Vaginal Labiaplasty: Current Practices and a Simplified Classification System for Labial Protrusion

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Background: Vaginal labiaplasty has been described for the management of functional and aesthetic problems associated with protrusion of the labia minora. Despite increasing numbers of procedures performed, there is a paucity of data to guide treatment paradigms. This systematic review aims to establish a simple, unifying classification scheme for labial protrusion and summarize current labiaplasty techniques and practices.
Methods: A systematic literature review was performed using the PubMed database. Additional articles were selected after reviewing references of identified articles.
Results: The search returned 247 articles. After applying inclusion criteria to identify prospective and retrospective studies evaluating different techniques, outcomes, complications, and patient satisfaction, 19 articles were selected. Labiaplasty of the labia minora was described in 1949 patients. Seven different surgical techniques were used for labiaplasty, including deepithelialization, direct excision, W-shaped resection, wedge resection, composite reduction, Z-plasty, and laser excision. Patient satisfaction rates for each technique ranged from 94 to 100 percent. The most common postoperative complication for all techniques was wound dehiscence (4.7 percent). Key areas for perioperative patient management were defined.
Conclusions: Labiaplasty is safe and carries a high satisfaction rate. However, current practices remain exceedingly diverse. The authors propose a simplified classification system based on the distance of the lateral edge of the labia minora from that of the labia majora, rather than from the introitus. Key areas for perioperative patient management include patient anesthesia, resection technique used, wound closure, and postoperative care. Further randomized studies using a standardized classification system are required to better compare different techniques and establish best practices. (*Plast. Reconstr. Surg.* 135: 774, 2015.)

Vaginal labiaplasty, the surgical reduction of the labia minora,[1] was first described in the plastic surgery literature by Hodgkinson and Hait in 1984.[2] Although this was the first description of labiaplasty in the plastic surgery literature, "circumcision" of the labia minora, a social custom in some cultures, had been described in other literature, and external genital surgery had previously been performed by plastic surgeons and gynecologists for a variety of indications.[2] Over the years, labiaplasty has become an increasingly popular procedure as the practice of vulvovaginoplasty has continued to gain popularity. According to data collected by the American Society for Aesthetic

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A "Hot Topic Video" by Editor-in-Chief Rod J. Rohrich, M.D., accompanies this article. Go to PRSJournal.com and click on "Plastic Surgery Hot Topics" in the "Videos" tab to watch.

Plastic Surgery, 5070 procedures were performed in 2012, up 44 percent from 2011.[3] The increasing popularity of the procedure has been attributed to increased exposure to female nudity in the media, which has helped define a narrow ideal for the appearance of female genitalia.[2,4]

Women pursue this procedure for a variety of reasons. According to a recent study that evaluated 131 patients' indications for pursuing labiaplasty,[5] although 37 percent of patients sought labiaplasty for strictly aesthetic reasons, 32 percent sought surgery for functional impairment such as pain and discomfort, and 31 percent sought surgery for both functional and aesthetic reasons. Various other indications for this procedure have been described in the literature. Hypertrophy of the labia minora can result in dyspareunia, interference with sports, difficulties with cleanliness, chronic urinary tract infections, and irritation.[6] Psychological symptoms relating to the appearance of the genitalia are not to be understated; the appearance of the labia minora can cause patients significant emotional distress, particularly in adolescent populations.[7]

Although these procedures are controversial, patients are generally very satisfied with outcomes. Overall patient satisfaction rates are in the 90 to 95 percent range.[8] However, problems remain. Although the ideal aesthetic is well defined, there are still no standardized diagnostic criteria for labial hypertrophy. According to an early definition, hypertrophy of the labia minora is present when the distance from the midline to the lateral free edge of the labial minora is greater than 5 cm when the labia are extended laterally.[9] More recently, others have proposed that this distance be reduced to 3 or 4 cm.[10,11] Despite these recommendations, there is no consensus regarding the use of these criteria in forming a diagnosis of labial hypertrophy, and it has been proposed that surgery should be pursued with the presence of any chronic symptomatology. A variety of classification schemes also exist,[12] again with no consensus regarding their use. Several different techniques for labiaplasty currently exist, and guidelines for their use have not been well defined.

In this article, we present a comprehensive, systematic review of the available literature regarding labiaplasty for aesthetic and functional indications. The ideal aesthetic is defined. Various techniques are discussed and clinical recommendations are made for their use to optimize patient outcomes. A new classification schema is proposed to better stratify patients for various treatment paradigms.

