Procedures and Instruments

Dual-Force Vaginoplasty for Treatment of Segmental Vaginal Aplasia

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BACKGROUND: Vaginal aplasia occurs in 1 in 5,000–10,000 female live births. In this report, we evaluated a novel dual-force vaginoplasty technique for treatment of 11 patients with segmental vaginal aplasia.

TECHNIQUE: The principle of the approach is to thin the atretic part between two counteracting forces. The instrument was inserted laparoscopically into the proximal hematocolpos. Two balloon catheters, one for drainage and one for traction, were threaded over the inserter. The traction catheter was then threaded over a silicon tube, leaving the balloon in the proximal portion of the vagina and connecting across the vaginal septum to a fenestrated Teflon olive, which was positioned against the distal surface of the vaginal septum. This created a dual "pushing and pulling" force across the septum, which, over 3–4 days, pulls the upper vaginal pouch down while the vaginal dimple is pushed up. The aplastic segment becomes thin and easy to dilate and permits achievement of vaginal patency. The drainage of the hematocolpos is predominantly through the balloon catheter so postoperative wound management is facilitated.

EXPERIENCE: Eleven menarchal girls were diagnosed with segmental vaginal aplasia. The dual-force vaginoplasty was performed on each and was tolerated well with no operative complications. They all reported establishment of the menstrual cycle and significant improvement of pain during follow-up.

CONCLUSION: Creation of a dual pushing–pulling force on the atretic vaginal segment is a feasible short procedure for management of segmental vaginal aplasia.

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Vaginal anomalies are associated with uterine anomalies in 45.2% and are isolated in 4.2% of müllerian duct anomalies.[1] The term "segmental vaginal aplasia" refers to an absent middle or lower part of the vagina resulting in distension of the upper vagina with accumulated menstrual blood. Primary amenorrhea with cyclic pain is a classic presentation that requires surgical reconstruction. Several approaches have been described to achieve a patent genital tract with variable success rates.[2–7] Vaginal reconstruction consists of full- to split-thickness skin, myocutaneous flaps, buccal mucosa, peritoneum, amnion, bowel, and tissue expansion.[8] These techniques have not been associated with favorable outcomes; surgery is generally associated with bleeding and significant operative time. Vaginal scarring, spotting, hypersecretion, discharge, and fistula formation were reported postoperatively.[8,9]

Balloon vaginoplasty has the advantage of establishing a naturally lined neovagina as compared with previous techniques. Generally, all balloon vaginoplasty procedures create a single unidirectional (upward) traction force for construction of a native tissue neovagina.[10–16] Although these procedures yielded satisfactory surgical outcomes, they have been associated with some technical and clinical difficulties related to dressing placement and postoperative dressing changes.

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Each author has indicated that he or she has met the journal's requirements for authorship.

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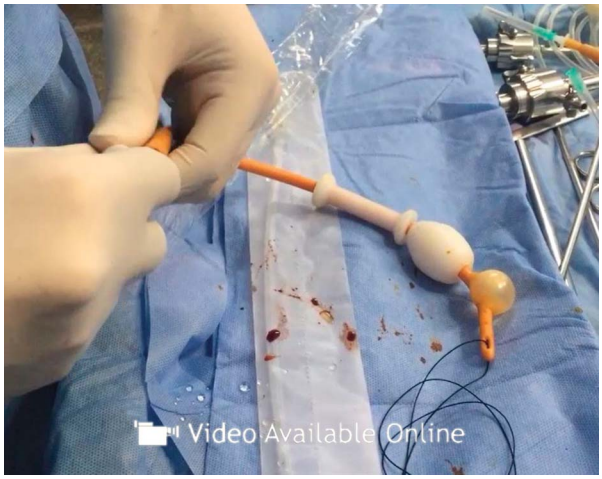

Video 1. Dual-force balloon vaginoplasty for lower vaginal aplasia. The video describes the instrumentation and technical points for treatment of segmental vaginal aplasia with upper hematocolpos. A balloon catheter was prepared and inserted into the distended vaginal pouch to pull it down against a Teflon olive placed at vaginal dimple. Hysteroscopy was used to accelerate washout of the retained blood and to confirm appropriate catheter placement. Video created by Ali M. El Saman, MD, and Dina A. El Saman, MS. Used with permission.

