

# Robot-assisted laparoscopic cervical cerclage as an interval procedure

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## Introduction

Robot-assisted abdominal cerclage performed in the pregnancy interval has the advantages of operating on the non-gravid uterus. This is the first report of two women with cervical insufficiency, who underwent robot-assisted abdominal cerclage in the pregnancy interval and delivered two healthy infants.

## Case 1

A 28-year-old woman gravida 4 Para 0 presented with a history of cervical insufficiency following three mid-trimester miscarriages, two at 16 weeks and one at 17 weeks. The last two mid-trimester miscarriages presented with painless rupture of membranes and cervical shortening was demonstrated on ultrasound in one. She also had one early miscarriage at 6 weeks. There was no patient history of cervical instrumentation, cervical surgery, congenital abnormality or uterine anomaly. There was

also no history of thrombophilia, translocation or maternal family history of recurrent miscarriage. She was appropriately counselled and offered an interval robot-assisted abdominal cerclage (Interval RA-AC).

The procedures were carried out using the da Vinci System. The ports were sited as per Fig. 1.

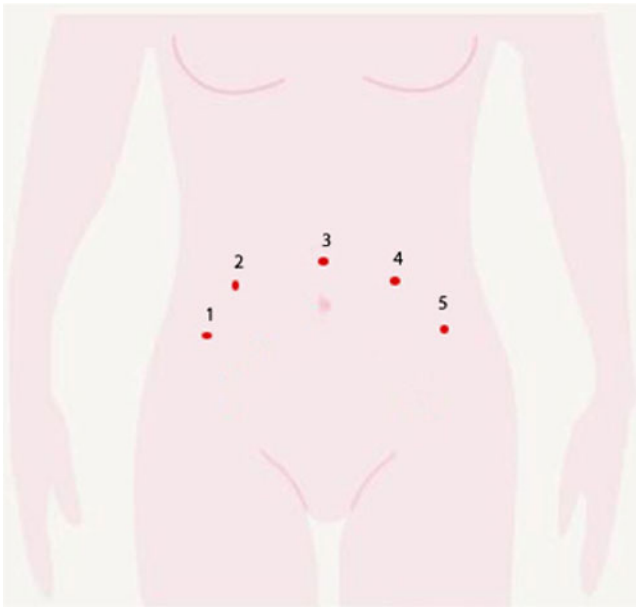
The procedure was performed as previously described [1, 2] using steep Trendelenburg position, uterine manipulation with a size 10 Hagar dilator in order to prevent over-tightening of the cervix, bladder reflection (Fig. 2) and broad ligament fenestration bilaterally (Fig. 3). A one Ethibond (Ethicon Inc., Johnson & Johnson, USA) suture was placed medial to the uterine artery bilaterally (Fig. 4) and tied posteriorly (Fig. 5). She was discharged without complication later that day and remained well. She subsequently became spontaneously pregnant. Her pregnancy was uncomplicated and she delivered a healthy female infant (weighing 2.58 kg) by elective caesarean section (CS) at 37 weeks gestation. There were no intraoperative difficulties. The suture was neither visualised nor felt at CS, and it was presumably deep in the substance of the myometrium. The cerclage remains in place for subsequent pregnancies.

## Case 2

A 33-year-old woman primagravida, presented at 20 weeks with concern regarding an increase in cervical mucus. There was no personal history of previous instrumentation, surgery or congenital abnormality of the cervix including a collagen disorder, or maternal family history of recurrent miscarriage. Speculum examination revealed dilatation of the cervix approximately 3–4 cm in the absence of pain and uterine activity. Fetal viability was confirmed and the absence of

