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Simple trachelectomy with pelvic lymphadenectomy as a viable treatment option in pregnant patients with stage IB1 (≥2 cm) cervical cancer: Bridging the gap to fetal viability

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HIGHLIGHTS

- Simple trachelectomy and lymphadenectomy is feasible in pregnant patients with stage IB1 cervix cancer.
- Long-term overall survival is favorable after simple trachelectomy in pregnant patients with cervical cancer.
- Perioperative morbidity after simple trachelectomy in pregnant patients with stage IB1 cervical cancer is low.

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ABSTRACT

Objective. Cervical cancer is the most common gynecologic cancer in pregnancy. This study aims to evaluate simple trachelectomy and pelvic lymphadenectomy in patients with stage IB1 (≥2 cm) cervical cancer wishing to maintain their pregnancy.

Methods. We included patients with stage IB1 (≥2 cm) cervical cancer who underwent simple trachelectomy and minimally invasive pelvic lymphadenectomy during pregnancy from January 2004 to August 2016. Data analysis included demographics, perioperative, obstetrics, and oncologic outcomes.

Results. A total of 5 patients were included. Median age was 30 years (range; 26–38). Median gestational age (GA) at diagnosis was 12 weeks (range; 7–18) and at treatment intervention 16.5 weeks (range; 12–19). Histologic subtypes included: adenocarcinoma (3 patients) and squamous cell carcinoma (2 patients). Median tumor size by clinical exam was 27 mm (range; 20–40), grade 2 (range; 2–3) and depth of invasion 10 mm (range; 1.5–12). All patients underwent laparoscopic (1) or robotic (4) pelvic lymphadenectomy followed by vaginal simple trachelectomy. Median operative time was 193 min (range; 155–259), estimated blood loss 100 ml (range; 50–550) and length of stay 2 days (range; 1–3). There were no intraoperative or postoperative complications (<30 days). Median number of lymph nodes removed was 14 (range; 5–15). One patient had bilateral microscopic positive nodes. The median gestational age at delivery was 39 weeks (range; 28–40.6). After median follow-up of 75 months (range; 18–168), all patients are alive without disease.

Conclusion. Simple trachelectomy with pelvic lymph node dissection may be a safe option in pregnant patients with stage IB1 (>2 cm) cervical cancer wishing to maintain their pregnancy.

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1. Introduction

Cervical cancer is the most common gynecologic cancer diagnosed during pregnancy; however, it is still a rare occurrence with an estimated incidence of 0.8 to 1.5 cases per 10,000 births [1,2]. Among patients with cervical cancer, it is estimated that only 1 to 3% are pregnant or in the postpartum at the time of the diagnosis [3,4]. Fortunately, the majority of these patients are diagnosed with early stage disease [5,6].

The standard treatment recommendation for non-pregnant patients with early-stage cervical cancer is either radical hysterectomy or the combination of chemotherapy and radiation [7]. In select cases (in non-pregnant patients), a fertility-sparing surgery such as conization or radical trachelectomy and pelvic lymphadenectomy (or sentinel lymph node mapping) may be considered [8–10].

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Table 1
Demographics, pathology and oncologic outcomes.

	Patient A	Patient B	Patient C	Patient D	Patient E
Age (years)	33	28	30	38	26
BMI (kg/m^2)	22.6	25.7	26.5	22.7	20
GA at diagnoses (weeks)	8	12	18	14.2	7
GA at surgery (weeks)	17	15	19	16.5	12
Tumor size (mm)	20 × 20 × 10	27 × 18 × 18	20 × 15	38 × 15 × 15	40 × 35.5 × 30
Histology	Adenocarcinoma	Adenocarcinoma	Squamous	Adenocarcinoma	Squamous
Grade	2	2	3	2	3
LVSI	No	No	No	No	Yes
DOI (mm)	10/15	1.5/12	5/10	12/NR	12/16
Nodes removed	14	15	5	8	14
Node status	Negative	Negative	Negative	Negative	ITC on 1 node each side
Definitive treatment (DT)	Laparoscopic TRH (40 days after delivery)	None	Laparotomic TRH at the time of C-section	SH 62 days after delivery	Chemoradiation
Follow up (months)	168	102	75	65	18

GA: gestational age; TRH: total radical hysterectomy; SH: simple hysterectomy; LVSI: lymph vascular space invasion; DOI: depth of invasion; NRT: no residual tumor; N/A: not applicable; ITC; isolated tumor cells.

