Stomas and Trauma

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ABSTRACT

The current dogma about the treatment of penetrating colon injuries is reviewed, both from the civilian and the military perspective. This discussion is still evolving, and the time-honored methods of diversion, including colostomy and ileostomy, are still appropriate for the most severe and devastating sorts of wounds, especially in the military context. For the vast majority of penetrating wounds, primary repair works well and should be practiced. For the few patients who have primary repair that fails and leaks, mortality rates are high. The art of surgery involves knowing when to divert and when to repair.

KEYWORDS: Penetrating colon trauma, colostomy, ileostomy, primary repair, damage control

Objectives: On completion of this article, the reader should be able to summarize the current status of the use of stomas in colon trauma, both in the civilian and military settings.

A series of comprehensive reviews have appeared in the surgical literature in the past several years that address the use of the stoma in trauma. Thus, at first glance, the reader might assume that yet again another review on this subject would be of little use, as we already have answered all the questions. The vital difference today, as compared with all these past reviews, is that we are in the middle of heated combat in both Iraq and Afghanistan, and for the first time in decades, we are accumulating serious wartime casualties at a significant rate. Registries have been formed, and efforts are being made to assess data coming out of the War Against Terrorism. Thus, the use of stomas in the treatment of trauma victims has once again become the subject of debate and controversy.

The present state of affairs was illustrated in the spring of 2007 by a series of e-mail messages between surgeons in the United States and in Iraq and Afghanistan. It should be stated that the military surgical

trauma community is a heterogeneous group, ranging from seasoned Vietnam veterans, who did prodigious amounts of colon surgery while on active duty decades ago, to mid-level surgeons who have been deployed several times to the war, to recently trained general surgeons, some fresh out of residency. All seem to have fervent opinions about this topic, especially as it relates to penetrating injuries of the colon. The e-mail traffic began when a senior surgeon and leader, deployed to Iraq for some months, asked for some reassurance and support after encountering heated criticism from some of the younger surgeons in theater, as he attempted to tell them about what he considered to be an excessive leak rate after primary repair. The surgeons who expressed the more conservative point of view, and favored more frequent use of stomas, were called “anecdotal” by one of those who would favor primary repair. These surgeons who favor the more liberal use of primary repair backed up their position by quoting the

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civilian surgical literature and their own background and experience, both on the battlefield and in civilian training and practice. Most (but not all) of these more aggressive surgeons are younger, and are generally less experienced than those of the conservative ilk. One very seasoned and respected surgeon from the Vietnam era pointed out how different the wounds of the ongoing conflict are from civilian wounds, and how much more complex the care becomes as patients are routinely flown thousands of miles within a day or two of injury. He also mentioned how insidious a leaking anastomosis can be, sometimes not evident at all for the first few days after surgery. Even the physiologic stresses of the flight to Germany and on to the United States may have negative consequences for a fresh anastomosis, including possible relative ischemia and the ever-present gas expansion and distension from the cabin altitude pressure. This debate rages on, with good arguments from both sides, as we all wish to do the best operation for the injured patient. Thus, rather than a static and worn-out topic, stoma creation has once again become a vitally important area that deserves to be examined in detail. To state the obvious, (which has always been the position of those prone to divert rather than repair the injured colon): there is one way to avoid the feared complication of a leaking anastomosis, namely to never create one in the first place. A severely injured patient cannot tolerate a leaking anastomosis. It can easily become a lethal event, as this study will demonstrate, and is to be aggressively avoided. On the other hand, if it is true that one can safely repair a colon without fear of a leak, then repair becomes the better option.

