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DISCUSSION

DR. J. DAVID RICHARDSON (Louisville, Kentucky): We presented a series of colon injuries at this meeting 4 years ago, and in that meeting Lewis Flint from our institution presented a method of grading patients with colon injuries in which we tried to make the same point, I think, that Dr. Jordan has made today. That is that it is possible to individualize patients with colon injuries for different types of treatment.

We did feel that primary repair was a good thing to be done for some patients, but we must admit that we were much more conservative than the Houston group in the use of primary repair. I think we used primary repair on actually a little bit less than 15% of the patients whom we treated.

We chose not to do primary repair if the patient was unstable. By unstable we meant if they were in shock on the operating table or had had a difficult preoperative resuscitation, if they had significant multisystem injuries that needed to be treated, or if they had a mesenteric injury. Furthermore, we wanted to treat the injury promptly, and we used a time frame of around 6 hours and specified that there be no severe fecal contamination. Basically, we held all of these things to be important as criteria that we could teach our residents to apply in some kind of uniform fashion.

We see in the report from Ben Taub that a number of the principles we espoused do not seem to be as important as we might have believed. We had no morbidity and no mortality from doing primary repair in what I would call a very conservative situation. It may be that we were too conservative, and I do think, in fact, that we probably have liberalized our use of primary repair somewhat.

The only problem that I had with this excellent manuscript was trying to get a handle on what are the elements of good judgment that allowed you to do a primary repair in some patients with severe fecal contamination and do colostomy in another group. What are the elements that allowed you to do exteriorization *versus* primary repair *versus* colostomy in patients who had delayed treatment? I would be interested in some details about your extensively injured group as well.

I want to comment briefly on our experience with exteriorization of the colon. I think that there is no question that this will work with many patients who have colon injuries. I must say, though, that we really have not been satisfied with it because of issues regarding the timing of when one returns the colon to the abdomen. Many of these patients develop serositis, the colon really does not appear healthy, and many patients develop obstructive symptoms before we really feel that it is time to drop the colon back in. Because of these factors, we have almost abandoned the use of exteriorization. I noted from the manuscript that you wait 10 days before returning the colon to the abdomen. I am surprised that this works. I would take issue with one statistic related to exteriorization. In the cases that broke down and were converted to a colostomy, I would have to consider that a failure of the method.

I enjoyed this excellent paper. Thank you for the privilege of the floor.

DR. M. VICTORIA GERKEN (Jackson, Mississippi): The charts of 2000 patients admitted to the University of Mississippi Medical Center Trauma Service since 1980 were reviewed with findings of 147 large bowel injuries for an occurrence rate of 7.4%. One hundred six of these injuries, or 72%, were incurred as a result of gunshot wounds. Nine patients had been injured by shotguns and one by a high-speed rifle. Fifteen patients were the victims of stab wounds, yielding a total penetrating trauma rate

of 89% of our colon injuries. Twelve colon injuries were the result of motor vehicle accidents. The remaining four cases were the result of falls and blunt instrument injuries.

In 36 cases, or 25%, the colon was the only intra-abdominal organ injured. There were associated small bowel injuries in 49% of our cases, stomach injuries in 20%, and liver injuries in 11%. Associated splenic injuries occurred in only 5% of our patients. Urologic injuries were found in 20% and neurologic injuries were associated in 6% of our cases. Bony fractures were seen in 13% and associated thoracic injuries were noted in 27 of our 147 patients.

In 44 of our patients or 31%, a colostomy was performed proximal to a repaired or resected injury. In 64 patients (44%), the injured segment was exteriorized. Thirty-three patients underwent colon resection without colostomy. Five patients died on the operating table before the colon injury could be definitively treated.

Only one of the 142 patients surviving the initial operation required drainage of a subphrenic abscess. This patient had sustained a gunshot wound to the abdomen and had other intra-abdominal injuries including small bowel injuries necessitating resection. This patient ultimately survived.

Of the 147 patients in this series sustaining colon injuries, 14 died, for a total mortality rate of 9.46%.

The factors that enter into the decision regarding primary repair *versus* colostomy are numerous. The degree of fecal contamination, the location of the injury, and the general condition of the patient all require critical judgment by the surgeon.