Management of cervical cancer when diagnosed in pregnancy varies according to the gestational age at presentation. In patients with early-stage disease (IA2 or IB1) who are diagnosed in late pregnancy (third trimester), one may delay definitive treatment until after fetal maturity [11]. In early pregnancy, most would not recommend delay of treatment given the risk of disease progression. For these patients, radical hysterectomy may be performed with the fetus in-utero or, alternatively, pelvic radiation therapy may be considered with anticipated pregnancy termination by spontaneous abortion.

Desire to maintain the pregnancy is the highest priority for many patients diagnosed with cervical cancer during the pregnancy. A thorough and detailed discussion in this setting centers on the risk and benefits of maintaining the pregnancy at the potential cost of compromising oncologic outcomes. Treatment options for those wishing to preserve the pregnancy include cervical conization, radical trachelectomy with pelvic lymphadenectomy, neoadjuvant chemotherapy (NACT) or surveillance until fetal maturity is achieved. Due to the rarity of this scenario, there is a paucity of data on the routine recommendation for such patients, and clinicians must rely on retrospective small case series.

In order to avoid termination of pregnancy and the morbidity of radical trachelectomy, while at the same time addressing the cancer diagnosis, a number of patients in our institution were counseled to undergo simple trachelectomy and lymphadenectomy through a minimally invasive approach. In this manuscript, we outline the results of this conservative management in pregnant patients with early-stage cervical cancer.

2. Material and methods

After approval from Institutional Review Board, we retrospectively identified all pregnant patients with newly diagnosed cervical cancer treated with simple vaginal trachelectomy and minimally invasive pelvic lymphadenectomy at MD Anderson Cancer Center between January 2004 and August 2016. Data were collected from clinic visits, operative reports, radiation and chemotherapy encounters. Demographics data collected included: age, body mass index (BMI), parity, gestational age (GA) at diagnosis, and tumor stage. Surgical variables evaluated were: surgery date, GA at surgery, surgical approach, operative time, estimated blood loss (EBL), intra- and postoperative complications up to 30 days. Pathologic tumor features were also included: histology, tumor grade, lymph vascular space invasion (LVSI), trachelectomy specimen margin, and nodal status. Obstetrics outcomes included were: GA at delivery, type of delivery, newborn weight. Definitive treatment received and oncologic outcomes were also analyzed for all patients.

A gynecologic oncology pathologist at MD Anderson Cancer Center evaluated all specimens. All patients underwent pelvic MRI without contrast and a chest x-ray prior to surgery. Extensive counseling was performed regarding options for standard of care with all patients and each consented to proceeding with a simple trachelectomy understanding that this approach was a deviation from standard of care. Intraoperative management included fetal monitoring, using fetal heart rate Doppler, prior to anesthesia induction and at completion of surgery. A radical trachelectomy was not offered to patients and none were performed during the time period of this study. Given the tumor size of all patients (>2 cm) reported in this manuscript, it would be challenging to consider a conization alone, as this approach might increase the risk of residual disease.

We used descriptive statistics to summarize the demographic and clinical characteristics of patients. We measured overall survival from the date of surgery to the date of last contact.

3. Results

A total of five patients with stage IB1 (>2 cm) cervical carcinoma were included for the analysis (Table 1). The median age was 30 years (range; 26–38) and the median BMI was 22.6 kg/m^2 (range; 20–26.5). All patients were diagnosed in either the first- or second trimester with a median gestational age of 12 weeks (range; 7–18). No patient had preoperative imaging that was suggestive of metastatic disease. Three patients were diagnosed with adenocarcinoma and two with squamous carcinoma. Three of five patients had grade 2 tumors and two had grade 3. Only one patient had evidence of lymph-vascular invasion. The median tumor size by physical examination was 30 mm (range; 20–35) and the median depth of invasion was 10 mm (range; 1.5–12). The median gestational age at surgery was 16.5 weeks (range; 12–19) with a median operative time of 193 min (range; 155–259) and estimated blood loss of 100 ml (range; 50–550). Lymphadenectomy was performed by laparoscopy in one patient and by robotics in the remaining four patients. The median number of lymph nodes removed was 14 (range; 5–15). Four patients had negative nodes and one patient had bilaterally positive nodes (isolated tumor cells) [see details below]. Median length of stay was 2 days (range; 1–3). There were no intraoperative or postoperative complications (<30 days) (Table 2).

