

# MANAGING THE OPEN ABDOMEN

VOLUME 1 • ISSUE 2 • Q2 2013

PERSPECTIVES, INSIGHTS AND ISSUES ON ABDOMINAL SURGERY



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small bowel through  
irrigation and separation

# MANAGING THE OPEN ABDOMEN

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## EDITOR'S WELCOME

WELCOME TO THE second issue of *Managing the Open Abdomen*. Our objective is to provide the general surgeon with stimulating and informative content focusing on issues relating to management of the open abdomen. In this issue, *Literature scan* highlights an article demonstrating the benefit of leaving the skin open after trauma laparotomy. *Current controversies* discusses the routine use of negative pressure therapy in management of the open abdomen. *Featured product* provides an overview of the Abdominal Reapproximation Anchor (ABRA®). *Technical corner* features tips and techniques that are of interest to the abdominal surgeon. A recently published study of negative pressure therapy is highlighted in *Surgery news*. In addition, this issue includes highlights of a recent open forum meeting on the open abdomen in our *Meeting Report* section.

## LITERATURE SCAN

### Benefits of leaving skin open after trauma laparotomy

Seamon MJ, Smith BP, Capano-Wehrle L, Fakhro A, Fox N, Goldberg M, Martin NM, Pathak AS, Ross SE. Skin closure after trauma laparotomy in high-risk patients: Opening opportunities for improvement. *J Trauma Acute Care Surg.* 2013;74: 433-40.

#### Background

Although many surgeons leave laparotomy incisions open after colon injury to prevent surgical site infection (SSI), other injured

patient subsets are also at risk. We hypothesized that leaving trauma laparotomy skin incisions open in high-risk patients with any enteric injury or requiring damage control laparotomy (DCL) would not affect superficial SSI and fascial dehiscence rates.

#### Methods

Patients who underwent trauma laparotomy (2004–2008) at two Level I centers were reviewed. To ensure a high-risk sample, only patients with transmural enteric injuries or need for DCL surviving 5 days or more were included. SSIs were categorized by the CDC (Centers for Disease Control



and Prevention) criteria and risk factors were analyzed by skin closure (open vs. any closure). Significant ( $p < 0.05$ ) univariate variables were applied to two multivariate analyses examining superficial SSI and fascial dehiscence.

#### Results

Of 1,501 patients who underwent laparotomy, 503 met inclusion criteria. Patients were young (median, 28.0 years; range, 22.0–40.0 years) with penetrating (74%) or enteric

(80%) injuries, and DCL (36%) and SSI (44%; superficial, 25%; deep, 3%; organ/space, 25%) were common. While no difference in superficial SSI after loose (n = 136) or complete skin closure (n = 224) was detected (p = 0.64), superficial SSIs were less common with open skin incisions (9.8%), despite multiple risk factors, than with any skin closure (31.1%, p < 0.001). Predictors of superficial SSIs and fascial dehiscence were each evaluated with multiple-variable logistic regression analysis. After adjusting for multiple potential confounding variables, any skin closure increased the risk of superficial SSIs approximately nine times (odds ratio, 8.6; p < 0.001) and fascial dehiscence six times (odds ratio, 5.7; p = 0.013).

## Conclusion

Management of skin incisions takes careful consideration like any other step of a laparotomy. Our results suggest that the decision to leave skin open is one simple method to improve outcomes in high-risk patients.

## Level of evidence

Therapeutic study, level III.

Abstract downloaded from National Library of Medicine

## Commentary

by Dr. Michel Gosselin

**S**URGICAL SITE INFECTIONS (SSIs) are unfortunately of frequent occurrence in our surgical and trauma patients. These infections will adversely influence patient outcomes and bring extra costs to the health care system. Trauma patients are certainly at risk, but no validated SSI risk adjustment tool applies to these patients. Studies and guidelines

often do not include these unique trauma patients. We, as surgeons, are then having to see which of these patients are most at risk and how can they be prevented.

The authors recognize that patients with any enteric injury or who require damage control laparotomy are at risk for site infections. They hypothesize that the risk of SSI in these patients is unaffected by the decision to either close, loosely close or leave skin incisions open. The primary objective of this study was to determine if leaving skin incisions open and packed after high risk laparotomy decreases superficial SSI rates. Secondly, the study looks to determine the effects of laparotomy skin incision management on fascial dehiscence.

