Transabdominal Cerclage

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Abstract: The transabdominal cerclage procedure was first introduced 50 years ago as an approach in those patients who had failed transvaginal cerclage. We review the history, indications, surgical technique, complications, and reported outcomes of the procedure. The procedure has evolved over time in its application and risks appear to be less than previously perceived. Physicians have found additional patient situations in which the procedure may be beneficial outside the indications defined 50 years ago. This is a valuable surgical technique which is likely underused.
Key words: transabdominal cerclage, transabdominal cervicoisthmic cerclage, cervical insufficiency

rate of late pregnancy completion. However, the paucity of large case collections in the literature suggests this surgical solution may be underused. We can speculate that reasons for this may lie in the perception of high surgical risk, the mandate of cesarean delivery if TAC is utilized and, possibility, a paucity of direct surgical experience. This chapter will focus on a review in regard to the indications for TAC, pregnancy outcomes, surgical risks, tenets of surgical management, and challenges commonly encountered during the procedure.

Introduction

Transabdominal cerclage (TAC), also known as transabdominal cervicoisthmic cerclage, was first described 50 years ago as an approach to cervical insufficiency not remediable by other surgical techniques.[1] Conceptually, it is targeted at closing the upper cervix—at or near the internal cervical os—to maintain strength at that level. Experience has shown a very high

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The authors declare that they have nothing to disclose.

Indications

Most of the early literature points out classic indications for TAC.[1,2] First, failure of a prophylactic vaginal cerclage in a prior pregnancy, placed when the patient has a convincing history of cervical insufficiency, should severely limit consideration of another prophylactic vaginal cerclage in a subsequent pregnancy. There is often a temptation when evaluating a patient who reports a history of a vaginal cerclage with subsequent second trimester delivery to suggest that a better technical result with vaginal cerclage can be had;

however, it is important to place trust in our surgical colleagues to properly perform a relatively simple procedure—particularly since the stakes involve a potential additional pregnancy loss or damaged baby. In those unfortunate patients with cervical insufficiency who fail a prophylactically placed vaginal cerclage, TAC is the most viable option.

Secondly, an exocervix which is significantly attenuated, either globally (hypoplasia) or focally (as in a deep cervical laceration or shortening of the exocervix by previous procedure), is problematic for surgical management in a patient with cervical insufficiency. Even a vaginal cerclage placed very high in the forniceal recesses may not support the cervix effectively due to the potential for caudal migration of the cerclage under pressure from the expanding gravid uterus. This migration consequently pushes the cerclage below the level of the intact cervical circumference leading to loss. Although assessment of the degree of attenuation is currently subjective, TAC could be considered the best surgical approach in these patients.

Other nonclassic indications for prophylactic TAC which may be considered include severe cervical hypoplasia without history of cervical insufficiency, radical trachelectomy, and higher order multifetal gestations. Secondary to the rarity of these conditions, only case reports and series exist supporting these indications. In regard to cervical hypoplasia, the cervical size required for competence is currently unknown, and clinicians will have to approach a small cervix in a primiparous patient with reason and experience.

RADICAL TRACHELECTOMY
This surgical procedure, performed for early stage cervical cancers, certainly shortens the cervix, but the most efficacious approach to reduce the risk of cervical insufficiency is enigmatic. There are no studies demonstrating the efficacy of TAC in these patients, likely because of the rarity of the particular situation.[3-5] When counseling a patient regarding placement of a TAC either during or after the radical trachelectomy procedure, the surgeon must consider several issues. First, the internal os is the prime maintenance of cervical sufficiency, and if the internal os is preserved, artificial support may be unnecessary. Alternatively, the scarring generated by the procedure may be adequate for competence. Lastly, the anatomic supports (uterosacral and cardinal ligaments in addition to the flaring of the cervix caudal to the internal os) that keep the TAC band from migrating caudally have likely been transected or removed as part of the radical procedure. In the absence of adequate case collections, this question is unlikely to be answered and care will be individualized.