Table 2
Perioperative outcomes.

	Patient A	Patient B	Patient C	Patient D	Patient E
GA at surgery (weeks)	17	15	19	16.5	12
EBL (ml)	75	50	550	100	350
OR time (minutes)	259	155	234	193	192
LOS (days)	2	1	3	2	1

GA: gestational age; EBL: estimated blood loss; OR time: operative time; LOS: length of hospital stay.

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Four patients delivered live newborns by Cesarean section (C-section) due to obstetric indications, and one patient delivered vaginally. This latter patient has since gone on to have another full term vaginal delivery of a second child. The median gestational age at delivery was 39 weeks (range; 28–40.6) and the median weight was 3841 g (range; 1020–4137). At a median follow-up of 75 months (range, 18–168) all patients are alive with no evidence of disease.

3.1. Patient A

A 33-year-old, G_1P_0, referred to our institution at 8 weeks gestation with newly diagnosed IB1 poorly differentiated cervical adenocarcinoma. Pelvic exam revealed a 3 cm exophytic lesion with no extension to vagina or parametrial tissue. At 17 weeks of gestation, the patient underwent a laparoscopic bilateral pelvic lymphadenectomy and a simple trachelectomy. Final pathology revealed a 20 × 20 × 20 mm moderately differentiated adenocarcinoma with no LVSI. Depth of invasion was 10/15 mm and the distance from closest ectocervical margin was 1.5 mm. Ecto, *endo*- and deep margins were free of tumor. Total size of surgical specimen was 44 × 40 × 30 mm. A total of 14 nodes were removed and none were positive. The patient delivered a 2863-gm newborn at 37 weeks via C-section due to severe pre-eclampsia. The patient did not undergo a radical hysterectomy at the time of C-section because of lack of availability of gynecologic oncologist in that facility. Fifteen days after the C-section, she underwent a laparoscopic radical hysterectomy. The final pathology from that specimen showed residual adenocarcinoma grade 2, no LVSI, depth of invasion of 6/17 mm and negative parametria. The patient did not undergo any further treatment. The patient was without evidence of disease 168 months after her diagnosis.

3.2. Patient B

A 28-year-old, G_1P_0, presented at 12 weeks gestational age with newly diagnosed stage IB1 cervical adenocarcinoma. On pelvic exam, a 2 cm mass on the posterior lip of the cervix with no parametrial extension was noted. Preoperative imaging (MRI) did not reveal any evidence of metastatic disease. At 15 weeks, the patient underwent a robotic bilateral pelvic lymphadenectomy and simple vaginal trachelectomy. Final pathology revealed a 27 mm, grade 2, adenocarcinoma with no LVSI. Depth of invasion was 1.5/12 mm. All margins were negative. Total size of surgical specimen was 40 × 30 × 12 mm. A total of 15 nodes were removed and all were negative for disease. The patient had a vaginal delivery of a 4137-gm newborn at 39 weeks. Although she was offered a completion radical hysterectomy, she declined and had no further treatment. Ninety-three months after her first child, she delivered a second healthy newborn (3770-gm) at 40.5 weeks and this was a vaginal delivery. After 102 months of follow-up she has no evidence of disease.

3.3. Patient C

A 30-year-old, G_6P_3, presented at 18 weeks gestation with stage IB1 squamous cervical cancer. Pelvic exam showed a 2–3 cm cervical lesion with no extension to vagina or parametrium. MRI showed no evidence of metastatic disease. The patient underwent a bilateral robotic pelvic lymphadenectomy and simple vaginal trachelectomy at 19 weeks gestation. The estimated blood loss was 550 ml and 1 unit of PRBC/blood transfusion was administered during the surgery. Final pathology showed a 20 × 15 mm squamous cell carcinoma, grade 3, with a depth of invasion of 5/10 mm. All margins were negative for disease. Total specimen size was 59 × 43 × 14 mm. A total of 5 lymph nodes were removed and all were negative for metastases. She delivered a 3912-gm baby by C-section at 37.6 weeks. The patient underwent a radical hysterectomy without further lymphadenectomy at the time of C-section. Final pathology did not show any evidence of disease. The patient was free of disease 75 months after her diagnosis.

