Case Report

Use of a Bakri balloon in the management of presacral hemorrhage

Blanca Segarra Vidal1,*, Raquel del Moral Rodríguez2, Anna Serra Rubert1 and Antonio Llueca Abella2

1 Multidisciplinary Unit of Abdominal Pelvic Oncologic Surgery (MUAPOS), Hospital General Universitario de Castellon, 12004, Castellon, Spain
2 Department of Gynecology, Hospital de Poniente, 04700, Almeria, Spain

*Correspondence: blancasv@icloud.com (Blanca Segarra Vidal)

DOI: 10.31083/j.jmcm.2020.04.927

This is an open access article under the CC BY 4.0 license (https://creativecommons.org/licenses/by/4.0/).

Presacral hemorrhage after pelvic surgery usually results in massive, life-threatening bleeding. It is often difficult to control this presacral hemorrhage with standard hemostasis techniques after rectal mobilization. Mobilization of the rectum is part of the daily maneuvers of most pelvic surgeons. This review shows a common cause of presacral hemorrhage and demonstrates that the Bakri tamponade balloon catheter can control massive pelvic bleeding. A comprehensive, detailed review of the pelvic anatomy and hemostasis techniques used to control presacral hemorrhage was conducted. Also, a case study illustrated the novel use of the Bakri balloon for effective hemorrhage control. The presacral venous plexus or basivertebral sacral veins may be the sources of significant hemorrhage during rectal mobilization. The Bakri balloon effectively targets them. The standard recommendation for safe posterior dissection of the rectum to prevent presacral hemorrhage is approaching the plane between the mesorectal fascia and presacral fascia. We found that the Bakri balloon tamponade effectively controlled presacral hemorrhage and offers advantages over conventional packing. Massive hemorrhage is a potential complication of pelvic surgical procedures. Surgeons should be aware of hemostasis techniques for managing acute pelvic bleeding. We believe that the Bakri balloon should be included as a treatment option.

Keywords
Hemorrhage; bleeding; packing; Bakri balloon; presacral space

1. Introduction

Massive hemorrhage from the pelvic floor is a potential complication of gynecological-obstetric and colorectal surgical procedures. A delay in control of the bleeding can lead to alterations in coagulation with consequent blood loss. A potential site of pelvic bleeding is the sacral venous plexus. Bleeding at this site is often difficult to control with standard hemostasis techniques. The steps in preventing massive pelvic hemorrhage include having a thorough understanding of the pelvic anatomy, anticipating possible risks of bleeding, and having a clear plan to deal with any surgical emergencies along with proper surgical equipment and an expert team of consultants.

When facing pelvic hemorrhage, the surgeon should determine whether the source of bleeding is venous or arterial. This will help determine the proper approach to hemostasis. Once the source of bleeding is identified, options to control it include standard pressure to the bleeding site, suture ligation, application of hemostatic agents, and proximal and distal vessel control with direct suture of large injuries to vessels. The Bakri tamponade balloon catheter is the first uterine tamponade balloon system designed specifically for the treatment of obstetric hemorrhage. However, it may also be used to control persistent, massive pelvic bleeding [1]. This device is a silicone balloon connected to a silicone catheter explicitly designed for the temporary control or reduction of postpartum uterine bleeding when conservative management is warranted. When the balloon is inflated with sterile liquid, it applies pressure to the uterine walls that may provide management of postpartum hemorrhage. As described herein, we successfully used a Bakri tamponade balloon catheter to treat presacral bleeding in a cancer patient and propose that it is an easier, faster, and more effective live-saving measure than conventional packing for the control of intractable pelvic floor hemorrhage.

2. Case presentation

A 66-year-old patient diagnosed with stage IIIC serous papillary adenocarcinoma of the fallopian tube 3 years prior to presentation had a lesion suspicious for pelvic recurrence of the adenocarcinoma with involvement of the bladder and rectum as determined using positron emission tomography/computed tomography. Diagnostic laparoscopy showed a pelvic mass in the vaginal vault fixed to the right lateral pelvic wall, bladder, and rectum and multiple carcinomatosis nodules in the pelvis. The peritoneal carcinomatosis index score was 12, and the Arbeitsgemeinschaft Gynäkologische Onkologie score was positive. The patient had several comorbidities but a good Eastern Cooperative Oncology Group performance status (0) and a history of hysterectomy with bilateral adnexectomy, knee arthroscopy, and carpal tunnel syndrome repair.