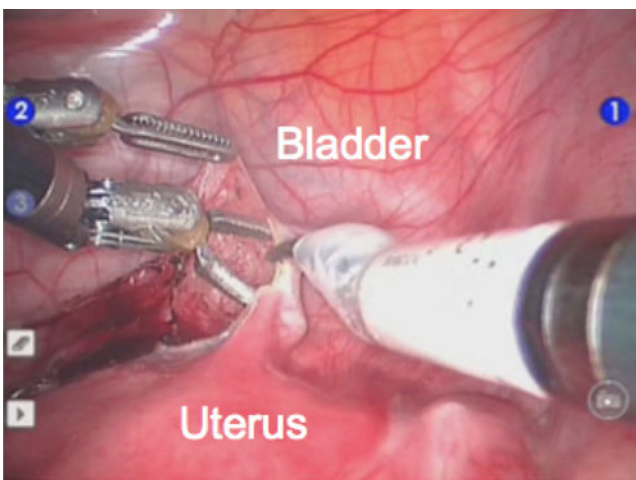
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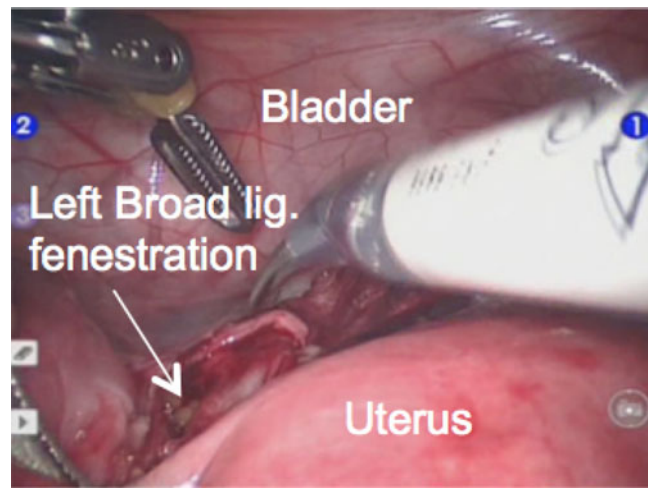


**Fig. 1** Port sites. 1. Camera port 12 mm (port 3). 2. Assistance port 12 mm — suction and needle insertion (port 4). 3. Three da Vinci trochars (ports 1, 2 and 5): Maryland grasper (port 1, robot arm 3), monopolar scissors (port 2, robot arm 1), gyrus bipolar patient left lower (port 5, robot arm 2). For suturing, we change the monopolar scissors for a needle grasper (port 2, robot arm 1)

infection and uterine activity checked, before an attempted rescue transvaginal cervical cerclage was performed with initial good effect and she was admitted for complete bed rest. However, a week later she laboured spontaneously and delivered a non-viable fetus at 21 weeks. Cervical insufficiency was attributed as the cause of the miscarriage. She was appropriately counselled and offered RA-AC. This was performed using a one Prolene (Ethicon Inc, Johnson & Johnson, USA) suture in this instance in the same fashion as previously, and she was discharged home the next morning. She spontaneously became pregnant and delivered a healthy