The goal of this article is to review past history, recent data, and to recommend best practices for civilian and military trauma, specifically that occurring in the United States, Afghanistan, and Iraq. A somewhat similar article was published in *Clinics in Colon and Rectal Surgery* by Seatter and Beilman in 2002,¹ mainly directed at civilian practice. Seatter and Beilman commented on small bowel injury (almost always successfully repaired rather than diverted), and described some of the differences in colon wounds based on location (In the past right colon injuries were more often repaired, while left colon injuries were diverted. This distinction appears to be less of a concern today, with many surgeons treating all parts of the colon equally, without consideration of location.) They concluded that although primary repair was indicated for low-grade injuries in both right and left colons over 90% of the time, there is less certainty in the case of the extensively damaged colon. A prospective randomized clinical trial is needed to better determine when diversion is preferable.

Our review will mention civilian trauma, including the most recent pertinent review articles from the

civilian literature, but will emphasize military war trauma with a concentration on current military data, as we accumulate lessons learned from the war. These lessons are pertinent to all areas of practice as most trauma surgery advances have come out of wartime experience in our country and elsewhere.

HISTORY

The treatment of colon injuries has evolved through the centuries. An excellent 2004 article by Perry, Brooks, and Muskat, reviewed the military treatment of colorectal trauma.² They point out that there has been a continuing decrease in mortality from colorectal injuries from war to war. The American Civil War had a mortality rate of over 90%, whereas mortality is less than 5% today. Over the centuries, there were a few bold surgeons who attempted repair of colon injuries. World War I was the first major conflict where high-velocity missiles were used, creating the same devastating wounds so familiar to the war trauma surgeon of today. The World War I practice was initially to simply watch patients with intestinal wounds, as they would die of intestinal complications and sepsis. Later in the war, some attempts were made at repair or diversion, which must have been difficult and fraught with danger to the patient.^{2,3} However, the experiences of World War II continue to influence our practices today. According to Dr. Michael E. DeBakey, it became necessary during World War II to set up a strict set of guidelines for surgeons, who very often were partially or poorly trained to handle the injuries of war, and were having excessive rates of complications early in the war. One of these cardinal rules involved the exteriorization of injuries to the large bowel. All surgeons in today's conflict should read and reread the seminal article written by Dr. DeBakey in 1947, talking about the lessons of World War II. He begins the article by quoting Lippman, "... the lesson of history is that the lesson of history is never learned." And he draws a very clear distinction between military and civilian surgery: "All the circumstances of war surgery thus do violence to civilian concepts of trauma surgery." He discusses the effects of the time lag introduced by the necessity of evacuation, the constant movement, and the treatment by several surgeons along the evacuation trail. DeBakey concluded that "Undoubtedly the transgression of any of these directives (requiring colostomy, etc.) would have been practical and safe in numerous selected cases, but not much reflection is needed to make clear the folly of permitting the privilege of selection under combat conditions to thousands of surgeons who had been trained under varying schools of surgical thought and who were of varying degrees of ability and experience."⁴ The punishment for repairing the injured colon was reportedly as severe as a court martial, although Perry et al² points out that it is

very difficult to find evidence that anyone was actually court-martialed.

The diversion of the injured colon was thus a concept deeply engrained into surgical teaching after World War II; it was standard practice until the 1970s. Tens of thousands of World War II surgeons returned home to begin civilian practice, fully convinced that colostomies had to be created for colon trauma. It was Stone and Fabian in 1979 who finally published a prospective clinical trial comparing diversion with primary repair, showing that a primary repair indeed could be a safe alternative to diversion.⁵ After their initial work was published, many others have validated the concept of primary repair, and over the past 25 years or so, the concept of primary repair has been taught and practiced by residents and staff physicians throughout the United States and the world, usually with good success. A meta-analysis of a series of six studies by the Cochrane Collaboration concluded, "Meta-analysis of currently published randomized controlled trials favors primary repair over fecal diversion for penetrating colon injuries." The authors also state that primary repair was favored over diversion when one looked at "... total complications, total infectious complications, abdominal infections including dehiscence, abdominal infections excluding dehiscence, wound complications including dehiscence, and wound complications excluding dehiscence." This study only dealt with nonmilitary, civilian wounds.⁶ This meta-analysis admittedly used data from a variety of dissimilar studies.⁶ The earliest study included was the previously mentioned classical study of Stone and Fabian, which had excluded all of the severely injured patients (some 48%) from randomization and assigned them "to obligatory colostomy." Other, later studies included all patients, and were more convincing about the arguments for primary repair.