PATIENTS AND METHODS

Search Strategy, Article Selection, and Data Extraction

A systematic review of the literature was performed using the PubMed database with the following search algorithm: ((labiaplasty) OR (labioplasty) OR (labial hypertrophy)) AND ((etiology) OR (epidemiology) OR (classification) OR (indications) OR (treatment)). Two investigators independently reviewed article titles and abstracts to identify prospective and retrospective clinical studies that assessed labiaplasty methods and outcomes. Selected articles that met these inclusion criteria then underwent full article review by the two investigators. Additional articles were then identified by manual review of the references of primary articles. All article selection was limited to English language articles between September of 1984 and November of 2013. A third investigator reconciled disagreements. Table 1 lists the information extracted from each article.

RESULTS

Search Strategy, Article Selection, and Methods Used

The primary literature search returned 247 articles (Fig. 1). The abstracts for these articles were reviewed in their entirety, and 45 articles were identified that pertained to vaginal labiaplasty. The references of these articles were then reviewed, yielding an additional 17 articles. Of

Table 1. Data Items Extracted, Including Study Design, Patient Demographics, Intraoperative Data, and Postoperative Data

Study design
No. of patients
Treatment and control groups
Patient demographics
Average age
Age range
Labial width
Comorbidities
Intraoperative data
Type of operation
Anesthesia
Incision
Suture
Concurrent operations
Operative time
Antibiotics
Postoperative data
Postoperative care
Antibiotics
Recovery time
Complications
Patient satisfaction

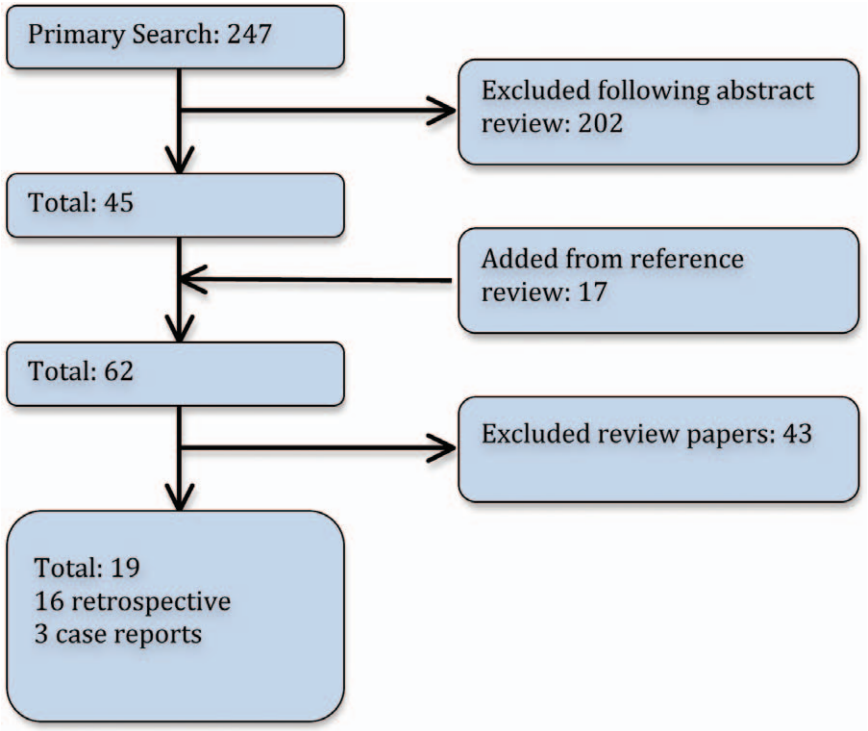

Fig. 1. Article search process and results totaling 19 articles.

the total 62 articles, all retrospective studies, prospective studies, and case reports were then identified, leaving a final number of 19 articles, including 16 retrospective studies and three case reports. Of these articles, seven different surgical techniques were used for labiaplasty, which include deepithelialization (three articles), direct excision (six articles), W-shaped resection (two articles), wedge resection (six articles), composite reduction (one article), Z-plasty (one article), and laser excision (two articles). Figure 2 depicts the normal anatomy of the vagina. Figures 3 and 4 illustrate the various surgical techniques.

