Perioperative predictors of colonic ischemia after ruptured abdominal aortic aneurysm

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Purpose: **Colonic ischemia and colonic resection occur frequently after ruptured abdominal aortic aneurysm (rAAA). The purpose of this study was to identify the perioperative risk factors that might help to determine earlier in the postoperative period which patients are at risk for colonic ischemia and colonic resection.**
Methods: **The medical records of the 43 patients who underwent repair of rAAA from January 1989 to November 1997 were reviewed. The data were reviewed for the following factors: acidosis, pressor agents, lactate levels, guaiac status, cardiac index, coagulopathy, early postoperative bowel movement, the lowest intraoperative pH level, the temperature at the conclusion of the case, the location and duration of aortic cross clamping, the amount of fluid boluses administered after surgery, the amount of packed red blood cells administered during the case, and the average systolic blood pressure at admission and during surgery. Univariate analysis was performed with Fisher exact test, χ^2 test, and Student *t* test. Multivariate analyses also were performed with the variables that were found to be significant on the univariate analysis.**
Results: **Thirteen of the 43 patients (30.2%) had colonic ischemia, and seven of the 13 underwent colonic resection (53.8%). The overall mortality rate was 51.2% (22/43)—five of the deaths were intraoperative and excluded from the study. In a comparison of the patients who had colonic ischemia with those who did not, statistically significant differences were found in the following variables: average systolic blood pressure at admission 90 mm Hg or less, hypotension of more than 30 minutes' duration, temperature less than 35°C, pH less than 7.3, fluid boluses administered after surgery 5 L or more, and packed red blood cells 6 units or more. Multivariate analysis indicated that the number of these variables present correlated significantly with the positive predicted probability of colonic ischemia occurring. No patient with two factors or fewer had an ischemic bowel, and the positive predictive probability of colonic ischemia for those patients with six factors was 80%.**
Conclusion: **The results of this study show that: (1) colonic ischemia after rAAA may be predicted with the presence of two or more specific perioperative factors, (2) the lack of a guaiac-positive bowel movement may be misleading for the early diagnosis of colonic ischemia, and (3) more than 50% of the patients with colonic ischemia will require a colonic resection. We recommend that any patient with rAAA with more than two perioperative factors undergo sigmoidoscopy every 12 hours after surgery for 48 hours to rule out colonic ischemia without waiting for early or guaiac-positive bowel movement.**
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The incidence of colonic ischemia has been reported to be clinically evident in 7% to 27% of patients after repair of ruptured abdominal aortic aneurysms (rAAA).[1-4] When flexible sigmoidoscopy was used routinely, the incidence rate appeared to increase to 60%.[1-4] The mortality rates that accompany this complication have exceeded 60% in patients with clinical diagnoses of colonic ischemia.[2,3,5-7] Recent studies have examined the perioperative fac-

