



REVIEW PAPER

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Pelvic Exenteration: An Updated Mini-Review from 1948 to 2020

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ABSTRACT

Introduction. Pelvic exenteration (PE) is a curative or palliative radical surgical procedure applied for advanced or recurrent pelvic or perineal cancers. From 1948 to date, improvements in surgical techniques, including urinary conduits and pelvic reconstruction, have improved its morbidity and mortality.

Aim. The present study reviews the evolution of PE, indications, complications and current results.

Material and methods. Large case series and studies on PE were searched in PubMed, covering all years available, and recent applications of PE were reviewed.

Results. Indications of PE are primary or locally advanced tumors (cervix. rectum. vulva. bladder), recurrence after radiotherapy (cervix), recurrence after primary resection (vulva, vagina, cervix, rectum) and palliative treatment for advanced tumors or pubic fistulas. Contraindication are distant metastases, involvement of iliac vessels, pelvic side-wall or para-aortic lymph nodes and invasion of sacrum proximal to S1/S2 or sciatic foramen. However, recent studies have reported more radical resections, including side-wall and vessels. Patient's health condition and fitness are also important in decision-making.

Conclusion. PE can be the last chance of cure or improving quality of life for advanced or locally recurrent pelvic cancers. 5-year survival rates with PE are better, but complications of such a radical surgery are still high, and should be improved.

Keywords. complications, indications, morbidity, mortality, pelvic exenteration

Introduction

Pelvic exenteration (PE) was first performed in a patient with advanced cervical carcinoma by Brunschwig in 1948, and he described the operation as 'the most radical surgery for pelvic cancer so far'.¹ First series of PE included 22 cases with 5 cases died during early postoperative period.² In his series, there was no survival ad-

vantage, but patients benefited from aggressive surgery and the quality of life (QoL) improved. From 1948 to date, improvements in critical care, use of antibiotics, hyperalimentation and prophylaxis for thromboembolism, advances in surgical instruments such as staplers and in surgical techniques, including urinary conduits and pelvic reconstruction, have improved morbidity and

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mortality. Recent rates of morbidity and perioperative mortality are 30-85% and 3-5%, respectively.³⁻⁵ However, there are reports presenting higher ratios of morbidity.⁶ The 5-year survival rate of PE is now between 20 and 75% with an improved QoL.⁷ The discrepancy in these numbers can be explained by the differences in patient selection criteria, presence of positive margins and extent of surgery.

Pelvic Exenteration

PE is first described for recurrent or locally advanced cervical cancer. Other gynecologic malignancies such as endometrial, vulvar, vaginal and ovarian cancers benefit from PE, especially in locally invasive or recurrent cases. Since the first operations undertaken to now, locally advanced or recurred bladder and ano-rectal cancers were also included in the indications of PE.⁸ Moreover, extent of PE has widened from pelvic side-walls to the sacrum.^{9,10}

In pelvic carcinomas, according to the location of the tumor, anterior (resection of bladder) or posterior (resection of rectum) PE operations have been described.^{11,12} However, the most recent publications suggest that the goal of PE is total exenteration (removal of all pelvic organs), including the rectum, bladder, and whole reproductive organs.¹³ Total PE targets R0 resection.¹⁴ Even some reports state that R0 resection is not possible in case of pelvic side-wall involvement (external iliac vessels, sciatic foramen, obturator nerve or bone invasion); in many clinical series recently published, one can see the resections of sacral bone, sacrifices of sciatic nerve, and even use of vessel grafts.^{9,15-17} For example, in 2017, Sasikumar et al. published a review suggesting PE with en bloc sacrectomy, for recurrent rectal adenocarcinoma.¹⁴ The authors have claimed that R0 (>1-mm resection margin) resection was achieved in 78% of patients. Disease-free survival associated with R0 resection was 55% at a median follow-up period of 33 months; however, none of the patients with R1 (<1-mm resection margin) survived this period.¹⁴