**Fig. 2** Bladder reflection

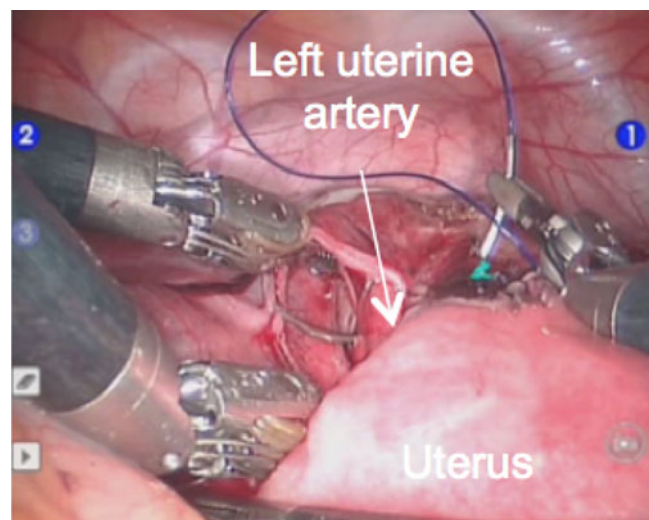


**Fig. 3** Left broad ligament fenestration

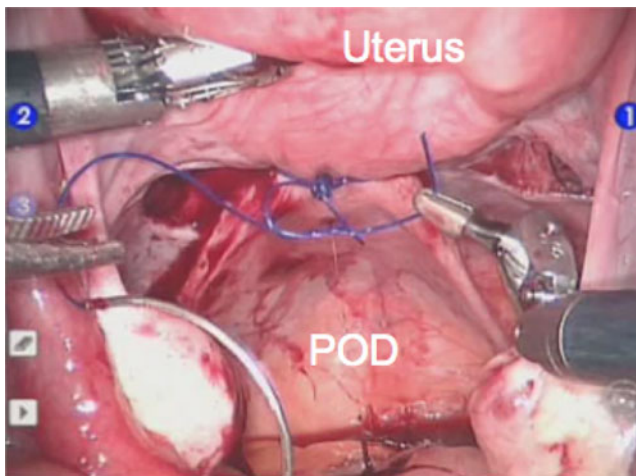
female infant (weighing 2.72 kg) by elective CS at 37 weeks after an uncomplicated pregnancy. Again, there were no intra-operative difficulties. The suture was felt during the CS and remains in place for future pregnancies.

## Discussion

Cervical insufficiency is a recognised cause of second-trimester miscarriage. Although there is no accepted definition, the term infers a structural weakness of the cervix, either congenital or acquired in nature [3]. It classically presents as painless progressive dilatation of the cervix resulting in second or early third trimester loss and is a retrospective diagnosis after exclusion of other causes. It is reported to complicate approximately 1% of the obstetric population [4] and contributes to 8% of recurrent second trimester losses [5].



**Fig. 4** Suture placed medial to uterine artery



**Fig. 5** Knot tying posteriorly

Cervical cerclage is a surgical technique for the management of cervical insufficiency whereby a suture is placed around the cervix, as close as possible to the internal os, enclosing it and thus reinforcing the cervix mechanically at the level of the internal os which is therefore physiologic [6]. A non-absorbable suture such as silk, monofilament or 5-mm Mersilene tape is used according to the surgeon's preference [7]. Indication for cerclage can be based on the patient's history, length of the cervix as measured using ultrasound, or as a rescue procedure. The recent 2011 guidelines on cervical cerclage from the Royal College of Obstetricians and Gynaecologist (RCOG), state that for women who have had three or more second trimester loss or preterm births, a history indicated cerclage should be offered [7]. The procedure is usually performed transvaginally as an elective procedure between 12 and 14 weeks gestation. For women who decline cerclage, ultrasound surveillance is useful to monitor cervical length as not all women develop a short cervix during pregnancy with a history of cervical insufficiency [7, 8]. Ultrasound indicated cerclage is recommended in cases of cervical length shortening during incidental surveillance. This is done usually between 14 to 25 weeks gestation, where the cervix is less than 25 mm in measurement and is only recommended in women with a history of second trimester loss or spontaneous preterm delivery [7]. A more recent meta-analysis by Berghella et al. [9] in 2011 also identified a reduction in preterm birth, perinatal morbidity and mortality with cerclage using these criteria.

A rescue cerclage is the term used to describe a cerclage performed in cases of premature cervical dilatation and exposed fetal membranes into the vagina, the presence of which may or may not be clinically obvious. The RCOG recommends the involvement of a senior clinician in the decision to perform such a cerclage depending on the particular case, as its appropriate use can delay delivery up to 5 weeks compared with expectant management/bed rest alone [7]. Early

complications of transvaginal cerclage include abdominal pain, vaginal bleeding, bladder injury, and premature pre-labour rupture of membranes and premature labour (presumably caused by manipulation of the cervix during the procedure). The risk of rupture of membranes is increased in the instance of a rescue cerclage with concurrent effacement, dilatation of the cervix and prolapsing membranes and the procedure is not recommended due to the high chance of cerclage failure if there is advanced dilation of the cervix or if membranes beyond the external os [7]. Late complications include subclinical or clinical chorioamnionitis and preterm delivery, uterine rupture or difficulty in cerclage removal [10, 11].

Shirodkar [12] first proposed cervical cerclage in 1955, whereby a suture is placed transvaginally at the level of the internal os, after a circular incision in the cervix and after dissecting the bladder free. In 1957, McDonald [13] simplified the procedure to a simple purse string suture placed around the cervix, which is technically easier to perform and associated with less bleeding. In a study comparing the two procedures, there was no significant difference found in outcome using the two techniques despite an increased cervical length achieved measured by ultrasound using the Shirodkar suture, being placed nearer to the cervicoisthmic junction [14].

