

45. Welch CE, Athanasoulis CA, Galdabini JJ. Hemorrhage from the large bowel with special reference to angiodysplasia and diverticular disease. *World J Surg* 1978; 2:73-83.
46. Gallagher JJ, Welch JP. Giant diverticula of the sigmoid colon. A review of differential diagnosis and operative management. *Arch Surg* 1979; 114:1079-1083.
47. Ouriel K, Schwartz SI. Diverticular disease in the young patient. *Surg Gynecol Obstet* 1983; 156:1-5.
48. Morgenstern L, Weiner R, Michel SL. "Malignant" diverticulitis. A clinical entity. *Arch Surg* 1979; 114:1112-1116.
49. Lauridsen J, Ross FP. Acute diverticulitis of the cecum. A report of four cases and review of one hundred fifty-three surgical cases. *Arch Surg* 1952; 64:320-330.
50. Peck DA, Labat R, Waite VC. Diverticular disease of the right colon. *Dis Colon Rectum* 1968; 11:49-54.
51. Gouge TH, Coppa GF, Eng K, et al. Management of diverticulitis of the ascending colon. 10 years' experience. *Am J Surg* 1983; 145:387-391.
52. Charnock RML, Rennie JR, Wellwood JM, Todd IP. Results of colectomy for diverticular disease of the colon. *Br J Surg* 1977; 64:417-419.
53. Penfold JCB. Management of uncomplicated diverticular disease by colonic resection in patients at St. Mark's Hospital 1964-1969. *Br J Surg* 1973; 60:695-698.
54. Alexander J, Karl RC, Skinner DB. Results of changing trends in the surgical management of complications of diverticular disease. *Surgery* 1983; 94:683-690.

#### DISCUSSION

DR. DAVID B. SKINNER (Chicago, Illinois): I greatly enjoyed the paper and the opportunity to review all the excellent detail in the manuscript, which I think you will all enjoy.

We, of course, have been influenced by the experiences at the Massachusetts General Hospital over the years, and we have recently reviewed the changes in the management of these cases at our University of Chicago Medical Center over the last decade.

(Slide) Our results were reported last year at the Central Surgical Association by Drs. Jeff Alexander and Richard Karl and are remarkably similar to the results that were presented here today. I would like to bring out a few points and pose some questions to Drs. Rodkey and Welch.

One of the things that struck us is that most of the patients today present as emergency or urgent cases, and, in fact, in our series the previous history of the disease was present in only 40%. I think in the Boston experience it is about 60%. One of the dilemmas here is how to select those cases that are going to get into trouble and should have an elective operation. I would appreciate any thoughts that the authors might have on the selection of cases for elective resection.

Our indications for operation were again remarkably similar and, as in the Boston series, over one-half of our patients presented with sepsis. The authors have highlighted the issue of immunosuppressed patients and the complications they get into. In the manuscript it is suggested that such patients might undergo elective resections if they have diverticulosis. I would ask the authors to sharpen that recommendation a little bit, and tell us precisely which groups of patients they would operate on; and in a patient with pancolonic diverticulosis, would they do a subtotal colectomy or only a sigmoid resection in an immunosuppressed patient?

Finally, our results again parallel the Boston experience in that the use of primary resection and anastomosis in cases other than those with generalized peritonitis or acute bowel obstruction yielded excellent results, with no deaths in 49 such primary resections, similar to the Boston experience of a one per cent mortality in that group. However, some of our colleagues still have had good results with the three-stage approach. Again, in these very complicated, ill patients with generalized peritonitis, I wonder if Drs. Rodkey and Welch feel that there is any remaining place for the three-stage approach to the severely ill patient with diverticulitis.

DR. OLIVER H. BEAHR (Rochester, Minnesota): I am not going to mention the number of cases, Mark; it would be disappointing.

I appreciate very much the opportunity to read the manuscript of this fine paper by Drs. Rodkey and Welch. They have carefully reviewed the state of the art in the management of diverticulitis by a review of their experience in managing the disease process by comparing data from a current decade with that of a previous decade.

Several facts, however, in their report and their manuscript are disturbing. One is that apparently there is an increase in the severity of the cases treated surgically from their hospital population. This is 18% of those patients hospitalized with the diagnosis of diverticulitis.

