Fertility-sparing surgery and fertility preservation in cervical cancer: the desire for parenthood, reproductive and obstetric outcomes.

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Abstract

Objective to evaluate the desire for parenthood and reproductive outcomes following fertility-sparing treatment for invasive cervical cancer including Vaginal Radical Trachelectomy (VRT), Radical Hysterectomy (RH) and chemoradiotherapy. **Design** Retrospective cohort study **Setting** Tertiary referral center in the Netherlands **Population** patients <45 years with invasive cervical cancer desiring to maintain reproductive potential. **Methods** Clinicopathologic and reproductive outcomes were retrieved from medical files and postal questionnaires for patients treated between 2009 – 2020. **Main outcome measures** Survival, recurrences, fertility and pregnancy outcomes **Results** 75 patients were identified of whom 34 underwent VRT, 9 RH and 32 had (chemo)radiotherapy. 26 patients started fertility preservation (FP) procedures of whom 23 (88.5%) successfully preserved fertility. After a median follow-up of 49 months, 5 patients developed recurrent disease and died. Reproductive outcomes were available for 58 patients of whom 89.6% maintained their desire for parenthood. Following VRT, 15 patients conceived 21 pregnancies which resulted in 15 live-births, yielding a pregnancy rate of 61.9% and live-birth rate of 75.0%. Following RH or (chemo)radiotherapy, 3 surrogate pregnancies were established (21.4%) using frozen-thawed oocytes (n=2) and ovarian tissue fragments (n=1) with good neonatal outcomes. **Conclusions** Many cervical cancer patients maintain the desire to become parents after cancer treatment. Vaginal Radical Trachelectomy and Fertility Preservation enable young women with invasive cervical cancer to become a parent after cancer treatment. Structural and timely fertility counseling is of the essence when attempting fertility-sparing treatment and should be available to all. **Keywords** cervical cancer / oncofertility / trachelectomy / fertility preservation / surrogacy

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Design Retrospective cohort study

Setting Tertiary referral center in the Netherlands

Population patients <45 years with invasive cervical cancer desiring to maintain reproductive potential.

Methods Clinicopathologic and reproductive outcomes were retrieved from medical files and postal questionnaires for patients treated between 2009 – 2020.

Main outcome measures Survival, recurrences, fertility and pregnancy outcomes

Results : 75 patients were identified of whom 34 underwent VRT, 9 RH and 32 had (chemo)radiotherapy. 26 patients started fertility preservation (FP) procedures of whom 23 (88.5%) successfully preserved fertility. After a median follow-up of 49 months, 5 patients developed recurrent disease and died. Reproductive outcomes were available for 58 patients of whom 89.6% maintained their desire for parenthood. Following VRT, 15 patients conceived 21 pregnancies which resulted in 15 live-births, yielding a pregnancy rate of 61.9% and live-birth rate of 75.0%. Following RH or (chemo)radiotherapy, 3 surrogate pregnancies were established (21.4%) using frozen-thawed oocytes (n=2) and ovarian tissue fragments (n=1) with good neonatal outcomes.

Conclusions Many cervical cancer patients maintain the desire to become parents after cancer treatment. Vaginal Radical Trachelectomy and Fertility Preservation enable young women with invasive cervical cancer to become a parent after cancer treatment. Structural and timely fertility counseling is of the essence when attempting fertility-sparing treatment and should be available to all.

Keywords cervical cancer / oncofertility / trachelectomy / fertility preservation / surrogacy**Introduction**

Cervical cancer is the fourth most common cancer among women worldwide and affects women at a significantly younger age than most other malignancies. Approximately 42% of the women diagnosed with cervical cancer is [?] 45 years [1, 2]. Combined with a trend towards delayed childbearing, many of these women may not have completed their desire for parenthood at time of cancer diagnosis. Recent studies on the effects of treatment-associated infertility and quality of life among young cancer survivors have quantified the impact of treatment-induced infertility, resulting in long-lasting emotional and physical distress [3, 4]. Together with the improved survival rates for cervical cancer, fertility-sparing treatment options are becoming increasingly for these women [5].

