Technical note

Xiphoidectomy

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Abstract

Complex surgical procedures in the upper abdomen require clear exposure. To improve exposure xiphoidectomy is indicated; however, in the past there was an extensive time commitment and unpredictable bleeding. We describe a rapid and bloodless approach to xiphoidectomy, utilizing a self-retaining retractor, controlled osteotomy, and complete removal to the xiphisternal junction. The xiphoid bone is dissected with high-voltage electrosurgery, denatured, and resected completely. Bleeding points are easily controlled with electrocoagulation. This procedure allows optimal exposure to the most superior aspect of the abdominal cavity.

Key words Gastrectomy · Cyto-reductive surgery · Esophagus · Peritonectomy · Self-retaining retractor

Introduction

Gastrointestinal cancer surgery may require clear exposure of the undersurface of the right and left hemidiaphragms, the esophageal hiatus, and the hepatic veins. One requirement for clear exposure of this area is the self-retaining retractor. Another adjunct to atraumatic dissection and reconstruction in this most superior aspect of the abdomen is xiphoidectomy. In the past this procedure was associated with an extensive time commitment and unpredictable bleeding from the branches of the internal mammary artery [1,2]. These bleeding points represent an arterial and venous plexus that joins the internal mammary vessels with the superior deep epigastric vessels.

This article describes a rapid and bloodless approach to xiphoidectomy. It will be of use to the surgeon performing gastric cancer surgery, cyto-reductive surgery with subphrenic peritonectomy, and major hepatic resections with ligation of a right, middle, or left hepatic vein.

Procedure

In order to perform a xiphoidectomy with a midline incision, this incision must be continued superiorly to the base of the xiphoid process. The epigastric fat pad is released from the posterior rectus sheath and a self-retaining retractor is used to widely expose the xiphoid bone and its attachments to the sternum.

Using electrosurgical dissection and progressive advancement of the self-retaining retractor (Thompson Surgical Instruments, Traverse City, MI, USA), the xiphoid bone is progressively exposed by releasing it from the anterior and posterior rectus sheath (Fig. 1). The dissection is performed with electrocoagulation current on high voltage in order to control the numerous arterial bleeding points that are just lateral to the limits of the xiphoid bone.

After the xiphoid is clearly exposed back to its origins on the sternum, a transverse line of high-voltage cutting electrosurgery marks the portion of the xiphoid which is to be removed (Fig. 2). The electrosurgical current denatures the protein within the bone at the base of the xiphoid so the bone is fractured precisely with minimal downward pressure at this line.

The xiphoid is released from the sternum and its base secured with a Kocher clamp (Fig. 3). The broad attachments of the diaphragm muscle to the xiphoid are divided as it is peeled away from the underlying tissues. Care is taken to dissect superior to the diaphragm muscle to avoid entrance into the left pleural space or the pericardial space.

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Fig. 1. High midline abdominal incision with anterior exposure of the xiphoid bone. Bleeding points on the surface of the bone are electrocoagulated

Fig. 2. Electrosurgical demarcation of xiphoidectomy at the xiphisternal junction. High-voltage cutting electrosurgery denatures the proteins within the bone

Discussion

Xiphoidectomy adds greatly to the exposure required with upper abdominal surgery. This improved exposure does not increase postoperative pain and does not in any way jeopardize the patient's full recovery. The xiphoid bone is expendable, without any loss of function.

The major objection to xiphoidectomy has been the blood loss, both acutely and chronically, that accompanies the operative procedure. Also, the long time required with the use of bone instruments to remove the xiphoid bone in a piecemeal fashion has discouraged surgeons from its complete removal. Using a self-retaining retractor to expose the base of the xiphoid, using high-voltage coagulation electrosurgery to achieve hemostasis, and using high-voltage cutting electrosurgery to define the line of transection at the base of

Fig. 3. Controlled bloodless fracture of the xiphisternal junction and traction on the xiphoid to peel it away from muscular attachments to the diaphragm

the xiphoid where it inserts into the sternum, allows for a rapid and bloodless removal of this structure.

Other surgeons have commented on the difficulty that occurs with a requirement for wide exposure of the extreme superior aspect of the abdominal cavity. Didolkar and Vickers [2] suggested a perixiphoid extension separating the seventh rib from the xiphoid process and lower sternum. Kitamura and colleagues [3] suggested that this exposure is better obtained through resection of the xiphoid process, leaving the seventh costal cartilage intact. They suggested that the hemostasis could be achieved through the use of bone wax. In their experience, inadequate hemostasis of the transected bone led to a high incidence of infection of the upper abdominal incision. Chuter and colleagues [1] defined the rich blood supply to this region through the internal mammary artery and the superior deep epigastric arcade.

In this report we show that preliminary electrosurgical demarcation of the transverse osteotomy site allows for two improvements in xiphoidectomy technique. First, the line of transection at the xiphisternal junction is well defined and well controlled. Electrocoagulation of the proteins within the xiphoid bone at a defined point allows for a uniform fracture of the xiphisternal junction. Second, there is a complete absence of bleeding from the venous plexus surrounding the xiphoid and from the exposed bone marrow. With a dry field, the exposure is markedly improved and the problem with postoperative bleeding (ooze from the marrow) and subsequent infection is avoided. Bone wax is never necessary.

The xiphoid, especially in the male patient, interferes with a clear visualization of the esophago-gastric junction. Resection of the xiphoid bone along with removal of the triangular ligament of the left lateral segment of

the liver allows retraction of this portion of the liver from left to right. These maneuvers facilitate full visualization of the esophageal hiatus for safe reconstruction of the patient following total gastrectomy.

In summary, this technique for xiphoidectomy is an improvement over prior techniques. With an extension of the skin incision superiorly and with a self-retaining retractor one can visualize the xiphisternal junction. With this clear exposure, bleeding points of the surrounding vessels are controlled with electrocoagulation. Electrosurgical denaturation of bone proteins insures a defined and bloodless fracture at this junction. The

result is a precise xiphoidectomy with clear exposure of the undersurface of the diaphragm at the level of the pericardial sac.

References

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