Oncologic and Fertility Outcomes Following Radical Trachelectomy in Early-Stage Cervical Cancer: Insights from a Single-Institution in Malaysia

ABSTRACT

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| **Aims:** Radical trachelectomy is a fertility-preserving surgical option for early-stage cervical cancer. It remains an uncommon choice among women, with limited cases reported in Malaysia. This case series explores the fertility and oncologic outcomes of radical trachelectomy in managing early cervical cancer among women of reproductive age in our institution.  **Study design:** We retrospectively evaluated five patients who underwent abdominal radical trachelectomy in National Cancer Institute, Putrajaya for a median follow-up period of 3 years.  **Place and Duration of Study:** Department of Gynecology Oncology at National Cancer Institute, Putrajaya Malaysia between January 2016 and December 2023.  **Methodology:** The medical records of all patients who underwent abdominal radical trachelectomy at National Cancer Institute, Putrajaya Malaysia were reviewed. Data were obtained from medical and pathologic records. Data collected included age, parity, stage, preoperative tissue diagnosis, tumor size, evidence of lymph vascular space invasion, estimated blood loss, margin, final histopathology report, surgical complication, obstetric outcome and additional chemoradiotherapy treatment.  **Results:** A total of 104 new patients were diagnosed with early cervical cancer. During this period, 99 radical hysterectomies and five radical trachelectomies were performed. The patients’ ages ranged from 27 to 40 years old. The median estimated blood loss was 400mL, median surgical time was 320 minutes and median length of hospitalization was 5 days. The oncological outcomes varied among the patients. Four out of five patients survived and remain disease-free, while one experienced recurrence, requiring debulking surgery and additional chemoradiation therapy. Reported complications included cervical stenosis, pseudocyst formation and wound breakdown, all of which were manageable without long-term effects. Notably, three patients achieved pregnancy, although only one resulted in a live birth.  **Conclusion:** Despite the rarity of the radical trachelectomy procedure in Malaysia, this case series highlights favorable outcomes, manageable complications, and the possibility of successful pregnancies with a risk of preterm labor, demonstrating its role in addressing both oncological and reproductive goals in women with early-stage cervical cancer |

*Keywords: Cervical Cancer, radical trachelectomy, fertility, Oncologic*

1. INTRODUCTION

Cervical cancer ranks as the sixth most common cancer among females in Malaysia based on the Summary of the Malaysian National Cancer Registry report 2017 to 2021 (National Cancer Registry Department, 2024). The age-standardized incidence rate (ASR) of cervical cancer in Malaysia from 2017 to 2021 was 6.0, showing only a slight decrease compared to the rate of 6.2 in the previous years (2012-2016), despite the availability of national screening program (National Cancer Registry Department, 2024). Several women diagnosed with cervical cancer have not completed their childbearing (Pareja et al, 2008). The number of women seeking fertility-preserving treatment options is steadily arising, driven by the increasing average of childbirth-age in Malaysia (Vital Statistics, 2022). In Malaysia, the age- standardized incidence rate (ASR) for individuals of reproductive age diagnosed with cervical cancer ranges between 0.1 to 5.9 (National Cancer Registry Department, 2024).

Early detection greatly improves the 5-year survival rate for cervical cancer. Various preventive strategies and treatment protocols were implemented to eliminate cervical cancer, and all countries must reach and maintain an incidence rate below 4 per 100 000 women as recommended by World Health Organization (WHO) (Noor et al, 2024). In Malaysia effective screening methods, such as HPV testing, cytology, and colposcopy, have been part of the national health program since 1969 and play a vital role in the early detection of cervical cancer (Noor et al, 2024). Early cervical cancer traditionally managed surgically by radical hysterectomy and pelvic lymphadenectomy. Increasing evidence in the literature suggests that radical trachelectomy is another viable option with satisfactory oncologic and obstetrical outcomes for women who wish to preserve their fertility (Yoshino et al, 2020; Smith et al, 2020; Chen et al, 2022; Siegler et al, 2024). Radical trachelectomy can be performed through a vaginal, abdominal, laparoscopic, or robotic approach and combined with open or laparoscopic pelvic lymph node dissection (Wu et al,2017).