HIGHER ORDER MULTIFETAL PREGNANCIES
Over the past 35 years, the rate of multifetal gestations has drastically increased because of the increasing utilization and success of advanced reproductive technology (ART).[6] With the institution of guidelines for the ART process, the incidence of triplet and other higher order multiples is under better control, with the incidence of twins estimated at 33.7 per 1000 and triplets and other higher order multiple gestations at 119.5 per 100,000.[7]

Multifetal gestations commonly result in premature delivery, and thus, represent a significant portion of admissions to the neonatal intensive care unit.[8] The mean gestational age at delivery for twin and triplet gestations is 35.8 and 32.5 weeks gestation, respectively.[9] Furthermore, 13% of all triplet pregnancies result in delivery at < 28 weeks' gestation and subsequently result in long neonatal intensive care unit stays with significant comorbidities and perinatal mortality.[8]

Although there have been conflicting studies,[10,11] research has generally shown

that a prophylactically placed vaginal cerclage in a multifetal gestation does not reduce the risk of premature delivery.[10-12] However, our retrospective case collection[13] compared the occurrence of extreme prematurity (<28 wk) in triplet gestations with a prophylactic TAC (N = 60), prophylactic vaginal cerclage (N = 31), or no cerclage placed (N = 50). The lowest rate of extreme prematurity was in those triplet gestations treated with a prophylactic TAC (2/60, 3.3%) compared with transvaginal cerclage (5/31, 16.1%) and no cerclage (6/50, 12.2). This comparison yielded a clinical trend in the rate difference of extreme prematurity when comparing the groups. When women who underwent a TAC for reasons other than triplet pregnancy were excluded from the analysis, triplet pregnancies with a TAC were statistically more likely to deliver after 28 weeks compared with those who had a TVC or no cerclage (P = 0.027).[13] Sustained closure of the internal os with TAC may be the reason for reduction of extreme prematurity as well as the observed reduction of incidence of ruptured membranes as a primary event.[13] Data on triplets managed with TAC subsequent to the cadre reported in 2011 show that the 34 additional patients so managed have not delivered before 28 weeks. However, balancing the risk of such prophylactic surgery in an already complicated pregnancy against the 13% risk of delivery of 3 extremely premature babies, with their attendant possibility of death and long-term disability, is complex. Patients in such a pregnancy must understand this assessment of risk faces them with the potential of surgical risk if eventual events indicate they may not have benefited. Although randomized prospective trials may not be feasible, this issue may become clearer and less controversial as others report experience from retrospective or concurrent studies. The occurrence of chorion sharing (as in dichorionic, triamniotic triplets) with

current ART techniques also contributes to fetal loss in the second/early third trimester and must also be considered.

Surgical Technique

The surgical technique is very simple in concept, but may be difficult in execution because of the increased paracervical vasculature/blood flow as well as the size and softness of the gravid uterus. Consequently, TAC in nonpregnant patients is a much simpler and less complicated surgery. Importantly, relatively small numbers of TAC procedures may be contemplated—even in a large referral center, and surgical experience is likely to be limited. The type of abdominal incision should be tailored to the patient's body habitus and uterine size. A midline vertical incision should be strongly considered in the obese patient. In addition, standard and robotic-assisted laparoscopic approach in nonpregnant patients is becoming more common and can be advantageous because of the quicker recovery and decreased blood loss associated with minimally invasive procedures.[14] In most descriptions, a woven permanent tape, 5 mm wide, is placed around the upper cervix through fenestrations created on either side of the cervix medial to the ascending branches of the uterine arteries. The tape is tied either anteriorly or posteriorly, according to the bias of the surgeon. The knot is secured by transfixing the tape ends to one another adjacent to the knot with a smaller permanent suture, but one should not pass the needle and tape through any part of the cervix, uterus, or attached ligaments.