In our institution, we have been much more conservative in our decision either to perform a colostomy or to exteriorize the wound. We have been rewarded with a lower incidence of intra-abdominal abscesses; however, our mortality rate is essentially the same as that of the authors.

I have two questions for the authors. First, does the type of associated intra-abdominal injuries influence your decision to perform a colostomy? For example, in the presence of a major pancreatic or duodenal injury where there is a significant incidence of postoperative fistulas, would you be more likely to exteriorize?

In the patient with multisystem injuries, would you now be more likely to repair primarily a simple colon injury in an attempt to expedite the surgery?

I thank the Association for the privilege of discussing this clinically significant paper.

DR. H. HARLAN STONE (Baltimore, Maryland): This, indeed is a marvelous manuscript. It is a great review of probably the largest series of colon wounds that has ever appeared and hopefully that will ever appear.

Today, the major question to be answered is: When and when not can a primary repair of the colon wound be done? Experience has suggested that there are perhaps seven crucial factors. However, on more detailed review, I would have to agree with Doctor Jordan that probably the single most significant factor is the presence of already established infection. A massive fecal contamination of short duration, such as only a few hours, is equal to a major fecal contamination that has been present for a day or two.

We also could find no correlation whatsoever with outcome of the colon wound alone with respect to other factors such as number of organs injured, amount of hemorrhage, depth or duration of shock, or how destructive the colon wound happened to be. However, as Dr. Jordan

pointed out, these are crucial with respect to survival of the patient. Death is rarely due to the colon wound. It is the associated injuries that account for fatalities.

(Slide) We could find absolutely no difference in rate of infection within the surgical incision between patients who had been randomized to colon wound closure *versus* an obligatory colostomy. What was significant was whether a drain was in place. (Slide) This was particularly true for the intra-abdominal infection rate. In other words, presence of a drain almost guaranteed that an intra-abdominal infection would occur, particularly in patients who had liver wounds drained with a colostomy in the vicinity. Thus, one question is: Was any relationship found between postoperative infection and the use of a drain?

(Slide) Secondly, we could not find any difference in survival for those patients who had been randomized to colon wound closure or had been randomized to colostomy. We did note, however, that many of these patients had problems with their colostomy, regardless of whether the wound was exteriorized as a colostomy or there was a proximal colostomy. In fact, all patients with a colostomy had a far greater morbidity because of that colostomy than apparently would have occurred otherwise, that is, if they had undergone primary closure of the colon wound.

In addition, the loop colostomy is somewhat difficult to control, (Slide) and we prefer an end stoma colostomy whenever possible. This is one of the reasons that we choose not to attempt a delayed return of the repaired colon to the abdomen, for, if it fails, the resultant colostomy is a loop.

I enjoyed this paper very, very much. Thank you.

DR. JON M. BURCH (Closing discussion): Dr. Richardson, the elements of good judgment are complex. We do not feel that contamination *per*

se is a critical factor in determining whether we do a particular procedure or another. However, we did find that of those patients who had extensive colon injuries, 36% also had extensive contamination, whereas of the patients who did not have extensive colon injuries, only 7% had extensive contamination. We feel that there is a relationship there. We defined extensive damage to the colon as being an injury that caused devascularization requiring resection or as a near transection of the colon.

The exteriorized repair is a technique that we have utilized less frequently during the 6-year study period. In 1979, about 30% of all our repairs were exteriorized repairs. This fell to only a few per cent during 1983 and 1984. I believe that we are feeling increasingly confident with primary repair, particularly in the left colon.

Dr. Gerken, I cannot explain why our abscess rate is higher than yours, and I certainly must compliment you on these excellent results. Associated injuries, in fact, any particular organ injury, do not mandate a colostomy in our experience. We have no reluctance to perform a simple closure or a resection and ileocolostomy with any associated organ injury including liver, pancreas, kidney, duodenum, or other injury that may require drainage.

In response to Dr. Stone's questions, we have not used drains for any colon injuries to my knowledge in these cases. I cannot tell you, therefore, if they increase the infection rate, but I would not be surprised if they did since they provide a route for bacteria to get in just as easily as for bacteria to get out.

I do not believe that we have any greater difficulty with managing or closing the colostomies that result from exteriorized repairs than we do from a loop colostomy that is created as a result in an exteriorization of an injury. My personal preference is an end colostomy and the majority of colostomies performed in these patients are end colostomies associated with mucous fistulae.