3.4. Patient D

A 38-year-old, G_4P_3 presented at 14.2 weeks gestation with a stage IB1 cervical adenocarcinoma. On pelvic exam, there was a 3.5 cm exophytic cervical mass. Vagina and parametrium showed no evidence of disease. MRI demonstrated a 38 mm polypoid mass protruding via the endocervical canal into the vagina involving the posterior lip of the cervix with no evidence of enlarged nodes (Fig. 1A & B). The patient underwent a robotic bilateral pelvic lymphadenectomy and a simple trachelectomy at 16.5 weeks. Final pathology showed a 38 × 15 × 15 mm moderately differentiated adenocarcinoma, grade 2, with depth of invasion of 12 mm, and no LVSI. All margins were negative for disease. Total specimen size was 55 × 45 × 30 mm. Eight pelvic nodes were removed with no evidence of disease on final pathology. The patient underwent a C-section at 40.6 weeks gestation and delivered a 4110-gm newborn. She underwent simple hysterectomy at an outside facility with no residual tumor in the specimen. The patient was without disease at 65 months of follow-up.

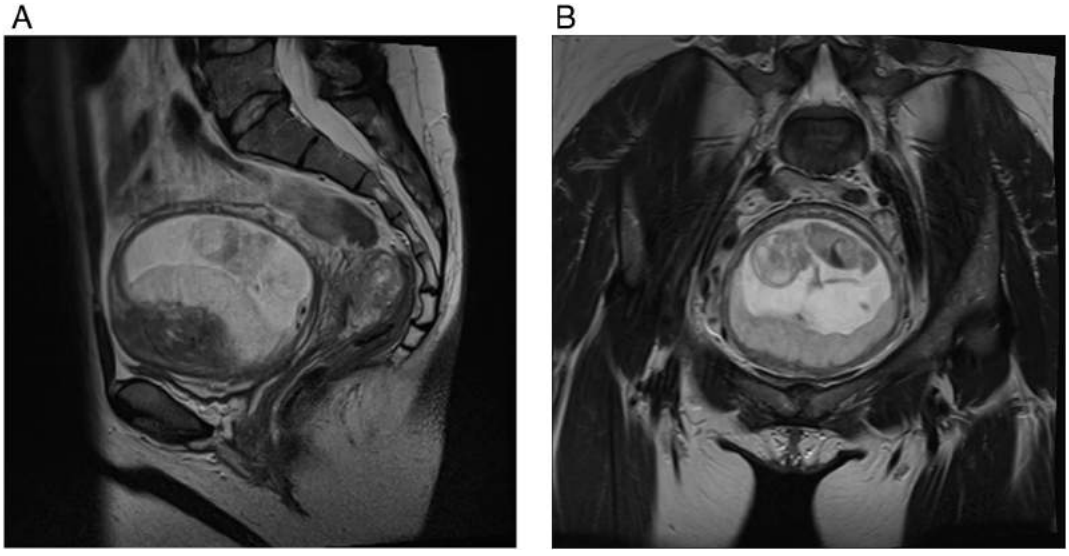

Fig. 1. A. MRI sagittal view of cervical lesion along with intrauterine pregnancy; B. Coronal view demonstrating intrauterine pregnancy and fetal placenta.

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3.5. Patient E

A 26-year-old, G_2 P_1 was referred at 7 weeks' gestation with a stage IB1 squamous cell carcinoma. On pelvic exam, she had a 3 cm cervical exophytic mass. Pelvic MRI showed a gravid 10 cm uterus and a 30 × 1.7 mm mass in the ectocervix involving the anterior and posterior cervical lips and all nodes were negative for disease. At 12 weeks gestation, the patient underwent a bilateral robotic pelvic lymphadenectomy and a simple trachelectomy. Final pathology revealed a 40 × 35 × 30 mm, grade 3, squamous cell carcinoma, with depth of invasion of 12/16 mm. There was evidence of LVSI. All margins were negative for disease. Total specimen size was 50 × 38 × 35 mm. A total of 14 nodes were removed. There were 2 lymph nodes with isolated tumor cells (ITC), one in the right (1/8) and one in the left pelvic nodes (1/7). The patient underwent ultra-staging because the initial H&E sections of the nodes had no definitive tumor; however, due to the presence of extensive LVSI and morphologic features of the carcinoma, a keratin stain with an ultra-staging protocol was performed on all blocks containing lymph node tissue.

