

Brief Reports

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Hetastarch Use in Bariatric Surgery: Word of Caution

In patients undergoing a laparoscopic vertical sleeve gastrectomy (LVSG), the postoperative bleeding rate has been reported to be 3.3 per cent.¹ We describe a case of hemorrhage after an LVSG secondary to the combined effects of preoperative chemoprophylaxis and intraoperative administration of hydroxyethyl starch (HES).

A 52-year-old man with a history of diabetes, hypertension, and obstructive sleep apnea presented to us for LVSG. His body mass index was 38 kg/m², he had no personal or family history of coagulopathy, was not on any supplements, and had a normal preoperative bloodwork. As per our routine, 5000 units of subcutaneous heparin was administered approximately 1 hour before the start of the operation. The LVSG was performed uneventfully. EndoGIA™ 4.8-mm (green) loads (Covidien EndoSurgery, Norwalk, CT) were used to transect the antrum; the remainder of the gastrectomy was done with EndoGIA™ 3.5-mm (blue) staplers. Bioabsorbable staple-line reinforcement (SeamGuard®, W. L. Gore & Associates, Inc., Newark, DE) was used for all stapler deployments. The gastrosplenic and gastrosplenic ligaments were then transected with the LigaSure™ device (ValleyLab, Boulder, CO). The gastric remnant was removed, the abdomen was reinsufflated, and a 19 Fr drain was left along the length of the staple line. There was no evidence of interim bleeding. Estimated blood loss was less than 75 mL. Throughout the case, systolic blood pressure ranged from 110 to 150 mm Hg. Almost 3 L of crystalloid and 1000 mL of hetastarch were administered during the operation.

Six hours into his recovery in the postanesthesia care unit, he became acutely hypotensive and tachycardic.

Sanguinous output was noted in the drain and abdominal distension was seen. The patient's hemoglobin was found to be 6.8 g/dL, which was markedly decreased from 12 g/dL preoperatively. Coagulation parameters and platelet counts were both normal. After an aggressive resuscitation, he was emergently returned to the operating room. Diagnostic laparoscopy revealed diffuse oozing from port sites, the gastric conduit staple line, and the lesser sac and retrogastric spaces. Aspiration of the blood and clots did not reveal a punctate arterial or venous source of bleeding or any damage to the spleen and liver. Transfusion of blood products, including platelet and plasma, led to a slowdown and eventual cessation of the diffuse oozing. The abdomen was desufflated to remove any tamponade effect on potential bleeding sources; none were found upon reintroduction of pneumoperitoneum. With two new 19 Fr drains left in place, the patient was transferred to the intensive care unit postoperatively. He was extubated and discharged home on the first and fifth postoperative days, respectively. His postoperative course remained unremarkable.

HES is a colloid product often used as an intravascular volume expander in adults, commonly for the treatment of shock caused by hemorrhage, burns, surgery, sepsis, or other trauma. It is a heterogeneous macromolecular agent derived from starch and is composed primarily of amylopectin. It has a longer half-life and maintains hemodynamic stability more effectively than crystalloids and is one of the more commonly used colloids. Its molecular weight is sufficiently low to allow for adequate metabolism and renal elimination, while maintaining osmotic activity. This helps to prevent the accumulation of HES in plasma after repeated doses.

However, large volumes of HES can result in significant hemodilution, and when used over a period of days, it can be associated with coagulation abnormalities. Adverse reactions associated with its use are minor defects in coagulation produced with recommended doses and dose-related hematologic abnormalities with infusions greater than 1500 mL. HES contributes to inhibition of platelet function by decreasing levels of

Address correspondence and reprint requests to Amir Mehran, M.D., Section for Minimally Invasive and Bariatric Surgery, University of California Los Angeles, Department of Surgery, 10833 LeConte Avenue, Box 956904, Los Angeles, CA 90095-6904. E-mail: amehran@mednet.ucla.edu.

von-Willebrand factor and fibrinogen, and by inhibiting thrombin synthesis. Thrombin inhibits Protein C and activates fibrinogen, Factors VIII and V in the coagulation cascade, and activates factor XIII, which is responsible for fibrin covalent cross-linking. The use of HES therefore results in a decrease in platelet-linking properties of von Willebrand factor, a decrease in fibrinogen levels, and a decrease in thrombin generation.

Although HES inhibits platelet function and decreases thrombin generation, heparin similarly inhibits coagulation via its action on antithrombin III. Unfractionated heparin is a sulfated glycosaminoglycan that activates antithrombin III; the resultant conformation changes cause its activation and subsequent inhibition of thrombin and factor Xa. The net result is an inhibition of the clotting cascade. The combined intraoperative use of heparin and hydroxyethyl starch, therefore, has the potential to increase the risk of postoperative bleeding in patients. Much of this evidence comes from the cardiac surgery experience, where heparin is routinely given intraoperatively. In a study of postoperative blood loss with the use of intraoperative hetastarch during cardiac surgery, the use of HES was found to be associated with increased blood loss in the first 4 hours after surgery. A mean increase in blood loss of 102 mL was seen in the first 4 hours after surgery. A greater percentage of the patients who received HES also had been on preoperative or perioperative IV heparin therapy compared with those who did not receive HES.²

Although the patients who received intraoperative HES in this study had significantly lower core temperatures, which could have also contributed to coagulopathy, the link between HES, heparin, and bleeding has been described in other work on cardiac surgery patients as well. A study of 238 consecutive coronary artery bypass graft patients found that those who received one unit of HES during surgery were more than twice as likely to bleed postoperatively compared with those who had not received any HES during surgery. This investigating group postulated that HES may not only precipitate certain clotting factors and make them unavailable for the coagulation cascade, but may also

impair platelet function by coating the surface or inducing platelet damage.³ Another study of 156 patients undergoing off-pump coronary artery bypass graft found similar conclusions. This recent randomized clinical trial found that patients who received one unit of HES intraoperatively had higher rates of bleeding and postoperative transfusion requirements than patients who received no HES.⁴

In our patient, significant postoperative bleeding, with its diffuse oozing nature and without an identifiable source, very likely resulted from the combined use of HES and heparin. Although HES is preferred by some over crystalloids due to its cost efficiency and longer half-life, the latter may be a safer choice in bariatric surgery where venous thromboembolism chemoprophylaxis is almost always used. Hence, we believe HES use is unnecessary and should be avoided in most elective bariatric surgery cases.

Tony Chan, M.D.
Cheryl Conovaloff
Amir Mehran, M.D.

*Section for Minimally Invasive and
Bariatric Surgery
University of California Los Angeles
Department of Surgery
Los Angeles, California*

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