Preoperative Data and Patient Demographics

Although average age was reported infrequently, the age range for patients undergoing these procedures ranged from 11 to 68 years. Preoperative labial width was reported by a handful of articles. Average preoperative labial width, measured from midline to the lateral edge of the labia minora, ranged from 2.7 to 5 cm (Table 2).[2,10–28] Wedge resection was not described in patients with a labial width less than 3 cm.[10,11,13]

Intraoperative

Labiaplasty of the labia minora was described in 1949 patients. Where the regimen of intraoperative antibiotics was specifically described, patients were administered broad-spectrum antibiotics[11,27] such as cefazolin[17] or 1500 mg of cefotaxime administered intravenously and 500 mg of metronidazole administered orally.[22] In general, local anesthesia was administered with anxiolytic medicines and monitored anesthesia care. General anesthesia was used for patients undergoing concurrent procedures. Common local anesthetic regimens included 1% lidocaine with 1:200,000 epinephrine,[11,15,22] 0.5% lidocaine with 1:200,000 epinephrine,[16] and 0.25% bupivacaine with 1:200,000 epinephrine[23] or 1:50,000 epinephrine[14] (Table 3).

Deepithelialization was described in 178 patients in three studies[13,15,16] (Table 3). Direct excision was described in 244 patients in six studies[2,13,17,18–20] (Table 3). Composite reduction was described in 812 patients in one study[27] (Table 3). Laser labiaplasty was described in 286 patients in two studies.[12,28] Wedge resection was described in 620 patients in six studies[10,11,13,24–26] (Table 3). Labiaplasty was less frequently described using a W-shaped resection (25 patients) or Z-plasty (15 patients) (Table 3).[12,14,22,23] Where it was described, operative time ranged from 28 to 55 minutes.[11,12,15] Laterality was described in seven studies; where described, cases were bilateral 92.9 percent of the time (579 of 623 patients) (Table 3). The incisions

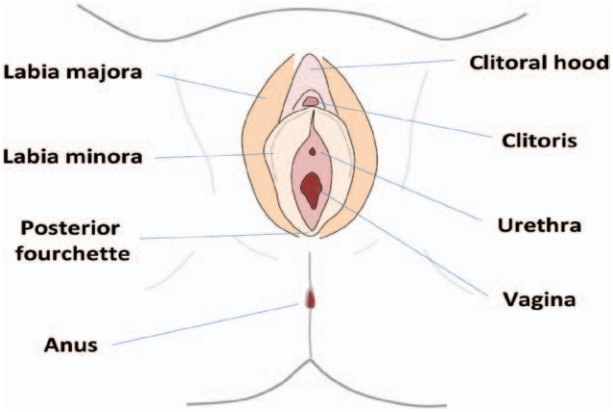

Fig. 2. Normal anatomy of the vagina.

and surgical techniques for each procedure are described in Figures 3 and 4. The type of suture varied greatly. The most commonly used sutures were 4-0 Vicryl sutures (Ethicon, Inc., Somerville, N.J.).[10,12,14,17,24,25] The use of 5-0 and 6-0 Monocryl (Ethicon) sutures[22,23,29] and 5-0 and 6-0 Vicryl sutures was also described.[24,27] Nonabsorbable (4-0) sutures were used in only two studies.[2,23] The technique of the closure varied; either continuous or interrupted sutures were used for both deep and superficial closure. Both a two-layer and a three-layer closure have been described (Table 3).

Postoperative Care

Postoperative care again varied greatly. Either topical (erythromycin, polymyxin B, bacitracin) or oral antibiotics (first-generation cephalosporins, clindamycin for patients with penicillin allergies) were recommended, with several recommending both (Table 4).[11,16,23,25] Where reported, avoidance of bathtubs and sexual activity was recommended from 40 days[17,25] up to 2 months.[16] Topical iodine and potassium permanganate baths were used in two studies.[14,16] Meticulous perineal hygiene and dressing with a sterile pad, antiinflammatory drugs and other analgesics, and ice pads for postoperative pain and inflammation were also recommended (Table 4).

Complications

Common postoperative complications included dehiscence, hematoma formation, hematoma, flap necrosis (for wedge resection), discomfort, visible scarring, superficial infections, underresection, and overresection. Suture granulomas, fistula formation, and a clitoral hood dog-ear were described in one retrospective study.[29] Data regarding complication rates are summarized for each technique in Table 5.

Satisfaction

Patient satisfaction rates for each technique ranged from 94 to 100 percent. These data are summarized in Table 4.

