Journal of Blood Medicine

Dovepress
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COMMENTARY

Peritoneal lavage: a simple tool to prevent bleeding during and after laparoscopic cholecystectomy

This article was published in the following Dove Press journal:
Journal of Blood Medicine

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Abstract: Bleeding remains one of the most serious complications of laparoscopic cholecystectomy and can increase mortality. Even if several patient-related and intraoperative factors increase the risk of bleeding, complete hemostasis should be achieved at the end of each surgical procedure. Although irrigation is a standard step, its importance is often underestimated. This commentary highlights the efficacy of peritoneal lavage in identifying bleeding sources and the effect of saline temperature.

Keywords: bleeding, prevention, cholecystectomy, peritoneal lavage

Introduction

Bleeding is one of the most severe complications of laparoscopy.[1] Overall, major hemorrhages happen in 0.08–0.25% of the cases, usually consequent to damage to the right hepatic artery, aorta, or vena cava during trocar introduction. These complications are not the focus of this commentary; rather, we discuss bleeding from the abdominal wall or gallbladder bed that are more frequent (2.0–4.1%).[2] There is a lack of data regarding the correlation between postoperative bleeding and the number of red cell transfusions. However, the rate of required blood transfusion after laparoscopic cholecystectomy seems to be lower than for open surgery.[1] Fatty liver degeneration, siderosis, chronic and recurrent cholecystitis, and thermal injury to the liver parenchyma seem to be related to greater postoperative bleeding risk.[3] Moreover, comorbidities such as cerebrovascular disease, previous myocardial infarction, kidney disease, heart failure, diabetes, peripheral vascular disease, and obesity should be considered bleeding risk factors. The problem of bleeding is so important that a risk scoring system has been developed based on factors recognized at hospital admission, and it could be used to assess bleeding risk.[4] The prescription of anticoagulant and antiaggregant drugs should also be adjusted according to bleeding risk.[2,4]

Intraoperative details

Several intraoperative factors should be taken into account to prevent bleeding and biliary damage due to an unclear field.[5] Although infrequent, injury to the hepatic pedicle vessels could occur and be life-threatening. Anatomical variants of the cystic artery[6] and modifications due to acute inflammation are other causes of bleeding.[5] Surgeons must pay attention during the dissection of Calot's triangle because it allows identification of the vessels that supply blood to gallbladder.

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DovePress
http://doi.org/10.2147/JBM.S215438

Finally, portal hypertension, altered coagulation, and regeneration nodules in the gallbladder bed are responsible for hemorrhage in patients with liver cirrhosis.[5]

Three rules should be followed to achieve good hemostasis. First, blood and clots should be removed to obtain the cleanest field possible.[5] Second, clipping and cauterization should only be used when the surgeon has identified the vessel and the source of bleeding.[3] Third, conversion to open surgery should be considered when complete hemostasis is not achievable after utilizing all the laparoscopic methods.[5]

The effect of peritoneal lavage on vessels

Peritoneal lavage with sterile water was introduced in 1905 by Joseph Price. In 1911, Torek reported a reduction in mortality rate from 100% to 30% when saline lavage was used.[7] Irrigation and hemostasis are two important steps of cholecystectomy.[8] Washing the liver bed with sterile saline is essential to remove body fluids[7] such as blood, clots, or bile in case of gallbladder perforation. A clean operating field makes easier to identify bleeding sources. In patients with stable hemodynamics, peritoneal lavage enables both identification of the source of bleeding and treatment with a laparoscopic approach.[9,10]

Peritoneal lavage also acts on vessels. In general, vasodilation occurs in superficial blood vessels at high temperatures to facilitate heat dispersal.[11] Conversely, vasoconstriction is induced by cold to protect from heat loss, but it is usually followed by vasodilatation, which has the aim of avoiding cold-induced damage.[12] Moreover, hyperactive tissues produce high levels of CO_2 and waste, and this stimulates vasodilatation and increased blood flow; the opposite process happens in hypoactive tissues. Although autoregulation of blood flow to tissues is strictly dependent on their activity, it seems to be influenced by temperature.[13] For example, transient receptor potential ankyrin-1 (TRPA1) is one of the channels that senses cold (<17°C). In a murine model, TRPA1 induces cold-induced vasoconstriction, which peaks 2 mins after cold exposure and determines the reduction in blood flow. In the subsequent "restorative phase," the blood flow returns to normal levels.[14] Conversely, high temperature could be responsible for tissue damage; 43°C is the cut-off in human cells.[15] Above this temperature, irreversible damage occurs and leads to cell death.[16]

From these observations, it is clear how the use of low- or high-temperature washing saline can be harmful. On one hand, cold saline can trigger the vasoconstriction of partially dissected vessels, giving us the false impression of complete hemostasis. Then, the following restorative phase could lead to bleeding at the end of surgery. Based on the results obtained by Aubdool et al,[14] we can deduce that observation of the hepatic bed should last at least 2 mins after the peritoneal wash. This allows sufficient time to induce the vasodilatation reflex in the vessels contracted by cold water. On the other hand, hot water (>43°C) can cause serious injuries. For these reasons, using fluids with temperature slightly higher than 37°C is advisable.[17] The temperature should not be assessed with a gloved hand; more precise methods should be used.[18]

Conclusion

Irrigation ensures a clean field that is essential to avoid injuries and precisely identify sources of bleeding. Peritoneal lavage is one of the available tools that a surgeon can easily use to identify and manage intraoperative bleeding, reducing the risk of delayed blood loss. It is mandatory to apply saline heated to the correct temperature to achieve good hemostasis that is safe for the patient and surgeon.

Disclosure

The authors declare no conflicts of interest in this work.

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