An editorial appeared in the *Journal of Trauma* in 1995, written by Nance and Nance, with a title that would give pause to seasoned surgeons like Dr. DeBakey. The authors unfortunately used some surgical hyperbole, "A Stake through the Heart of Colostomy." The authors demonstrate just how far the pendulum had swung in the treatment of colon injuries by this statement: "In our view, a surgeon using colostomy in the management of penetrating colon injury should be required to justify the continuation of this *obsolete* and *discredited* practice" (emphasis added).⁷ Hence, it is not surprising to find that many surgeons have been trained to do primary repairs, and have used that training in Afghanistan and Iraq, avoiding colostomies whenever possible, deemed by Nance and Nance to be "obsolete and discredited." Unfortunately, not all who have had primary repair have been treated successfully, and a certain number of failed colonic anastomoses have been noted, sometimes with dire consequences.

ANALYSIS OF DATA

A word of caution about the quality of articles concerning this topic is in order. Our literature contains a fair number of retrospective studies, which report on a series of patients who suffered penetrating colon injuries. And the common tactic of the author is to simply divide the patients into those who underwent repair, or resection and repair, versus those who were diverted. Then the two groups are compared for postoperative complications, mortality rates, etc. These studies often report that the patients in the primary repair group fair better than the diverted patients, but fail to mention that there is a natural selection bias at play. Most surgeons have no quarrel with repairing the small wound in the stable patient. But for the truly massive, devastating wounds of high-velocity weapons—those patients more often end up with colostomies. They are sicker, more prone to sepsis, infections, and all of the postinjury miseries. To then compare these two groups, without compensating for the difference in their wounds, is truly ludicrous, especially when colostomies are actually blamed for making the patient ill. Some studies have tried to compensate for this inherent bias by using trauma severity scores. Can we trust such studies? Do we believe this kind of data? One such study was by Moreels et al from Les Medecins sans Frontieres who reported on their results in Cambodia. They had 102 patients with penetrating intraperitoneal colon injuries. They found that those who had primary repair had a fatality rate of 20%, while those who had colostomies had a 30.8% fatality rate. Although they claim to have made adjustments for "confounding factors," one is still left with the impression that two very different groups are being compared.⁸ It is an unfair race from the outset. Stoma patients will always come in second.

One example of a good contribution to the literature was written by Demetriades and 21 coauthors; it was a prospective study from 19 trauma centers, examining all their colon trauma cases, and analyzing how the diverted patients had done compared with those who underwent primary repair. They concluded, "The surgical method of colon management after resection for penetrating trauma does not affect the incidence of abdominal complications, irrespective of associated risk factors." There were other risk factors that were associated with increased complications, including fecal contamination, transfusion of 4 or more units of blood, and use of a single-agent antibiotic. Nevertheless, it did not matter whether the patient was diverted or repaired; the results were more or less the same. In this seminal study, it was still the surgeon who decided whether to repair or divert. There was no randomization involved. Despite all the use of trauma severity scores, mathematical models, and extensive analyses and comparisons, one is still left with the suspicion that the sickest patients were diverted, and those less injured were repaired. In the discussion of this

article, several comments were made about “surgical gestalt” and how important that becomes in the decision-making process. One skeptical surgeon asked this compelling question: “Because two thirds of the patients entered onto the study were primarily repaired, my question is—were the less sick patients preferentially primarily repaired?”⁹

The Cochrane Collaboration study by Nelson and Singer, quoted above, is particularly convincing because they used only studies with randomized assignment of repair or diversion. The surgeon did not decide what to do, but was told what to do, according to the article. It must have been difficult to participate in such a study. Imagine being told that you had to create a colostomy for a very small penetrating wound, easily repairable with simple suture. Or that you had to do a primary repair in an extensive colon injury, with fecal contamination. Participating in such a randomized trial is almost unethical because the best interests of many patients are not always served, and common sense is sometimes ignored.