DISCUSSION

Vulvovaginal plastic surgery, an umbrella term encompassing multiple procedures that are quite distinct from one another, has come under scrutiny and has been the topic of discussion in the news, media, online, and in medical editorials. The absence of measurable standards of care, lack of evidence-based outcome norms, and little standardization in nomenclature have raised questions about the level of safety and efficacy of "vaginal rejuvenation." To address this issue, Mirzabeigi et al. offered a formal attempt to standardize the nomenclature of "vaginal rejuvenation" and elective vulvovaginal plastic surgery.[1] Mirzabeigi et al. defined labiaplasty as reduction of the labia minora and recommended against the use of proprietary terms such as "vaginal rejuvenation" that would potentially group several procedures together.

Labiaplasty has become an increasingly popular procedure. The National Health Service of England reported a near doubling in the number of labial reductions from 1999 to 2005, and similar trends have been noted in the United States and worldwide.[4] However, little effort has been made to compare the efficacy or prevalence of various techniques, and even less has been done to explore and establish optimal practice guidelines for this procedure. The purpose of this study was to elucidate the current techniques available and establish current practices for labia minora reduction and the management of these patients.

Labial hypertrophy is most commonly congenital in origin.[24,30] However, there are a number of potential acquired causes, such as exogenous androgenic hormones in infancy,[31] sensitivity to topical estrogen,[2] stretching or weight attachment of the labia,[32] dermatitis secondary to urinary incontinence, vulvar lymphedema,[10] and myelodysplastic diseases.[33] Although many systems to stage the severity of labial hypertrophy exist, there is still no consensus on how best to define and classify this condition. The most widely used classification system, first described by Franco in 1993, divides labial hypertrophy into four stages: stage I, less than 2 cm; stage II, 2 to 4 cm; stage III, 4 to 6 cm; and stage IV, greater than 6 cm.[17] The distance is measured in centimeters from the base of the labia minora (the vaginal introitus) to the distalmost tip.