A retrospective analysis was undertaken and 503 high-risk patients comprised the final and substantial study sample. The 2 groups are different in certain aspects and this is not looked at in detail. The study also looked at numerous potential confounding variables, but it is certainly difficult to be complete in a topic as broad as SSI.

The results showed that patients with open incisions after laparotomy had lower rates of any SSI including superficial and deep infection classes, although no difference in organ/space infection was detected. Open incision patients had lower rates of fascial dehiscence than those who underwent any degree of skin closure. This paper shows data that suggest that leaving skin incisions open after high-risk trauma laparotomy decreases postoperative SSI and fascial dehiscence rates, thus improving patient outcomes. Few studies have yet to show exactly why SSI rates are decreased when contaminated incisions are left open. Also, most studies look at general surgical problems such as appendicitis

rather than traumatic injury.

There are a few study limitations as recognized by the authors. This is a retrospective study. A selection bias could be possible when decisions were made by the trauma surgeons and not study protocols. Validation of these study findings in a randomized controlled trial would be beneficial in better understanding the influence of wound closure on the development of postoperative complications. Also, this paper looked at the inpatient data and did not evaluate a diagnosis of SSI after discharge, which is certainly a possibility in these patients.

To leave the wound open or to close still remains a very relevant subject and is a frequent question in our clinical practice. Leaving the wound open certainly brings specific wound care needs but now with the benefits of a negative pressure therapy, wound care can be managed much easier and faster. Some might find it old-fashioned to leave the wound open, and it still often remains a question of personal preference, experience and habit. But it is interesting to have some new data suggesting that one option seems to be better in some of these high risk patients. It would be interesting to determine more precisely which patients.

This paper looks at a common situation and offers us another tool while deciding whether to close or leave open in our high risk traumatic wounds. Other aspects of surgical management and patient care are important in preventing wound infections and must be followed. Another interesting topic in certain sub-groups of these patients is not only to leave the skin open, but also to leave the abdomen open to enhance the outcome--yet another interesting topic for another day.

# CURRENT CONTROVERSIES

## Negative pressure therapy for general surgical management of open abdomen?

Franklin ME, Alvarez A, Russek K. Negative pressure therapy: A viable option for general surgical management of the open abdomen. *Surg Innov.* 2012 Dec;19:353-63.

### BACKGROUND

Management of the open abdomen (OA) is challenging for surgeons and requires experienced medical teamwork. The need for improvements in temporary abdominal closure methods has led to the development of a negative-pressure therapy (NPT; ABThera OA NPT, KCI USA, Inc, San Antonio, TX).

### METHOD

The authors present a 19-patient case series documenting their use of NPT for OA management in nontraumatic surgery. All received NPT until the fascia was considered ready for closure.

### RESULTS

Of 19 patients, 17 (89.5%) achieved fascial closure with a Kaplan-Meier (KM) median time to closure of 6 days. Mean hospital and intensive care unit stays were 32.1 and 26.6 days, respectively. During their hospitalization, 5 patients (26.3%) died, with a KM median time to mortality of 53 days.

### CONCLUSION

These findings demonstrate effective use of NPT for managing the OA in critically ill patients, and this has led the authors to use it in their general surgery practice.

## Discussion by Dr. Michael Ott

THE ADVENT OF damage control surgery for the management of trauma and intra-abdominal catastrophes has decreased mortality and improved patient outcomes dramatically. Unfortunately, one of the negative consequences of damage control surgery is the necessity to manage the open abdomen and inherent potential loss of domain that occurs. Franklin et al. recently explored the use of negative pressure therapy for the management of the open abdomen in the setting of general surgical intra-abdominal catastrophes.

In this recent article the authors present a case series of 19 patients who presented with acute abdominal catastrophes that mandated damage control surgery and management of the open abdomen. Their results demonstrated an 89% fascial closure rate at a median of 6 days, and a mortality rate of 26%. The cohort includes all types of catastrophe with a broad spectrum of co-morbidities and BMI. No direct complications from the use of negative pressure were encountered. The authors conclude that this is not only safe but superior to many other techniques of managing the open abdomen.