MITIGATING FACTORS

A factor in the decision-making process about whether to repair or divert is the setting, which might be even more important than the injury severity. If the injury occurs in a prosperous country with a robust health care delivery system in place and with plentiful supplies readily available, a colostomy can be the procedure of choice, if necessary, to maintain the health and life of the patient. On the other hand, if one is in a Third-World country, where there are no colostomy supplies available and where it might be difficult or impossible for the patient to access the health care system to later have a take-down of the stoma, then surgeons might be more inclined to attempt primary repair. Another major factor to consider is whether the patient will be quickly evacuated elsewhere and out of the control of the operating surgeon versus whether the patient will be in place during convalescence, and easily observed over a more prolonged period. Some military surgeons in places like Afghanistan and Iraq freely admit that they do more primary repairs for the local nationals, who are not transported away, and thus can be observed easily (Lt Col Jeff Nelson MD, FACS, FASCRS, Army Colorectal Surgeon, personal communication, January 7, 2007). Also, for the local population, it becomes very difficult to re-access American health care to get a take-down operation of the diverting stoma. Some of the military data that we present in this report is skewed because of the setting of injury, more perhaps than its severity.

CIVILIAN TRAUMA

The civilian literature has several reports, written by a variety of authors from different institutions, all more or

less demonstrating that primary repair of colon injuries is to be preferred over diversion. One extensive recent review by Cleary, Pomerantz, and Lampman¹⁰ is a complete reference for the student of colon and rectal injuries. They begin their review by briefly mentioning the possible role that laparoscopy can play in the assessment of these injuries, concluding that laparoscopy is most useful for finding diaphragmatic injury or peritoneal penetration, but may easily miss subtle injuries to small and large bowel, and does not assess the retroperitoneum well. They discuss in some detail the various grading scales for severity of injuries to the colon, including the Flint, the Colon Organ Injury Scale (CIS), and the revised CIS. Also, the data on leak rates for primary repair is discussed. Some prospective, non-randomized studies of primary repair report a leak rate of less than 1%. (This admirable achievement of less than 1% should be remembered as we discuss current U.S. military results later in this article). They summarize the conflicting recommendations of several civilian surgeons, some more conservative than others. Many trauma surgeons still are creating stomas when trauma severity scores are excessive, and the patient is critically wounded. They discuss in some detail the difficulties and morbidities of stoma take-down, one of the oft-cited reasons for not creating a stoma, and they suggest that some sort of loop stoma is always easier to take-down than an end stoma. Blunt colon injuries were also reviewed, and their diagnosis and treatment discussed. These blunt injuries are difficult to diagnose, and there is no one radiologic, laboratory, or endoscopic test that can always be relied upon to make the diagnosis. Most of these patients end up in surgery, having a formal exploration. Decisions about diversion are similar to those made for penetrating colon trauma. Cleary et al¹⁰ also discuss penetrating rectal trauma, and the pros and cons of repair versus diversion, as well as whether it is necessary to use the traditional distal washout, and presacral drains. Authors are cited who do not believe in diversion, or distal washout, or presacral drains. Most trauma surgeons are less enthusiastic about repairing penetrating rectal injuries, and divert rather than attempt to repair. The authors mention that the opening up of virgin tissue planes, looking for the site of injury, should be avoided, and if there is any question of injury, diversion is the proper course to take.

Miller et al¹¹ encourage the use of clinical pathways to improve outcomes following penetrating colon wounds. They reported that if their patients had a preoperative or intraoperative requirement for 6 or more units of blood or significant comorbidities, those patients had a suture line failure rate of 14% and of those patients who had an anastomotic leak, 33% died. These numbers are remarkably similar to the military data that we present below. By instituting the use of clinical pathways, the authors were able to diminish morbidity

and mortality significantly. They state that ultimately, only 7% of their colon wounds required colostomy.