Indications of PE can be summarized as primary but locally advanced tumors (cervix, rectum, vulva, bladder etc.), recurrence after radiotherapy (cervix), recurrence after primary resection (vulva, vagina, cervix, rectum etc.) palliative treatment for pubic fistulas (rectovaginal, vesicovaginal etc.).² Contraindication of PE are distant metastases, involvement of common or external iliac vessels, metastases to para-aortic lymph nodes, involvement of sacrum proximal to S1/S2, tumor extension through sciatic foramen and pelvic side-wall involvement.^{2,3} Clinical triad of leg edema, ureteral obstruction, and leg pain is pathognomonic for pelvic side-wall involvement and considered as a contraindication to surgery. However, recent studies have reported

an even more radical resection, the laterally extended resection, including striated muscle and vessels.^{3,18} Patient's health condition and fitness are also important in decision-making. However, intensive care units (ICU) with adequate equipment can make it easier to choose candidates for operation. If operation will supply an improvement in QoL, even in metastatic tumors, palliative surgery can be undertaken, as well. Age and ureteral obstruction are not absolute contraindications anymore.⁷

Currently, there are many articles presenting PE series where the authors prefer to use robotic or laparoscopic techniques to minimize the morbidities.^{11,13,19-21} Most of them report superior results in comparison with classical open operations.

Preoperatively, all candidate patients should undergo a thoroughly physical examination such as lymph node palpations, digital rectal exam, etc. Tumor marker measurements might help. Distant metastases should be excluded by radiographic scans, computerized tomography (CT), magnetic resonance imaging (MRI) and/or positron emission tomography (PET) scans. Rigid rectosigmoidoscopy and colonoscopy should also be performed.

Cystoscopy can be necessary at the beginning of operation, to assess bladder metastasis and to place ureteral stents. On modified-lithotomic position, after xiphoid to pubis midline incision, all viscera are evaluated for metastases. All adhesions should be taken down very carefully, and thick or suspicious adhesions should be excised for histopathology. Liver, paraaortic lymph nodes, pelvic side-walls, sacro-coccygeal bone, region lateral to the obturator fossa and external iliac vessels should be evaluated for possible metastases.¹⁻⁵ Then exenteration starts with total or modified techniques.

Total PE is defined as the excision of the rectum, distal colon, bladder, reproductive organs, draining lymph nodes, and pelvic peritoneum. After exploration of the abdomen, the pelvic dissection is begun at the level of the aortic bifurcation.^{8,13} Anterior PE is used for anterior pelvic tumors involving cervix, vagina or bladder. It is the removal of pelvic peritoneum, lower part of ureters, reproductive organs, bladder, and lymph nodes. Posterior vaginal wall and uterus are the margins of resection.^{11,22} In posterior PE, the uterus, adnexa, cervix, posterior wall of vagina and rectum are removed. Bladder is preserved. In middle or upper rectum cancers, primary anastomosis can be created. Tumors below the level of levator ani muscle require permanent colostomy as sphincters are excised.^{12,23} Lastly, another modified PE, composite PE is the removal of bony resections, including portions of the sacrum-coccyx, ischium and symphysis pubis. In composite PE, one should remember S1/2 level, as above this level is unresectable.^{24,25}

Following resections, reconstruction procedures such as urinary conduit or colostomy, pelvic floor or vaginal reconstructions start. Urinary conduit can be

done by isolating a distal ileal segment and anastomosing the ureters here and then taking this segment under the skin.²⁶ Indiana pouch is made from ascending colon and ileocecal valve.²⁷ In Kock's pouch, all the pouch, valves and outlet are made from terminal ileum.²⁸ Mitrofanoff pouch includes an outlet from appendix.²⁹ Miami pouch is a popular continent urinary reservoir because of 90% overall long-term continence rates.^{5,30} Transverse colon is anastomosed to the ascending colon in a U-shaped fashion to create the colonic reservoir. Anti-refluxing uretero-colonic anastomoses are then created, and ileum is anastomosed at the level of the ileocecal valve, then exteriorized as a stoma for self-catheterization. Pelvic dead space filling to prevent fistula or abscess formation or bowel obstructions can be done by myocutaneous flaps (e.g. rectus abdominis, gracilis or gluteus maximus), synthetic meshes or omentum.^{5,31} Neovagina construction can be done by gracilis or rectus abdominis muscles.³²

Postoperative complications of a PE will depend mainly on what was removed and the patient's overall health. Reconstructions may also be problematic for the patients. In general, the most common major complications are intraabdominal collections and wound infections.^{3,33} Major complications are related to gastrointestinal tract (fistula or obstruction), urinary tract (fistula, infection, or obstruction), or wound (abscess, dehiscence/necrosis, or hemorrhage). Patients receiving pelvic radiotherapy prior to exenteration may have a much higher complication rate.³⁴ Reconstruction of the irradiated pelvis after exenteration by omental flap or myocutaneous flaps decreases the complications.^{31,32} In most cases, a new local recurrence or distant metastasis is inevitable. Therefore, adjuvant chemo-radiotherapy can be necessary later on.

