Pelvic exenteration (PE) is an ultraradical surgery involving the en bloc resection of the pelvic organs, including the internal reproductive organs, the distal urinary tract (ureters, bladder, and urethra), and/or the anorectum. It is mainly applied as a salvage surgery for recurrent gynecologic tumors of any origin (vulva, vagina, cervix, uterus, and also ovary). The morbidity postprocedure is higher than 50% and is related mainly to the urinary and digestive diversion and the reconstructive surgery complications. Global mortality varies from 0 to 9%, depending on the study.
The purposes of this study were to review our single-institution experience in PE for gynecologic malignancy and to define the best patients that could benefit from this type of surgery.

MATERIAL AND METHODS

After institutional review board approval, a retrospective review of the medical charts of patients who underwent PE at La Paz University Hospital from January 2008 to June 2014 was carried out. Ten patients underwent anterior (APE), posterior (PPE), or total PE (TPE) for gynecologic malignancies. All cases were evaluated in a multidisciplinary committee integrated by gynecologic oncologists, radiotherapist, medical oncologists, and pathologist. Pelvic exenteration was performed with curative intend in all cases. Seven of the 10 patients were referred to our center for surgical rescue from other gynecology departments in the country. Follow-up information of patients from these departments was obtained by contacting with their gynecologic oncology teams.

Preoperative studies included blood tests, tumor markers, abdominal-pelvic magnetic resonance imaging, and, in some cases, computed tomographic (CT) scan. Positron emission tomography–CT was performed additionally in our center in all patients. No patient showed signs of distant metastasis. In some cases, cystoscopy and/or proctoscopy was performed.

Each PE was performed and directed by the gynecologic oncology team, in collaboration with urology, gastrointestinal surgery, and plastic surgery departments. Surgical technique was performed in 3 stages: explorative, ablative, and reconstructive. First, the explorative stage was performed with a diagnostic laparoscopic abdominopelvic exploration to ensure that the tumor was limited to the pelvis and no peritoneal disease was present; if it was the case, a midline laparotomy was conducted, except in 1 patient whose procedure was completed laparoscopically. Once the abdomen was open, a profound pelvic exploration was conducted; if there was a high probability of surgical free margins, the ablative procedure was performed. During the ablative procedure, if free margins seemed uncertain, biopsies were taken and sent for frozen section. After the surgical specimen was extracted, pelvic reconstruction was conducted using different techniques, depending on the patient’s preference and physical possibilities.

Pelvic exenteration was classified as either APE, PPE, or TPE. Anterior PE consisted of the removal of the reproductive tract and bladder. Posterior PE consisted of the removal of the reproductive tract and rectosigmoid colon. Total PE consisted of the removal of the bladder, reproductive tract, and rectosigmoid colon. Regarding the level of pelvic visceral, PE can be subclassified as supralevator (above the levator muscle), infralevator (preservation or resection of the levator muscle), and vulvectomy (extension of resection of the urogenital diaphragm).

Patients were admitted to the intensive care unit for at least 48 hours, and then transferred to the regular gynecologic ward. All perioperative details and postoperative complications were recorded. Postoperative complications were classified as early complications (those that occurred in

| TABLE 1. Resumed main characteristics of PEs performed |  |
|---|---|---|---|---|---|---|---|---|---|---|
| Age at First Diagnosis, y | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Tumor Type | Endometrium | Ovary | Cervix | Vagina | Endometrium | Endometrium | Cervix | Vagina | Vulva | Leiomyosarcoma |
| Histologic Type | Adenocarcinoma | Serous | Epidermoid | Sarcoma | Endometrium | Epidermoid | Epidermoid | Epidermoid | Leiomyosarcoma | Epidermoid |
| Histologic Grade | 1 | 2 | 2 | 3 | 4 | 4 | 4 | 4 | 4 | 5 |
| Primary Treatment | S + RT | S + CH | S + RT | S | S + RT + CH | S + RT + CH | S | S + CH | S | S + CH |
| Time to Recurrence, mo | 32 | 84 | 204 | 7 | 17 | 17 | 7 | 7 | 30 | 53 |
| Time to PE, mo | 1.5 | 1.5 | 24 | 24 | 5 | 5 | 2 | 12 | 7.8 | 7 |
| Time to Recurrence, cm | 3.7 | 1.8 | 5 | 10.5 | 1 | 1.5 | 1.5 | 1 | 2.8 | 10.5 |
| Size of Recurrence, cm | 1.8 | 1 | 5 | 7.8 | 1 | 1.5 | 1.5 | 1 | 2.8 | 10.5 |
| Time to PE, mo | AWD | AWD | AWD | AWD | AWD | AWD | AWD | AWD | AWD | AWD |
| Time to Recurrence, cm | AWD | AWD | AWD | AWD | AWD | AWD | AWD | AWD | AWD | AWD |
| Type of PE | APE | TPE | TPE | TPE | TPE | TPE | TPE | TPE | TPE | TPE |
| Actual Status | AWD | AWD | AWD | AWD | AWD | AWD | AWD | AWD | AWD | AWD |
| Follow-up Time, mo | 69 | 28 | 15 | 1.77 | 10 | 16 | 11 | 12 | 11 | 6 |

ANED, alive with no evidence of disease; AWD, alive with disease; DOD, dead of disease; DOOC, dead of other causes; CH, chemotherapy; RT, radiotherapy; S, surgery.
the first 30 days after surgery) and late complications (those that occurred after the first 30 days).

