of epithelial turnover,\(^6\) and decreased ability to resist bacterial translocation in all types of patients.\(^7\) In immunocompromised patients these perforations are also detected at an advanced stage because of the failure of the peritoneal defenses to limit the perforation.\(^8\)

Ogilvie\(^9\) first described massive colonic dilatation without obstruction in 1948. Since then, this syndrome of NCD has been described in association with several conditions,\(^10,11\) including pelvic and abdominal surgery as well as uremia. Bauer and Overgaard\(^12\) described the occurrence of NCD in a renal transplant recipient 5 days after transplantation in association with poor allograft function. The graft was subsequently lost. This patient had another episode of NCD almost a year later, 3 days after his second transplantation, which did not appear to function. All of our patients with NCD had a common clinical presentation. Colonic dilatation occurred within a short time following a transplantation that was associated with poor allograft function due either to ischemia or rejection.

The pathogenesis of NCD is unknown. Ogilvie,\(^9\) in his initial description, speculated an inhibition of sympathetic stimuli to the colon. Electrophysiological studies have described arrest of normal spike and motor activity of the colon in response to distention.\(^13\) The use of high doses of cyclosporine in our patients is an unlikely explanation as we have not encountered this problem in liver transplant recipients with...
somal dosage schedules of cyclosporine. Even though elec-

trolyte abnormalities have been reported to cause NCD,51

of our patients had any extensive electrolyte imbal-
ses. Extraperitoneal dissection during the placement of
the kidney could be another causative factor by disturbing
the peritoneal autonomic network. Infusions of papaverine
and prostaglandin E, both known smooth-muscle relaxants,
were administered to two patients with hyperacute rejection
and may have contributed to the onset of NCD.

Kukora and Dent54 first described colonoscopic decompression
of NCD, and subsequently Berntson and coworkers55
reported the endoscopic placement of a decompression catheter
in recurrent NCD. Other similar experiences have been
reported.56,57 In our experience, colonoscopic decompression
was successful in five of six patients.

Right-sided colon perforations following renal transplantation
have been reported only in a few patients.58 Ischemic and
necrotic colitis, right-sided fecal impaction, and non-
perforation of cecal ulcers have all been implicated. Unrelied
NCD leads to cecal perforation and its reported mortality is
high.59 In six of the patients in this series, right-sided colon
perforations associated with NCD developed. Their patho-
gensis might be explained by Laplace's law of relating wall
tension to the radius of a hollow viscus.60 In a distended
colon, the ecum by nature of its larger diameter than the
remainder of the large intestine has the highest wall tension
and thereby is more susceptible to distention-induced ischemia.
Van Zwalenburg62 showed that gradual increase of
intraluminal pressure from 50 to 130 mm Hg caused cessation
of capillary, venous, and eventually all circulation in the bowel
wall. Wangensteen64 estimated that an intracecal pressure of
26 cm H2O was necessary for cecal perforation. The patho-
}gical findings of mucosal hemorrhage, necrosis, ulceration, and
submucosal venular thrombosis in the resected specimens of
our patients with NCD and right-sided colon perforation
would suggest that cecal distention led to ischemia and
perforation.

Once colon perforation has occurred, early and adequate
surgery is an essential factor in protecting these patients from
uncontrolled sepsis.65 In our series of 11 colon perforations,
6 of the 7 patients who had surgery within 24 hours of onset
of perforation survived. Only 1 of the 4 patients operated
on more than 24 hours after the onset of perforation
survived. The other 3 died of unremitting generalized sepsis.
As reported in the literature, primary Anastomosis following
colon resection has had disastrous consequences in these
immunocompromised patients and should be avoided.66,67,68
The only patient with primary anastomosis in our experience
suffered an anastomotic leak but survived after further
surgery.

It was gratifying to observe that six of the seven survivors
managed to keep functioning allografts despite colon perfora-

tion and peritonitis. It seems prudent to drastically reduce or
temporarily stop immunosuppression in patients when a colon
perforation develops.

This study was supported by research grants from the Veterans Administration
and Project Grant Dk-29963 from the National Institutes of Health,
Bethesda, Md.

References

1. Church JM, Fazio VW, Braun WE, Novick AC, Steinmuller DR. Perfora-
tion of the colon in renal homograft recipients: a report of 11 cases and a review

2. Guice K, Rattazzi LC, Marchioro TL. Colon perforation in renal trans-

3. Bernstein WC, Nivatvongs S, Tal lent MB. Colonic and rectal compli-

4. Bretschneider L, Mamo fO, Osborne DP. Intestinal obstruction due to
staped ia!ic: complication of medical therapy for gastrointestinal bleeding.

5. Penn I, Bretschneider L, Simpson K, Martin A, Starzl TE. Major colonic

6. Cons del WE, Noe trant TT, Eckhauser FE, Dent TL. Therapeutic and
diagnostic colonoscopy in non obstructive colon dilatation. Ann Surg
1965;197:416-421.

7. Bauer T, Overgaard K. Acute pseudo-obstruction of the colon in kidney-transplan-

8. Hadjipanayakis EJ, Evans DB, Smellie WAB, Calne RY. Gastrointestinal


1945;2:671-673.


13. Starling JR. Treatment of nontoxic megacolon by colonoscopy. Surgery

14. Nakhgevanny KB. Colonoscopic decompression of the colon in patients

15. Sullivan MA, Snape WJ, Matarazzo SA, Petrokub RJ, Jeffries G, Cohn
S. Gastrointestinal myoelectrical activity in idiopathic intestinal pseudo-ob-

16. Kukora JS, Dent TL. Colonoscopic decompression of massive nonob-

17. Berntson E, Meyers R, Reyna T. Pseudoobstruction of the colon: case
report including a new endoscopic treatment. Gastrointest Endosc. 1982;25:
90-92.

18. Dening RH, Salvatierra O, Belzer FO. Intestinal necrosis and perfora-

Colorectal complications of renal allotransplant transplantation. Arch Surg
1978;113:84-86.

20. Car son SD, Krom RA, Uchida K, Yokota K, West JC, Wel I R III.


22. Wojtalik RS, Lind enauer SM, Kahn SS. Perforation of the colon associ-


24. Van Zwalenburg CV. Strangulation resulting from distension of hollow

25. Wangensteen OH. Intestinal Obstructio ns. 3rd ed. Springfield, Ill:
Charles C Thomas Publisher; 1955.

26. Faro RS, Corry RJ. Management of surgical gastrointestinal compli-