Standard treatment for invasive cervical cancer includes radical hysterectomy (RH) with pelvic lymphadenectomy for early-stage disease and chemoradiotherapy for advanced stage-disease. Both with obvious implications for fertility [6]. The past two decades, fertility-sparing treatment options have been introduced in the management of invasive cervical cancer. These include Vaginal Radical Trachelectomy (VRT) and fertility preservation (FP) for more advanced disease. Studies showed that VRT is an oncologically safe treatment alternative in carefully selected patients with overall good obstetric and neonatal outcomes [7, 8]. When requiring RH or chemoradiotherapy, biological parenthood is feasible through fertility preservation (FP) and a surrogate. While all these treatment options enable patients to have a biological offspring after cancer treatment, well-known complications following VRT include infertility and prematurity[9] . Furthermore, lit-

tle is known about reproductive outcomes following FP and gestational surrogacy pregnancies due to the experimental nature of these procedures.

To date no studies have addressed the desire for parenthood after cancer treatment among cervical cancer survivors nor did they address reproductive outcomes for all patients with invasive cervical cancer including both fertility-sparing surgery and fertility preservation.

The aim of this study is to evaluate fertility-sparing management for invasive cervical cancer as a whole, addressing the desire for parenthood and reproductive outcomes of patients who underwent either fertility-sparing surgery or fertility preservation. These data will provide both patients and clinicians with realistic expectations regarding reproductive intentions and outcomes in cervical cancer treatment and therefore improve counseling in newly diagnosed cervical cancer patients.

Materials and methods

Study design and participants

This retrospective cohort study reports reproductive intentions and outcomes of women who underwent fertility-sparing surgery or fertility preservation procedures for invasive cervical cancer in a tertiary referral clinic for gynecological oncology in the Netherlands. Using a computerized database, patients [?] 45 years old, diagnosed with invasive cervical cancer stage IA2 to IVA and who desired to maintain reproductive potential between January 2009 and January 2020 were identified. Patient, tumor and treatment data were retrieved from medical files. Data on reproductive intentions and pregnancy outcomes were derived from both medical files and postal questionnaires sent to all but deceased patients.

Setting & Treatment

In our hospital, fertility-sparing treatment options for cervical cancer include VRT with Sentinel Node Procedure (SNP) and Pelvic Lymph Node Dissection (PLND), radical hysterectomy (RH) with ovarian preservation and fertility preservation (FP) procedures prior to (chemo)radiotherapy.

After standardized diagnostic workup including medical history, physical examination, laboratory tests, MR-imaging and histopathological analysis, an individualized treatment plan was made during weekly multidisciplinary treatment meetings. Staging was done according to the International Federation of Obstetrics and Gynecology 2018 classification [6]. Available treatment options included:

1) VRT with laparoscopic or robotic SNP and PLND was indicated in IA2-IB1 tumors measuring [?]2 cm as recommended by international guidelines [6, 10]. Our surgical technique was previously described by [7, 11] and included SNP with frozen section (FS) analyses, complete PLND and a vaginal radical trachelectomy. A 2-step procedure consisting of a separate laparoscopic or robotic SNP and PLND procedure with serial sectioning was performed in patients with an estimated risk of lymph node (LN) positivity of >10% to rule out lymph node metastases. In absence of LN metastases, a VRT was performed in a second session. In these cases the FS was not performed and final histopathology determines whether or not the VRT was performed or chemoradiotherapy was required. A complementary radical hysterectomy was performed in presence of positive or close surgical margins and adjuvant chemoradiation was recommended in case of positive lymph nodes. Neo-adjuvant chemotherapy followed by VRT was performed on an individualized shared decision making basis.

2) Robot-assisted radical hysterectomy with SNP and PLND was indicated in FIGO stage IB2 and IIA1 disease [6]. As previously described, first the SNP was performed and sent for FS analyses before the PLND was completed using the da Vinci robot [12].In absence of lymph node metastases, a radical hysterectomy was performed. Adjuvant radiotherapy was indicated in presence of deep cervical stromal invasion, lymphovascular space invasion (LVSI) and large (> 4cm) tumor size [13, 14]. Adjuvant chemoradiotherapy was recommended for patients with LN metastases or (microscopic) parametrial involvement [14].