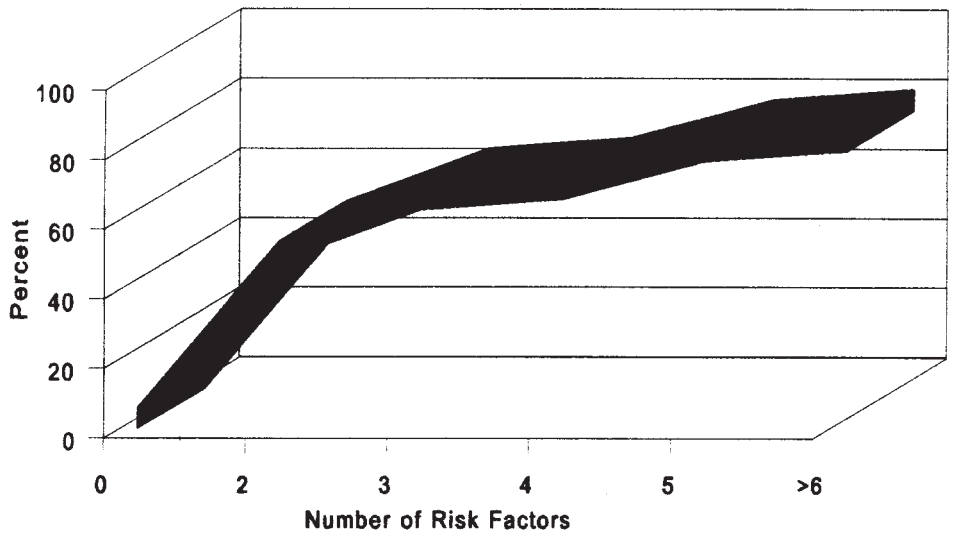

Fig 1. Positive predictive probability of colonic ischemia occurring given the number of perioperative risk factors, as determined by multivariate analysis.

tors associated with the risk of developing colonic ischemia. The results of these studies have focused on the maintenance of perioperative cardiac output and the avoidance of the use of perioperative vasopressors in reducing the risk of colonic ischemia.[6] However, these factors have not been proved to be uniformly predictive of colonic ischemia.[7-10] Because of this, other investigators have focused on the need for routine flexible sigmoidoscopy to identify those patients with colonic ischemia early to decrease subsequent mortality rate with early intervention. The purpose of this study was to identify those perioperative risk factors that might help to determine earlier in the postoperative period which patients are at risk for colonic ischemia and would benefit from early sigmoidoscopy.

METHODS

The medical records of 43 consecutive patients who underwent repair of rAAA in our institution between January 1989 and November 1997 were reviewed retrospectively. The data were collected for the following 23 different factors: age; sex; guaiac status; medical history; estimated blood loss; total operative time; preoperative loss of consciousness; lowest intraoperative pH; lowest postoperative cardiac index; average systolic blood pressure at admission (aSBP); suprarenal and infrarenal aortic cross clamp times; use of perioperative inotropes and pressors; body temperature at the conclusion of the procedure; coagulopathy or hemodynamic stability; amount of packed red blood cells administered during the procedure (PRBC); presence of a persistent acidosis within 72 hours after surgery; presence of an early perioperative bowel movement within 48 hours after surgery; amount of postoperative fluid boluses administered in the first 48 hours after surgery (FL); and presence and duration of preoperative hypotension, intraoperative hypotension, and postoperative hypotension. The procedures were performed by 11 vascular surgeons who practiced in our institution.

Univariate analysis was performed with χ^2 test or Fisher exact test for categorical data and the Student *t* test for numerical data with the In Stat program (GraphPad Software, version 1.1 la, GraphPad Software, Inc, San Diego, Calif) for the personal computer. The multivariate analysis initially was performed with the SPSS 6.1 package (SPSS, Inc, Chicago, Ill) for Windows 3.1 (Microsoft, Redmond, Wash) and run as various forms of a regression analysis. This was done initially with all the factors studied but then was narrowed to those factors that were found to be significant in the univariate analysis. The data then were analyzed by determining whether an increasing number of perioperative risk factors present in a given patient predicted an increased risk of colonic ischemia.

RESULTS

The 30 men (70%) and 13 women (30%) in the study group had a mean age of 74 years (range, 56 to 99 years). The overall mortality rate for the study

Table I. Comorbid factors for patients with and without colonic ischemia

	CIS+ n = 13(34%)	*CIS- n = 25(66%)*	*Total n = 38(100%)*
Mean age (years)	71	75	74
Mortality	7 (54%)	10 (40%)	17 (45%)
Hypertension	7 (54%)	9 (36%)	16 (42%)
Diabetes	0	1 (4%)	1 (3%)
Coronary artery disease	6 (46%)	8 (32%)	14 (37%)
COPD	1 (8%)	4 (16%)	5 (13%)
Alcohol abuse	0	1 (4%)	1 (3%)
Peripheral vascular disease	0	1 (4%)	1 (3%)
Congestive heart failure	0	2 (8%)	2 (5%)
Chronic renal insufficiency/failure	3 (23%)	2 (8%)	5 (13%)
Arrhythmia	1 (8%)	1 (4%)	2 (5%)
CVA	1 (8%)	2 (8%)	3 (8%)
Smoking	5 (38%)	1 (4%)	6 (16%)

CIS+, Positive for colonic ischemia; *CIS-,* negative for colonic ischemia; *COPD,* chronic obstructive pulmonary disease; *CVA,* cardiovascular accident.
No statistical significance found between groups.