After approval of secondary cytoreduction by the multidisciplinary tumor board at Hospital General de Castellón in Castel-
In lón, Spain, the surgeon discussed the potential treatment options with the patient. The patient and the gynecologic oncology team decided to proceed with a tumor-reductive surgery and a peritoneectomy. The intraoperative findings included a tumor recurrence infiltrating the mid-distal third of the rectum and the urinary bladder at the level of the trigone. The patient underwent complete surgery consisting of a pelvic exenteration, which included resection of the rectum, urinary bladder, and tumor recurrence with the largest diameter of 10 cm. During mobilization of the rectum, hemorrhage occurred at the level of the presacral veins. Direct electrocoagulation of the bleeding vessels was attempted with a monopolar electrocautery device in spray coagulation mode. This was followed by bipolar coagulation and suture ligation without success. Given that the bleeding was not controlled and exposure of the active bleeding zone of the presacral area was limited, surgeons decided to remove the mass to improve the exposure. During this time, the patient became hemodynamically unstable, with hypotension, tachycardia, and low urinary output. The patient's blood loss at that time was estimated to be 4000 mL, and she went into hemorrhagic shock. Packing of the pelvis with placement of a Bakri balloon was then performed (Fig. 1 and 2).

The balloon, with the stopcock at the distal part of its inflation port detached, was inserted through the laparotomy incision, and the port was passed through the opened vagina using forceps. When proper tamponade position was achieved at the level of the presacral vessels, the balloon was inflated gradually up to 500 mL with a sterile normal saline solution through the reattached stopcock. Continuous traction was performed by anchoring the balloon shaft to the thigh, and the drainage port was connected to the fluid collection bag. Surgical gauze was placed around the Bakri balloon to reinforce the compression and keep the balloon in position due to the wide pelvic resection to ensure control of bleeding and prevent movement of the balloon in the pelvis. The bleeding was then controlled. A ureterostomy and colostomy were performed afterward, and the patient was administered intravenous antibiotics with piperacillin-tazobactam 4 g/0.5 g every 8 hours.

After stabilization of the patient in the intensive care unit, she underwent reoperation 48 hours later. With removal of the pelvic packing, reduction of the Bakri balloon compression, and removal of surgical compresses, bleeding persisted in the S3-S4 area. This time, the bleeding was controlled by suturing several presacral veins that converged in the area of the hemorrhage and applying a fibrin sealant patch (TACHOSIL; Takeda Canada Inc., Toronto, Ontario, Canada). Next, a Bricker urostomy and end-to-end ileoileal anastomosis were performed. The patient recovered for 16 days in the intensive care unit and then was discharged home 26 days after her reoperation.

3. Discussion

The presacral space includes areolar connective tissue, branches of the sacral plexus, the middle sacral vessels, iliolumbar and middle hemorrhoids, and the associated lymphatics. The presacral venous plexus may be the source of significant hemorrhage during mobilization of the rectum. The vascular anatomy of the sacral venous plexus is complex. It constitutes a wide network of veins primarily formed by the anastomosis between the medial and lateral sacral veins on the anterior sacral surface. This plexus receives contributions from the lumbar veins of the posterior abdominal wall and the basivertebral veins that pass through the sacral foramen. The standard recommendation for safely performing a posterior dissection of the rectum is to approach the plane between the fascia proper of the rectum (mesorectal fascia) and the presacral fascia [2]. The presacral fascia, which is tightly attached to the surface of the sacrum, covers the sacral plexus, pudendal nerve, sympathetic sacrum, and presacral venous plexus. The adventitia of the presacral veins is intimately linked with the adjacent peristeum of the sacral foramen and can be easily lacerated during pelvic surgeries. The presacral fascia joins the superior sacrectal ligament over the left primitive iliac vein. Below this vein, the presacral fascia continues with Waldeyer's fascia. The site with the highest risk of vessel injury in this lower part of the sacrum is where Waldeyer's fascia is thinnest and joins directly to the presacral fascia. When injured, the veins at this site may be the source of additional hemorrhage.