Benson and Durfee [15] first described the transabdominal cervical suture, placed during laparotomy at the level of the cervicoisthmic junction, in 1965. It involves a laparotomy and insertion of a suture enclosing the internal os above the level of the cardinal and uterosacral ligaments. Abdominally placed cerclage can be performed in early pregnancy around 12 weeks or in the pre-pregnancy interval (interval cerclage). Interval cerclage is better where possible, due to the technical advantage of operating on the non-pregnant uterus and unaffected fertility associated with the procedure. First trimester miscarriages can still be managed using dilatation and curettage. Second trimester intra-uterine death requires a hysterotomy. The suture remains in place until term, necessitating delivery of the infant by CS, and remains in place for future pregnancies. This type of cerclage is considered in women following failed transvaginal cerclage, or where extensive surgery has left very little cervical tissue or there is a congenitally short cervix and therefore transvaginal cervical cerclage is impossible [7, 11, 16, 17]. This procedure can improve fetal survival rate from 70% to 95% through prolonging gestation [18–20]. Although transabdominal cerclage is associated with a higher risk (3%) of serious operative complications (bleeding requiring transfusion, injury to the bowel, bladder or uterine artery), a study by Zaveri et al in 2002 showed that when performed following previous failed transvaginal cerclage, there was a reduced risk of perinatal death and delivery <24 weeks [17]. A higher incidence of complications, ranging from 7% [15] to 25% [21], has been described elsewhere in the literature. However, no randomised controlled trials have been performed comparing the transvaginal versus the transabdominal approach.

Disadvantages to an abdominal cerclage placed at laparotomy include longer hospitalisation and greater patient recovery time. As yet there is inadequate evidence to suggest the benefit of abdominal cerclage using laparoscopy compared with laparotomy [22]. Laparoscopic surgery is associated with less post-operative pain, a quicker recovery time and shorter hospital stay, smaller scars, reduced infections and reduced scarring. However, conventional laparoscopy requires additional training. Dexterity is limited by the fulcrum effect of the straight stick laparoscopic technique producing counter-intuitive movement of the instruments and by the two dimensional field of view. It is heavily dependent on manually held and operated instruments and the surgeon is reliant on an assistant.

Robot-assisted laparoscopy has been in use following FDA approval of the use of the da Vinci robot for gynaecological surgery in 2005. The robot-assisted approach overcomes many problems associated with laparoscopy and has several advantages. Compared with laparoscopy, it allows easier broad ligament dissection, visualisation of the vasculature and knot tying [1].

The first ever Interval robot-assisted abdominal cerclage (Interval RA-AC) using the da Vinci robot was performed in 2007 [2] and described a successful cerclage using a 5-mm Mersilene ligature as a day procedure but with no reported pregnancy outcome. RA-AC has also been performed successfully during pregnancy [1, 23] at 12 weeks gestation again using a Mersilene tape. Bleeding and trauma were reportedly minimised to the gravid uterus by using the suction irrigator to hydro dissect the plane between the bladder and cervicouterine junction. Successful pregnancy and delivery of a healthy infant was reported in this case [1].

In our two reported cases, we performed interval RA-AC's as recommended, in accordance with recent guidelines with operating on the non-pregnant uterus advantageous with minimal blood loss and trauma [7]. We found that broad ligament fenestration and suture placement was straightforward using the da Vinci robot, as has been previously reported [1, 2]. We had a similarly favourable outcome using Ethibond and Prolene sutures instead of the described 5-mm Mersilene band. The procedure was done as a 'day case' and neither woman required further analgesia post-operatively. Both were delivered at term after uncomplicated pregnancies and no operative difficulties were encountered at CS.

To our knowledge, these are the first two reported cases of interval robot-assisted laparoscopic abdominal cervical cerclage with a successful pregnancy and neonatal outcome. We found that the improved surgical view with optional magnification, ease of manipulation of instruments and comfort and independence for the surgeon, affords a more advantageous surgical experience compared with conventional laparoscopy that is of benefit to both the patient and the

surgeon. This is an important development in the placement of transabdominal cervical cerclage.

**Declaration of interest** The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

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