Table II. Risk factors for colonic ischemia found to be significant on univariate analysis

Variant	*CIS+ n = 13*	*CIS- n = 25*	*P value*	*Odds ratio*
aSBP ≤90 mm Hg	8	5	.014	6.40
PreHYPO >30 minutes	10	8	.014	4.78
Body temperature <35°C	11	13	.049	5.077
PRBC ≥6 units	12	11	.01	11.90
FL ≥5 L	9	4	.002	11.813
pH <7.3	9	8	.032	4.70

CIS+, Positive for colonic ischemia; *CIS-,* negative for colonic ischemia; *aSBP,* average systolic blood pressure on admission; *preHYPO,* preoperative hypotension; *PRBC,* packed red blood cells; *FL,* fluid bolus.

group was 51% (22/43)—five of the deaths were intraoperative and excluded from the study. Thirteen of the remaining 38 patients (34.2%) had colonic ischemia, with 7 of the 13 patients (53.8%) subsequently undergoing colectomy. The mortality rate for those patients with colonic ischemia was 53% (7/13) versus 40% (10/25) for those without colonic ischemia (P = NS). The mortality rate for those patients who underwent colectomy was 71% (5/7) versus 33% (2/6) for those patients with colonic ischemia alone (P = NS).

The preoperative comorbid medical conditions included smoking, hypertension, diabetes, arrhythmia, alcohol abuse, congestive heart failure, peripheral vascular disease, cerebrovascular accident, chronic obstructive pulmonary disease, chronic renal insufficiency/failure, and documented coronary artery disease. There were no significant differences in the incidence rates of these comorbid medical conditions between those patients with and without colonic ischemia (see Table I).

In a comparison of patients with and without colonic ischemia, statistically significant differences were found in the following variables: aSBP 90 mm Hg or less (P = .014; odds ratio, 6.40), preoperative hypotension more than 30 minutes' duration (P = .014; odds ratio, 4.78), body temperature less than 35°C (P = .049; odds ratio, 5.077), pH less than 7.3 (P = .032; odds ratio, 4.70), FL 5 L or more (P = .002; odds ratio, 11.813), and PRBC 6 units or more (P = .01; odds ratio, 11.90; Table II). We found no statistical difference between the two groups in regards to the following factors: the use of perioperative pressors; intraoperative and postoperative hypotension; the duration and location of the aortic cross clamp; the time to normalization of the lactate; and the presence of persistent postoperative acidosis, coagulopathy, or hemodynamic instability.

A multivariate analysis of those factors that were found to be significant on the trivariate analysis indicated that the number of these variables present correlated directly with the positive predictive probability of colonic ischemia occurring (Fig 1). No patient with two factors or fewer had colonic ischemia, and

the positive predictive probability of colonic ischemia for those patients with six factors or more was 80% (Fig 1; Table III). A comparison of those patients with colonic ischemia who underwent colectomy versus those with colonic ischemia alone revealed a statistical difference between the mean aSBP (128 vs 68 mm Hg; $P = .03$) and the mean FL (11.2 vs 4.5 L; $P = .009$).

In our series, eight of 13 patients with colonic ischemia underwent postoperative sigmoidoscopy for a definitive diagnosis. Two patients had endoscopic signs of mild ischemia, two patients had nonconfluent areas of focal colitis (moderate ischemia), and four patients were believed to have confluent areas of transmural colitis. The two patients with mild colitis were observed and survived. Of the two with moderate colonic ischemia, one patient underwent re-exploration and not resection because of a lack of transmural infarction and the other patient, who had a delay in diagnosis, was in multisystem organ failure at the time of the diagnosis of colonic ischemia. This patient was not considered an operative candidate and subsequently died. Three of the four patients with full thickness colonic ischemia were taken to the operating room for resection. One of these three patients was in septic shock at the time of the surgery and died several days after surgery. The fourth patient was treated without surgery after a massive postoperative myocardial infarction with hemodynamic instability and also died.