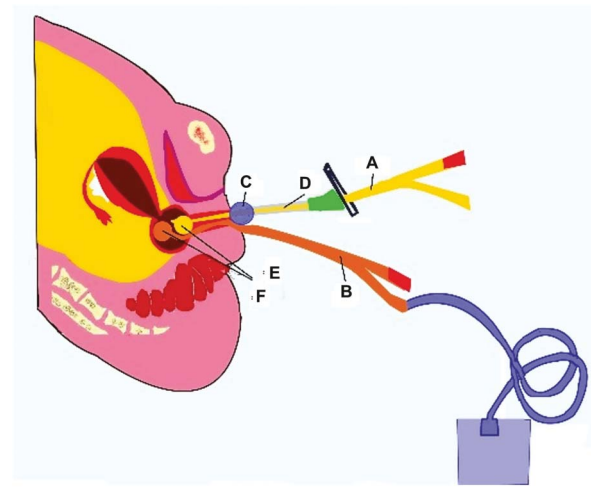

Fig. 1. Application of drainage and "pull–push" catheters. Pull–push catheter (**A**); drainage catheter (**B**); fenestrated Teflon olive used for pushing the dimple up (**C**); silicon tube used as a pusher (**D**); balloon of catheter A inside the upper vaginal pouch (**E**); balloon of catheter B inside the upper vaginal pouch (**F**). Illustration created by Ali El Saman. Used with permission.

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We describe a novel technique of dual forces over the nonpatent segment, simultaneously pulling down the upper vaginal pouch and pushing up the vaginal dimple. This technique achieves bidirectional (up and down) tissue expansion for treatment of middle and lower segmental vaginal aplasia.

TECHNIQUE

An 18-French Foley catheter was prepared by threading a Teflon pushing sleeve followed by the Teflon olive (4 cm in diameter 5 in length) past the Foley balloon tip (Video 1, available online at http://links.lww.com/AOG/A940). An endoscope was inserted into the vagina and the vaginal septum was punctured. The upper vaginal pouch was irrigated to allow drainage of the retained menstrual blood and then the collapsed balloon was passed into the upper vaginal pouch and inflated. The balloon was then inflated to 30 cc. Irrigation was used as necessary. The Teflon pushing sleeve then was advanced to position the Teflon olive tightly against the vaginal septum and tension maintained by positioning an umbilical cord clamp snugly against the Teflon sleeve. This created both pressure upward on the septum by the olive and

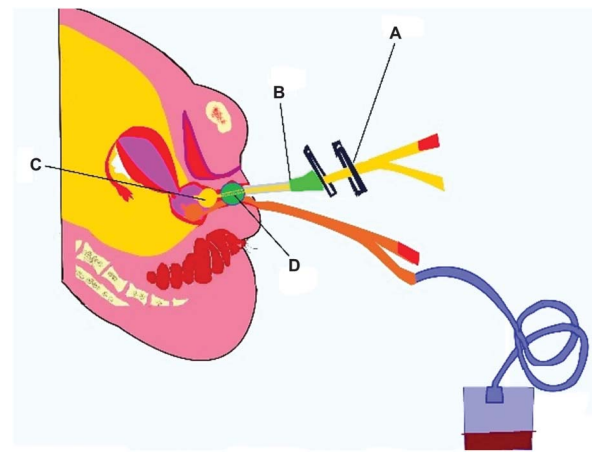

Fig. 2. Placing the pusher catheter to act on a fenestrated Teflon olive. Additional plastic cord clamp applied at 2-cm distance (**A**); the pusher tube in place (**B**); vaginal balloon pulled down (**C**); the Teflon olive is pushed up (**D**). Illustration created by Ali El Saman. Used with permission.

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Scan this image to view Video 1 on your smartphone.

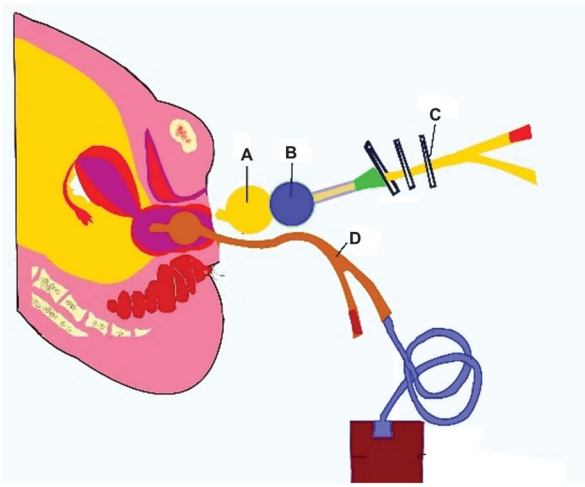

Fig. 3. Diagrammatic presentation of the patient at day 4. The balloon (**A**) is in contact with the Teflon olive (**B**) after the application of the third cord clamp (**C**) while the drainage catheter (**D**) is still in place. Illustration created by Ali El Saman. Used with permission.