MILITARY TRAUMA SURGERY

More recent additions to the surgical literature on this topic have advanced the discussion and debate over the management of colorectal trauma in military settings. Since 2000, several studies of various impact have discussed the topic of colorectal injuries during combat, focusing upon prevalence, associated morbidity and mortality, and whether or not an "ideal" surgical approach can be determined based on wartime experiences.

Payravi and colleagues reported their review of abdominal casualties from the Iran/Iraq war in 2001.¹² The authors reviewed 522 laparotomies performed on wounded troops over a 5-year period. Colon trauma was found to be the most common injury. Mortality from colon injury was 11% with a reported complication rate of 27% in these patients. Anastomotic fistula, leakage, and abdominal abscesses comprised the majority of complications in this group; however, the authors do not discuss the specific management of these injuries with respect to surgical treatment. Because of this major limitation, this study does little to contribute to the debate regarding diversion versus primary repair.

In 2004, Angelici and colleagues described their experience with gunshot wounds to the colon during the Somali civil war.¹³ They report a series of 24 patients during a 2-year period, excluding rectal injuries from their analysis. The majority of patients, 75%, underwent resection of the injured colon with anastomosis. Four of the other patients received resection/reanastomosis with a "protective" colostomy. The remaining two patients underwent exteriorization of an injured segment with loop colostomy or an end colostomy with distal stump closure. The 6 patients who comprised the "colostomy" group all had more severe injuries based upon Colon Injury Scale grading. The authors describe an overall sepsis-related mortality of 25%, but they do not report specific leak rates or other complications related to the surgical management. They concluded that an ideal procedure for colon injuries does not exist and that the operating surgeon must weigh multiple complex and varied subjective factors in deciding the treatment approach.

A more extensive review of wartime colonic injuries was published in 2005 by Hudolin and Hudolin.¹⁴ The authors report 259 colonic injuries during the 1992 to 1995 Bosnia-Herzegovina conflict and compare patients who underwent primary repair to those who received colostomy. Their series is relatively evenly divided between the two methods of treatment—122 patients (47%) had primary repair and 137 patients (53%) had a colostomy. The rate of associated injuries was high (96%); the mechanisms of injury in all but one

case were explosive weapons or bullet wounds. Complications in both groups of patients were also high—27% with primary repair and 30% after colostomy with no statistical significance between the groups. There were eight reported anastomotic leaks (6.5%) in the repair group and two leaks (1.4%) in the colostomy group. Overall mortality was 7.7%, although the study was limited somewhat by a lack of late follow-up for most casualties. The authors conclude that, in the hands of experienced surgeons, primary repair of colonic injuries during wartime was safe and effective.

The most recent published report on this topic details the experience of combat surgeons and the care of colorectal injuries from Operation Iraqi Freedom. Steele and colleagues report 175 colon and rectal injuries in United States, coalition, and local national forces arising from the current Iraqi conflict.¹⁵ The authors retrospectively review 16 months of experience at the U.S. Army's 31st Combat Support Hospital in Iraq from 2003 to 2004. The majority of patients (91%) with colorectal trauma had other associated injuries, and the mean Injury Severity Score in this series was 24. Patients were classified by one of several selected means of treatment: primary repair (to include resection with anastomosis), stoma (including proximal diversion with or without primary repair), or damage control. Patients with multiple sites of colon/rectal injury were included and analyzed separately. Of note, the majority of patients in this series were local national forces who were likely to remain at the initial hospital for the duration of their treatment and postoperative recovery. The remaining patients, U.S. troops and coalition force members, comprised approximately one-third of the study group.