Three of the five patients with colonic ischemia who did not undergo postoperative sigmoidoscopy underwent a planned re-exploration for signs of colonic ischemia at the original procedure, which included discolored or spastic bowel. This decision was made despite the fact that two of these patients did not have a bowel movement in the perioperative period. Those two patients died shortly after re-exploration, and one of them had ischemia of the entire small bowel and colon. The third patient survived after having a colectomy at the second look operation.

Colonic ischemia was diagnosed in two patients on the basis of a guaiac-positive bowel movement in conjunction with other clinical findings. These two patients died with the diagnosis of colonic ischemia. One of them had a massive myocardial infarction and died on the second postoperative day. The other patient had a guaiac-positive bowel movement that went unrecognized for several days until the ninth postoperative day when the patient was taken to the operating room with a fever and peritoneal signs. Intraoperative findings revealed a necrotic sigmoid that was resected. This patient died subsequently from multisystem organ failure. A summary of the indications for exploration and the corresponding pathologic evaluations of the individual specimens is illustrated in Table IV.

Table III. Probability for development of colonic ischemia given number of risk factors determined with multivariate analysis

No. of risk factors	*Positive predictive value*	*P value*	*Odds ratio*
2	48%	.0037	—
3	63%	.00018	30.857
4	66%	.001	13.33
5	77%	.003	13.417
≥6	80%	.03	10.667

DISCUSSION

Colonic ischemia has previously heen reported in 27% to 60% of patients after the repair of an rAAA.[1-4] The mortality rates after this complication have exceeded 60%.[1-4] Although in this study we found a higher mortality rate for patients with colonic ischemia as compared with those patients without colonic ischemia, this did not achieve the statistical significance that has heen found in other studies.[6] The focus of recent investigations that involved this problem has been on the identification of potential risk factors that predispose to the development of colonic ischemia in the patient.[3,6-8] The findings of these studies imply that there must be several factors present in the perioperative period in those patients who undergo emergent repair that are not seen in their elective counterparts. Piotrowski et al[7] reported that preoperative shock and operative blood loss are the most important factors that predict the development of colonic ischemia after rAAA repair. Our results concur with these findings in that those patients with a mean aSBP of less than 90 mm Hg, preoperative hypotension of more than 30 minutes' duration, and intraoperative transfusion requirements greater than 6 units of PRBC were more likely to have colonic ischemia. Piotrowski et al[7] also report that the status of the inferior mesenteric artery (IMA) did not alter the incidence rate of colonic ischemia. In our study, the incidence rate of IMA occlusion could not be determined. However, none of the patients in this study underwent reimplantation of the IMA.

This study revealed that there are certain factors that are predictive of colonic ischemia and that the lack of a bowel movement does not reliably rule out the presence of colonic ischemia. The following factors were found to be predictive of colonic ischemia:

Table IV. Indications for colectomy and pathologic findings

Patient	*Indication for exploration*	*Pathology*
A.P.	Fever, guaiac-positive BM at day 7, abdominal tenderness, no sigmoidoscopy, sigmoid resection	Transmural necrosis of sigmoid
J.T.	Guaiac-positive BM at day 1, sigmoidoscopy revealing grade III ischemia, sigmoid resection	Transmural necrosis of sigmoid
O.C.	Abdominal pain, increased serum lactate at day 6, sigmoidoscopy revealing grade II ischemia in sigmoid, sigmoid resection	Diverticulosis and acute serositis of sigmoid
R.N.	Intraoperative signs of mild ischemia, guaiac-positive BM at day 1, no sigmoidoscopy, left colectomy	Ischemic colitis with gangrene of left colon
A.P.	Guaiac-positive BM at day 2, sigmoidoscopy revealed grade II ischemia in left colon, left colectomy	Ischemic colitis with patchy areas of gangrene
G.M.	Right colonic ischemia that necessitated right hemicolectomy recognized during surgery, found diffuse areas of grade III ischemia during planned second look, no resection	Ischemic bowel with mucosal hemorrhage of the cecum
C.C.	Intraoperative findings of patchy areas of ischemia that necessitated planned second look, right colectomy performed at second look	Ischemic colitis of the right colon