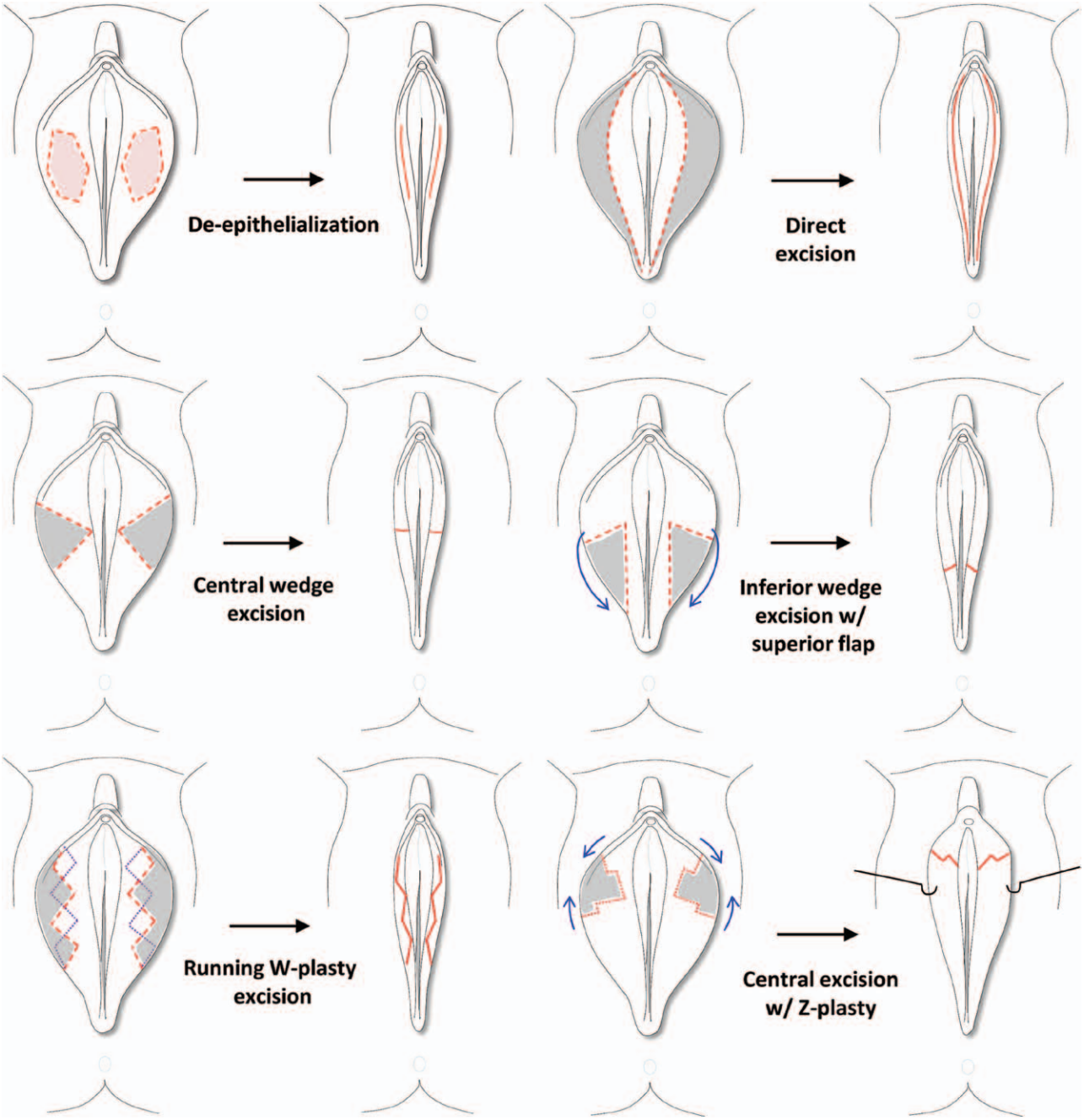

Fig. 3. (*Above, left*) Deepithelialization; central portion of medial surface of each labium minus is deepithelialized and reapproximated. (*Above, right*) Direct excision; excess tissue is excised using a contoured excision parallel to each labium majus, sparing the fourchette. (*Center, left*) Central wedge resection; central wedge of excess tissue is excised and each labium minus is reapproximated. (*Center, right*) Inferior wedge resection; inferior wedge of excess tissue is excised and each labium minus is reapproximated. (*Below, left*) W-resection; complementary, running, W-shaped resections along medial and lateral aspect of each labium minus, sparing clitoris and fourchette. Tissues are reapproximated in an interdigitated fashion. (*Below, right*) Z-shaped wedge resection; central wedge of excess tissue is excised with Z-shaped incisions and each labium minus is reapproximated.

The labia minora vary in length, thickness, symmetry, and protuberance. The mean width of the labia minora is 2.5 cm, with a range of 7 mm to 5 cm.[34,35] Although there is no established anatomical standard regarding the size of the labia minora, in their original description of the technique, Hodgkinson and Hait stated that labia minora that protrude past the labia majora are both aesthetically and functionally unsatisfactory.[2] According to various, often anecdotal reports,

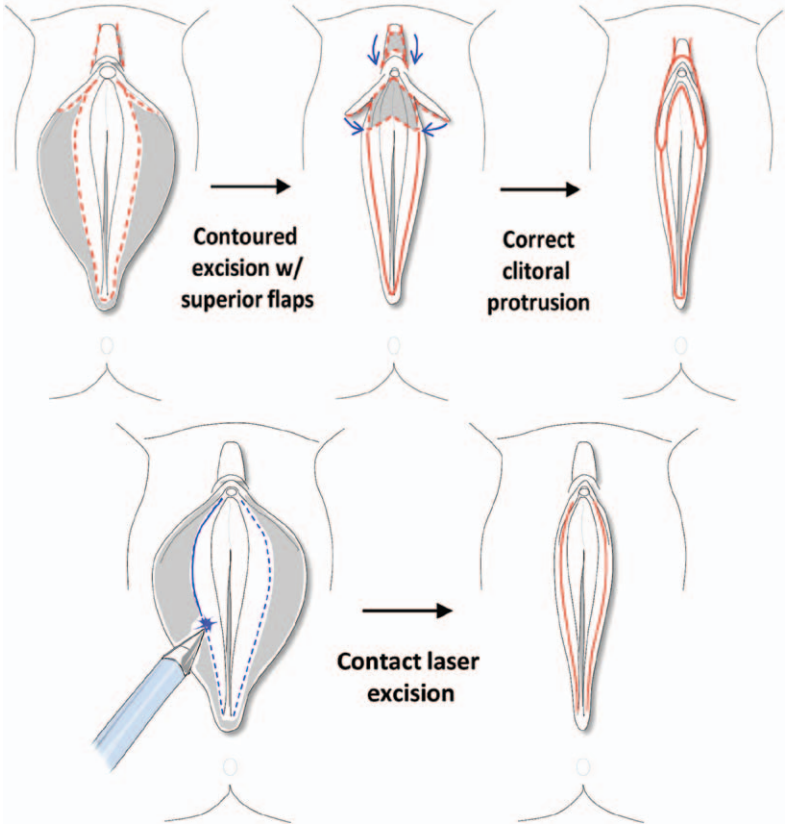

Fig. 4. (*Above*) Composite reduction; a curved excision is performed and narrow, superiorly based pedicled flaps and the frenulum clitoris are preserved. A crescent of tissue is removed below the clitoris to an extent that determines the degree to which the clitoris is shifted caudally. A central, rectangular skin segment cranial to the clitoris is also excised and tissues are reapproximated. (*Below*) Laser excision; a contact laser is used to excise tissue in a manner similar to direct excision or wedge resection.