While it is evident that in the hierarchy of evidence-based medicine, case series reports do not represent the highest level of evidence, there are several criteria by which we can evaluate an article of this nature. In their article entitled, *How to critically appraise an article*<sup>1</sup>, Young and Solomon give several methodological points to consider in the appraisal of a case study. Young and Solomon focus on how the cases were identified and included in the series as being of the greatest importance when considering the validity of the work.



In the current article the cases were identified prospectively and consecutively thus minimizing the potential for selection bias, one of the greatest downfalls of case series research. The patients used represent a broad spectrum of co-morbidities, BMI and types of intra-abdominal catastrophes. Therefore, the study population is representative of the kinds of intra-abdominal catastrophes that are common in a general surgical practice. No patients were excluded limiting again selection bias. This methodological design ensures that the study population is sufficiently similar to the kinds of cases the average general surgeon may encounter, making the data highly relevant and applicable. Another strength of the paper is the pragmatic nature of the study in which the only intervention that was manipulated was the use of negative pressure therapy for the management of the open abdomen, making it evidence grounded in the real world of emergency general surgical practice.

Not all practice change requires a randomized controlled trial and the current article adds significantly to the literature and discussion surrounding the use of negative pressure wound therapy in the management of the open abdomen. It demonstrates that it is safe with minimal complications and has a high rate of fascial closure being achieved in a reasonably short time. The evidence presented suggests strongly that the use of negative pressure therapy should be considered for the management of the open abdomen in the setting of damage control surgery for general surgical intra-abdominal catastrophe.

### Reference

1. Young JM, Solomon MJ, How to critically appraise an article, *Nature Clinical Practice Gastroenterology & Hepatology* (2009) 6, 82-91 doi:10.1038/ncpgasthep1331

# MEETING REPORT: SPECIAL FEATURE

## Dialogues in Open Abdomen Management

**D**IALOGUES IN OPEN ABDOMEN MANAGEMENT was held on April 10, 2013 in Whistler, BC. The meeting was designed as an interactive forum for surgeons who deal with the open abdomen, and the focus of the meeting was discussion of the open abdomen and use of the ABThera™ Open Abdomen Negative Pressure Therapy System.

The objectives of the meeting were to discuss and raise awareness around:

- Temporary abdominal closure (TAC) techniques used in Canada
- Challenges facing hospitals in using ABThera™
- Optimal patient profiles for ABThera™

This meeting report summarizes the discussion between the attending surgeons.

The meeting participants agreed that it is important to take control of the open abdomen early, as an inflammatory state often exists, and it is vital to address this pathological process as soon as possible. Studies in this area are lacking, however. Negative pressure therapy (NPT) helps to manage the patient and doesn't contribute to the inflammatory state. Patients with an open abdomen are heterogeneous; the population includes damage or trauma, sepsis, and abdominal compartment syndrome (ACS). Treatment does not necessarily have the same goals for all open abdomen patients. Early control means different things depending on the patient profile.

Ease of use is an important message for ABThera™, especially as perceived complexity is a barrier to use of ABThera™. One doctor commented, "The key thing is that ABThera™ is so easy anyone can do it. It is not hard to do. Patients look better, care of the patients is easier for the nurses, and it reduces mortality. The answer for the open abdomen is ABThera™."

Indications for an open abdomen include trauma, intra-abdominal sepsis, severe pancreatitis, ruptured abdominal aortic aneurysm (AAA), prolonged surgery, and scheduled second-look laparotomy. It is critical to look for abdominal compartment syndrome (ACS) when the patient has risk factors, such as large-volume fluid resuscitation; acidosis; hypothermia; coagulopathy; polytransfusion; pulmonary, renal or hepatic dysfunction; ileus; and abdominal surgery and primary fascial closure with distended abdomen.

If the abdomen is open, temporary abdominal closure (TAC) is critical. Techniques, some of which are historical, include towel clamps, a Bogota bag, mesh, a Wittman patch, Barkers' vacuum pack, vacuum-assisted closure (VAC), and ABThera™. The Wittman patch, a progressive tension technique, demonstrated improved survival in 1989, and adds to recovery of domain; it is sometimes used with ABThera™. Compared with ABThera™, Barker's vacuum pack is associated with increased mortality, morbidity, and hernias and decreased primary closure. The Frazee study showed a saving of \$176,000 with ABThera™ compared with Barker's technique.