3) For patients with stage IB3 to IVA stage disease, treatment consisted of concurrent external beam chemoradiotherapy followed by MRI guided brachytherapy performed by a radiation oncologist [15].

Routine follow-up visits were performed every 3 months for the first year, every 4 months for the second year and biannually for the last three years.

Fertility preservation counseling

Pre-treatment fertility counseling was offered to all patients primarily treated with RH or chemoradiotherapy. When adjuvant treatment was indicated upon surgery, emergency fertility counselling was performed within one week to prevent any delay in starting (chemo)radiotherapy.

Fertility counselling was performed by a reproductive specialist and included discussion on treatment-induced infertility and information provision on FP procedures; ovarian transposition, cryopreservation of embryos and/or oocytes and ovarian tissue cryopreservation (OTC). Selection of FP procedure was decided upon shared-decision making, in consensus with patient, gynecologic oncologist, reproductive specialist, and radiation oncologist.

Postal questionnaires

Additional and up-to-date data on reproductive intentions and outcomes were derived from postal questionnaires. All patients were sent an information letter and informed consent form for participating in the questionnaire. The questionnaire addressed the desire for parenthood, attempts to conceive, fertility problems, obstetric and neonatal outcomes. Three and four weeks after sending the initial invitation, respondents received a reminder asking them to participate. Deceased or severely ill patients were excluded from receiving the questionnaire.

Statistical analyses

A data-management plan was constructed in order to improve the reproducibility of our study. Data was anonymously collected using Castor Electronic Data Capture [16]. Due to the size of the study population, we were limited to descriptive and basic statistics in SPSS statistics (version 25) only.

Results

Patient and treatment characteristics

Between January 2009 and January 2020 a total of 219 patients [?]45 years were treated for cervical cancer at our hospital of whom 75 desired to maintain reproductive potential. Of these, 34 patients were treated with vaginal radical trachelectomy, 9 with radical hysterectomy and 32 patients with (chemo)radiotherapy. An overview of patient and tumor characteristics per treatment is presented in **Table I** . A flow-chart describing the intention to treat, performed treatment and reproductive outcomes treatments is presented in **Figure 1.**

Intention to treat and treatment performed

Whereas 38 patients were scheduled for VRT with SNP and PLND, the procedure was actually performed in 35 patients. VRT was abandoned in 3 patients due to LN metastases upon serial sectioning after separate SNP/PNLD procedures. Patients were then treated with chemoradiotherapy. Following VRT, 1 patient required a complementary hysterectomy due to positive resection margins upon final pathology, leaving 34 patients who were successfully and only treated with VRT. One patient with tumor size >2cm was treated with neoadjuvant chemotherapy and subsequent VRT in an individualized setting after shared decision making.

A total of 17 patients were scheduled for radical hysterectomy with SNP and PLND, and one had a complementary hysterectomy after VRT as aforementioned. RH was abandoned intraoperatively in 4 patients due to LN metastases upon frozen section analysis of the sentinel node. Patients were then treated with chemoradiotherapy. RH was completed in 14 patients, of whom 5 patients required adjuvant (chemo)radiotherapy. Adjuvant radiotherapy was indicated for 3 patients due to positive resection margins (n=1) or parametrical involvement (n=2), whereas adjuvant chemoradiotherapy was performed in 2 patients with LN metastases upon final pathology.

Chemoradiotherapy was primarily indicated in 20 patients and additionally indicated in 9 patients upon pathologic risk factors as mentioned before. As adjuvant radiotherapy was indicated upon final pathology in another 3 patients, a total of 32 (42.7%) patients were treated with (chemo)radiotherapy.

Fertility preservation

All 32 patients treated with (chemo) radiotherapy received pre-treatment fertility counselling. An overview of patient decisions and treatment flow regarding FP procedures is presented in **Supplementary 1** . After counselling, 26 patients (81.3%) started FP procedures whereas 5 patients (15.6%) decided to not preserve fertility and 1 patient (3.1%) with neuroendocrine tumor was advised to not start FP due to oncologic reasons. Personal reasons for not pursuing FP after counseling included fear of postponing cancer treatment or the complexity of gestational carrier procedures.