Table 2. Preoperative Data, Including Average Age and Labial Width, for Each Study

Technique	Reference	Type of Study	No.	Average Age (Range) (yr)	Average Labial Width (cm)
Deepithelialization	Choi and Kim, 2000[15]	Retrospective	6	26.5 (13–40)	n/a
	Cao et al., 2012[16]	Retrospective	167	20–43	n/a
	Ellsworth et al., 200910[13]	Retrospective	5	n/a	2.7
Direct excision	Felicio Yde, 2007[17]	Retrospective	229	20–68	n/a
	Hodgkinson and Hait, 1984[2]	Case report	3	32 (30–36)	n/a
	Ellsworth et al., 2010[13]	Retrospective	4	n/a	4.375
	Girling et al., 2005[18]	Retrospective	"Several"	n/a	n/a
	Jothilakshmi et al., 2009[19]	Retrospective	6	13.7 (11–16)	n/a
	Lynch et al., 2008[20]	Case report	2	11 (10–12)	n/a
	Murariu et al., 2010[21]	Retrospective	14	36.2	3.5
W-shaped resection	Maas and Hage, 2000[22]	Retrospective	13	30 (19–42)	n/a
	Solanki et al., 2010[23]	Retrospective	12	32 (15–52)	
Wedge resection	Rouzier et al., 2000[10]	Retrospective	163	Median, 26 (12–67)	>4
	Alter, 1998[24]	Case report	4	n/a	n/a
	Munhoz et al., 2006[11]	Retrospective	21	38 (31–49)	>3
	Ellsworth et al., 2010[13]	Retrospective	3	n/a	5
	Kelishadi et al., 2013[25]	Retrospective	22	35 (19–57)	n/a
	Alter, 2008[26]	Retrospective	407	n/a	
	Murariu, 2010[21]	Retrospective	10	36.2	3.5
Composite reduction	Gress, 2013[27]	Retrospective	812	n/a	n/a
Z-plasty	Giraldo et al., 2004[14]	Retrospective	15	34 (22–45)	n/a
Laser	Pardo et al., 2006[12]	Retrospective	55	10–55	n/a
	Smarrito, 2014[28]	Retrospective	231	n/a	n/a

n/a, not applicable.

Table 3. Intraoperative Data, Including Type of Anesthesia, Laterality of Labiaplasty, Type of Incision, Type of Sutures Used, and Concurrent Operations, for Each Study