Results have been described by median and range. No contrast of hypotheses was carried out because of the lack of cases for comparisons.

RESULTS

Among the 10 patients reviewed, 9 patients presented with recurrent gynecologic tumors, and 1 patient had cervical cancer stage IVA. Pelvic exenteration was performed for various gynecologic tumors: 3 patients presented with cervical cancer, 2 with endometrial cancer, 2 with vaginal cancer, 1 with vulvar cancer, 1 with ovary cancer, and 1 with leiomyosarcoma. Histologic characteristics are described in Table 1.

Median age at primary tumor diagnosis was 53 years (ranged from 27 to 72 years). Median age at PE was 54 years (ranged from 43 to 73 years). Median time from primary diagnoses to relapse was 24 months (ranged from 7 to 204 months). All patients had received previous treatments: 2 patients had surgery; 2 patients had surgery and radiotherapy; 2 patients had surgery and chemotherapy; 1 patient had surgery, radiotherapy, and chemotherapy; 2 patients had radiotherapy exclusively; and 1 patient had neoadjuvant chemotherapy (NACH). Median tumor size was 4.6 cm at PE (ranged from 1.8 to 10.5 cm).

One patient received NACH and presented with a 9-cm cervical tumor, stage IVA, with ureterovaginal and rectovaginal fistulas, and affection of the right-side pelvic wall. No metastatic disease was found in the positron emission tomography–CT. After 3 cycles of chemotherapy, consisting of taxol 175 mg/m² and cisplatin 50 mg/m², the size of the tumor decreased to 5 cm, with no wall invasion, and it was decided to perform TPE with curative intend. The patient received postoperative radiotherapy.

One patient underwent APE; 1 patient, PPE; and 8 patients, TPE. Four patients underwent supraelevator PE and the other 6 patients underwent infralevator PE.

All patients had some form of concomitant reconstructive operation. Urinary diversion was performed in all TPEs and APEs with ileal conduits, Bricker type, placed in the right side of the abdomen. Permanent colostomy in the left side of the abdominal wall was performed when PPE or TPE was conducted. Perineum reconstruction was performed in the 6 patients who underwent infralevator PE. In 2 patients, neovagina reconstruction was conducted, both of them with a gracilis myocutaneous flap (Figs. 1 and 2). In 2 patients, perineum reconstruction was performed with myocutaneous flaps, one with a rectus abdominis myocutaneous flap and other with a gracilis myocutaneous flap. In 2 patients, perineum reconstruction was conducted with a biological mesh. Lymph node dissection was performed in 6 patients, resecting para-aortic, pelvic, inguinal, or mesorectal lymph nodes, depending on the tumor type and prior lymph node dissection. Only 2 patients had positive nodes in the final histologic report, being localized in the inguinal and pericolic region. Laterally extended endopelvic resection (LEER) was performed in 1 patient who presented with affected margins in the intraoperative frozen section. One patient had positive margins, and one had close margins at less than 1 mm in the definitive pathology report.

Mean time of surgery was 545 minutes (ranged from 335 to 800 minutes). Eight patients required blood transfusions during the surgical procedure. Mean hospital stay was 26.2 days (ranged from 11 to 54 days).

There was no postoperative mortality. Eight patients presented with early complications. Five patients presented with local or systemic infections. Two patients presented with wound infections and were treated with wide-spectrum antibiotics. The other 3 patients presented with signs and symptoms of sepsis, 1 patient presented with an intestinal perforation requiring surgery to repair it, and the other 2 patients presented with complicated pyelonephritis.

In addition, 5 patients presented with urinary diversion–related complications, 3 required repositioning of the ureteral pig tail as a consequence of ureteral obstruction, and 1 required a temporary left nephrostomy due to the presence of a ureteral leak. The other 2 patients presented with complicated pyelonephritis, one of them as a consequence of a ureteral obstruction.

Two patients presented with digestive diversion complications, both of them with paralytic ileus. One was treated with conservative measures, and the other required an ileostomy.

