Cervical inversion as a novel technique for postpartum hemorrhage management during cesarean delivery for placenta previa accreta/increta

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ABSTRACT

Objective: To describe the use of cervical inversion for postpartum hemorrhage (PPH) management during cesarean delivery for placenta previa accreta/increta.

Methods: In a retrospective, descriptive study, data were reviewed for cases in which cervical inversion was used to manage PPH during cesarean delivery at a center in Zahedan, Iran, between July 2, 2011, and September 25, 2014. Cervical inversion was applied when placental bleeding was persistent and the sites could not be clearly located. The cervix is inverted using ring forceps or straight Allis forceps, after which the placental bed is sutured to control bleeding. After bleeding is controlled, the cervix is returned to its original position.

Results: Cervical inversion was successfully applied to 10 cases. Mean time to completion of cervical inversion was 4.1 ± 0.7 minutes. In all 10 cases, the bleeding was stopped within 3–5 minutes from the beginning of the cervical inversion procedure. No apparent complications were reported, and blood transfusions or obstetric hysterectomies were not necessary. Conclusion: Cervical inversion is a simple, cost-effective, and time-saving procedure for PPH management in placenta previa accreta/increta. It could become a routine procedure for preserving the uterus and fertility of affected women.

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1. Introduction

Maternal mortality is approximately 14% in low-income countries, and 4% in high-income countries [1]. Postpartum hemorrhage (PPH) remains a major leading cause of direct maternal mortality [2,3], accounting for almost half of all postpartum deaths in low-resource countries [4]. The definitive treatment for severe PPH is hysterectomy, but this procedure is associated with intraoperative comorbidity and postpartum depression, and compromises fertility [5]. As a result, other surgical procedures should be considered initially [6].

Bleeding from the placental bed should be controlled by strong myometrial contractions and constriction of blood vessels. The absence of these mechanisms in placenta previa—partial or complete coverage of the internal cervical orifice by placental tissue [7]—can lead to PPH [5]. The risk factors for placenta previa include implantation in the lower segment over a surgical scar, advanced maternal age, smoking, multiparity, previous placenta previa, alcohol and illicit drug use, spontaneous and induced abortions, multiple pregnancy, maternal anemia and diabetes, pregnancy after in vitro fertilization, hydramnios, and chronic hypertension [7–9].

The severe bleeding observed among women with placenta previa arises because the lower uterine segment is morphologically and functionally different from the upper segment [7]. The highly vascular lower segment is slow to retract, which causes severe blood loss [7, 10]. When uterotonic drugs fail, surgical interventions or other procedures are needed to control bleeding. Over-sewing of the bleeding sites, uterine compression sutures, ligation or embolization of uterine and hypogastric arteries, and intrauterine balloon tamponade are the most common procedures used to control bleeding [11]. Over-sewing of the bleeding site is the most common procedure used for PPH management, but in many cases, the bleeding points located in the lower segment and cervical canal are too deep and their locations are unclear because of the severity of the bleeding [3].

The aim of the present study was to describe and present data from novel technique—cervical inversion—for PPH management in cases of placenta previa accreta/increta. In this maneuver, the cervix and lower segment are inverted through the Kerr incision into the uterus by using ring or straight Allis forceps. The procedure transiently blocks blood vessels and reduces the bleeding, thereby providing direct visualization and better access to the bleeding sites during the suturing procedure.

2. Materials and methods

In a retrospective, descriptive study, data were reviewed for cases in which cervical inversion was used at the Zahedan University of Medical Sciences and Health Services, Zahedan, Iran, between July 2, 2011, and September 25, 2014. This technique had been used...
in women with placenta previa and placenta accreta/increta who experienced PPH during cesarean delivery. The ethics committee of Zahedan University of Medical Sciences approved this study. All patients provided written informed consent.

Women with placenta previa are always managed by cesarean delivery at the study hospital. After delivery of the fetus and the placenta, an inspection and palpation of the uterine cavity is performed to gently exclude as much retained placental tissue as possible. At the same time, the uterus is massaged and suitable oxytocic and uterotonic drugs are administered. Since 2011, the cervical inversion technique has been used for all women with placenta previa and placenta accreta/increta whose bleeding persists after these steps.