The first report of radical vaginal trachelectomy was documented by Daniel Dargent in 1994 (Vo et al, 2024). Currently the National Comprehensive Cancer Network guidelines suggest that radical trachelectomy is a treatment option for selected women with early-stage cervical cancers (Stage 1A2 to 1B2) (NCCN, 2024). Surgeon should adhered with strict patient selection criteria to balance surgical safety with potential risk of morbidity to the patient.

The oncological outcomes following radical trachelectomy in early cervical cancer are favourable (Kohler et al., 2024). Based on literature reviews, radical trachelectomy offers treatment outcomes equivalent to those of radical hysterectomy for early cervical cancer (Kasuga et al.,2023). Majority of centres showed low recurrence and death rates ranging from 0-6.8% and 0-5.2% respectively (Kohler et al, 2024). Given the low recurrence and death rate, there is substantial potential for women of childbearing age to conceive. Studies showed that radical trachelectomy is associated with a favourable pregnancy rate and live birth rate, making it an important consideration for young women diagnosed with early cervical cancer (Kohler et al, 2024).

The option of fertility preservation for women with operable cervical cancer remains uncommon, with no previously reported cases in Malaysia. Limited availability of opportunities and skilled surgeons presents a significant challenge, as radical trachelectomy is rarely performed and only a few surgeons possess the necessary expertise. The goal of this study was to explore the fertility and oncologic outcomes in a series of patients who underwent radical trachelectomy for early-stage cervical cancer at National Cancer Institute, Putrajaya, Malaysia.

2. Methodology

**2.1 Study population**

The medical records of all patients who underwent abdominal radical trachelectomy at National Cancer Institute, Putrajaya, Malaysia between January 2016 and December 2023, were reviewed. Approval from the institutional review board was obtained prior to data collection. Data were obtained from medical and pathological records. Data collected included age, parity, stage, preoperative tissue diagnosis, tumor size, presence of lymphovascular space invasion, estimated blood loss, surgical margins, final histopathology report, complications, obstetric outcomes and any additional chemoradiotherapy treatment.

**2.2 Eligibility Criteria**

Patient were considered eligible if they met the criteria for radical trachelectomy which included a confirmed diagnosis of cervical cancer and a desire for future fertility preservation. Patients were informed that radical hysterectomy remains the standard treatment for women with early-stage cervical cancer.

**2.3 Surgical techniques for Abdominal Radical trachelectomy**

The radical trachelectomy procedure was similar in part to an abdominal radical hysterectomy. A midline laparotomy was performed. The uterus was exposed and bilateral pelvic lymph nodes was dissected first. After the development of pararectal and paravesical spaces, the bilateral parametria were exposed. The ureters were then dissected bilaterally to their insertion into the bladder with lateral mobilization. The uterine arteries were preserved bilaterally. The rectovaginal space was exposed, and the cardinal and uterosacral ligaments were resected. The cervix was transected at the level of the isthmus, including 2 cm of the upper vagina. The specimen was sent for frozen section evaluation to ensure that at least a 5mm margin was free of tumor. If the evaluation revealed a positive margin, patients proceeded with radical hysterectomy. A cerclage was placed in all patients using permanent sutured tied at the posterior aspect of the uterus. An intrauterine copper device was inserted in all patients except one (Table 1, patient 1). Finally, the vaginal cuff was sutured to the lower uterine segment with 1-0 synthetic absorbable surgical sutures. The abdominal wall was then closed after securing hemostasis.

**2.4 Follow-up**

Postoperative follow-up was conducted two weeks after surgery. The complete histopathological report was reviewed during this visit. Concurrent chemoradiotherapy was offered to patients with lymphovascular invasion, positive lymph nodes, high-grade tumors, or positive surgical margins. Follow-up visits were then scheduled every three months for the first two years and every 6 months for the subsequent five years. These visits included pelvic examinations, pelvic ultrasounds and Pap smears. Patients were allowed to attempt pregnancy if there was no evidence of residual or recurrent disease after 12 months of follow-up.