One might think that careful palpation and selection of the level of the internal os by the surgeon might be important, but the anatomic features of the uterus make this moot. The smallest circumference of the cervix is, in most circumstances, just caudal to the lower uterine body. The larger circumference of the lower uterine body
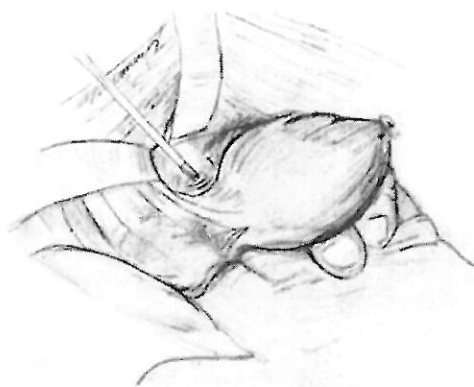
FIGURE 1. Elevation of venous plexus by surgeon's fingers and fenestration of broad ligament medial to uterine artery.

keeps the surgeon from placing the tape too far above the internal cervical os. The more caudal expanding cervical circumference, along with the uterosacral and cardinal ligaments, limits caudal placement and migration.

Adequate exposure can be challenging due to obesity and pelvic adhesions, and exposure is critical to safety if venous hemorrhage is encountered. Both of these situations can make access to the posterior cul-de-sac extremely difficult and significantly complicate the procedure. Preoperative planning is essential, and if difficulty is anticipated, it is best to utilize a midline vertical incision for optimal exposure. From our experience, hemorrhage from the paracervical veins is perhaps the most treacherous and complicated part of the procedure. If venous bleeding is encountered, it can usually be controlled with metal hemostatic clip application. In an attempt to avoid, or control, bleeding from the venous plexus, isolation of the uterine artery may be required. Then, the tape can be passed medial to the uterine artery but lateral to the venous plexus. This will compress the venous plexus. The fine dissection often required may be facilitated by Loupe magnification, excellent lighting into the field, and compression of the veins

by the surgeon's finger behind the broad ligament (Fig. 1). Arterial disruption, or the need for uterine artery ligation, should be a rare event. Planned placement of the tape lateral to both uterine arteries should not be done as this would interrupt the arterial supply from those vessels as the pregnant uterus enlarges and could cause deleterious effects on the pregnancy.

As in all surgeries, technique constantly evolves. Initial placement of the synthetic tape was described as by needle puncture of the area medial to the uterine arteries on each side.[1] We begin the procedure by identifying the uterine artery, and then gently dissect a fenestration among the veins until the surgeon's finger can be visualized through the broad ligament. Next, through the fenestration created, we pass a thin grasping device from anterior to posterior, grasp one end of the tape and draw it through the fenestration from posterior to anterior. This is repeated on the opposite side of the cervix, ending placement with both ends of the tape positioned for tying anteriorly (Figs. 1 and 2). We caution against passing a needle through the edge of the cervix, as this will not reliably avoid hemorrhage and may weaken the integrity of the cervix itself (note the description of Mahran[15] technique below).

Laparoscopic techniques, standard or robotic-assisted, have been described in recent years.[14,16 22] In a more recent paper, Tulandi et al[23] reviewed studies totaling 678 pregnancies between 1990 and 2013. Laparoscopic abdominal cerclage included 138 patients, and abdominal cerclage by laparotomy included 540 patients and found no significant difference in deliveries >28 weeks' gestation between the 2 methods. We believe provider judgment and skill should drive the decision on the method of the TAC. Placement of TAC before pregnancy avoids some risks, and has not been shown to limit conception or assisted reproductive technology techniques.

We have limited laparoscopic approach to nonpregnant patients after performing a safety trial, which pointed out the risks and difficulties with this route in pregnant patients between 11 and 14 weeks gestation.[20,21] The difficulties of lifting a uterus of this size, which may be compared with a water balloon in a patient under general anesthesia, to operate in the area of the upper cervix risks trauma to the uterus and parametrial vasculature. It may be that a laparoscopic approach may be facile and safe if performed very early in pregnancy, but we are reluctant to perform the surgery so early, as subsequent natural loss may then be ascribed as consequent to the surgery.