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downward against it by the Foley balloon situated in the pouch (Fig. 1). Laparoscopy was performed to evaluate for possible inadvertent uterine or pouch of Douglas rupture or entry. To avoid possible bladder and rectal injuries during the procedure, the bladder was emptied before insertion. The progression of the trocar was done guided by rectal digital monitoring (tactile sensation) and it was advanced just anterior to the anterior rectal wall. Cystoscopy was performed routinely in all cases to confirm bladder and ureteral integrity.

"Pushing and pulling" forces were increased daily by pulling the catheter stem down and applying another cord clamp at a distance of 2 cm proximal to the previously applied clamp (Figs. 2 and 3). This moved the Teflon olive upward, providing further "pushing" force while also pulling the Foley balloon downward. This process was repeated daily for 3 to 4 successive days. On the third or fourth postoperative day, the atretic segment was thinned out into a very delicate diaphragm. It was dilated easily by extracting the distended balloons through it (Fig. 3) followed by easy introduction of two lubricated examining fingers for further dilation. No anesthesia or sutures were required during removal or dilation. An actual illustration of the procedure is shown in Figure 4 and shown in the video (http://links.lww.com/AOG/A940).

EXPERIENCE

The study was conducted at the Woman's Health Hospital, Assiut University, Assiut, Egypt. The institutional review board approved the study and written informed consent was obtained from both the patients and their parents after counseling. Postmenarchal females with congenital vaginal aplasia between January 2013 and June 2014 were considered eligible and were provided information about this and alternative procedures. Of 32 females who were diagnosed with müllerian anomalies during this timeframe, 11 menarchal girls were diagnosed with segmental vaginal aplasia and were counseled and consented to undergo the dual-force procedure by our team. The authors' group previously treated 15 similar patients with inverted single-force balloon vaginoplasty between 2010 and 2012.

Initially recruited patients were clinically assessed through abdominal examination and pelvic and rectal examination. Abdominal–pelvic ultrasonography and magnetic resonance imaging were used for accurate delineation of uterine and vaginal anatomy. Ultrasonography and magnetic resonance imaging helped to recognize hematometra, size of hematocolpos, associated genital pathology (hematosalpinx or ovarian cysts), or renal anomalies. Patients with functioning uteri and an absent mid- or lower vaginal segment with distended upper vaginal pouch (hematocolpos) were considered eligible. The distended pouch should

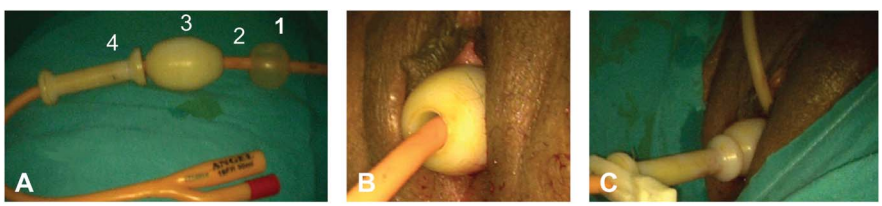

Fig. 4. Photographs of the procedure. **A**. Balloon to be seated in the distended vaginal pouch (**1**); catheter stem to be passed across the aplastic segment (**2**); Teflon olive to be placed pressing the vaginal dimple (**3**); pusher to press the Teflon olive up (**4**). **B**. The catheter in place with the Teflon olive pressing the vaginal dimple up. **C**. The pusher in place with an umbilical cord clamp applied on the catheter stem for maintaining pressure and traction.

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be significantly large that it could be felt per rectal examination and be seen distending the Douglas pouch by ultrasonography or magnetic resonance imaging.