Technique	Reference	No.	Anesthesia	Laterality	Incision	Suture	Concurrent Operations
Deepithelialization	Choi and Kim, 2000[15]	6	General (2 patients), local (4 patients), 1% lidocaine with 1:200,000 epinephrine	n/a	Vertical oval area on central/lateral labia minora	4-0 catgut, continuous sutures	Two patients had McIndoe procedure for vaginal agnesis
	Cao et al., 2012[16]	167	Local anesthesia, 0.5% lidocaine with 1:200,000 epinephrine	n/a	Central and posterior deepithelialization	5-0 Vicryl, interrupted	n/a
	Ellsworth et al., 2010[13]	5	General or local anesthesia	100% bilateral	According to Choi and Kim	According to Choi and Kim	n/a
Direct excision	Felicio Yde, 2007[17]	229	Lidocaine without epinephrine, benzodiazepines for sedation	n/a	S shaped	4-0 Vicryl or 4-0 chromic gut, continuous sutures	n/a
	Hodgkinson and Hait, 1984[2]	3	General anesthesia (1 patient); general and local anesthesia, lidocaine with 1:100,000 epinephrine (2 patients)	n/a	Labial reduction to a length of 1 cm; within 1 cm of clitoral tip not including fourchette	4-0 Prolene, running, locking (1); 5-0 chromic catgut	Two patients had reduction mammaplasty
	Ellsworth et al., 2010[13]	4	General or local anesthesia	100% bilateral	S shaped	According to Felicio Yde	n/a
	Girling et al., 2005[18]	"Several"	20 mg oral diazepam, followed by IV diazepam until speech is slurred (20–80 mg), 75-mg bolus of ketamine plus 1% lidocaine with epinephrine in area of incision, 5 cc of 2% lidocaine with epinephrine in each labium	n/a	Curved excision approximately parallel to labia majora	5-0 Vicryl continuous, locking	n/a
	Jothilakshmi et al., 2009[19]	6	Not specified	50% (3) unilateral, 50% (3) bilateral	Direct excision	3-0 Vicryl Rapide	n/a
	Lynch et al., 2008[20]	2	General anesthesia, lidocaine with epinephrine	50% (1) unilateral, 50% (1) bilateral	Direct excision	4-0 nylon, interrupted, suture removal at 14 days; 4-0 Vicryl, subcuticular	n/a
	Murariu et al., 2010[21]	14	n/a	n/a	Direct excision	n/a	n/a
W-shaped resection	Maas and Hage, 2000[22]	13	General or regional anesthesia, local anesthesia, 1% lidocaine with 1:200,000 epinephrine	n/a	Running, W-shaped resection, sparing clitoris and fourchette	6-0 Monocryl, interrupted	n/a
	Solanki et al., 2010[23]	12	General anesthesia, 0.25% bupivacaine with 1:200,000 epinephrine	8% (1) unilateral, 92% (11) bilateral	Running, W-shaped resection, sparing clitoris and fourchette	5-0 Monocryl, interrupted deep dermal followed by 5-0 Vicryl Rapide, superficial continuous absorbable sutures	n/a

(*Continued*)

Table 3. (*Continued*)

Technique	Reference	No.	Anesthesia	Laterality	Incision	Suture	Concurrent Operations
Wedge resection	Rouzier et al., 2000[10]	163	Not described	15% (24) unilateral, 85% (139) bilateral	Inferior wedge	4-0 Vicryl, buried running	n/a
	Alter, 1998[24]	4	General or regional, lidocaine with epinephrine	n/a	Central wedge	4-0 absorbable sutures, subcuticular; 4-0 and 5-0 Vicryl, external	n/a
	Munhoz et al., 2006[11]	21	1% lidocaine with 1:200,000 epinephrine	4.8% (1) unilateral, 95.2% (20) bilateral	Inferior wedge	Resorbable sutures in layers	The patient with Paget disease and unilateral intraepithelial vulvar carcinoma underwent partial vulvectomy of the affected side and a contralateral aesthetic inferior wedge resection and superior pedicle flap reconstruction technique
	Ellsworth et al., 2010[13]	3	General or local	100% bilateral	Inferior wedge	According to Alter/Rouzier/Munhoz	The patients undergoing concomitant cosmetic procedures were treated under general anesthesia, and the remaining patients were treated with reduction using local anesthesia in the office
	Kelishadi et al., 2013[25]	22	Local anesthetic, 1% lidocaine with 1:100,000 epinephrine; anxiolytic medicines and MAC anesthesia were provided for select candidates	n/a	Posterior wedge	4-0 Vicryl, interrupted, three-layer closure	n/a
	Alter, 2008[26]	407	Lidocaine with epinephrine and Marcaine	3% (14) unilateral, 97% (393) bilateral	Central wedge	5-0 Monocryl on an atraumatic TF needle; used for all three layers of closure; leading edge and distal medial/lateral labium closed with vertical mattress; remainder of medial closure running, lateral interrupted	Four had a second more posterior V labial excision performed on one side at the same time because of severe posterior asymmetry of the labia
	Murariu et al., 2010[21]	10	n/a	n/a	Central wedge	n/a	n/a

(*Continued*)

Table 3. (*Continued*)