Day, Postoperative day; *BM,* bowel movement.

aSBP 90 mm Hg or less, preoperative hypotension more than 30 minutes' duration, body temperature at the end of the case less than 35°C, intraoperative pH less than 7.3, greater than 5 L of FL in the postoperative period, and greater than 6 units of PRBC transfused during the case. Other authors have suggested that hypotension and a low flow state with redistribution of blood flow away from the splanchnic territory are preliminary events that lead to hypoperfusion of the colon.[12]

The following factors were not predictive of colonic ischemia: the presence and duration of intraoperative and postoperative hypotension, suprarenal and infrarenal aortic cross-clamp times, total operative time, estimated blood loss, the use of perioperative inotropes and pressors, or the time to normalization of the serum lactate.

Farooq et al[5] reported that the initial operative findings at the time of the aneurysm repair may suggest a risk for further transmural ischemic colitis. This is consistent with the findings in this study in which three patients underwent a planned re-exploration without the use of sigmoidoscopy. These three patients all underwent a subsequent bowel resection, either at the initial operation or on re-exploration. The recommendation for routine flexible sigmoidoscopy after a successful repair of rAAA within 48 hours has been previously reported.[3] Endoscopic findings include a mild colitis that involves only a hemorrhagic mucosa, a moderate colitis with nonconfluent areas of ischemia limited to the mucosa, and full thickness colonic ischemia. Those patients with mild and moderate colitis should undergo follow-up sigmoidoscopy at 12-hour intervals and undergo re-exploration if the endoscopic findings or clinical status worsen. Those patients with transmural infarction should undergo reoperation in a timely fashion because those patients in our study who had a delay in diagnosis had a dismal prognosis. Although its use in these patients has not been proved to reduce mortality rates, sigmoidoscopy has been shown to reliably predict the presence of full thickness colonic ischemia necessitating resection.[11] Another method that has been used to predict colonic ischemia is transluminal pH mucosal monitoring.[13] However, this method is not widely available nor is it practical in an emergent situation.

Those patients with colonic ischemia who underwent colectomy were found to have a significantly lower aSBP and required more FL in the postoperative period as compared with those patients who did not undergo a bowel resection. This most likely represented a more advanced degree of shock predisposing the splanchnic circulation to a greater degree of hypoperfusion. Similarly, Bjorck et al[14] found that those patients who underwent abdominal aortic aneurysm repair (elective or rupture) and who were in shock at the time of the repair were at the greatest risk for developing colonic ischemia. The higher mortality rate in those patients who underwent colectomy did not achieve statistical significance. This may be related to a small sample size.

In this study, a multivariate analysis of those factors found to be significant on univariate analysis interestingly revealed an increased positive predictive value as the number of risk factors increased from two to six. The predictive probability for colonic ischemia was found to be 48% in patients who possessed two or more perioperative risk factors and up to 80% in those with six factors.

We, therefore, believe that to reduce the mortality rates for the patients with colonic ischemia, we must take an aggressive approach that involves routine postoperative sigmoidoscopy every 12 hours for 48 hours to rule out colonic ischemia for any patient with more than two factors. Sigmoidoscopy should be followed by a timely decision to reoperate and resect bowel in appropriate situations because more than 50% of the patients with colonic ischemia will require a colectomy.

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DISCUSSION

Dr Julie Ann Freischlag (Los Angeles, Calif). The authors are to be congratulated on a fine presentation and manuscript. This group of 43 patients, who underwent treatment for ruptured abdominal aortic aneurysms over a time period of 8 years from 1989 to 1997, was analyzed retrospectively to identify risk factors before surgery that could help identify those patients who are at risk for colonic ischemia and colon resection. Univariate and multivariate analyses then were used.