One of the meeting's faculty

members explained that his hospital changed to ABThera™ for several reasons. There were more open abdomen cases and greater awareness of open abdomen. The hospital looked at data and outcomes for primary closure rates, mortality, and fistulas and they wanted uniformity at the hospital. "Our experience indicated ABThera™ was better, safer, and easier to use. Our primary closure rates are going up and mortality is going down. Several steps were involved in the change. First we decided what we were looking for: NPT with ABThera™. Then we developed a majority agreement among our colleagues. A good relationship with the manufacturer's representative was also important. Education was an important step. The hospital management also needed to agree. Although ABThera™ is easy to use, it is important to use it right. We developed treatment algorithms and guidelines and now have a postoperative note for NPT for ABThera™ in open abdomen. Indications in our hospital include ACS, trauma (damage control), abdominal sepsis, necrotizing pancreatitis, and mesenteric ischemia. Our primary closure rate is about 85%, and we have a mortality rate of 15% and a fistula rate of 2%."

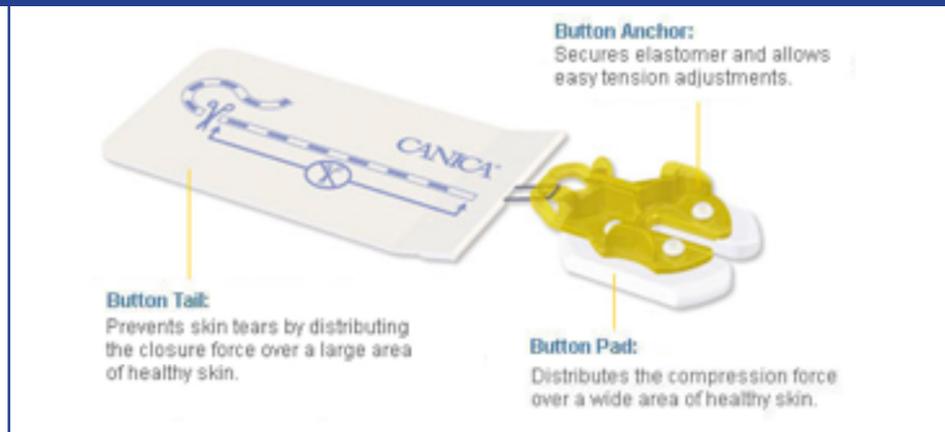
Several meeting participants suggested the utility of a consensus meeting of experts to agree where ABThera™ can be used, especially if it is supported by the literature. The consensus meeting would specifically address the Canadian situation.

# FEATURED PRODUCT

## ABRA®

THE ABDOMINAL REAPPROXIMATION ANCHOR (ABRA®) Abdominal Wall Closure, from Canica, “is indicated for retracted, full-thickness midline abdominal closure after laparotomy for Abdominal Compartment Syndrome (ACS), abdominal hernia, mesh removal, AAA, or abdominal trauma, and for retention of abdominal wall closure.”

The ABRA system is able to achieve a low-tension primary closure, while maintaining domain, or quickly restoring lost domain. This system eliminates the risk of



hernia without the need for mesh; re-approximates the skin margins, eliminating the need for skin grafts; preserves fascial margins; and restores normal abdominal physiology. ABRA restores the primary closure option for full-thickness, retracted midline abdominal defects, as it pulls muscle planes together under low tension while leaving fascial margins intact

and ready to suture, for a sound primary closure. The ABRA system can be used with negative pressure wound therapy (NPWT), and it allows bedside dressing changes. It can also reduce the number of operating room procedures by 50% and reduce length of stay. ABRA is compatible with magnetic resonance imaging.

Source: <http://www.canica.com/abra.asp>



## SURGERY NEWS

### New retrospective study reports greater effectiveness of KCI ABThera™ System compared to traditional technique

Released: March 5, 2013

Kinetic Concepts, Inc. announced today that ABThera™ Open Abdomen Negative Pressure Therapy System (ABThera™ OA NPT) was associated with a significantly higher ultimate midline fascial closure rate compared to traditional Barker vacuum pack technique (BVPT) according to a new retrospective study published in the Journal of the American College of Surgeons.<sup>1</sup> Improved patient results and savings from successful closure offset the added cost of the negative pressure device, according to the study authors.