The concern would be whether or not they are being too conservative in offering surgical management of diverticulitis to those patients not operated on.

Second, their mortality rate is about the same in the second decade as in the first; however, it is up slightly from 4.4% to 6.3%. This would raise concern regarding the change in the surgical management of their patients; that is, are they improperly selecting an operation for the specific cases, or might the resection be too extensive?

The mortality rate associated with those cases when splenectomy became necessary likewise is of concern, because undoubtedly the splenectomy was necessary because of technical error.

There is concern regarding the increased use of one-stage resection in the light of a more serious disease seen in the majority of the patients surgically treated and because of an increase in surgical mortality.

In our experience, free perforation with fecal or generalized peritonitis carries a mortality of eight per cent, and this is comparable with their mortality rate for these cases. Likewise, the best results are in those cases in which a colostomy is established and resection carried out at the first stage.

In other cases done where the operation is electively carried out, 50% of the patients with complications of abscess, perforation, localized perforation, obstruction, and 50% of the patients done at an interval between acute episodes of diverticulitis, there was no mortality.

Likewise in these cases, 42% of the patients had retained diverticulosis; the point being whether or not it is reasonable in resecting bowel for diverticulitis to attempt to remove all evidence of diverticulosis. In following these patients for as long as 7 years, less than 10% of the patients had recurrent symptoms of diverticulitis, and in this particular group of patients only four per cent required subsequent operative procedures.

In a recent study that has not been published as yet, progression of diverticulosis in patients after resection, followed for up to 10 years, there was progression of diverticulosis in 14.7%, but recurrence of diverticulitis in only 11%, and in none of these patients was reoperation necessary.

The questions that I have for the authors are these: (1) Are insufficient numbers of patients with documented diverticulitis admitted to your hospital population not being offered surgical management, and is this resulting in an increased mortality in your patients? (2) About one-half of your patients are being treated by one-stage operation, even in light of more severe disease and mortality. Might a return to a more frequent use of multistage procedures, rather than single-stage procedures produce better results? (3) Likewise, in view of the fact that diverticulosis remaining after resection for diverticulitis does not give rise to subsequent trouble, are your resections too extensive, resulting in mortality and morbidity? (4) Do you have a rule of thumb to carry out or advise surgical treatment of diverticulitis in those patients who have severe disease and are not treated surgically at the initial period of hospitalization?

PRESIDENT RAVITCH: Ollie, would you tell us whether you usually take down the splenic flexure and resect as much of the left colon as is convenient, or do you just take out the sigmoid?

DR. BEAHR'S: The resection is conservative. In other words, just the area of diverticulitis. In order to reestablish continuity, it is necessary to take down the splenic flexure in about 10% of the cases.

PRESIDENT RAVITCH: "Conservative" is a good word only if you are a Republican. (Laughter)

DR. S. ARTHUR LOCALIO (New York, New York): I am pleased to discuss this report by Drs. Rodkey and Welch, and I wish to thank them for making the complete manuscript available. I predict their communication will become required reading for all interested in diverticular disease of the colon. The major trends and concepts described by the authors are compatible with our experience and data.

The increasing percentage of acute diverticular disease seen by the surgeon in the hospital setting, we believe is a reflection of the medical treatment of diverticulosis with a high fiber diet and Metamucil on an outpatient basis. Even patients with mild diverticulitis are treated at home with antibiotics.

Surgery for diverticular disease without perforation or abscess is restricted to such complications as bleeding, obstruction, fistulae, or inability to exclude cancer. Pain as a sole indicator for surgery has dramatically decreased.

Resection and anastomosis for acute diverticulitis with localized abscess performed in a single stage has not increased the mortality rate and has decreased the morbidity rate.

Resection of the perforated segment in all patients with spreading or generalized peritonitis has resulted in a significant decrease in mortality, with the exception of those patients who are on high doses of steroids or who are severely immunodepressed. This procedure terminates the continuing contamination of the peritoneal cavity. The proximal loop is brought out as an end colostomy and the distal loop as a mucus fistula or Hartman's Pouch. Restoration of intestinal continuity by anastomosis is deferred to a second stage. This sequence has superseded the classic three-stage operation.