The patients range from 12–18 years of age (Table 1). At presentation, they reported progressively worsening cyclic lower abdominal pain for 7–13 months. Vaginal inspection revealed a blind vaginal dimple, 1–2 cm in depth that ended at the hymeneal ring. Rectal examination revealed a tense cystic mass approximately 4–6 cm above the introitus in each patient.

Table 1. Characteristics of 11 Patients With Segmental Vaginal Aplasia Treated by Dual-Force Vaginoplasty

	Patient No.										
Characteristic	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Age (y)	11	10	16	17	11	11	11	13	11	11	11
Symptom											
Cyclic pain	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Duration (mo)	13	7	13	8	13	7	10	8	9	10	7
Urinary retention	No	No	No	No	No	Yes	No	No	No	Yes	No
Clinical findings											
Pelvic–abdominal mass	Yes	No	Yes	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Suprapubic tenderness	Yes	No	Yes	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Ultrasonography											
Hematocolpos	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cystic mass	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Hematometra	No	No	Yes	Yes	No	No	No	Yes	No	Yes	No
MRI											
Previously done	No	Yes	No	No	No	No	No	No	No	Yes	No
Associated anomalies											
Renal	No	Yes	No	No	No	No	No	No	No	No	No
Polydactyl	No	No	No	No	No	No	No	No	No	No	No
Laparoscopy											
Distended Douglas pouch	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Evidence of retrograde menstruation	Yes	No	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes
Adhesion	Yes	No	Yes	No	Yes	Yes	No	Yes	Yes	Yes	Yes
Staining	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Endometriosis	No	No	Yes	Yes	No	No	No	Yes	No	No	No
Procedure											
Penetration through Douglas pouch	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes
Penetration through uterine fundus	No	No	No	No	No	No	No	No	No	No	No
Totally vaginal approach	No	No	No	No	No	No	No	No	No	No	No
Drainage catheter	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
Duration (min)	60	65	65	65	60	60	60	65	65	60	60
Postoperative											
Traction days	3	4	3	4	3	4	3	4	4	3	4
Mild pain	Yes	Yes	Yes	No	Yes	Yes	Yes	No	No	Yes	Yes
Severe pain required narcotics	No	No	No	Yes	No	No	No	Yes	Yes	No	No
Balloon and the olive expulsion day	3	4	3	5	3	4	3	5	5	3	5
Communication tract											
Healthy and covered epithelized	Yes	Yes	Yes	No	Yes	Yes	Yes	No	Yes	Yes	Yes
Fibrous ring (dilatable)	No	No	No	Yes	No	No	No	Yes	No	No	No
Follow-up											
Satisfactory communication (3 mo)	Yes	Yes	Yes	NA	Yes	NA	Yes	NA	Yes	Yes	NA
Required dilatation (1 y)	No	No	No	No	Yes	No	Yes	No	No	No	No
Not available (1 y)	Yes	No	No	Yes	No	Yes	No	Yes	No	No	Yes
Get married (1 y)	No	No	Yes	Yes	Yes	No	No	Yes	No	No	No
Sexual intercourse											
Easy and painless	NA	NA	Yes	No	Yes	NA	NA	No	NA	NA	NA
Initial dyspareunia	NA	NA	No	Yes	No	NA	NA	Yes	NA	NA	NA
Required dilatation*	NA	NA	No	Yes	No	NA	NA	Yes	NA	NA	NA

MRI, magnetic resonance imaging; NA, not applicable (sexually inactive).
* The required dilation was self-done by insertion of gauge 24 balloon catheter then inflating it up to 50 mL saline.

The procedure was carried out under general anesthesia. One gram of cefazolin was given preoperatively. Patients were positioned in dorsal lithotomy; legs were placed in hanging stirrups. The total operative time was 60–65 minutes. The procedures were well-tolerated by patients and no operative complications were reported. A dual-force application course was completed within 3–4 days during which the distended upper vaginal pouches were pulled down and the 1- to 2-cm vaginal dimples were pushed up by the Teflon olive. The balloon and the olive became in contact on day 3–5. The thinned tissue was dilated by extracting the distended balloons and introduction of two examining fingers. Patients were discharged on the fourth or fifth day postoperatively. The 3-month vaginoscopic assessment universally revealed a normal vagina; no contractures or scarring were recognized. Seven patients were examined 4–5 months postoperatively, and a wide and patent communication site was identified at the site of the prior atretic portion of the vagina with no scars or contractures. Thereafter, patients were followed through the referring colleagues and by phone communication over 11–27 successive menstrual periods; a normal menstrual flow was successively established with remarkable improvement of pain in all patients.