The patient was extensively counseled to undergo chemotherapy and radiation; however, she declined and decided to continue her pregnancy. At that point, the patient was counseled to undergo treatment in the form of cisplatin (50 mg/m^2) and paclitaxel (175 mg/m^2) with a plan for treatment until fetal viability. She began her treatment at 20 weeks gestation. She completed a total of two cycles of chemotherapy but at 28 weeks she had preterm premature rupture of membranes. She delivered by C-section a 1020-gm newborn. After her delivery, the patient underwent treatment with chemotherapy (weekly cisplatin) and radiation. After 18 months of follow-up she has no evidence of disease and the baby is alive and healthy.

4. Discussion

Treatment of cervical cancer at the time of pregnancy is determined by several important factors. The patient's desire to maintain the pregnancy is at the forefront of the decision-making process. In patients with early stage disease, the recommendations vary according to the gestational age at the time of diagnosis. According to International Gynecologic Cancer Society (IGCS) and European Society of Gynecologic Oncology (ESGO) Guidelines [11], treatment options for stage IA2 or IB1 tumors are different if diagnosis is before or after 22 to 25 weeks of gestation. Those diagnosed before 22–25 weeks, should undergo pelvic lymphadenectomy and, if lymph nodes are found to be positive, definitive radiation and chemotherapy is recommended. For tumors <2 cm with negative nodes, the guidelines recommend simple trachelectomy or conization. The guideline recommendation for patients with stage IB1 tumors (>2 cm) and negative nodes, is neoadjuvant chemotherapy until fetal maturity [11]. Delay of treatment is a valid option in cases of negative nodes as it has been previously published in a review including 76 patients with stage IB1 cervical cancer reporting a 95% rate of survival at a mean follow up of 37.5 months with a median delay of 16 weeks without recurrences [12].

Radical trachelectomy is currently considered a viable option for patients with early-stage cervical cancer who wish to preserve fertility [7]. This has also been proposed as an option in pregnant patients willing to continue their pregnancies. This procedure either by laparotomic or vaginal approach has been published in pregnant patients with intent to achieve appropriate oncologic outcomes while maintaining the pregnancy until fetal maturity is reached. In the study by Căpîlna et al. [13], the authors reported on 21 cervical cancer patients (stages IA2 to IB2) who underwent radical trachelectomy during pregnancy. A total of 6 pregnancies ended in spontaneous abortions, all within 16 days of the surgery. Radical trachelectomy is no longer recommended by either the 2014 guideline mentioned above [11] nor in a recent review by Halaska et al. [14] because of the high rate of surgical and obstetrical complications. These include a prolonged surgery, significant blood loss and poor obstetric outcomes, such as a 32% rate of early abortions [11,12].

In an effort to identify less aggressive approaches a number of investigators have published on the role of simple trachelectomy or conization in patients with >2 cm early-stage cervical cancer. The first to publish on this approach was Ben Arie et al. [15] in 2004. Since then, several other reports have been published totaling four cases (Table 3) [6,15–17]. Of these four cases, two had stage IB1 tumors, one had stage IA2, and one patient had a stage IB2 tumor. The median gestational age at diagnoses was 17.5 weeks (range; 8–23). Two of the four patients underwent a conization and pelvic lymphadenectomy, while the other 2 patients underwent a simple vaginal trachelectomy. Both patients that had a simple trachelectomy had a cerclage placed at the time of the procedure. Two patients were diagnosed with squamous cell carcinoma and two with adenocarcinoma. The median tumor size was 30 mm (range, 20–60) and the median depth of invasion was 8 mm (range, 4–17). The median gestational age at surgery was 19.5 weeks (range; 15–29). All patients had negative nodes. The median gestational age at delivery was 38.5 weeks (range; 34–39). At a median follow up of 21 months (range; 16–36), all patients were alive with no evidence of disease.