Three patients presented with reconstructive surgery complications. One patient required closure of the neovagina 48 hours after surgery, as a consequence of necrosis of the gracilis flap. One patient underwent abdominal wall repair because of an abdominal evertion. One patient presented with an asymptomatic partial thrombosis of the left hypogastric vein. In total, 7 patients were reoperated after PE.
Regarding late complications, we identified 8 events. One patient with undifferentiated sarcoma died of sepsis 54 days after surgery. One patient developed multiple abdominal abscesses 6 months after PE and was treated with intravenous wide-spectrum antibiotics. One patient presented with an intestinal obstruction 4 months after PE, requiring intestinal resection. Three patients presented with late urinary infections. One patient presented with acute peritonitis caused by a rectovaginal fistula. One patient underwent surgery to repair an enterocutaneous fistula developed 9 months after PE.

Median follow-up was 14 months (ranged from 5 to 69 months). Seven patients recurred, with a median time to recurrence of 12 months (ranged from 7 to 36 months). Four patients presented with pelvic recurrence, and 3 patients presented with metastatic dissemination. Three patients died of disease 12, 15, and 28 months after PE. Four patients remain alive with disease 10, 14, 19, and 69 months after PE. Two patients are currently disease-free, with a follow-up time of 6 and 11 months, respectively.

Among the 2 patients who presented with lymph node infiltration, one recurred 8 months after TPE and the other is free of disease 6 months after TPE. Among the 2 patients in which free surgical margins were not obtained in the definitive pathological report, one presented with close margins, recurring 11 months after PE, and the other presented with positive margins, recurring 7 months after PE.

DISCUSSION

Pelvic exenteration could be the only potentially curative option for selected patients with recurrent or persistent gynecologic tumors. A complete resection with free margins should be the primary goal of PE. Despite improvement in surgical and reconstructive techniques, PE continues to be an invasive surgery with high morbidity and questionable results.

The various improvements in perioperative management and reconstruction techniques have been the determinant factors in lowering the morbidity and mortality associated to PE, currently presenting with a morbidity rate of 50% and a mortality rate less than 5%. Many reconstructive techniques have been described to reestablish pelvic functions lost by PE.

To restore the anorectal function, a permanent colostomy is performed. If a supralevator PE preserving the anal sphincter is conducted, bowel continuity can be restored performing a low coloanal or coloanal anastomosis. However, low coloanal or coloanal anastomosis is associated with 30% to 40% risk of anastomotic leak. Goldberg et al. abandoned the surgical option of low rectal anastomosis after PE because of the high recurrence rate in the pelvis at or near the site of anastomosis. In our series, all patients after TPE and PPE underwent permanent colostomy.

Urinary reconstructive techniques, to restore the urethrovaginal function, can be classified into 2 groups: incontinent diversions, such as ileal conduits, or continent diversions including both cutaneous reservoirs and orthotopic neobladder connected to the urethra. To select the most adequate urinary diversion for each patient, potential complications, therapeutic goals, and quality of life have to be taken into account. Orthotopic neobladder formation after PE is possible if the urethra is conserved. It is very important to take into account that it should not compromise cancer control of a potentially curative surgery, and nonurethra invasion should be ensured. Orthotopic neobladders present with the advantage of permitting the preservation of "normal" body image; on the contrary, one of its drawbacks is the difficulty to acquire day and night continence that can require several months. When reviewing the urologic literature, daytime continence varies between 77% and 97% and nighttime continence varies between 57% and 83% in orthotopic neobladder performed in women. Chiva et al. published in 2009 a series of 6 patients who underwent orthotopic neobladder reconstruction after PE acquiring satisfactory daytime continence with less optimal nighttime continence. Continent cutaneous diversion requires intermittent self-catheterization, but eliminates the necessity of a permanent urostomy. When reviewing the urologic literature, continent cutaneous diversions present with a higher incidence of urinary leaks in the early postoperative period and frequent long-term complications, related to stomal stenosis, difficult self-catheterization, and calculus formation. Ileal conduits represent with the fastest, easiest, and least complication-prone urinary diversion. The most common complications related to the performance of an ileal conduit diversion are pyelonephritis, ureteric obstruction, and urinary calculi and stomal complications, and the risk of complications increases over time. The most common urologic diversion performed after PE is the ileal conduit because it is the fastest and less technically challenging diversion. Urh et al. published a study comparing the outcomes of patients undergoing continent or incontinent diversions after PE, concluding that there were no differences in postoperative complications, except for calculus formation. In selected cases, cutaneous continent diversions after PE are a feasible option. It is important to take into account that overall complication rate of urinary diversions is higher in previous-radiated pelvis than in patients without radiated pelvis. In our series, 5 patients (50%) presented with urinary diversion–related complications, 4 of whom had previously received radiotherapy. These results accord with the literature as it is described that overall complication rate of ileal conduits after pelvic radiation is as high as 76.9%.