Waldeyer's fascia arises from the presacral fascia and spreads caudally to join the mesorectal parietal fascia above the anorectal junction. It has two components: one posteriorly covering the
orrhage, multiple techniques can be used to control this life-
on it, are essential. Cancer, the gain of access to this space and keeping the dissection
tum and the mesorectal parietal fascia. During surgery of rectal
gastric nerve fascia)\[3\]. Another anterior avascular space exists which is
presacral vessels and another more superficially covering the hy-
pogastric and sacral splanchnic nerves (referred to as the prehy-
pogastric and sacral splanchnic nerves (referred to as the prehy-
parietal vessels and another more superficially covering the hy-
the use of these materials does
not carry a risk of infection or secondary complications of for-
eign bodies because they are absorbable\[12\]. Also, these ma-
terials can be used in locations with irregular surfaces, such as the
sacrum. Oxidized cellulose is also used in combination with
cyanoacrylate glue similarly to that described by Chen et al.\[13\]
and Zhang et al.\[14\] who controlled massive presacral bleeding in
five patients using an absorbable hemostatic gauze made of chem-
ically treated cellulose and spread with medical adhesive (alpha-
cyanoacrylate) compressing the blood vessels. Another successful
approach to achieving hemostasis has been the use of cyanoacry-
late glue\[15\]. Others have proposed the use of bone cement (poly-
methylmethacrylate) for orthopedic procedures\[16\] and bone wax
\[17\].

Researchers have evaluated electrocoagulation and suture
methods for hemostasis in multiple studies. Several variations of
these techniques have emerged that have proven effective, such as
bipolar coagulation in spray mode with continuous aspiration. A
unique approach is indirect coagulation techniques using muscle
fragments. This technique consists of resecting a fragment of the
anterior abdominal rectus muscle (\(\approx 2 \times 2 \) cm), transferring it to
the damaged presacral area, and pressing on the zone of bleed-
ing by applying coagulation with monopolar energy using a long
dissection forceps at maximum power until achieving optimal co-
agulation. In 1994, Xu and Lin\[18\] reported on the use of this
technique in 11 patients with presacral hemorrhage. Of note is
that if the fragment of the anterior abdominal rectus muscle does
not remain attached to the bone, it does not imply failure of the

\[18\] reported on the use of this
technique in 11 patients with presacral hemorrhage. Of note is
that if the fragment of the anterior abdominal rectus muscle does
not remain attached to the bone, it does not imply failure of the
technique\[19\]. Jiang et al.\[20\] demonstrated another simple, ef-
effective suture technique consisting of suturing in circles by ligating
the presacral veins around the bleeding site while applying contin-
uous pressure. The authors highlighted that the tissues that must
be included in the suture ligation are the presacral fascia, presacral
veins, and deep connective tissue.

Foley catheter-condom as a pelvic pressure tampon tool, may
be another simple and effective method that can easily control pelvis
bleeding. A balloon tamponade tool is formed with a Foley
catheter and a condom, that it is a material straightforward to get
in any medical center. The tampon may be inflated up to 2200 mL
until there is no need to use additional gauzes because it can be in-
flated to much larger volumes than the Bakri balloon. Moreover,
the condom volume could be decreased according to the urine out-
put, as the Bakri balloon\[21\].

Surgical packing should not be seen as a “bailout” technique
for managing hemorrhages. Instead, it is a specific skill that, when
used thoughtfully, complements the other surgical skills essential
for managing massive bleeding. Therefore, pelvic packing should
be part of the armamentarium available to control bleeding in in-
accessible surgical areas.

The bakri tamponade balloon catheter is the first uterine tam-
ponade balloon system designed specifically for the treatment of
obstetric hemorrhage\[22\]. It consists of a silicone balloon with