In our study, we report the largest series of conservative approach (simple trachelectomy and minimally invasive lymphadenectomy) in pregnant patients with large (>2 cm) early-stage cervical cancer. In a

Table 3
Tumors >2 cm treated with conization or simple trachelectomy and pelvic lymphadenectomy reported in the literature.

Author	FIGO stage	GA dx (weeks)	GA at surgery (weeks)	Surgery	Histology	Grade	N of PLN	Adjuvant treatment	GA at delivery (weeks)	Definitive treatment	Status at follow up	Follow up (months)
Ben-Arie 2004	IA2	15	17	Conization	Squamous	3	0/NR	no	39	RT 6 w after delivery	NED	36
Van Calsteren 2008	IB1	8	15	Conization	Adenocarcinoma	1	0/71	no	38.5	No	NED	20
Trimesterde 2010	IB1	20	22	ST + cerclage + lap. PL	Squamous	3	0/11	Cisplatin 3 cycles	NR	TRH[a] + ChemoRT	NED	16
Salas 2015	IB2	23	29	ST + cerclage	Adenocarcinoma	1	–	no	34	TRH	NED	22
Ramirez	IB1	12 (7–18)	16.5 (12–19)	ST + laparoscopic PL (1) ST + robotic PL (4)	Adenocarcinoma (3) Squamous (2)	G2 (3) G3 (2)	14 (5–15)	None (4) Chemotherapy (1)	39 (28–40.6)	TRH (2) SH (1) None (1) Chemo radiation (1)	NED	75 (14–168)

NR: not reported; NCM: no cervical mass seen; PL: pelvic lymphadenectomy; Lap: laparoscopic; ST: simple trachelectomy; TRH: total radical hysterectomy; RT: radical trachelectomy; NRT: No residual tumor; Adenoca: adenocarcinoma; DOI: depth of invasion; TS: tumor size.

[a] TRH at the time of C-section.

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recent publication by Pareja et al. [18] the authors evaluated multiple strategies for a conservative management in non-pregnant patients with cervical tumors >2 cm. The authors found that the recurrence rate was 6%, 7.6% and 17%, for abdominal radical trachelectomy (tumors ≥2 cm), neoadjuvant chemotherapy followed by surgery, and vaginal trachelectomy (tumors ≥2 cm); respectively. In our study, we also report that a laparoscopic or robotic lymphadenectomy is feasible in pregnancy. Others have also confirmed the same safety and feasibility, and thus far, there are 32 cases of laparoscopic lymphadenectomy in either the first or second trimester [19–23]. One must consider that if the diagnosis of cervical cancer is made after 22–25 weeks, lymphadenectomy may not be feasible due to the large uterine size and the potential risks for mother and fetus of general anesthesia.

Of interest, in our series, none of the patients underwent a cerclage placement at the time of surgery or in subsequent pregnancies. This practice did not adversely impact pregnancy outcomes as the median gestational age at delivery was 39 weeks. In a recent review by Bentivegna et al. [24], the authors reported on fertility results of 2777 women who underwent fertility-sparing surgery. Of these, 212 women underwent simple trachelectomy or conization. In that study, the rate of prematurity for patients who underwent either simple trachelectomy or conization was 15% and that for women who underwent radical trachelectomy (either as a vaginal, abdominal, or minimally invasive approach) ranged from 39% to 57%. Most likely, lower prematurity rates are seen with the simple trachelectomy because radicality of the surgery is less extensive than a radical trachelectomy. Thus, suggesting that perhaps there is no need for use of cerclage in the setting of a less radical procedure. At this time, based on current literature it is very difficult to determine impact of cerclage placement on fetal loss or prematurity in patients undergoing simple trachelectomy or conization alone.