While 26 patients started FP procedures, oocyte cryopreservation failed in 5 patients due to poor ovarian response. 2 of them underwent emergency ovarian tissue cryopreservation (OTC) and 3 decided to not start alternative FP procedures. Fertility was successfully preserved in 23 (88.5%) of the 26 patients who started FP procedures.

9 patients underwent more than one procedure; i.e. a combination of the aforementioned. Ovarian transposition was performed to retain hormonal function in 5 patients or for fertility preservation purposes in 2 patients. Vaginal oocyte pickup procedures and laparoscopic retrieval of ovarian tissue were performed succesfully in all patients. FP procedures were all performed within 6 weeks after diagnosis, therefore it did not interfere with cancer treatment.

Follow-up study cohort

By May 2020, the mean follow-up (FU) time was 55 months (1-132) in the VRT group, 25 months in the RH group (8-64) and 49 months in the (chemo)radiotherapy group (1-134). During FU, five patients (6.7%) developed recurrent disease at a median time of 12 months after diagnosis (range 3-24 months) and died following palliative chemotherapy with a median survival time of 17 months (range 13-32 months). All were diagnosed with tumor stage IIB or higher and were treated with chemoradiotherapy.

Desire for parenthood

As 4 patients died shortly after cancer treatment and follow-up data could not be retrieved in another 13 patients, reproductive outcomes were analyzed in the remaining 58 patients (81.7%).

51 (87.9%) of the 58 patients reported to have a current or future desire for parenthood after cancer treatment. 4 patients (8.6%) reported to be to be uncertain about their desire for parenthood and 2 patients (3.9%) reported to have withdrawn their desire for parenthood. An overview of the desire for parenthood and reproductive outcomes is presented in **Supplementary 2** .

Reproductive outcomes - VRT

In the VRT group, data on reproductive outcomes were available for 29 of the 34 patients. Among those, 28 patients reported to have either an active or future desire for parenthood and 24 patients had attempted to conceive.

12 of the 24 patients who attempted conception (50.0%) experienced difficulty conceiving for which they consulted a reproductive specialist. Causes for difficulties conceiving included cervical stenosis in 4 (33.3%) patients, male factor in 2 (16.7%) patients, tubal pathology in 1 (8.3%) patient or unknown fertility problems in 5 (41.7%) patients. Among the patients with cervical stenosis, 2 patients presented with dysmenorrhea and hematometra whereas 2 patients were asymptomatic. All underwent isthmic dilatation procedures for reproductive purposes which succeeded in 2 patients. The remaining 2 patients experienced persistent stenosis of the cervical ostium and ultimately received experimental transmyometral embryotransfers resulting in an ongoing pregnancy in 1 patient. To date, 5 patients (41.7%) who experienced difficulties conceiving and

consulted a reproductive specialist, have ultimately conceived through ART while 7 patients (58.3%) are still attempting conception via ART or naturally.

So far, a total of 15 patients conceived a total of 21 pregnancies following VRT, yielding a pregnancy rate of 62.5%. Reproductive, obstetric and neonatal outcomes are presented in **Table II** and**Table III** respectively**.** A total of 15 pregnancies reached the third trimester (75.0%) and resulted in 15 healthy babies. All women delivered via cesarean sections, which were scheduled between 38 and 39+0 weeks. There were no fetal losses or neonatal complications identified in our study cohort.

Reproductive outcomes following RH-CRT

Among the patients treated with hysterectomy or (chemo)radiotherapy and thus requiring a gestational carrier, reproductive outcomes were available for 29/41 patients. 23 of the 29 patients (79.3%) desired to have children after cancer treatment, and 14 of these 23 (60.1%) were referred for gestational surrogacy treatments. This resulted in 3 ongoing gestational surrogacy pregnancies (21.4%), while 7 patients (50.0%) are still searching for a suitable gestational carrier and 2 patients (14.3%) discontinued gestational surrogacy treatments. One of these patients adopted a child. Two pregnancies were established using frozen-thawed oocytes and one pregnancy was established through orthotropic auto-transplantation of ovarian tissue and ovarian stimulation. There were no obstetric or neonatal complications and all gestational carriers delivered at term.

