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Classification—Important Step to Improve Management of Patients with an Open Abdomen

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Abstract This short report is a distillation of the proceedings from a consensus group meeting in January 2009. It outlines a proposed classification system for patients with an open abdomen (OA). The classification allows (1) a description of the patient's clinical course; (2) standardized clinical guidelines for improving OA management; and (3) improved reporting of OA status, which will facilitate comparisons between studies and heterogeneous patient populations. The following grading is suggested: grade 1A, clean OA without adherence between bowel and abdominal wall or fixity of the abdominal wall (lateralization); grade 1B, contaminated OA without adherence/fixity; grade 2A, clean OA developing adherence/fixity; grade 2B, contaminated OA developing adherence/fixity; grade 3, OA complicated by fistula formation; grade 4, frozen OA with adherent/fixed bowel, unable to close surgically, with or without fistula. We propose that this classification system will facilitate communication, clarify OA management, and potentially improve patient care.

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Introduction

The knowledge that a tense abdomen is a life-threatening condition is very old. The pediatric surgeon Gross recognized the clinical importance of a "tense" abdomen in 1948 as a complication of the repair of large omphaloceles [1]. However, it was not until 1984 that the term "abdominal compartment syndrome" (ACS) was suggested by Kron et al. [2]. Recent publications of consensus documents from the World Society of the Abdominal Compartment Syndrome (WSACS) in 2006 and 2007 have refined the definitions [3] and guidelines for management of ACS [4].

Despite increased understanding of ACS, clinicians often face the problem of managing a patient with an open abdomen (OA). The patient may reach this situation through a number of clinical pathways: (1) the septic contaminated abdomen that cannot be closed because of infection and/or a second-look laparotomy is mandatory; (2) a tense abdomen after massive resuscitation or a prolonged major surgical procedure, at risk of developing

ACS; (3) a "damage control" situation where the patient remains inadequately resuscitated and needs a period of intensive care therapy prior to a definitive surgical procedure; and (4) primary or secondary ACS, requiring lifesaving decompressive laparotomy. Much has been made in the literature of the underlying etiology of ACS and how it should guide therapy. More specifically, there seems to be some confusion regarding the treatment of patients with trauma versus sepsis as the primary clinical cause and whether management should therefore differ. It is important to realize that the fundamental underlying pathophysiologic process is the same for both scenarios, the only difference being the time line of the evolving pathologic process.

Managing the patient with an OA is a great challenge, even for an experienced clinician. Ivatury's review in this month's issue of the *World Journal of Surgery* [5] outlines the key therapeutic approaches to such patients. Some kind of temporary abdominal closure (TAC) is needed to protect the intestines, maintain a sterile or at least clean environment, and avoid fluid and temperature loss. Establishing what constitutes the best "dressing" in this situation remains a difficult and controversial challenge [6–11]. It seems evident, therefore, that there are a number of areas where the best patient management remains unclear. To help clarify some of these issues, the authors thought that a robust, simple clinical classification for describing the OA within this diverse and complex patient population would be useful.

We have focused on the OA; but when discussing management, it must be remembered that the focus is the patient, not the abdomen. Nutrition, ambulation, and control of infection and the inflammatory reaction are important for the prognosis. Early enteral nutrition is probably beneficial [5]. These issues should also be addressed when evaluating various TACs and their respective cost-effectiveness.

Aims of the classification

Discussions regarding classification were based on the work of Banwell and Téot [12] and Swan and Banwell [13] as well as a consensus meeting held in October 2007. The proposed classification system outlined here was designed to fulfill a number of purposes. It needed to describe the natural history of clinical deterioration among these patients from relatively simple to much more complex scenarios. In so doing, it would allow clinical guidelines to be established for the management of these various scenarios. The principal goals of these clinical guidelines would be to: (1) prevent further deterioration and escalation within the classification system resulting in a more complex OA; and (2) appropriately manage and maintain the patient's OA at the lowest and simplest grade to facilitate the ultimate goal of achieving primary delayed fascial closure as quickly as clinically appropriate. Such a classification system would additionally help standardize clinical reporting and thus allow units managing these patients to compare treatments and outcomes more easily and to be involved in studies across centers.

Proposed classification system

The proposed classification system is outlined in Table 1. The grades are briefly described here, with their proposed management discussed.