For cervical inversion, the surgeon enters his/her index finger into the lower segment and cervical canal until it touches the cervical lips. Then, he/she grasps the anterior or posterior cervical lip using a suitable instrument such as ring forceps or straight Allis forceps. The cervix is inverted into the uterus by pulling the instrument back through the Kerr incision (Figs. 1 and 2). After this maneuver, the placental bed is sutured to control the bleeding. The cervix is then pushed back to its original position and the Kerr incision is repaired.

3. Results

During the study period, cervical inversion was applied by N.S. to 10 cases of placenta previa with concurrent placenta accreta/increta. The mean age of the patients was 26.3 ± 4.5 years. Eight women had either two or three previous deliveries by cesarean, one was primiparous, and the other had one previous vaginal delivery.

The mean time to complete cervical inversion was 4.1 ± 0.7 minutes. In all 10 cases, the bleeding was stopped within 3–5 minutes from the beginning of the cervical inversion procedure. No difficulties were recorded in performing the procedure, and there was no trauma to the lower segment of the uterus or cervix in any of the women. Furthermore, there was no need for blood transfusion owing to blood loss during the cesarean delivery and no requirement for obstetric hysterectomy.

4. Discussion

Cervical inversion was used for the first time in 2011 in an attempt to manage PPH in a young woman with placenta previa and focal placenta increta, while preserving her uterus and future fertility. As reported in the present study, this procedure has since been effectively applied to nine further cases with no apparent complications. On the basis of the present results, cervical inversion could be a reasonable method for successful management of PPH in cases of placenta previa diagnosed by clinical evidence. The technique is effective and simple: the surgeon can see the bleeding sites directly and thus avoid further tears, narrowing of the cervical canal, and needle site bleeding.

Fig. 1. Schematic illustrations of cervical inversion. (A) Horizontal incision of the uterus (Kerr incision). (B) Inversion of the cervix and lower segment into the uterus; the inverted region is shown as a dotted line. (C) Inversion of the cervix and lower segment into the uterus; a window has been removed for better observation of the inverted region. (D) Repair of the Kerr incision after the cervix has been returned to its original position. Figure published with the permission of the artist, Zahra Heidari.
There are various methods to prevent and manage PPH. Use of uterotonic is the first step in controlling bleeding; if the drugs fail, other techniques such as uterine tamponade and gauze packing, a Foley’s catheter, Sengstaken-Blakemore tube, or Bakri balloon can be applied [12]. Treatment of severe PPH by uterine or hypogastric artery ligation and arterial embolization is effective, but these approaches can be difficult to perform in practice and complications have been reported [10]. As described in previous studies [13,14], the reasons for low use of uterine artery embolization include the small number of modern angiography units with an experienced skilled team on-call 24 hours per day and the perceived risk of transferring a patient in unstable condition to the angiography suite.

Johanson et al. [15] described a method of tamponade using a hydrostatic balloon catheter. However, the major disadvantage of packing the uterus is that the bleeding can continue but remain obscure for a while. In cases of profuse bleeding, precise identification of the bleeding site might be difficult. Applying blind compression sutures—e.g. transverse annular, parallel vertical, or circular ischemic-cervical sutures—can be associated with further complications, including uterine cavity closure, infection, and pyometra due to blood entrapment, intrauterine adhesions, and partial uterine wall necrosis. Furthermore, repeated blind sutures will result in further loss of critical time. By contrast, surgeons can see the bleeding sites directly and control them with fewer sutures using cervical inversion.

Another conservative surgical technique is the B-Lynch or brace suturing technique, in which pressure is applied by the compression sutures. This method can cause progressive total or partial myometrial ischemic necrosis and myometrial defects, which might be hazardous in future pregnancy. In addition, it is only applicable to bleeding in the upper segment [3]. Moreover, surgeons experienced in this procedure might not be readily available everywhere.