3. results

Between January 2016 and December 2023, a total of 104 new patients were diagnosed with early-stage cervical cancer and underwent surgery at the National Cancer Institute, Putrajaya. During this period, 99 radical hysterectomies and five radical trachelectomies were performed. In our case series, Table 1 presents the patients’ characteristics and outcomes. The patients’ ages ranged from 27 to 40 years. Preoperatively, as defined by the International Federation of Gynaecology and Obstetrics (FIGO) staging system, four patients had stage 1B1 disease and one had stage 1A2. Three patients were diagnosed preoperatively with squamous cell carcinoma, while two were diagnosed with adenocarcinoma. Four patients were diagnosed through cervical conization, and one via colposcopically directed biopsy.

**Table 1. Patient characteristics and outcomes**

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| **Particular** | **Patient 1** | **Patient 2** | **Patient 3** | **Patient 4** | **Patient 5** |
| Age | 28 | 36 | 40 | 27 | 35 |
| Parity | 1 | 2 | Nulliparous | 1 | Nulliparous |
| Clinical stage | 1B1 | 1A2 | 1B1 | 1B1 | 1B1 |
| Pathologic stage | 1B1 | 1A2 | 1A2 | 1B1 | 1B1 |
| Surgical time (min) | 320 | 480 | 300 | 280 | 350 |
| Blood loss (mL) | 200 | 1000 | 400 | 600 | 400 |
| Final HPE | Squamous cell carcinoma | Squamous cell carcinoma | Squamous cell carcinoma | Large Cell Neuroendocrine | Adenocarcinoma |
| LVSI | Negative | Negative | Negative | Positive | Negative |
| Positive LN | 0 | 0 | 0 | 0 | 0 |
| Tumor Size (cm) | 2 | 0.5 | 0.5 | 1.5 | 1.8 |
| Complication | Cervical Stenosis | Wound breakdown | No | Pseudocyst | No |
| Follow-up  (months) | 36 | 36 | 36 | 28 | 24 |
| Attempt to conceive | Yes | No | Yes | No | Yes |
| Pregnancy outcome | Miscarriage |  | Miscarriage |  | Live birth |

In terms of intraoperative findings, the median estimated blood loss was 400 mL (range: 200 – 1000 mL). The median surgical time was 320 minutes (range: 280 – 480 minutes), and the median length of hospitalization was 5 days (range: 5 to 6 days). The median follow-up duration was 36 months (range, 24-36 months). All specimens sent for frozen section analysis had clear margins. No lymph nodes involvement was identified in any of the patients based on final histology. However, one patient was found to have lymphovascular space invasion. All patients had tumors smaller than 2cm. Final histopathology revealed that four patients had well-differentiated squamous cell carcinoma, while one patient was diagnosed with high-grade neuroendocrine carcinoma.

There was no intraoperative complication however, three patients develop postoperative complications. One patient experienced postoperative laparotomy wound breakdown, possibly due to prolonged surgical time of approximately 480 minutes. The patient was obese, but the wound was managed conservatively with daily dressing, resulting in primary healing (Table 1, patient 2). One patient developed cervical stenosis following radical trachelectomy, which was successfully managed with repeated cervical dilatations under regional anaesthesia (Table 1, patient 1).

Only one patient who underwent radical trachelectomy with pelvic lymph nodes dissection in year 2020 had recurrence after 18 months follow-up (Table 1, patient 4). She developed a pelvic collection two weeks postoperatively, requiring diagnostic laparoscopy for a pseudocyst. Histopathology revealed high-grade neuroendocrine carcinoma. She was referred for definitive surgery and chemoradiation therapy, but she declined treatment. Follow-up ultrasound and computed tomography (CT) scan revealed a post-surgical collection, which improved with medical treatment. She was monitored regularly as an outpatient. However, during cancer surveillance, a CT scan revealed local recurrence, lung metastasis, and regional lymphadenopathy. A diagnosis of local recurrence with distant metastasis was made. She agreed to undergo complete debulking surgery and recovered well, followed by concurrent chemoradiation therapy. Unfortunately, a follow-up CT scan three months later showed disease progression, evidenced by worsening lung, liver and nodal metastases. She subsequently received palliative care and passed away six months later.