DISCUSSION

In this case series, we performed bidirectional force balloon vaginoplasty under laparoscopic guidance through application of a pulling down force on the distended upper vaginal pouch in conjunction with application of an upward pushing force to the vaginal dimple. Compared with existing reconstructive procedures that use amniotic membranes[3] or bowel[6] or skin grafts,[2] the current procedure reconstructs the vagina using native tissue with minimal dissection, a short surgical time, and a high success rate with no subsequent vaginal stenosis.

Tissue dissection to establish communication between the upper and lower vaginal portions with grafting procedures might result in scarring. Contracture of scar tissue is an important cause of failures and recurrences of cryptomenrrhea.[10,17,18] Endoscopic communication averts the need for dissection or grafting. Instead, gradual tissue distension and smooth displacement are used to create a naturally lined vaginal canal. Endoscopic procedures have been shown to be promising and reported failures were primarily attributed to a short period of stent retention. Reoperation for failure was easy and amenable for endoscopic management as a result of absence of adhesions.[10,12,19]

Previously, we treated similar cases by a single force pull-down balloon vaginoplasty; a multilayered plentiful dressing was needed to maintain the cord clamp well supported and far from the vulva to avoid pressure necrosis.[19] Repeated soaking of the dressing during urination and defecation resulted in inconvenience for both the patient and caregivers (Fig. 5).

In the current technique, use of a Teflon olive precluded the possibility of dressing contamination.

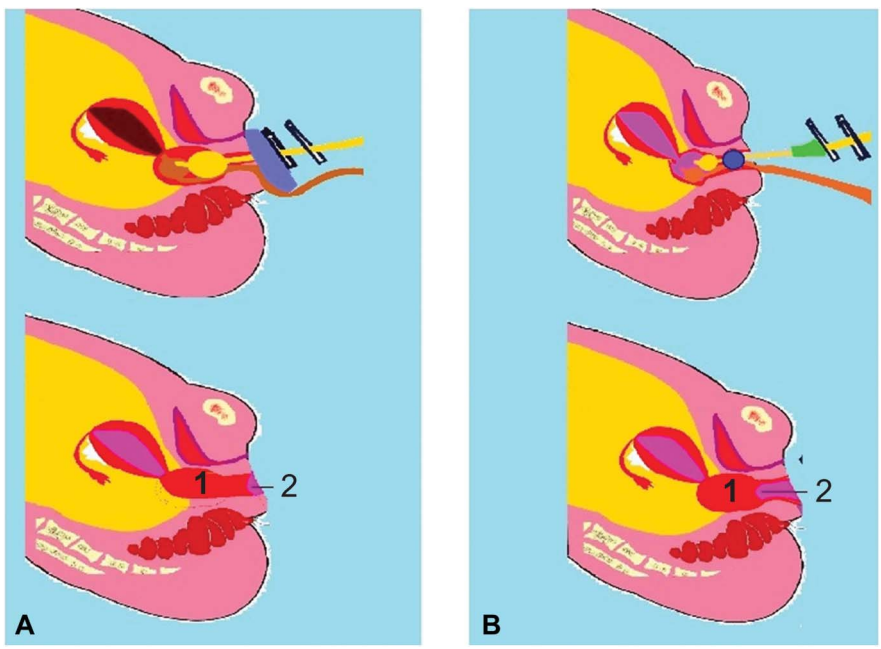

Fig. 5. Comparison between conventional inverted balloon vaginoplasty (**A**) and pull and push balloon vaginoplasty (**B**). **1** points to the part of the neovagina that resulted from pulling force on the proximal distended vaginal pouch; **2** points to the part of the neovagina that resulted from the upward pushing force representing dimple contribution. Illustrations created by Ali El Saman. Used with permission.

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Furthermore, it adds another force of pushing and pulling on dimple tissue. The value of this additional force is to save time and to enhance the role of dimple tissue in construction of the neovagina. Indeed, this might provide a valuable decrease of the tension on the upper vaginal pouch as illustrated in Figure 5.

Although the study is limited by the number of recruited patients, we believe it has the novel concept of using dual forces for fast creation of a wide and smooth commutation, which could present a promising surgical option for this group of patients.

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