One of the most important problems after PE is the large defect created in the perineal-pelvic floor after the ablative procedure. It has been conclusively demonstrated that to lower postoperative complications, it is necessary to fill this defect. Flaps are being widely used to reconstructed the perineum defect after PE because they present with several advantages such as providing skin coverage, reliability, good blood supply, and bulky tissue to fill the pelvic cavity. Myocutaneous flaps used in pelvic reconstruction are abdominal flaps and thigh flaps, such as gracilis flap, gluteus maximus, and anterolateral thigh flap. All flaps are safe, with a frequency of viability of 85% and a frequency of partial flap loss of 10% to 30%. In a study published by Nelson and Butler comparing surgical outcomes of VRAM flap vs thigh flaps for immediate reconstruction of perineum defects
showed that vertical rectus abdominis myocutaneous flaps were associated with fewer complications than thigh flaps, not increasing abdominal wall morbidity. Neovagina reconstruction can be performed either with abdominal flaps or with thigh flaps. Because PE causes severe deficits in body image and sexuality, making it difficult to adapt, reconstruction with neovagina formation is a suitable option and should be contemplated in these cases. Some studies have proved that neovaginal reconstruction improves quality of life after PE. In our series, 2 patients underwent neovaginoplasty with gracilis flap; one patient required neovagina closure 48 hours after PE as a consequence of flap necrosis, and the other patient presented with no early or late complication 6 months after PE with satisfactory aesthetic result.

Overall survival rate at 5 years for PE performed for gynecologic cancers ranges from 30% to 60%, depending on the study. Negative surgical margins and complete surgical margins are known to be the most important prognostic factors. Lymph node involvement is associated as well with poor survival. In our series, there was a clear association between positive margins and lymph node affection with worse prognosis. Of the 7 patients with more than 12 months of follow-up, 3 have recurred in less than 12 months after PE; of these 3 patients, 2 presented with positive surgical margins and 1 patient presented with positive lymph nodes.

Pelvic exenteration was classically contraindicated when the tumor presented with pelvic wall invasion. Höckel et al described a surgical technique for recurrent cervical carcinoma involving the pelvic wall, LEER. Laterally extended endopelvic resection consists of a systemic approach of muscular and fascial removal for pelvic wall affection, improving survival without major complication associated. In one of the patients of our series, we had to perform a LEER to obtain free margins.

When considering PE in older patients, age should not be an absolute contraindication, but physical condition and concomitant morbidity must be taken into consideration. Some studies have demonstrated that after PE, patients 65 years and older had similar complication and survival rates to those of younger patients. In our series, 2 patients were older than 65 years, both of them were 73 years old at the time of PE, one died in the postoperative period, and the other presented with no severe complications.

In patients with advanced or pelvic recurrent cervical carcinoma who present with pelvic wall fixation, NACH is a possible treatment. Neoadjuvant chemotherapy pretends to reduce the tumors volume, consequently increasing the possibility of complete tumor resection with PE obtaining free surgical margin. Landoni et al published a series of 61 patients who underwent PE, of which 31 received NACH, analyzing the impact of NACH on PE feasibility. Patients undergoing NACH had significant larger tumors and more frequently pelvic sidewall affection, although negative margins were achieved in 80% of the patients in the up-front PE group and 74% in the NACH one. The authors reported statistical better survival for patients with free margins resection regardless of prior NACH without worsening of early and late complications, concluding that NACH before PE represents with a feasible therapeutic option. This procedure was followed with one of our patients who presents with no late complications and is currently free of disease 6 months after PE.

Pelvic exenteration was first described as a salvage surgery for recurrent or persistent cervical cancer; since then, it has been performed for vaginal, vulvar, ovarian, and endometrial tumors limited to the pelvis. The major problem of endometrial and ovarian cancer is their tendency to present with distant abdominal invasion, not being adequate candidates for PE in most cases. Most published series of PE in gynecologic tumors include various gynecologic tumors, with a higher proportion of cervical cancer, making it difficult to compare results in terms of tumors origins. Baiocchi et al published a series of 107 PEs including cervix, uterine corpus, vagina, and vulvar tumors, observing a 5-year overall survival for those patients with endometrial cancer (64.3%) than those with cervical cancer (23.1%). Chiantera et al published a series of 21 patients who underwent PE for recurrent endometrial adenocarcinoma observing a 5-year overall survivor of 40% for the entire cohort and a 60% for the subgroup of patients with free margins and absence of nodal involvement. Patients with cervical cancer are known to be appropriate candidates for PE. Patients with vaginal, vulvar, ovarian, and endometrial cancer can benefit from PE, provided that they present with a tumor limited to the pelvis and free surgical margins can be obtained with high probability with PE.

To conclude, PE may be the only curative option for patients with pelvic recurrent gynecologic cancers. Patient selection, free surgical margins, no lymph node involvement, and adequate pelvic reconstruction are the most important factors for PE to produce favorable outcomes.

REFERENCES