References

1. Brown KGM, Solomon MJ, Koh CE. Pelvic exenteration surgery: The evolution of radical surgical techniques for advanced and recurrent pelvic malignancy. *Dis Colon Rectum*. 2017;60:745-754.
2. Bacalbasa N, Balescu I. Pelvic exenteration - reconsidering the procedure. *J Med Life*. 2015;8:146-149.
3. Peacock O, Waters PS, Kong JC, et al. Complications after extended radical resections for locally advanced and recurrent pelvic malignancies: A 25-year experience. *Ann Surg Oncol*. 2019. doi: 10.1245/s10434-019-07816-8.
4. Waters PS, Peacock O, Warriar SK, et al. Evolution of pelvic exenteration surgery- resectional trends and survival outcomes over three decades. *Eur J Surg Oncol*. 2019. doi: 10.1016/j.ejso.2019.07.015.
5. Bogani G, Signorelli M, Ditto A, et al. Factors Predictive of 90-day morbidity, readmission, and costs in patients undergoing pelvic exenteration. *Int J Gynecol Cancer*. 2018;28:975-982.
6. Platt E, Dovell G, Smolarek S. Systematic review of outcomes following pelvic exenteration for the treatment of primary and recurrent locally advanced rectal cancer. *Tech Coloproctol*. 2018;22:835-845.
7. DiverEJ, Rauh-Hain JA, del Carmen MG. Total pelvic exenteration for gynecologic malignancies. *Int J Surg Oncol*. 2012; 2012: 693535.
8. Ferenschild FT, Vermaas M, Verhoef C, et al. Total pelvic exenteration for primary and recurrent malignancies. *World J Surg*. 2009;33:1502-1508.
9. Kato K, Omi M, Fusegi A, Takeshima N. Modified posterior pelvic exenteration with pelvic side-wall resection requiring both intestinal and urinary reconstruction during surgery for ovarian cancer. *Gynecol Oncol*. 2019. doi: 10.1016/j.ygyno.2019.07.015.
10. Vizzielli G, Naik R, Dostalek L, et al. Laterally extended pelvic resection for gynaecological malignancies: A multicentric experience with out-of-the-box surgery. *Ann Surg Oncol*. 2019;26(2):523-530.
11. Martínez-Gómez C, Angeles MA, Martínez A, Ferron G. Laparoscopic anterior pelvic exenteration in 10 steps. *Gynecol Oncol*. 2018;150:201-202.
12. Berretta R, Marchesi F, Volpi L, et al. Posterior pelvic exenteration and retrograde total hysterectomy in patients with locally advanced ovarian cancer: Clinical and functional outcome. *Taiwan J Obstet Gynecol*. 2016;55:346-350.
13. Konstantinidis IT, Chu W, Tozzi F, et al. Robotic total pelvic exenteration: Video-illustrated technique. *Ann Surg Oncol*. 2017;24:3422-3423.
14. Sasikumar A, Bhan C, Jenkins JT, Antoniou A, Murphy J. Systematic review of pelvic exenteration with en bloc sacrectomy for recurrent rectal adenocarcinoma: R0 resection predicts disease-free survival. *Dis Colon Rectum*. 2017;60(3):346-352.
15. Kim HS, Kim R, Lee M. Super-radical hysterectomy for recurrent cervical cancer. *Surg Oncol*. 2017;26:331-332.
16. Solomon MJ, Brown KG, Koh CE, Lee P, Austin KK, Masaya L. Lateral pelvic compartment excision during pelvic exenteration. *Br J Surg*. 2015;102:1710-1717.
17. Höckel M. Ultra-radical compartmentalized surgery in gynaecological oncology. *Eur J Surg Oncol*. 2006;32:859-865.
18. Brown KG, Koh CE, Solomon MJ, Qasabian R, Robinson D, Dubenec S. Outcomes after en bloc iliac vessel excision and reconstruction during pelvic exenteration. *Dis Colon Rectum*. 2015;58:850-856.
19. Yang Q, Tang J, Xiao L. Disease-free survival after robotic-assisted laparoscopic total pelvic exenteration for recurrent cervical adenocarcinoma: A case report. *Medicine (Baltimore)*. 2018;97:e11611.
20. Uehara K, Nakamura H, Yoshino Y, et al. Initial experience of laparoscopic pelvic exenteration and comparison with conventional open surgery. *Surg Endosc*. 2016;30:132-138.
21. Ogura A, Akiyoshi T, Konishi T, et al. Safety of Laparoscopic Pelvic Exenteration with Urinary Diversion for Colorectal Malignancies. *World J Surg*. 2016;40:1236-1243.