More than half of all patients in Steele's series underwent either primary repair or resection with reanastomosis. *In this repair group, the authors report a leak rate of 13% and report that patients who leaked eventually received stomas for failure of in-continuity management.* There was one leak (2% incidence) reported in the stoma group and four leaks (17%) in the damage control subset. *Most striking from Steele's data was this: their mortality rates in patients who experienced an anastomotic leak was 31%.*

Our own experience in caring for casualties from Operation Iraqi Freedom has allowed an opportunity to review firsthand similar endpoints and outcomes. At the National Naval Medical Center (NNMC) in Bethesda, Maryland, we retrospectively identified 23 patients over a 20-month period who arrived at our institution via medevac from Iraq with either colon or rectal injuries (Duncan et al, in press). Similar to prior studies, these patients all had associated injuries with a mean Injury Severity Score (ISS) of 24 (range = 9 to 54). Focusing upon the nature of triage and evacuation from the modern-day battlefield overseas, we found that patients arrived, on average, 6 days following their initial injury

during which time they visited between two to three separate medical facilities with surgical capability. In this cohort, complications were high (48%) with one death. Thirteen patients (57%) underwent diverting stomas as treatment; the remaining 10 patients (43%) received either primary repair or resection with anastomosis. In the latter group, there were three leaks (30%); two were recognized in Germany and one manifested soon after arrival at the NNMC. All 3 patients with leaks required reoperation and diversion. In approximately half of the patients with ostomies where follow-up data was available, we found no morbidity or mortality associated with stoma reversal.

Although admittedly a small series of patients, our data has been provocative in reassessing the role for temporary stomas. In contrast to the larger recent series from Hudolin and from Steele and colleagues, our cohort of patients represents a specific population of injured patients that navigate the complex and sometimes lengthy process of evacuation from the site of injury to initial surgical treatment to definitive and continuous care. The contribution, if any, of this unique military factor—treating and moving critically ill trauma patients through multiple locations, various surgeons, and around the world—to anastomotic complications remains to be elucidated. The high leak rate seen with primary repair and/or resection and reanastomosis in our series contrasts sharply with the lack of complications or mortality arising from elective stoma reversal in otherwise young, fit patients. Additionally, the severity of wartime wounding patterns, the multiple levels of care involved, and the complex nature of military medical triage and evacuation for today's injured military patient have prompted rethinking of the role of a temporary intestinal diversion.

DAMAGE CONTROL AND STOMAS

A brief mention about “damage control” deserves to be included in this report because the principles of damage control have become so closely tied to the treatment of the wounded gastrointestinal tract, and often result in the creation of a stoma. The idea of damage control is to quickly control spillage, stop bleeding, and then work with the patient, resuscitating and warming, until coagulopathy, acidosis, and hypothermia are corrected, with a secondary operation done within a few days of the damage control procedure. Sebesta¹⁶ described his experiences in Iraq from January 2003 to January 2004, wherein 333 penetrating abdominal wounds were treated; 92 (27.6%) of these patients had a damage-control procedure of some sort. Sebesta describes the treatment of penetrating pelvic wounds with stapling of the sigmoid colon, distal washout, packing, and leaving the abdomen open with a wound suction dressing, and then returning to the operating

room 12 to 24 hours later for a more definitive procedure.

The term “damage control” was coined long ago in the Navy; it involves going through several extraordinary, emergency steps aboard a ship on fire or damaged after attack, to save it and prevent it from sinking. These steps are quite separate and apart from repairing the ship. They involved sealing compartments, stopping water from coming in, putting out fires, etc. Dr. William Schwab, who had seen damage control principles applied to a Navy ship as a young officer, began using the term to describe the similar steps that surgeons should apply to the patient struggling for life, after major trauma. And if the surgeon spends too much time in the operating room initially, the patient can end up “... dead but fully repaired” according to Dr. Schwab.¹⁷ The question of what to do with bowel that has been stapled off is addressed at the second (or even later) operation. There are anecdotal reports of small bowel anastomoses successfully done, and mention of diversion of the colon with creation of stomas in the majority of large bowel injuries. There are no good guidelines or firm rules about what to do with the colon in this situation. Much would depend on the quality of the tissue, whether there was excessive inflammation or edema, etc.