Discussion

We present our 10-year experience with fertility-sparing management for cervical cancer in a tertiary referral hospital in The Netherlands, including both fertility-sparing surgery and fertility preservation procedures.

Desire for parenthood

One of the objectives of this study was to investigate whether patients maintain their desire for parenthood after cancer treatment. Although results from previous studies suggest that not all patients maintain their desire for parenthood after cancer treatment (27.7 – 71.8%), we found that nearly 90% does [17, 18]. Possible explanations may be that we specifically selected the subset of women desiring to maintain reproductive potential and that the majority of women was nulliparous at time of diagnosis. As treatment-induced infertility significantly impairs the quality-of-life in cancer survivors, these results stress the importance of fertility-sparing treatment options in this population [3, 4].

Vaginal Radical Trachelectomy

Over the past two decades, VRT with pelvic lymphadenectomy has been accepted as an oncologically safe fertility-sparing alternative to RH in carefully selected patients with early-stage disease. In accordance with previous studies, we found that 4 patients (10.8%) were found to have more extensive disease or LN metastases when attempting fertility-sparing surgery [9, 19]. In our cohort, no VRTs were abandoned intraoperatively as all patients with LN metastases were identified during separate SNP/PLND procedures. Fertility-sparing surgery in cervical cancer warrants careful risk stratification. Apart from routine preoperative MR-imaging and physical examination, we feel that SN assessment prior to VRT contributes in proper patient selection by detection of (micro) LN metastases. This two-step procedure prevents not only for undertreatment but also for delay in starting chemoradiotherapy due to surgical morbidity after VRT or RH.

No recurrences occurred after a median FU of 52 months, which is favorable when compared with previous literature reporting rates of 2.7 – 7.1% [9, 19, 20]. Given that our findings are based on a limited number of cases, the results are encouraging but should be interpreted with considerable caution.

Although many uncomplicated live-births have been reported after VRT, well-known complications include infertility and prematurity. We report a pregnancy rate of 62.5% and a live-birth rate of 75.0%, which is comparable to previously reported rates ranging from 41 - 67% and 51 – 73% respectively[9, 19, 21]. Although 5 of the 12 (41.7%) patients experiencing difficulty conceiving ultimately conceived through ART, we report a relatively high number of patients experiencing fertility issues. As most of our patients were nulliparous, it

is difficult to establish whether fertility problems were related to VRT or due to intrinsic factors. As reported by others, cervical stenosis is a well-known cause of subfertility after VRT, presenting in approximately 8.1% of the patients [22, 23]. Cervical stenosis may cause significant morbidity due to dysmenorrhea, haematometra and difficulties when performing assisted reproduction technologies. As all patients in our cohort required surgical dilatation of the cervical ostium due to either haematometra or the inability of performing ART, we feel that clinicians should make an effort to timely recognize and treat cervical stenosis to improve fertility outcomes.

The rates for first- (19.0%) and second term miscarriages (4.8%) were both in line with those reported in previous studies and not higher than in the general population [9, 21]. We report only 1 (5.0%) preterm delivery which is low when compared with the prematurity rate of 25% as reported in a review concerning 200 pregnancies[24]. There were no severe obstetric or neonatal complications in our study cohort. Our data confirm the earlier described favorable obstetric and neonatal outcomes after VRT in most patients.