In our case series, three out of five patients attempted to conceive. Two experienced spontaneous abortion, while one achieved a successful pregnancy. This patient (Table 1, patient 5) underwent in-vitro fertilization (IVF) one year after surgery. She later underwent an emergency midline classical caesarean section at 36 weeks of gestation in view of preterm prelabour rupture of membranes in the context of a cervical cerclage placed post-trachelectomy. Intraoperatively, the omentum was noted to be adherent to the anterior abdominal wall, the lower uterine segment was not formed, and both fallopian tubes and ovaries appeared normal. She delivered a healthy baby girl weighing 1.87 kg with a good Apgar Score.

**4. DISCUSSION**

This case series represents one of the first reported experiences of radical trachelectomy in Malaysia, highlighting both the oncological and obstetric outcomes in a highly selected group of patients with early-stage cervical cancer. Of the 104 patients who underwent surgical treatment for early-stage cervical cancer between January 2016 and December 2023, only five were selected for radical trachelectomy, highlighting the careful patient selection criteria applied at our institution. Strict criteria such as tumor size less than 2 cm and negative pelvic lymph nodes are associated with relapse and mortality rates of 4% and 2% respectively (Pareja et al., 2024).

The limited number of cases reflects both the rarity of suitable candidates, as well as the still-limited uptake of this procedure in our local practice. Fertility-sparing radical trachelectomy remains infrequently performed procedure worldwide, with even more limited procedure in Malaysia. A recent survey in the United States reported 815 cases conducted across 89 centers over a decade (2001–2011), with most centers performing a low volume of surgeries (Danisch, 2024). The abdominal radical trachelectomy technique is technically demanding and requires a significant learning curve to achieve surgical competence.

Another contributing factor may be that approximately 76% of patients in the Malaysian population are diagnosed at Stage II or beyond, necessitating radical surgery and chemoradiation therapy (Faridah et al., 2019). The Second National Health & Morbidity Survey (NHMS II), conducted in 1996, found that only 26% of eligible women undergone cervical cancer screening via Pap smear (Zakiah et al., 2019). By 2006, this figure had increased to 43.7% according to NHMS III, but it dropped significantly to just 12.8% in the NHMS 2011 (Zakiah et al., 2019). In response to these findings, Malaysia implemented Liquid-Based Cytology (LBC) in 2014 to improve screening coverage and facilitate HPV testing, aiming to enhance early detection and intervention for cervical cancer (Zakiah et al., 2019).

All five of our patients met the key eligibility criteria based on NCCN guideline for radical trachelectomy, including tumour size ≤2 cm, negative nodal status, and early FIGO stage (four Stage IB1 and one Stage IA2) (NCCN, 2024). Histologically, squamous cell carcinoma was the predominant subtype. One patient had high-grade neuroendocrine carcinoma, a histologic subtype typically associated with poor prognosis. The only recurrence in this series occurred in that patient, who developed local and distant metastases despite salvage therapy. This outcome supports existing literature that discourages fertility-sparing surgery in cases of neuroendocrine tumours due to their aggressive behaviour and higher risk of recurrence (Cibula et al., 2023).

According to European guidelines, fertility-sparing treatment is not recommended for rare and aggressive histological subtypes of cervical cancers, such as neuroendocrine carcinomas, HPV-independent adenocarcinomas, and carcinosarcomas (Cibula et al., 2023). Neuroendocrine cervical carcinomas have a high tendency for nodal involvement and distant metastases, which aligns with our case, where a follow-up CT scan performed 18 months later revealed abdominal and pelvic lymphadenopathy with lung metastases (Salvo et al., 2019). According to updated management guidelines for neuroendocrine cervical cancer, the overall 5-year survival rate is approximately 36%, with a median overall survival ranging between 22 and 25 months (Salvo et al., 2019). Even though fertility-sparing surgery is not recommended for neuroendocrine cervical cancer based on current guidelines, our literature search identified a case report describing a successful pregnancy following radical trachelectomy, with the patient remaining disease-free after 24 months (Park et al., 2008). In our case series, the patient diagnosed with a neuroendocrine tumour was followed up for 28 months from the initial diagnosis, unfortunately she passed away thereafter.