Matsubara et al. [16] introduced cervix-holding by round forceps placed simultaneously over the anterior and posterior cervical lips to control hemorrhage after cesarean delivery for placenta previa. They stated that hemostasis was achieved by this method for two main reasons. First, the intrauterine blood is able to compress the bleeding surface, and second, handling the cervix might create uterine contractions and control bleeding. It seems likely that cervical inversion might have a similar effect on uterine contractions.

The cervical inversion procedure transiently decreases the vascular blood flow to the lower uterine segment, leading to rapid hemostasis. The uterine lower segment is supplied by three principal arterial branches: an upper branch formed by the uterine artery, a middle branch constituted by the cervical artery, and a lower one made up by the vaginal arteries. These arteries anastomose with each other along the border between the uterine isthmus and vagina, or in the intramural part of the cervico-vaginal junction. In certain pathologic conditions such as placenta percreta, unusual interconnections form among these arteries, which can lead to difficulties and failure to control bleeding and hemostasis [17]. In these situations, uterine anastomotic interactions may cause alterations in the arterial flow between the uterine and vaginal arteries [18]. When the cervix is inverted, the pressure on vessels in the lower segment transiently blocks them and reduces blood flow, providing additional time for suturing the bleeding points on the placental bed.

After cesarean delivery, poor healing of the uterine scars might affect regeneration of the uterine isthmus, making the lower segment thin and weak during subsequent pregnancies. The American College of Obstetricians and Gynecologists recently suggested that the absolute risk of uterine dehiscence in repeated cesarean is low, and that most women with one prior low-transverse cesarean should be offered the opportunity of labor [19]. The cervical inversion technique might be applicable to repeated cesarean procedures for several reasons. First, the Kerr incision is made in the middle of the previous scar and thus might reduce its diameter. Second, if the procedure is performed immediately after delivery of the neonate and placenta, the lower segment will be relatively soft and easily inverted. Third, almost all women with placenta previa have a planned cesarean delivery or are referred for emergency cesarean immediately after the beginning of parturition bleeding before advanced dilatation or effacement (ripening) of the cervix and severe bleeding occurs; as a result, in almost all cases, the cervix is unripe and the lower segment is in a tensile state, such that grasping the cervical lip and inverting the cervix will be simple.

The cervix softens during pregnancy, which is essential for cervical effacement and dilatation and successful labor and childbirth. It is thought that prostaglandins, together with relaxin, can induce cervical softening by inducing collagen breakdown within the tissues and/or by altering the glycosaminoglycan (GAG) and proteoglycan composition. Collagen breakdown would facilitate a higher degree of movement and stretch in the tissue, which is required for softening. Similarly, an increase in the GAG content of the tissues stimulated by prostaglandin would result in a decrease in collagen fibril agglutination and ultimately would reduce the stretch resistance of the remaining collagen [20]. Elevation of the GAG hyaluronan is a well known change that facilitates the degradation of collagen fibers and can cause further viscoelasticity of the cervix. Cervical softening occurs in the weeks or days preceding childbirth [21]; thus, the cervix can be inverted at this stage without difficulty. Furthermore, owing to the shorter cervix in cases of placenta previa [22], cervical inversion might be applied even more readily and successfully.

A case of inversion or “imagination” of a partly effaced and dilated cervix into the lower segment at the time of cesarean delivery was reported by Sivasuriya and Herath [23]. They observed a pouch-like protrusion, identified it as the cervix uteri, and pushed it back to the original anatomic position without any postoperative complications. It should be considered that, in any clinical emergency, the staff needs to perform in stressful conditions. In these situations, high priority should be given to procedures that can be performed in accordance with simple and effective techniques.

The main limitation of the present study was the small sample size. If the present observations are confirmed in a larger series, cervical inversion could become part of the routine procedures used to treat women with placenta previa. Cervical inversion could be
used for management of PPH because it compresses and occludes lower-segment arteries, leads to relative hemostasis, and provides additional time for suturing the bleeding site. Furthermore, the procedure is easy to perform and does not need specialist skills, materials, or equipment; it is a rapid maneuver that can preserve the uterus and future fertility of women with placenta previa and placenta accreta/increta.

Conflict of interest

The authors have no conflicts of interest.

References