HIGH-VELOCITY WOUNDS AND UNRECOGNIZED ISCHEMIA

One positive feature of damage-control techniques is the ability to assess viability of tissue at the time of the second-look. This is particularly important in patients who have had high-velocity wounding agents or who have survived major explosions with IEDs (improvised explosive devices). These wounds remind us of the possibility that tissues far from the missile tract can be injured because of phenomena such as cavitation, and that eventual ischemia and necrosis can occur, even in tissue that at the time of initial exploration appears to be viable. One case that illustrates this possibility is as follows. A 36-year-old male was shot while fighting the current War Against Terrorism with a high-velocity round in the right lower quadrant, with a large exit wound created in the right flank. He was urgently taken to the operating room and explored, and found to have transection of the cecum. He had no hemodynamic instability, and no other injuries except an open fracture of the iliac crest as part of the exit wound. The surgeon resected the cecum and distal ileum, and created an ileo-ascending colostomy anastomosis. He was treated in the postanesthesia care unit (PACU), and then quickly put on an aerovac flight, 4 hours postoperative. During the air evacuation to Germany, he became unstable, and required pressor agents and

intubation. He arrived in Germany in septic shock, and was taken immediately to the operating room, where he was reexplored. It was found that *the ascending colon was devitalized up to the hepatic flexure*. His exit wound was also purulent. The dead colon was resected, and an ileostomy and mucus fistula were created, and the exit wound débrided. He responded to treatment, quickly resolved his sepsis and need for pressors and ventilation, and was eventually transferred to Walter Reed Army Medical Center (Washington, DC) for further care. (This case was kindly provided by Colonel Ron Place, Colorectal and Trauma Surgeon, Landstuhl U.S. Army Regional Medical Center, Landstuhl, Germany).

This particular case is not about bad surgery, or even about bad surgical judgment. At the initial operation, the tissues must have appeared to be viable, but were not. Perhaps if a planned second look had been part of the patient's care, the anastomosis would not have been attempted.

The one message of this report that should resonate with trauma surgeons is that a leaking anastomosis is associated with an approximate 30% chance of death. A leaking anastomosis has huge consequences for our patients, and obviously should be avoided at all cost. The ability to predict which patient will develop a leaking anastomosis is the key to knowing who to divert, but unfortunately, we do not yet have a fail-safe algorithm to help us make this decision (Colonel David G. Burris, Chairman, Norman M. Rich Department of Surgery, USUHS, Trauma Surgeon, personal communication, January 7, 2007). Most evidence indicates that leaks are associated with high trauma severity scores, use of multiple units of blood, hypotension, other injuries, etc. This diversion versus repair decision should be made by the surgeon who is caring for the injured, and involves gestalt, the setting, resources, past experiences, and especially the wounding mechanism and the condition of the patient. It should never be considered a "complication" when the surgeon makes the decision to divert, and it should never be considered a "complication" when the surgeon decides instead to repair.

SUMMARY

The discussion about diversion versus repair versus resection and repair of colon injuries has not ceased. However, the data from several civilian reports is convincing. For low-velocity missile injuries, primary repair should be the rule, and diversion the rare exception. For high-velocity missile injuries with elevated trauma severity scores, consideration for diversion is appropriate, but apparently even some of these more critically wounded patients can be safely repaired, either primarily or after resection. The data coming from wartime

experience is less convincing for primary repair. Consequently, military surgeons in Iraq and Afghanistan should not hesitate to divert, and should not have to apologize later for having diverted, if they believe that a stoma will prevent an anastomotic leak. The leaking anastomosis has a very high mortality rate, and needs to be avoided at all cost. Even in the military setting, the majority of patients with penetrating colon trauma can be safely repaired primarily.

DISCLAIMER

The opinions expressed in this article are those of the authors, and do not necessarily reflect the thinking of the Department of Defense, the U.S. Air Force, the U.S. Navy, or the Uniformed Services University of the Health Sciences.

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