There are several points to be considered when dealing with the management of pregnant patients with early-stage cervical cancer. First, is the consideration of neoadjuvant chemotherapy as a non-surgical option in order to reach fetal lung maturity. For stage IB1 tumors >2 cm, with negative nodes, neoadjuvant chemotherapy in the form of cisplatin (75 mg/m^2) with paclitaxel (175 mg/m^2) at a 3-week interval is the currently recommended regimen [25,26]. An alternative to cisplatin-based chemotherapy is the use of carboplatin because of its better maternal toxicity profile [11,27]. There are several reported cases of NACT for stage IB1 tumors during pregnancy (N = 20) allowing the pregnancy to be continued until 33.2 weeks. With a median age of 32.4 years and a median GA at diagnoses of 19.2 weeks, 6.25% patients had a complete response, 62.5% a partial response, in 28.1% the disease stabilized, and in 3.1% of patients the disease had progressed. Overall survival rate is 94% (15/16 patients) in stage IB1 patients at a median follow-up of 12 months [26,28–30]. Second, there is very limited data on the routine use of sentinel lymph node (SLN) mapping in pregnant patients. Three cases had been reported in the literature thus far. In one case the tracer used was Tc99 and in the other two cases, it was ICG [31,32]. None was found to have disease in the SLN. All patients have had a full lymphadenectomy in addition to the SLN mapping. Third, the timing of the surgery is also an important element to consider. Approximately 0.5% to 2% of pregnant women undergo non-obstetric surgery during their pregnancies [33]. Surgery is recommended in the 2nd trimester, as the uterine size still allows adequate visibility and also this timing may decrease the risk of miscarriages. Fourth, minimally invasive surgery (MIS) has many advantages in pregnancy [34] including decreased fetal depression due to less opioids requirements, lower risk of wound complications, diminished postoperative maternal hypoventilation, shorter hospital stays, and decreased risks of thromboembolic events due to early mobilization [35–40]. Minimally invasive surgery may be safely performed until 26–28 weeks. Fifth, the mode of delivery remains a topic of debate after undergoing a simple trachelectomy. As there are many advantages in terms of reduced blood loss, operative and infection risks and reduced length of stay, a vaginal birth is preferred whenever possible. Reducing infectious risk is especially important in patients who received prior chemotherapy [11]. Sixth, there are those who consider that preservation of the uterine arteries may be associated with a lower rate of premature births and intrauterine growth retardation [41,42]. However, we are not aware of any work that has compared uterine functional differences and obstetrical outcomes between a uterine artery-preserving group and uterine artery-ligating group after radical trachelectomy. In fact, a study by Tang et al. [43] evaluated blood supply to the uterus in patients who had uterine artery preservation and those who had such blood supply ligated. The authors of that study used computed tomography angiography and showed that there was an 87.5% chance of postoperative occlusion after preservation of the uterine artery. However, in the cases presented in this study, this question is irrelevant as these patients aimed to preserve their pregnancy and thus obviating the need for preservation of the uterine artery by nature of the circumstance and by the fact that the patients only underwent a simple trachelectomy. Lastly, one must always be concerned regarding specimen margin at the time of surgery, particularly in patients with adenocarcinoma who may be predisposed to 'skip lesions'; and thus the reason for sending the specimen for careful frozen section evaluation by an expert gynecologic oncology pathologist. We do recognize that this is a small series of patients and certainly definitive conclusions regarding safety are to be viewed with caution. The long follow-up without recurrence in any of the patients in our series, and those in the literature, provide evidence supporting this approach.

In conclusion, we found that, although simple trachelectomy and pelvic lymphadenectomy is not within the current recognized recommendations of standard of care, in a very select group of patients it may be considered an option to preserve the pregnancy with the aim of definitive treatment at the time of delivery or shortly thereafter. Oncologic safety is currently based on a total of nine cases, reported herein, where there have been no recurrences with a median follow up of 75 months (range, 18–168). One must also emphasize that patients should be extensively counseled regarding all options based on gestational age at the time of diagnosis.

Conflict of interest

The authors report no conflict of interest.

Author contribution

Conception and design: Gloria Salvo, Michael Frumovitz, Rene Pareja, Pedro T Ramirez

Administrative support: Joseph Lee

Collection and assembly of data: Gloria Salvo, Joseph Lee

Data analysis and interpretation: Gloria Salvo, Michael Frumovitz, Rene Pareja, Pedro T Ramirez

Manuscript writing: Gloria Salvo, Michael Frumovitz, Rene Pareja, Pedro T Ramirez

Final approval: All authors

Accountable for all aspects of work: All authors

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