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Form Approved
OMB No. 0704-0188

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1. REPORT DATE 01 MAY 2013		2. REPORT TYPE N/A		3. DATES COVERED -	
4. TITLE AND SUBTITLE Commentary on "predictors of failed primary abdominal closure in the trauma patient with an open abdomen"				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S) Lundy J. B.,				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) United States Army Institute of Surgical Research, JBSA Fort Sam Houston, TX				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release, distribution unlimited					
13. SUPPLEMENTARY NOTES					
14. ABSTRACT					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT UU	18. NUMBER OF PAGES 2	19a. NAME OF RESPONSIBLE PERSON
a. REPORT unclassified	b. ABSTRACT unclassified	c. THIS PAGE unclassified			

Commentary on “Predictors of Failed Primary Abdominal Closure in the Trauma Patient with an Open Abdomen”

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Damage-control laparotomy is the mainstay of therapy for the management of abdominal trauma in physiologically ill patients. The goals of damage-control laparotomy include hemostasis and control of contamination, with some form of temporary abdominal closure (TAC) needed upon completion of the abbreviated laparotomy. Ideally, TAC should be atraumatic, be rapidly and easily applied, minimize the risk of intraabdominal hypertension, control peritoneal effluent, allow for quick reentry into the peritoneum, and maximize future attempts to achieve primary fascial closure. The result of the prolonged open abdomen leads to the loss of abdominal wall domain and the need for skin autografting over viscera with planned ventral hernia. As the open abdomen after injury became more common, many TAC methods were developed to include towel-clip skin closure, suture skin closure, Bogota bag, synthetic mesh, mesh zipper, Wittmann patch, three-layer negative-pressure dressing, fascial sutures, and commercial negative-pressure dressings. The methods that are most commonly used can be classified into two main groups: negative-pressure dressings of varying complexity and cost and techniques that apply traction to the fascia and/or skin to limit retraction and theoretically prevent further domain loss. To date, no method has been borne out to be superior to the other. A review suggested that although the generic three-layer vacuum pack technique (nonadhesive bowel drape, towel, closed suction drains) for TAC is the standard, other methods should be measured against it and the choice of TAC should be a matter of surgeon preference.¹

In this issue of the *Southern Medical Journal*, Beale and colleagues report their retrospective, single-center, 3-year findings from a level I trauma center during the modern era of damage-control surgery, with the primary intent of defining risk factors for failed abdominal fascial closure after damage-control laparotomy and determining whether two methods of temporary abdominal closure (fascial-based or vacuum-based methods) affected the rate of successful closure (SC).² The authors' regression model identified more severe abdominal injury as quantified by the Penetrating Abdominal Trauma Index and worse admission base deficit as predictors of failed closure (FC) in advance of discharge. Most interesting was the finding that a lower injury severity score (ISS) was a predictor of FC. The rate of FC was 29%, which is consistent with literature describing FC rates of 15% to 28% with negative-pressure-based TAC techniques and 18% to 22% with fascial-based methods. Beale and colleagues found no difference between closure rates when fascial-based methods were compared with negative-pressure methods.²

The finding that a lower ISS predicted FC adds to a growing literature urging a different statistical analytical method for the evaluation of this variable in trauma studies.³ The ISS has multiple values that are nonvalid based on the way the system scores injuries; therefore, it is a collection of discrete scores that should not be considered continuous. As such, the use of ISS and the new ISS should be considered categorical variables during statistical analysis. It is likely that if the authors would have considered ISS as a categorical variable and either dichotomized scores as severe (eg, ISS greater or less than 15) or created tertiles/quartiles based on ISS, the results would reveal that FC was predicted by more severe injury.

Given the continued high rate of FC in this and previous studies and a mix of equivalent methods for TAC, one is led to speculate that this is an area that we as trauma surgeons can improve upon. With American Association for the Surgery of Trauma and Western Trauma Association–led multicenter studies ongoing, it is feasible that a similar trial could be conducted to compare fascial-based to negative-pressure–based methods of TAC. As TAC methods have evolved, a combination of these techniques has been termed vacuum-assisted fascial closure, and

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The views expressed herein are those of the authors and do not necessarily reflect those of the US Army Medical Department of the Department of Defense.

The author has no financial relationships to disclose and no conflicts of interest to report.

Accepted February 19, 2013.

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0038-4348/0-2000/106-332

DOI: 10.1097/SMJ.0b013e318292440f

it is possible that this combination results in the most effective way to care for the perioperative damage-control laparotomy patient and achieve the highest rate of SC. This statement is supported by single-center reports describing high rates of SC with a vacuum-assisted fascial closure technique using the commercially available Vacuum-Assisted Closure (KCI, San Antonio, TX) device with interrupted fascial tension sutures.⁴⁻⁶ Surgeons at Denver General Hospital have reported 100% FC with this combined method.⁵ Commercially available devices are not mandatory, and the three-layer negative pressure method can be combined with fascial sutures and is applicable in resource-limited environments, including the deployed setting. Speaking from personal experience in the combat environment at the UK Multinational Role III Hospital, Helmand Province, Afghanistan, I saw this method deployed frequently when treating a host nation casualty with an open abdomen after damage-control laparotomy.

No matter the technique used for TAC, one important recommendation for surgeons to consider is a protocolized approach to the management of the patient with an open abdomen.^{1,6} Ideally, a protocol would be in place in all trauma centers, guiding indications for damage-control laparotomy methods for initial TAC after index laparotomy, nutrition support in patients with an open abdomen, methods for ongoing TAC to include fascial-based and negative-pressure-based

options and a combination of both, acute reconstructive options to achieve FC, and when to abort attempts to achieve FC and commit the patient to planned ventral hernia. Given the wide assortment of options and limited high-level evidence to guide current practice, Beale and colleagues should be commended for reporting their experience and contributing to our understanding of FC after damage-control laparotomy.

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