In a comparison of their results with our review from the Medical College of Wisconsin in Milwaukee of 122 patients with ruptured abdominal aortic aneurysms from 1981 to 1992, many similarities exist. The average age was 74 years in their series and 72 years in ours. And an overall mortality rate of 51% was the same as the rate in our series. The overall incidence rate of bowel ischemia was higher in their series at 34.2% versus 18% in our series, but the mortality rate for those patients with bowel ischemia was similar—53% in their series and 50% in ours.

In the authors' univariate analysis, the average admitting systolic blood pressure of less than 90 mm Hg, the preoperative hypotension of greater than 30 minutes' duration, the body temperature of less than or equal to 35°C at the end of the case, the intraoperative pH of less than 7.3, and the fluid requirements of either greater than or equal to 5 L of fluid bolus or greater than or equal to 6 units of packed red blood cells were associated with colonic ischemia. With their addition of the multivariate analysis, the number of variables presented augmented the probability of colonic ischemia. With six of these terrible factors present, the incidence rate of colonic ischemia was 80%. In our series, bowel ischemia correlated with the number of blood transfusions also and we used the factor of 10 units of packed red blood cells but not hypotension or the time for the patient to get to the emergency room or the operating room. The mortality rate in our group of patients was 50% as well, and none of our patients who had initial colonic ischemia at the time of the first operation survived.

It is certainly the recommendation of these authors, along with us and others, that a protocol needs to be in place for sigmoidoscopy in patients who do survive surgical repair of their ruptured abdominal aortic aneurysms. In this reported series, those patients with two or more of these risk factors for bowel ischemia are recommended to undergo sigmoidoscopy every 12 hours for 48 hours to evaluate their colonic mucosa. Our series advocated the

use also of early sigmoidoscopy during the first 24 to 48 hours, not necessarily every 12 hours, in those patients who underwent large numbers of blood transfusions.

I have three questions.

1. Can you comment on the patient who has a delayed presentation of bowel ischemia—say, at 3 to 7 days after surgery? Do you feel that all those patients could have been diagnosed with early sigmoidoscopy, or can this complication develop later on in the postoperative period?
2. Are there patients who may not have two or more of your identified risk factors who should undergo early sigmoidoscopy anyway, and can you describe those case scenarios for us?
3. In our series, 28% of our patients had a known history of an abdominal aortic aneurysm and, for other medical reasons, an elective repair was not performed. Was this true in your series of patients? Is there a role for early intervention in these patients despite comorbid conditions, especially if endovascular repair may be proved to have good long-term results? Do you believe that endovascular repair has any role in the treatment of a ruptured abdominal aortic aneurysm? It seems that, despite all our good care, the mortality rates from ruptured abdominal aortic aneurysms stays high.

I would like to thank the Society for allowing me to discuss this excellent paper.

Dr Vivienne J. Halpern. Thank you, Dr Freischlag, for your kind comments.

I believe it is most likely that the patients who are seen late actually had colonic ischemia all along. In most series, both yours and ours, we have a few patients who expressed their colonic ischemia late. And it is clear from series like that by Ernst et al (Surgery 1983;93:102-6), in which routine colonoscopy was performed, that the actual incidence rate of colonic ischemia is higher than clinically evident. It is also clear from all the series that if colonic ischemia is recognized late, it is uniformly fatal. And that is why it is so important to identify this complication earlier in its course when intervention may, either by maximizing hemodynamic status or by resection, be more effective.

There may be an occasional patient in whom something occurs late in their course—say, septic shock from another infectious source—in whom a nonocclusive mesenteric ischemia may occur. But I think that most of these patients had ischemia all along.

