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A Simple Technique to Improve Visibility and Illumination During Robotic Surgery

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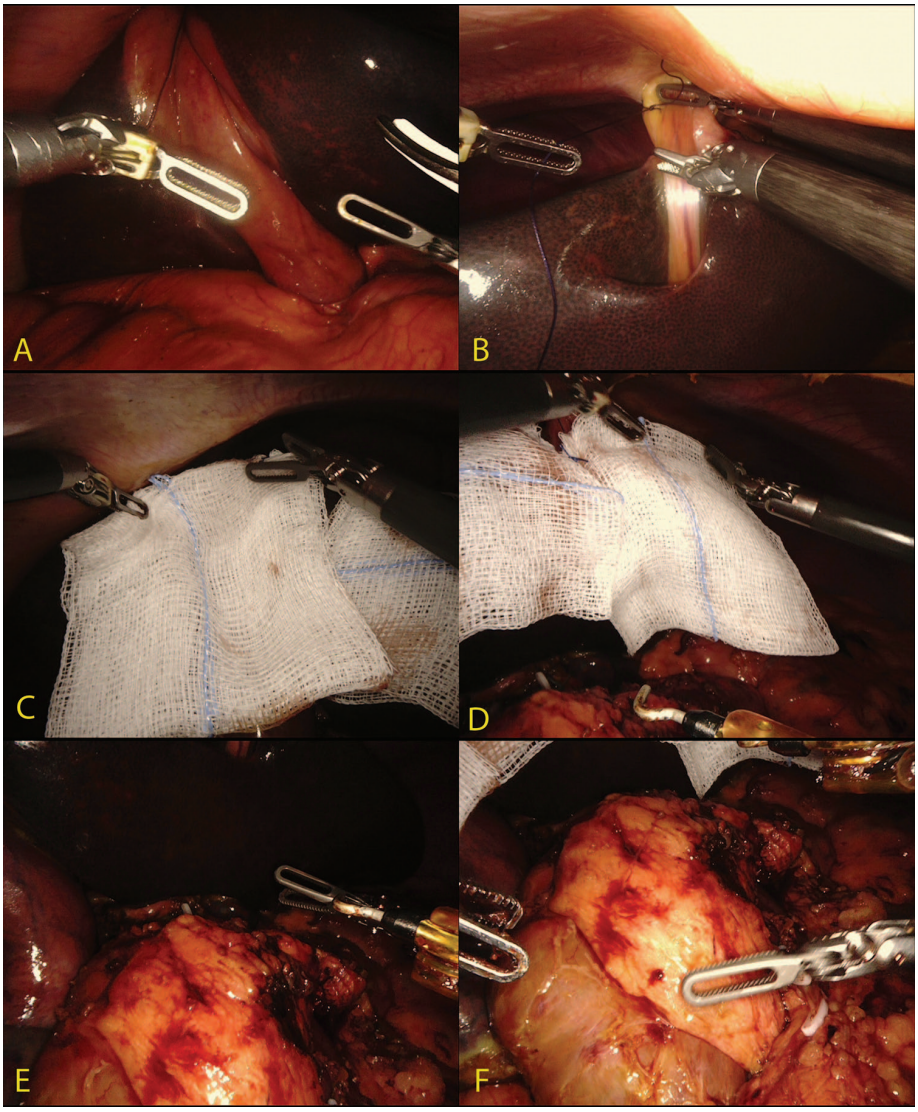

Figure 1. A simple technique to improve visibility and illumination during robotic surgery. (A) The liver is sutured to the abdominal wall by the gallbladder. (B) The round ligament is sutured to the abdominal wall. (C) The dark right liver is covered by clean white gauzes. (D) The left liver is covered by clean white gauzes. (E) Intraoperative view before the technique shows a dark background with high level of light absorption by the dark liver. (F) Intraoperative view after the technique shows a brighter background with high level of light reflection, improving visibility of the surgical field.

Dear Editors,

Effective illumination of the surgical field is one of the most important prerequisites for a safe and efficient surgery.[1] In the minimally invasive setting, such as laparoscopy and robotic surgery, the source of light is provided by a small telescope, often 10 mm for laparoscopy and 12 mm for robotic surgery. The latest robotic platform uses an even smaller light source, a built-in 8-mm camera. Although usually enough to provide adequate illumination, it may be encumbered if a large quantity of blood is accumulated in the surgical field. This occurs due to absorption of the light by the dark color of coagulated blood. This is a common knowledge and most surgeons with experience in minimally invasive surgery deal with this on daily basis. Precise hemostasis and tissue manipulation along continuous aspiration of blood are essential for a clear operative field.

High light intensity is required to obtain the correct color of the surgical image, but this may be limited by the narrow caliber of the telescope. Recently, with the introduction of the newest robotic platform (da Vinci Xi robotic platform; Intuitive Surgical Inc, Sunnyvale, CA) that uses an 8-mm camera, we noted that in some circumstances that light source was not enough to provide adequate visualization of the surgical field. Differently from the presence of blood, which is a common but reversible cause of darker image, we noted a marked absorption of the light from the liver, especially in those cases with cholestasis. This can be seen at the beginning of the procedure, before any dissection. One way to overcome this lack of illumination is the use of an ancillary light source to augment visibility, such as previously described by Asti et al.[1] However, their tool is not yet available.

In order to improve illumination and visibility during robotic surgery, we have used a simple trick. The liver is sutured to the abdominal wall by the gallbladder (if it is present and about to be removed) and round ligament. The next step is to cover the liver with clean gauzes in order to replace the liver background (dark) to a white and brighter background (Figure 1).

The amount of light reflected depends on the smoothness and color of the surface. White and smooth surface has the better light reflection. Also, the angle at which the light strikes the object influences the amount reflected. If the light strikes the surface of the white background formed by the combined gauzes at a low angle, reflection is favored. We use the knowledge of light absorption and reflection in our favor. Covering the dark liver, we remove the light absorption that reduce the illumination of the surgical field. Replacing the dark background by a white and smooth surface using 3 or 4 gauzes can immediately improve surgical visibility.

This simple technique is routinely used in our robotic surgical procedures whenever necessary. We recommend the use of this technique to improve visibility and illumination during minimally invasive surgeries when a dark surgical field cannot be improved otherwise.

Authors' Note

Any underlying research materials related to our article are available on request at the email of the corresponding author.

Author Contributions

All authors equally contributed to acquisition of data, and/or analysis and interpretation of data.
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