Operative Risks

The largest published cohort to date tabulated the operative and perioperative complication rates in 300 TACs performed by 1 surgeon.[24] The complications assessed included wound infection, organ damage, hemorrhage requiring blood transfusion, and fetal loss. This report found the rate of transfusion was < 1% despite the concern for hemorrhage described above. Migration of the synthetic band through the cervical wall (presumably as a result of pressure from the enlarging and possibly contracting uterus) seems to occur rarely according in most series,[2,24,25] but Mahran[15] reported this to occur in 25% of completed pregnancies. This may have been a result of variation in surgical technique that Mahran described in which the band actually traverses the uterine isthmus anteriorly and the uterosacral ligaments posteriorly. Incidence of fetal loss, defined as fetal death within 2 weeks of surgery, is likely no > 2%[24]—with some uncertainty in regard to whether the loss is secondary to the surgery or a naturally occurring loss at early gestation. Incidence of wound infections, bladder or bowel damage, and necessity for

hysterectomy at the time of the TAC appears to be rare.[15,24,25] We have encountered 1 bowel injury in a patient who had had a large bowel perforation with generalized peritonitis years before the TAC. Bowel preparation and general surgery availability was part of the preparation in this case because of the history. We prefer to give our patients a broad spectrum antibiotic within 30 minutes before surgery.

Postoperative Complications

A recent publication describes the incidence of uterine rupture in patients who have undergone periviable classic cesarean as significantly higher than in prior near-term cesareans.[26] However, uterine rupture after TAC placement in a previously scarred uterus is rare, occurring only once in our experience.[24,27] This patient had a unicornuate uterus with a prior hysterotomy. Uterine rupture is particularly pertinent, though, as the effects can be catastrophic on the mother's and fetus's wellbeing. The few cases of tearing of the uterine wall above the cerclage with rapidly progressing labor simply emphasizes the need for sensitivity to preterm labor and a careful eye to timing of a planned cesarean delivery. The significant occurrence of vaginal delivery in 1 report from Egypt underlines the need for prenatal surveillance in these pregnancies.[15] Interestingly, intraoperative and postoperative fetal losses, both occurring before 20 weeks gestation and after that, have been predominantly in multifetal pregnancies.[24] Singleton fetal loss within 2 weeks of surgery occurred in only 3 of 226 cases (1.3%) and 1 twin pregnancy and 2 fetuses in a triplet pregnancy were lost in the same timeframe.

Outcomes

The success of the TAC approach can best be expressed as achievement of a term
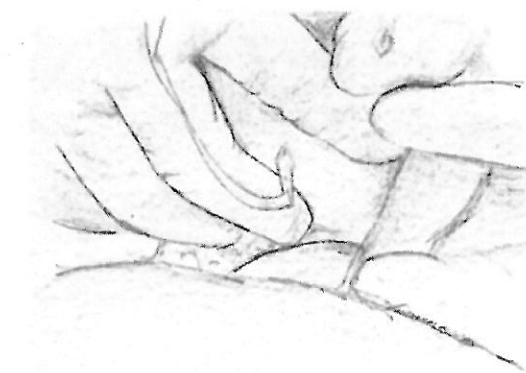
FIGURE 2. Grasper has been used to fenestrate the medial broad ligament and grasp one end of the tape.

pregnancy or avoidance of extreme prematurity (birth at < 28 wk). Achievement of overall pregnancy success is limited to about 95%, probably due to the collateral risks inherent in the pregnancies addressed with this technique.[24] The latter success criterion (delivery after 28 wk is achieved) is most applicable to multifetal pregnancies.[13] Technical failure of the TAC itself, allowing the cervix to open in the second trimester, will undoubtedly occur, but should be quite unusual.

Although there are numerous case reports and series describing TACs and outcomes,[1,2,15,24,25,28-38] only 3 publications[15,24,25] have reported case collections by individual surgeons of more than 100 each. Using the standard published indications for TAC, these large series have demonstrated upwards of 90% success rates even in the face of fairly devastating obstetrical histories.

Conclusions

This review has discussed patient selection, technique, and potential complications of TAC. It seems clear that this surgery can be efficacious in selected patients, in experienced hands, with very low risk. This brings the question of what should be offered to patients with cervical insufficiency, in view of the balance of risk of pregnancy loss and extreme prematurity when other approaches are used. As in all clinical situations, the patient must be clearly informed of this risk assessment.

An additional conundrum is obvious. Surgical experience at the operating table is obviously important, but such direct surgical mentoring is limited to the few programs where at least 1 surgeon has extensive experience. Surgeons with such experience should be supported in efforts to train others who are likely to receive referrals of these somewhat unusual patients.

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