Validating the Use of Rectus Muscle Fragment Welding to Control Presacral Bleeding During Rectal Mobilization

Eduardo Ayuste Jr. and Manuel Francisco T. Roxas, Division of Colorectal Surgery, Department of Surgery, University of the Philippines–Philippine General Hospital Medical Center, Manila, Philippines.

The incidence of presacral bleeding during rectal mobilization is low, but such bleeding may be massive and even fatal. Haemostasis can be difficult to achieve using conventional methods because of the complex interlacing of the venous network at the sacral periosteum. Historically, pelvic packing and metallic thumbtacks have been the more commonly used methods in our institution. However, the need for repeat surgery to remove the packs and the difficulties encountered in tack application have forced us to explore other methods. In 1994, the procedure termed muscle fragment welding, which uses electrocautery through a rectus muscle fragment, was introduced to control presacral bleeding. From January 1999 to February 2002, six of 416 patients undergoing pelvic surgery in our institution developed massive presacral haemorrhage and, therefore, this technique was used. Haemostasis was immediate and permanent. No major untoward postoperative events such as re-bleeding or infection were noted. One case developed a second-degree burn in the right elbow due to a misplaced ground conduction plate. Rectus muscle fragment welding is, in our experience, an effective and practical method of controlling presacral haemorrhage. [Asian J Surg 2004;27(1):18–21]

Introduction

The presacral plexus, which lies posterior to the fascia propria of the rectum and just below the presacral fascia, is usually exposed during mobilization of the rectum from its sacral attachments. Inadvertent entry into the presacral fascia may result in significant bleeding from this venous plexus and from sacral basivertebral veins.

The incidence of major presacral haemorrhage is low, but the haemorrhage may be massive and even fatal. Haemostasis can be difficult to achieve because of the complex interlacing of the venous network at the sacral periosteum. When bleeding is encountered in this region, attempts at ligation, electrocautery and application of thrombogenic agents are usually futile.

Reported methods for controlling presacral bleeding include modified pelvic packing, Sengstaken-Blakemore tube, silastic balloon, or use of sterilized metallic thumbtacks (which may be ridged or unridged) inserted with the help of an applicator.

The technique of electrocautery through a fragment of rectus muscle pressed on the bleeding vein was first described by Xu and Lin in 1994. Harrison et al recently presented their experience with this technique in four cases, calling the procedure muscle fragment welding, a term we have adopted here in the interests of consistency and standardization. We report six cases of presacral haemorrhage successfully controlled using this method.

Patients and methods

From January 1999 to February 2002, six of 416 pelvic operations were complicated by presacral haemorrhage during rectal mobilization for carcinoma and diverticular...
disease. Patient data and the outcomes of interventions were studied.

Surgical technique
Fingertip pressure was applied directly to the bleeding vessel for control, after which a fragment of rectus muscle approximately 1 to 2 cm in diameter (Figure 1) was excised and mounted on a Kelly clamp (Figure 2). The finger was rapidly withdrawn and the fragment of rectus muscle pressed directly over the bleeding point, thereby avoiding any further bleeding. Electrocautery was applied through the Kelly clamp until the muscle sizzled, “boiled”, or was fried (Figure 3). The welding time was usually 2 minutes. Cautery strength was pegged at 50 to 60 amperes. If bleeding continued, a second fragment of muscle was applied. The charred muscle fragment was generally left in place on the sacrum, although removal did not necessarily result in re-bleeding.

Results
Patient data and intervention outcomes are summarized in the Table. All patients were female, and their ages ranged from 33 to 65 years, with a mean of 54 years. Five patients had rectal carcinoma while Patient 3 had sigmoid diverticulitis. All underwent rectal mobilization that inadvertently resulted in profuse presacral bleeding at the S3 and S4 levels.

In two cases (Patients 1 and 5), rectus muscle fragment welding caused immediate and permanent haemostasis. Two cases (Patients 4 and 6) required a second strip of muscle welding before complete haemostasis was achieved. In Patient 2, suture ligation and thumbtack application were initially attempted, with little success. Muscle fragment welding controlled the bleeding, but only after 1,500 mL of blood had already been lost. In the oldest patient (Patient 3), the surgeon initially decided to apply pelvic packs and terminate the procedure. The packs were removed 2 days later, but this resulted in intraoperative bleeding, which was subsequently controlled using muscle fragment welding; estimated total blood loss was 2,000 mL. Patients in whom other methods of haemostasis were first attempted (such as suture ligation, thumbtack application, or pelvic packing) suffered greater blood loss than patients in whom early attempts at muscle welding were made.

The only morbidity associated with the procedure occurred in Patient 4, who developed a second-degree cautery burn on her right elbow postoperatively. This was probably
due to a misplaced ground conduction plate. No other major postoperative events were noted.

**Discussion**

The source of most bleeding in the presacral area is the presacral venous plexus, the lowest portion of the anterior external vertebral plexus that is intricately interlaced with the internal venous plexus through the basivertebral veins at the third to fifth sacral vertebral bodies. The veins have no valves, so blood flows through this plexus bi-directionally. There is an inherent propensity for these veins to tear, especially when a faulty presacral plane of dissection is struck, as the adventitia is continuous and fixed to the sacral periosteum.

The most likely area of injury to the presacral veins is the lower sacrum, where Waldeyer’s fascia, which runs cephalad to sacral segments 3 and 4, is thick and may directly attach to the presacral fascia. In the six cases reported, presacral bleeding was encountered at the S3 and S4 levels.