Treatment of patients on high-dose steroids or who are severely immunodepressed has been marked by a high mortality, and there is an urgent need for earlier diagnosis and improved therapy. The diagnosis of perforation and spreading peritonitis is frequently delayed because signs and symptoms may be masked by the steroids. These patients may come from dermatology, neurosurgery, hematology, medical oncology, and internal medicine. The authors emphasize this problem in the immunosuppressed transplant patient.

The observation that incidental splenectomy in the patient with perforation and generalized peritonitis increases mortality should be heeded—and I would like to ask if this, too, is an immunologic problem.

DR. GEORGE H. A. CLOWES, JR. (Boston, Massachusetts): I arise simply to point out that people with generalized peritonitis still have the same mortality they had 10 years ago. What it says to me is that all our fancy intensive care units and the methods that are used to resuscitate and try to support these people have not changed the situation dramatically since the previous decade.

I would suggest that it is the operation that is done that counts in this case, and the effectiveness of allowing the patient to localize his own infection that results in survival or death.

Now, we have spent a lot of time looking at why people die of sepsis and septic shock. The usual cause of death in a case like this, in our experience, has been progressive multisystem failure. The first organ to fail usually is the liver. These patients develop jaundice with peritoneal infection. Histologic examination of biopsies taken from these patients from the liver usually shows hepatocyte swelling, swelling

of the mitochondria; and with that goes a progressive failure of protein synthesis and lack of synthesis of those proteins that are required for survival.

I do not know how we reverse that yet. Obviously, we support the respiration. We support the nutrition. But it is just not very successful. I would like the authors to tell us a little bit more about the mechanism of death in the people with generalized peritonitis and those who die of sepsis.

DR. GRANT V. RODKEY (Closing discussion): We certainly thank the discussants for a lively series of questions.

I would like to start with Dr. Skinner's comment about those patients who come in without prior indication of disease. The experience at the Massachusetts General Hospital for the last 30 years has been that one-third of the patients who come in with diverticulitis require operation at the first admission. The question is how to select who that will be, but we really do not have any strong indications, except that males under 50 and people with immunosuppression at all ages seem to be particularly at risk.

The question about pandiverticulosis in patients with immunosuppression cannot be answered with certainty. We have followed the plan of resecting a fairly generous segment of bowel to try to get rid of most of the muscle abnormality, and our average length of resected segment is about 25 cm.

We do not think that all diverticula must be removed for good results, but we do think that the area of narrowing and major muscular deformity should be removed.

"Is there a place," Dr. Skinner asked, "for the three-stage operation?" Yes, we think so; in particular those patients who might have local perforation or local peritonitis and pelvic abscess. Our data do not suggest the clear superiority of any of the methods for this group of cases, and I think a three-stage approach is certainly appropriate for them and in cases of acute obstruction.

Dr. Behr's observations that the severity of illness has increased in our recent series and that we have done more one-stage resections are both correct. On the other hand, the one-stage resection has been done mainly in those people who did not have major septic complications. I do not believe that the increased frequency of one-stage resections has been a significant cause of the slight increase in mortality rate.

The question of selection of which cases should be operated, or whether we are advising operation in enough early cases, is certainly quite to the point. We do think that we ought to operate on more people at an earlier stage of the disease. However, it is hard to define exact criteria. Both the internist and the patient need to be convinced of the potential benefit of operation before onset of complications of the disease.

Follow-up of patients who have had an initial attack is important but may be difficult for the surgeon to whom the patient was referred for the acute attack. Where it is possible to do so, we agree with Dr. Behr's suggestion that we ought to carry out interim operations on more of these patients who have had severe primary attacks of diverticulitis. We have dealt with this recommendation more completely in the main body of the paper.

We agree that there is not much proximal progression of diverticulitis after an adequate resection, and very little likelihood of recurrent diverticulitis. We have had very few cases of recurrent diverticulitis in the whole series that we have followed over the past 40 years.

I will close simply by saying, in response to Dr. Clowes, that 82% of our patients died with sepsis. Actually, 21 of 22 had multiple systems failure. The postoperative survival averaged 32 days—and all of them required intensive treatment.