In terms of those patients without factors, it is obvious that a patient with a guaiac-positive bowel movement, or any movement at all, should undergo a sigmoidoscopy, whether or not there are any factors listed in our data present. Another group of patients who might be candidates for early sigmoidoscopy are those patients who had some signs in the operating room that there might be some ischemia, for example a spastic bowel. These patients should probably have a flexible sigmoidoscopy done within the first 12 hours of surgery unless they are too unstable to undergo it.

In terms of your last question, most of our patients actually did not have a known aneurysm. In fact, there were only two patients. This is about 5% of this patient base.

The papers presented at this meeting regarding endovascular repair certainly provide data that support its use in patients who are excluded from open repair by comorbid conditions. The question really will be whether a repair of the aneurysms in patients who are likely to die from their comorbid conditions really improves their survival or quality of life.

In terms of using endovascular repair for ruptured aneurysms, I do not think it is appropriate at this stage for several reasons. One, from my understanding from people who do it, is that it takes awhile to get all the equipment and the personnel together, which is a time delay for somebody who needs urgent surgery. And second, perhaps most importantly, is the patency of branch vessels, like the lumbars and the inferior mesenteric artery, and the possibility that you may have an endoleak at the end of the case, in which case the leak will continue from the ruptured area. I do not think that it is appropriate at this stage to use endovascular techniques in the repair of ruptured abdominal arotic aneurysms.

Dr Salaheddine Tomeh (Phoenix, Ariz). I would like to thank you for addressing a perplexing complication of ruptured abdominal aneurysm repair.

I have several questions.

1. You have presented several photographs that represent various stages of colonic ischemia. Could you specify endoscopic criteria for reoperation on an ischemic colon?
2. Besides sigmoidoscopy, are there other diagnostic criteria, such as blood counts, for reoperation?
3. When the aneurysm extends into one or both iliac arteries, wtih increased risk of bowel ischemia, would your postoperative measures to detect ischemia be any different?

Dr Halpern. In terms of the degree of colonic ischemia, the first picture that was shown was mild ischemia. In those patients, it was pretty clear from the literature that they could be safely observed and followed with serial examinations. And clearly, if there is any progression of their ischemia, then they should undergo exploration. For the frank areas of necrosis, those patients should undergo exploration. I think the real problem comes in the patients with moderate ischemia as to when to explore. That was the implication of our last slide, that with some of the factors that we found, for example fluid requirements of greater than 5 L and preoperative systolic hypotension of less than 90 mm Hg, those patients who had these seemed to require colectomies more often. But our patient population was small. Clearly, if you had moderate ischemia in a patient who was showing signs of sepsis, who had an unresolved increase in lactate level and metabolic acidosis, that patient should undergo exploration.

In terms of iliac artery aneurysms, we did not have any in our series. However, if I did encounter a patient with an iliac artery aneurysm, obviously I would try to keep one of

the internal iliacs in the circulation. I would also look at the patency of the inferior mesenteric artery and perhaps consider reimplanting it in that case if the patient was stable enough to undergo that.

Dr Christopher K. Zarins (Stanford, Calif). I wonder if you could tell us how many patients had inferior mesenteric artery revascularization? If 30% of your patients had colon ischemia, would you consider recommending that all patients with ruptured aneurysms undergo inferior mesenteric artery revascularization?

Dr Halpern. Actually none of our patients had inferior artery revascularization. And, in terms of determining whether or not the inferior mesenteric artery was patent, it was not clearly recorded in any of the operative records. Piotrowski et al (Am Surg 1996;62:557-61) in 1995 looked at a series of patients with colonic ischemia after ruptured aneurysms and found that there was no difference in those who had the inferior mesenteric artery reimplanted versus those who did not. In fact, he had a slightly higher incidence rate of colonic ischemia in that series. So, I cannot recommend routine reimplantation of the inferior mesenteric artery. The procedure admittedly does not add much time to a procedure, but for a patient who already is cold and coagulopathic, it is probably not a good recommendation. However, if there were a situation like an iliac artery aneurysm or a patient whose bowel was looking ischemic and the patient was stable, then you could consider reimplanting a patent inferior mesenteric artery.