- *Grade 1A: clean OA without adherence between bowel and abdominal wall or fixity (lateralization of the abdominal wall).* This relatively simple scenario is common following a decompressive laparotomy for ACS after a ruptured abdominal aortic aneurysm or abdominal trauma not affecting the gastrointestinal (GI) tract. The patient may have other risk factors for poor outcome, but the prognosis regarding the OA is favorable. The aims of treatment are straightforward: to maintain a clean OA without adherence between the intestines and the abdominal wall, without lateralization of the abdominal wall, contamination or fistula formation, and, ultimately, to achieve primary delayed fascial closure.
- *Grade 1B: contaminated OA without adherence/fixity.* Typical scenarios are patients with perforated diverticulitis, anastomotic breakdown after colorectal surgery, or trauma affecting the GI tract. The aims of treatment are twofold: first, to move toward a lower grade within the classification system by transforming the OA into a clean situation (e.g., by deviating the fecal flow with a stoma); and second, to focus on preventing deterioration into a less favorable state by preventing adhesions, fixity, and fistulation.

Table 1 Proposed classification of the open abdomen

Grade	Description
1A	Clean OA without adherence between bowel and abdominal wall or fixity (lateralization of the abdominal wall)
1B	Contaminated OA without adherence/fixity
2A	Clean OA developing adherence/fixity
2B	Contaminated OA developing adherence/fixity
3	OA complicated by fistula formation
4	Frozen OA with adherent/fixed bowel; unable to close surgically; with or without fistula

OA Open abdomen

- *Grade 2A: clean OA developing adherence/fixity.* This patient may have been treated in a suboptimal fashion, having been grade 1A or 1B prior to becoming grade 2A. Adhesions have developed between the intestines and the abdominal wall, and/or the fascia is beginning to become fixed laterally. Primary delayed fascial closure now becomes difficult as a result of the initial management. Every effort should be made to prevent and/or reverse this situation, gently breaking down the adhesions and utilizing additional techniques to overcome the ensuing lateralization of the abdominal wall. Ideally, the patient should be converted to grade 1, if possible; but, equally, the aim of treatment is to prevent further deterioration to a less favorable situation by trying to minimize the abdominal wall defect and prevent fistulization. One option is to perform a partial fascial closure, perhaps combined with skin and subcutaneous tissue-only coverage or a combined mesh and split-thickness skin graft. Such procedures can result in good functional abdominal closure without substantial morbidity.
- *Grade 2B: contaminated OA developing adherence/fixity.* This patient may have a septic abdomen, where source control has not yet been achieved and where adhesions and/or fixity may preclude subsequent fascial closure. The aims of treatment are twofold: (1) control contamination so the patient improves to grade 2A for later closure of the OA according to the principles outlined above; and (2) prevent further deterioration with development of an enteric fistula and/or of a completely frozen abdomen (grades 3–4).
- *Grade 3: OA complicated by fistula formation.* The development of an enteric fistula represents significant clinical deterioration in the patient with an OA. A number of techniques have been reported that may allow early closure or fistula control in this situation. It may be possible, and indeed preferable, to convert the patient to a lower OA grade and therefore to a simpler clinical scenario. Once again, the primary focus of treatment in this group is to minimize fascial lateralization and thus the subsequent fascial defect. In addition, attempts must be made to prevent the development of further adhesions and deterioration to grade 4 OA. Protecting the fascia and skin from deterioration is important in all grades of OA, but with a fistula this concern is even greater. A TAC that permits deviation of intestinal contents is crucial for success.
- *Grade 4: frozen OA with adherent/fixed bowel, unable to close surgically, with or without fistula.* The key here is prevention. Early, appropriate intervention in the scenarios outlined above should prevent the fixed, frozen abdomen. The management of this situation (more often with fistulation) is well documented elsewhere and relies principally on returning the patient's physiology and nutrition to normal, protecting skin and fascia, and preventing sepsis. Ultimately, a complex reconstruction is required, usually at about 6 to 12 months.

Conclusion

We hope the OA classification system outlined above will contribute to the understanding, treatment, and ultimately the outcome of these patients. The authors recognize the complexity of the OA, and clearly there is much more that needs to be clarified with regard to etiology, pathophysiology, and management. The suggested classification system needs to be evaluated in prospective studies.

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