Radical hysterectomy and chemoradiotherapy

For patients requiring radical hysterectomy or (chemo)radiotherapy, biological parenthood is only feasible through ART and surrogacy. Pre-treatment fertility preservation requires close collaboration of both gynecological-oncologists, reproductive specialists and radiation specialists to minimize delay in starting cancer treatment. In our cohort, all patients requiring (chemo)radiotherapy received pre-treatment fertility counseling and fertility was preserved in 23 patients (88.5%), These results suggest that the structural implementation of oncofertility services is feasible in a multidisciplinary oncofertility center. As maintaining fertility potential is of utmost importance in young patients with cervical cancer, we advocate the implementation of a well-integrated oncofertility care program in all centers treating young cancer patients. To minimize delay in cancer treatment, we believe that efforts should be made to perform fertility counseling within one week after diagnosis. Furthermore, we emphasize the importance of weighing in the possible delay of FP in patients with high-risk disease and feel that an individualized risk assessment regarding oncological safety should be carefully evaluated for each patient.

Gestational surrogacy is considered to be a good reproductive option for patients without a (functional) uterus with an ongoing pregnancy rate of 66.7%[25].We report a live-birth rate of 21.4% among the women who started gestational surrogate treatments. Barriers explaining this discrepancy include the challenge of finding a suitable gestational carrier who is approved by the regulations in centers performing surrogate treatments [25]. The process of finding a gestational carrier is additionally complicated by the Dutch law, that prohibits commercial surrogacy and the public search for a surrogate. Lastly, the chance of achieving a biological genetic offspring may be additionally complicated as some patients may fail to preserve oocytes leaving OTC as only option to preserve fertility. Restoration of ovarian function after frozen-thawed ovarian cortex fragments is achieved in 25 – 30%, resulting in over 130 live-births worldwide [26, 27]. However, this procedure is still considered experimental in the Netherlands. We report only one birth in our cohort after auto-transplantation of frozen-thawed ovarian tissue fragments in an experimental setting. As this may be the only option for patients who cannot delay cancer treatment or fail to preserve oocytes, we do support to continue using this technique.

We expect that the number of surrogate pregnancies in our cohort is likely to increase, as 7 patients are still searching for a gestational carrier and one patient found a gestational carrier for which she currently is within fertility treatments.

Strengths and limitations

Pregnancy- and live-birth rates may have been underestimated as a result of the experimental nature of novel fertility treatments and retrospective study design. By sending out postal questionnaires we tried to minimize missing data.

Conclusion

This study demonstrates that many cervical cancer survivors desire to become parents eventually and that

biological parenthood is feasible even in advanced stage disease without compromising oncologic safety. We believe that the findings of this study provide both patients and clinicians with realistic expectations regarding biological parenthood after cervical cancer treatment, which may improve the process of counselling and shared-decision making in newly diagnosed patients. To further improve the chances at biological parenthood in young cancer patients, we advocate the implementation of structural and joined oncofertility care programs in all centers treating young cancer patients.

Supplementary data

Supplementary figures are available *on BJOG online* .

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Author's roles

R.C.J.v.d.P was responsible for data collection, cleaning and analysis, interpretation and discussion and drafting of the article. A.M.E.B., C.G.G. and R.P.Z. initiated the study, contributed to data collection, involved in data interpretation, and critically revised the article. I.M.J-S. contributed to data collection and revised the article. All authors critically reviewed and approved the article.

Details of ethical approval

The study was conducted in accordance with the Declaration of Helsinki Ethical Principles and Good Clinical Practices and was approved by the local Medical Ethical Research Committee on 07-03-2019(document no:19-427).

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Conflict of interest

All authors declare that they have no conflict of interest.

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Table I: Clinical and histopathological characteristics of study cohort[a]

