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Fluid Restriction During Pancreaticoduodenectomy

Is It Effective in Reducing Postoperative Complications?

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Keywords

• Fluid restriction • Hypertonic saline • Pancreaticoduodenectomy
• Whipple operation • Pancreatic cancer

Key points

- Perioperative fluid restriction has been shown to reduce complications in patients undergoing a wide variety of operative procedures.
- Hypertonic saline is an effective means of maintaining appropriate hemodynamic parameters among surgical patients, while contributing to overall fluid restriction.
- The use of hypertonic saline within a moderately restrictive fluid regimen is effective in reducing postoperative complications in patients undergoing pancreaticoduodenectomy.

INTRODUCTION

Nearly 50 years ago, Moore and Shires [1] published an editorial in the *Annals of Surgery* entitled "Moderation," detailing the quandary of fluid resuscitation as it relates to both trauma and elective surgery. Despite their prescient commentary, in the interval to contemporary times, fluid restriction has not been

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widely practiced, with much of the focus in the care of surgical patients being directed to the avoidance of under-resuscitation. Only in recent years has there been a renewed interest in restricted resuscitation practices in the surgical literature, and fluid management is gaining a more prominent role in modern surgical thinking. Today, there are data from several surgical disciplines that have suggested that overzealous resuscitation may be linked to a wide variety of complications, including increased rates of paralytic ileus, delayed gastric emptying (DGE), cardiopulmonary incidents, and blood transfusions, as well as wound and anastomotic complications [2–7]. Likewise, in the care of patients with trauma, excessive resuscitation has been shown to have equally damaging effects, leading to a worsening of coagulopathy, pulmonary dysfunction, and increased rates of abdominal compartment syndrome [8–10]. Restricted fluid administration has begun to play a role in many enhanced surgical recovery pathways, with evidence that it reduces the overall rate of surgical complications [3].

As the search for the ideal resuscitation strategy continues, pancreatic surgery may serve as the perfect model for examination. Pancreaticoduodenectomy (PD) is often a long and complex operation that is associated with significant fluid shifts in the perioperative period. PD is also associated with one of the highest morbidity rates in all of surgery, ranging from 40% to 60% [11,12]. Fluid restriction may be a means to help reduce the rate of complications and improve outcomes in patients undergoing PD. To concentrate on the optimal amount of fluid for an individual patient, many surgeon-authors have rightly adopted the terminology of goal-directed fluid resuscitation [13–17]. This concept may be particularly well adapted to patients having PD, given the physiologic impact sustained by these patients through the development of a systemic inflammatory response syndrome (SIRS). Patients having PD are particularly predisposed to an aggressive inflammatory response, possibly related to dissection around and transection of the pancreas. Combined with post-PD pancreatitis, this contributes to the large fluid shifts that may occur in this unique patient population [18,19].

This article discusses the specific aspects of fluid resuscitation that pertain to patients having PD, and also discusses the underlying physiology and approach to fluid restriction.

PHYSIOLOGY AND APPROACH TO FLUID RESTRICTION

Early surgical research (much attributed to Walter Cannon in Boston and Alfred Blalock, first at Vanderbilt and then at Johns Hopkins) focused extensively on the extracellular fluid compartment, fluid shifts between compartments, and the appropriateness of crystalloid administration [20]. In the Vietnam War era, radiolabeled sulfur studies described contraction of the extracellular space, with loss of fluid into the so-called third space (eg, ascites, alveoli,) [21–23]. Although the methods and conclusions of many of these studies have been called into question, it seems clear that the inflammatory response to surgery results in a systemic capillary leak reaction, sequestering