<table>
<thead>
<tr>
<th>Packing techniques</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traditional pelvic packing</td>
</tr>
<tr>
<td>Silicone rubber (SILASTIC) tissue expander</td>
</tr>
<tr>
<td>Perineal Sengstaken-Blakemore tube</td>
</tr>
<tr>
<td>Inflatable sterile saline bag</td>
</tr>
<tr>
<td>Breast implant sizer</td>
</tr>
<tr>
<td>Muscle tamponade</td>
</tr>
<tr>
<td>Foley catheter-condom balloon tamponade</td>
</tr>
<tr>
<td>Bakri tamponade balloon</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tacking techniques</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metallic thumbtacks</td>
</tr>
<tr>
<td>Topical hemostatic agents</td>
</tr>
<tr>
<td>Hemostatic matrix and absorbable hemostat</td>
</tr>
<tr>
<td>Oxidized cellulose and cyanoacrylate glue</td>
</tr>
<tr>
<td>Bone cement</td>
</tr>
<tr>
<td>Bone wax</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Direct/indirect electrocoagulation and suture</th>
</tr>
</thead>
<tbody>
<tr>
<td>Muscle fragment welding</td>
</tr>
<tr>
<td>Spray electrocautery</td>
</tr>
<tr>
<td>Argon beam coagulation</td>
</tr>
<tr>
<td>Bipolar coagulation</td>
</tr>
<tr>
<td>Circular suture ligation</td>
</tr>
</tbody>
</table>

Table 1. Hemostasis techniques used for presacral hemorrhage.
Bakri balloon tamponade is one of several strategies to control presacral hemorrhage (Table 1). It compresses the underlying sponges over the bleeding area using vaginal traction, thereby efficiently transferring the pressure to all surfaces of the surgical region at the same rate. It offers the potential advantage of vaginal removal without the need for reoperation after confirmation that the hemorrhage has stopped. The lacerated area responsible for the hemorrhage may be assessed using gradual balloon deflation. The balloon adapts to the configuration of the uterine cavity to tamponade uterine bleeding. The central lumen of the catheter allows sponges over the bleeding area using vaginal traction, thereby efficiently transferring the pressure to all surfaces of the surgical region at the same rate. It offers the potential advantage of vaginal removal without the need for reoperation after confirmation that the hemorrhage has stopped. The lacerated area responsible for the hemorrhage may be assessed using gradual balloon deflation. The balloon pressure over the bleeding surface may be modified using external weight and/or grade of filling if complete hemostasis has yet to be achieved. Furthermore, the use of a Bakri balloon may prevent abdominal drainage because it also serves as a drain (Table 2). The balloon is placed in the presacral space by passing it inflation port first through the laparotomy or vaginal vault. Next, the balloon must be filled with sterile saline through the vaginal canal until the base of the balloon contacts the vaginal vault. Lastly, the drainage port is connected to a fluid collection bag to monitor hemostasis.

In conclusion, the Bakri balloon may be a treatment option for patients with severe pelvic hemorrhage. The surgeon should always have a clear, definitive plan for the management of acute pelvic bleeding and be alert to the fact that a multidisciplinary approach using the expertise of surgeons, anesthesiologists, and intensive care specialists must be used to help prevent severe hemodynamic instability and, potentially, hemorrhagic shock.

Table 2. Differences between conventional packing and the Bakri tamponade balloon.

<table>
<thead>
<tr>
<th></th>
<th>Conventional packing</th>
<th>Bakri balloon</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reintervention</td>
<td>No reintervention</td>
<td>Vaginal withdrawal</td>
</tr>
<tr>
<td>Withdrawal: yes or no</td>
<td></td>
<td>Vaginal withdrawal</td>
</tr>
<tr>
<td>Nonmodifiable pressure</td>
<td>Gradual pressure via external weight and/or grade of filling</td>
<td>Built-in drain</td>
</tr>
<tr>
<td>Abdominal drainage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Risk of sepsis</td>
<td>Gradual deflation, possible re-evaluation</td>
<td>--</td>
</tr>
<tr>
<td>Dehiscence predisposition if recent anastomosis</td>
<td></td>
<td>--</td>
</tr>
</tbody>
</table>

Note: recurrence of hemorrhage is possible after both procedures.

Funding
This work was supported by the Fundación Alfonso Martín Escudero, Madrid, Spain.

Ethics approval and consent to participate
The patient gave their informed consent for participated in this case study. The study was conducted in accordance with the Declaration of Helsinki.

Acknowledgements
The authors thank the Research Medical Library at The University of Texas MD Anderson Cancer Center for their professional language editing of the manuscript.

Conflicts of interest
The authors have no conflicts of interest to disclose.

Submitted: September 27, 2020
Accepted: November 10, 2020
Published: December 20, 2020

References
[10] van der Vurst TJ, Bodegom ME, Rakic S. Tamponade of presacral...