Whenever presacral bleeding occurs, the first temporary manoeuvre is direct pressure with the finger at the point of bleeding. Measures to effect permanent haemostasis are then considered: pelvic packing, balloon tamponade, use of thumbtacks and, recently, rectus muscle fragment welding. Attempts to stop presacral bleeding with forceps, suture ligation, and even mere pelvic packing may tear the vein, resulting in further haemorrhage.

Pelvic packing effectively controls presacral bleeding. However, this requires repeat surgery to remove the packs, and cases of incomplete haemostasis may still occur. This was noted in Patient 3, where significant bleeding recurred when the packs were removed after 2 days. Furthermore, pelvic packing increases the risk of pelvic sepsis, length of hospital stay, and time to wound healing. Metallic thumbtacks were first used to control presacral bleeding by Wang et al in 1985. Several reports attest to their efficacy. Titanium thumbtacks were later developed to address concerns of tissue reaction, and an instrument for thumbtack application has been described. Metallic thumbtacks were first used in our institution in 1988. Titanium thumbtacks are not available in our setting and we use the ordinary metal thumbtacks sold in bookstores. Although we have noted no untoward postoperative events, the placement of thumbtacks has been, in some cases, difficult and unsuccessful. Ordinary metal thumbtacks tend to bend when pressed on the sacrum. Application is usually difficult at presacral levels S3 and S4 because of the normal curvature of the sacrum at this point. An applicator to help overcome this difficulty is not available. Finally, each attempt to place the thumbtack in lieu of the tamponading finger results in additional blood loss.

<table>
<thead>
<tr>
<th>Patient</th>
<th>Gender</th>
<th>Age (yr)</th>
<th>Diagnosis</th>
<th>Operation</th>
<th>Blood loss (mL)</th>
<th>Procedures used to control bleeding</th>
<th>Early postoperative condition</th>
<th>Condition on last follow-up</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>F</td>
<td>56</td>
<td>Stage III rectal carcinoma 3 cm FAV</td>
<td>APE</td>
<td>400 mL</td>
<td>Muscle welding</td>
<td>Uneventful</td>
<td>No problems at 18 months</td>
</tr>
<tr>
<td>2</td>
<td>F</td>
<td>52</td>
<td>Stage III rectal carcinoma 5 cm FAV</td>
<td>APE</td>
<td>1,500 mL</td>
<td>Suture ligation; thumbtack application; muscle welding</td>
<td>Uneventful</td>
<td>No problems at 15 months</td>
</tr>
<tr>
<td>3</td>
<td>F</td>
<td>65</td>
<td>Sigmoid diverticulitis</td>
<td>Hartmann’s procedure</td>
<td>2,000 mL</td>
<td>Pelvic packing; muscle welding</td>
<td>Uneventful</td>
<td>No problems at 6 months</td>
</tr>
<tr>
<td>4</td>
<td>F</td>
<td>60</td>
<td>Stage III rectal carcinoma 5 cm FAV</td>
<td>Stapled low anterior resection</td>
<td>400 mL</td>
<td>M muscle welding, with repeat application</td>
<td>Second-degree cauter burn in right elbow</td>
<td>No problems at 2 months</td>
</tr>
<tr>
<td>5</td>
<td>F</td>
<td>33</td>
<td>Stage III rectal carcinoma 3 cm FAV</td>
<td>APE</td>
<td>500 mL</td>
<td>Muscle welding</td>
<td>Uneventful</td>
<td>No problems at 1 month</td>
</tr>
<tr>
<td>6</td>
<td>F</td>
<td>57</td>
<td>Stage III rectal carcinoma 6 cm FAV</td>
<td>Low anterior resection</td>
<td>300 mL</td>
<td>Muscle welding, with repeat application</td>
<td>Uneventful</td>
<td>No problems at 1 month</td>
</tr>
</tbody>
</table>

FAV = from anal verge, as measured by rigid proctosigmoidoscopy; APE = abdominoperineal excision.
More recently, Braley et al described the successful use of an expandable breast implant sizer (Mentor®, Mentor Corporation, Irving, TX, USA) to tamponade presacral bleeding in one patient. The device was easily deflated and removed through the perineal wound 2 days after surgery. Such a device is not readily available in our hospital.

In our experience, presacral haemorrhage is easily controlled using electrocautery applied through a fragment of rectus muscle pressed with a clamp over the bleeding vessel. Blood loss is minimized because of continuous direct tamponade over the bleeding site, with very little manipulation. The muscle strip acts primarily as a water-containing electrode that allows conduction of energy and heat to the presacral vein. The high water content of the muscle fragment is a good electrical conduit that allows the muscle to reach boiling point (the optimum temperature for coagulation). This usually takes at least 2 minutes. The cauterized muscle fragment usually adheres to the presacral tissue as a charred coagulum. However, even if the muscle fragment falls off, further bleeding is not usually encountered as the presacral vein has also been cauterized. In cases where there is some residual bleeding, repeating the muscle welding procedure is safe and effective.

One complication noted with the procedure was second-degree cautery burns. This was due to a misplaced cautery grounding plate, an occurrence that is easily avoided by practising due diligence.

This technique has been successfully used on six patients in our institution, without any major complications. In our experience, the procedure is cheap, simple, and effective.

References