22. Kathopoulos N, Thomakos N, Mole I, Papaspirou I, Ntai S, Rodolakis A. Anterior pelvic exenteration for exstrophic bladder adenocarcinoma: Case report and review. *Int J Surg Case Rep.* 2016;25:13-15.
23. Minar L, Felsinger M, Rovny I, Zlamal F, Bienertova-Vasku J, Jandakova E. Modified posterior pelvic exenteration for advanced ovarian malignancies: a single-institution study of 35 cases. *Acta Obstet Gynecol Scand.* 2017;96:1136-1143.
24. Kokelaar RF, Evans MD, Davies M, Harris DA, Beynon J. Locally advanced rectal cancer: management challenges. *Onco Targets Ther.* 2016;9:6265-6272.
25. Gawad W, Khafagy M, Gamil M, Fakhr I, Negm M, Mokhtar N, Lotayef M, Mansour O. Pelvic exenteration and composite sacral resection in the surgical treatment of locally recurrent rectal cancer. *J Egypt Natl Canc Inst.* 2014;26:167-173.
26. Tatar B, Yalçın Y, Erdemoğlu E. Palliative pelvic exenteration using iliofemoral bypass with synthetic grafts for advanced cervical carcinoma. *Turk J Obstet Gynecol.* 2019;16:80-83.
27. Kaufmann OG, Young JL, Sountoulides P, Kaplan AG, Dash A, Ornstein DK. Robotic radical anterior pelvic exenteration: the UCI experience. *Minim Invasive Ther Allied Technol.* 2011;20:240-246.
28. Waters WB, Vaughan DJ, Harris RG, Brady SM. The Kock pouch: initial experience and complications. *J Urol.* 1987;137:1151-1153.
29. Souma T, Terai A, Arai Y, Hashimura T, Takeuchi H, Yoshida O. Continent urinary reservoir using sigmoid colon and appendix after pelvic exenteration for bulky leiomyosarcoma: a case report. *J Urol.* 1995;153:1907-1909.
30. Sanchez-Valdivieso E, Gonzalez Enciso A, Herrera Gomez A, Chavez-Montes de Oca V, Munoz Gonzalez D. Preliminary experience with the Miami type ileocolonic urinary reservoir in the practice of oncologic gynecology. *Arch Esp Urol.* 2001;54:327-333.
31. Singh M, Kinsley S, Huang A, et al. Gracilis flap reconstruction of the perineum: An outcomes analysis. *J Am Coll Surg.* 2016;223:602-610.
32. Qiu SS, Jurado M, Hontanilla B. Comparison of TRAM versus DIEP flap in total vaginal reconstruction after pelvic exenteration. *Plast Reconstr Surg.* 2013;132:1020e-1027e.
33. Tortorella L, Casarin J, Mara KC, et al. Prediction of short-term surgical complications in women undergoing pelvic exenteration for gynecological malignancies. *Gynecol Oncol.* 2019;152:151-156.
34. Wydra D, Emerich J, Sawicki S, Ciach K, Marciniak A. Major complications following exenteration in cases of pelvic malignancy: A 10-year experience. *World J Gastroenterol.* 2006;12:1115-1119.