	Vaginal Radical Trachelectomy (n=34)	**Radical Hysterectomy (n=9)**
Age, median (range)	31 (25-37)	30 (25-37)
BMI, median (range)	22.5 (18.0-36.7)	21.2 (17.3-36.7)
Parity		
Nulliparous	27 (79.4%)	7 (77.8%)
Parous	7 (20.6%)	2 (22.2%)
Stage		
IA2		1 (11.1%)
IB1	30 (88.2%)	3 (33.3%)
IB2	3 (8.8%)	4 (44.4%)
IB3	1 (2.9%)	
II		1 (11.1%)
Grade		
I	7 (20.6%)	2 (22.2%)
II	18 (52.9%)	5 (55.6%)
III	9 (26.5%)	2 (22.2%)
Histology		
Squamous cell carcinoma	27 (79.4%)	5 (55.6%)
Adenocarcinoma	6 (17.6%)	4 (44.4%)
Adenosquamous carcinoma	1 (2.9%)	
Neuroendocrine		
Median tumor size in mm (range)	9.0 (6.0-40.0)*	20.0 (7.0-35.0)
LVSI		
No	21 (61.8%)	6 (66.7%)
Yes	13 (38.2%)	3 (33.3%)
Lymph node metastasis		
No	34 (100%)	9 (100%)
Yes	0 (0%)	0 (0%)
Neoadjuvant chemotherapy	1 (2.9%)	
Follow-up in months	55 (1-132)	25 (8-64)
Recurrence	-	-
Deceased	-	-
[a] according to the FIGO 2018 staging	[a] according to the FIGO 2018 staging	[a] according to the FIGO 2018 stagi

Table II: reproductive outcomes VRT

Pregnancies (n=21)	
Way of conception	

Naturally
IUI
IVF/ICSI
TMET
Pregnancy outcome (n=20)
1st trimester miscarriage
2nd trimester miscarriage
Preterm delivery 32-37 WOG
At terme delivery [?] 37 WOG
Ongoing pregnancies
Complications pregnancy [a]
PROM
PPROM
1st trim vaginal bleeding
2nd trim vaginal bleeding
Cervical insufficiency
Cerclage erosion
Chorioamnionitis
Pregnancy rate [b]
Live-birth rate [c]
IUI, intra-uterine insemination; IVF, in vitro fertilization; ICSI, intracytoplasmatic sperm injection; TMET, transmyometra

Table III: obstetric and neonatal outcomes study cohort

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Patient no.

Treatment

Pregnancy

Way of conception

Time to conception (months)

Outcome

Gestational weeks

Fetal weight (g)

Obstetric and neonatal complications

1

VRT

1

IUI

13

Live birth

39+0

U

2

Naturally

29

Miscarriage 1st trim

8

3

Naturally

32

Live birth

38+0

U

2

VRT

4

IUI

19

Ongoing pregnancy

24+

U

3

VRT

5

Naturally

21

Live birth

39+0

2806

6

IUI

58

Live birth

38+5

3480

4

VRT

7

TMET

71

Ongoing pregnancy

38+0

3440

5

VRT

8

Naturally

39

Live birth

37+2

2340

spontaneous rupture of membranes, dysmaturity

6

VRT

9

Naturally

11

Miscarriage 1st trim

7

7

VRT

10

Naturally

20

Live birth

37+5

U

11

Naturally

28

Live birth

38+3

U

gestational diabetes

8

VRT

12

Naturally

1

Live birth

37+6

U

conceived within one month after VRT, 1st and 2nd trimester hemorrhage

9

VRT

13

Naturally

22

Miscarriage 2nd trim

17+0

U

PROM, chorioamnionitis, placenta previa

10

VRT

14

ICSI

Live birth

38+0

U

11

VRT

15

Naturally

10

Live birth

37+5

3385

spontaneous rupture of membranes

12

VRT

16

ICSI

53

Live birth

38+0

2745

2nd trimester iatrogene hemorrhage for which admission

13

VRT

17

IUI

39

Live birth

39+0

2858

cervical insufficiency

18

IUI

Live birth

39+0

U

14

VRT

19

Naturally

7

Live birth

36+3

U

PROM, 2nd trim blood loss

15

VRT

20

Naturally

59

Miscarriage 1st trim

7

uterine myomas

21

Naturally

41

Miscarriage 1st trim

6

16

CRT

22

ET + surrogacy

U

Live-birth

38+0

U

17

CRT

23

ET + surrogacy

U

Live-birth

U

U

18

CRT

24

Ovarian tissue autotransplantation + ICSI + ET + surrogacy

U

Live-birth

39+0

U

IUI, intra-uterine insemintation; TMET, trans-myometral embryo transfer; ICSI, intracytoplasmatic sperm injection; ET, embryotransfer; PROM, prelabor rupture of membranes; VRT, vaginal radical trachelectomy; CRT, chemoradiotherapy.

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