Her case highlights the critical importance of thorough histological assessment during frozen section examination at the initial surgery (Table 1, Patient 4). Intraoperative frozen section examination is also crucial to ensure negative surgical margins, thereby reducing the need for a second surgery (Alexander et al., 2022). The accuracy of frozen section analysis in radical trachelectomy specimens is a significant factor to consider, particularly in fertility-sparing surgery for cervical cancer. According to a study by Kay J Park in 2008, there was an 84% concordance between the frozen-section diagnosis and the final histological diagnosis when using histology alone (Li et al., 2015).

The surgical outcomes in our series were acceptable. The median operative time was 320 minutes, and the median estimated blood loss was 400 mL, both consistent with other reports of laparotomy-based trachelectomy approaches (Chen et al., 2022; Wu et al., 2017). There were no intraoperative complications, although two patients experienced notable postoperative issues, wound breakdown and cervical stenosis, both managed conservatively.

In our initial case of radical trachelectomy, no intrauterine device (IUD) was inserted intraoperatively, and the patient subsequently developed cervical stenosis, necessitating twice cervical dilatation under regional anaesthesia. Based on this experience, we implemented routine IUD placement in subsequent patients, after which no further cases of cervical stenosis were observed. Although no standard guideline exists, some clinicians place devices in the cervical canal or uterine cavity to reduce the risk of cervical stenosis after surgery (Wang et al., 2020). In a systematic review of 1547 patients, such tools were used in 27.4% of cases, and their use was associated with a significantly lower incidence of cervical stenosis (4.6% vs. 12.7%) (Wang et al., 2020). Catheters were the most commonly used tools, followed by intrauterine devices (IUDs). The lowest rate of stenosis occurred with IUD use (Li et al., 2015).

Obstetric outcomes remain a key concern in fertility-sparing management. In our series, three out of five patients attempted conception postoperatively, resulting in one successful live birth via in vitro fertilization and two first-trimester miscarriages. The successful pregnancy required a classical caesarean section at 36 weeks due to preterm prelabour rupture of membranes. In our findings, the number of successful pregnancies was relatively low. However, other studies report consistently high pregnancy rates following radical trachelectomy, ranging from 53% to 76% (Kohler et al., 2024).

Patient who undergo radical trachelectomy face a higher risk of preterm birth due to the shortened residual cervix. Studies have reported an incidence ranging from 41.8% to 63.1%. (Kasuga et al.,2023). To reduce the risk, prophylactic cerclage at the time of the procedure is recommended.

Preserving the uterine artery during radical trachelectomy is a critical factor that significantly impacts obstetric outcomes (Wang et al., 2020). By carefully preserving this vascular structure during the surgery, adequate blood supply to the uterus is maintained. In our case series, surgeons meticulously preserve the uterine arteries bilaterally during the radical trachelectomy procedure to ensure optimal uterine perfusion post-surgery.

4. Conclusion

In conclusion, this case series shows that radical trachelectomy can be a safe and effective options for women with early-stage cervical cancer who wish to preserve their fertility. The results suggest that this procedure offers a viable option without compromising oncological outcomes. Ongoing research and longer follow-up studies are essential to further validate the efficacy and safety of this procedure within the Malaysian context. Overall, the findings from this case series contribute valuable insights to the field of gynaecologic oncology and emphasize the importance of individualized treatment strategies in optimizing outcomes for women facing early cervical cancer diagnoses in Malaysia.

Consent

All authors declare that written informed consent was obtained from the patient and next of kin for publication of this case series. A copy of the written consent is available for review by the Editorial Board members of this journal.

Ethical approval

This study was registered under National Medical Research Register (NMRR) of Malaysia and was approved by the committee prior to the commencement of this study (NMRR ID-25-00878-4YG). Research ID (RSCH ID-25-00262-FPZ).

**Disclaimer (Artificial intelligence)**

Option 1:

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

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Abbreviations

NCCN National Comprehensive Cancer Network

HPE Histopathology Examination

LVSI Lymphovascular space invasion