“My bias going into this study was that there would be no difference in outcomes between the two techniques,” said Richard C. Frazee, MD, FACS, Vice Chairman Surgical Services, Scott & White Hospital, and lead author of the study. “However, the study showed a clear advantage favoring the ABThera™ OA NPT, and we continue to use it for our open abdomen patients with good success.”

Leaving the abdomen open during the management of complex abdominal problems has become common practice. A prolonged open abdomen can result in fluid loss, infection, loss of abdominal domain, organ dysfunction and death. Clinical research has shown that removing potentially detrimental peritoneal fluid and achieving primary fascial closure are important goals when managing patients who require an open abdomen for the treatment of critical illness.<sup>2</sup> The methods of temporary abdominal closure (TAC) chosen may play an important role in patient outcomes.

In this study, 37 open abdomen patients who had temporary abdominal closure with ABThera™ OA NPT from 2010 to 2011 were compared to 37 patients using BVPT for open abdomen management from 2009 to 2010. This study analyzed patient demographics, body mass index (BMI), preoperative albumin, indication for open abdomen management, number of operations, use of sequential closure and success with closure. Although the initial up-front cost of the ABThera™ OA NPT was higher than that of BVPT, the authors

suggest that ABThera™ OA NPT was associated with potential significant cost savings due to a reduction of long-term morbidity and subsequent ventral hernia repair.

In 33 patients (89 percent), ultimate midline fascial closure was achieved with the ABThera™ OA NPT group versus 22 patients (59 percent) using BVPT ( $p < 0.05$ ). Based on the difference in closure rates between these two methods, the authors estimated that 11 ventral hernias could have been prevented for a cost savings of \$176,000.

“KCI is committed to changing the practice of medicine and improving patient lives,” said Ron Silverman, MD, chief medical officer, KCI. “The clinical results and health economic implications of this important study should prove very helpful to clinicians managing patients with an open abdomen, which is a complex and often life-threatening condition.”

The ABThera™ Open Abdomen Negative Pressure Therapy System is indicated for temporary bridging of abdominal wall openings where primary closure is not possible and repeat abdominal entries are necessary. This system is intended for use in open abdominal wounds with exposed viscera, including, but not limited to, abdominal compartment syndrome (ACS).

For more information or to download the article, please visit [www.abthera.com](http://www.abthera.com).

Source: <http://www.kci1.com>

# TECHNICAL CORNER

## Avoiding adhesions in the small bowel through irrigation and separation

by Dr. Sonny Dhalla

**A**FTER A CASE of diffuse peritonitis it is not an uncommon event to see bowel and mesentery sticking



**Figure 1:** Matted loops of small bowel with loss of domain in patient not going through vigorous lavage after fecal peritonitis.



**Figure 2 & 3:** Gangrous bowel resection and 48 hrs later with full lavage and separation, demonstrating minimal adhesions.

to other loops with fibrous adhesions after TAC with ABThera and V.A.C systems. Sometimes one sees even early formation of interloop abscesses. This will undoubtedly delay recovery if left behind in the early phase but in later phases of recovery, may lead into recurrent small bowel obstructions and pain.

If a patient is required to have repeated V.A.C. dressings due to abscess or general contamination, it is my practice to separate small bowel loops and possibly omentum with copious lavage of saline. This is in the hopes of preventing and possibly minimizing adhesions and future small bowel obstructions (Fig 1- 4). After obtaining appropriate cultures, saline lavage is carried out for each abdominal quadrant. Separation of loops of small bowel is carried out bluntly (even using abdominal sump sucker), followed by another set of



each quadrant saline lavage. This entails a minimum of 8-10 liters of saline. Either primary closure is carried out or another TAC closure with ABThera is achieved and the process is repeated with the next operation.

Adherence to this regime has led me to avoid repeated operations over the last 10 years for small bowel obstructions. This has also been observed in patients who have been subjected to repeat operations for a ventral hernia repair.



**Figure 4:** Bile peritonitis undergoing ABThera TAC change at the outset of case prior to final closure of abdomen, showing minimal adhesions



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