Technique	Reference	No.	Anesthesia	Laterality	Incision	Suture	Concurrent Operations
Composite reduction	Gress, 2013[27]	812	Oral analgesics, 1% lidocaine and 0.5% Carbostesin, 1:100,000 epinephrine	n/a	Curved incision with cranial based pedicled flap	5-0 Vicryl, continuous for subcutaneous closure; 6-0 Vicryl, interrupted for superficial	n/a
Z-plasty	Giraldo et al., 2004[14]	15	0.25% bupivacaine with 1:50,000 epinephrine	n/a	Two 90 degree Z-plasties with excision of intervening tissue	4-0 Vicryl, interrupted	n/a
	Pardo et al., 2006[12]	55	Regional anesthesia	n/a	Direct excision with Nd:YAG laser	4-0 Vicryl	36 (65.5%) were combined with vaginal hysterectomy, anterior or posterior perineoplasty, and/or tension-free vaginal tape placement In 20 of these 36 cases, two other interventions were combined with labiaplasty
Laser	Smarrito, 2014[28]	231	n/a	n/a	Lambda-shaped wedge resection with a CO_2 laser	n/a	n/a

n/a, not applicable; IV, intravenous; MAC, monitored anesthesia care; Nd:YAG, neodymium:yttrium-aluminum-garnet; CO_2, carbon dioxide.

many women desire a "prepubescent" aesthetic, with the labia minora tucked within the confines of the labia majora.[36] To achieve this aesthetic, the labia minora should not project beyond the labia majora, giving the vulva a smooth, "clamshell" appearance. The labia should be roughly symmetric and should have minimal redundancy.

There is a wide range for the anatomically normal width of the labia minora and, to some extent, the labia majora. To take the breadth of individual patient anatomy into consideration and avoid confusion in diagnosis, we propose a simplified classification system for labial *protrusion* based on the distance of the lateral edge of the labia minora from that of the labia majora, rather than from the introitus. Labial protrusion is classified as class I (0 to 2 cm), class II (2 to 4 cm), and class III (>4 cm) (Fig. 5). Different classes of labial protrusion may be amenable to different treatment paradigms; however, future studies should validate this approach.

Since the inception of labiaplasty into the plastic surgery literature by Hodgkinson and Hait in 1984, there have been multiple novel technique introductions and permutations. A myriad of surgical techniques have been reported in the literature, including deepithelialization,[13,15,16] direct excision,[2,13,17,18–20] W-shaped resection,[22,23] wedge resection,[10,11,13,24–26] composite reduction,[27] Z-plasty,[14] and laser labiaplasty.[12,28] When performing a labiaplasty, the essential goals should include the reduction of the hypertrophied labia minora with maintenance of the neurovascular supply, preservation of the introitus, optimal color/texture match, and minimal invasiveness.

Although there are many different techniques for labiaplasty, few studies have defined an algorithm for pairing the degree of deformity with the optimal surgical procedure. According to Ellsworth et al., patients with Franco type I and type II labia minora hypertrophy may be treated most effectively with the deepithelialization technique.[13] Patients with Franco type III or type IV labia minora hypertrophy may be less appropriate candidates for the deepithelialization technique because of inability to reduce labial volume completely and poor aesthetic outcomes. Instead, these patients may be more suitable candidates for either the direct excision technique or the wedge resection technique. Although both techniques allow for significant reduction in labial size, the direct excision technique amputates the naturally darker corrugated edge. For women who prefer to retain the naturally darker labial edge, the wedge resection is the procedure of choice. Using this algorithm, Ellsworth et al. found that

Table 4. Postoperative Data, Including Postoperative Care, Recovery Time, Satisfaction Rate, and Rate of Reoperation, for Each Study

Technique	Reference	No.	Postoperative Care	Recovery Time	Satisfaction Rate	Reoperation
Deepithelialization	Choi and Kim, 2000[15]	6	n/a	n/a	100% satisfied	n/a
	Cao et al., 2012[16]	167	Erythromycin ointment to suture lines, sterile pad, oral antibiotics, one hip bath per day in potassium permanganate	No sexual activity for 2 mo	100% satisfied	1.2% (2 patients) received revision resections
	Ellsworth et al., 2010[13]	5	According to Choi and Kim	According to Choi and Kim	100% satisfied	0%
Direct excision	Felicio Yde, 2007[17]	229	Antiinflammatory drugs, ice packs for comfort/edema, meticulous wound hygiene	40 days (no sex, no bathtubs)	98% satisfied	n/a
	Hodgkinson and Hait, 1984[2]	3	Perineal pad for dressing, perineal hygiene and analgesics	n/a	100% satisfied	n/a
	Ellsworth et al., 2010[13]	4	According to Felicio Yde	According to Felicio Yde	75% very satisfied, 25% not satisfied because of overexcision	25% (1 patient) not satisfied, considering fat grafting for overreduction
	Girling et al., 2005[18]	"Several"	No dressing is applied; shower daily, topical antibiotic ointment daily to suture lines	n/a	100% satisfied	n/a
	Jothilakshmi et al., 2009[19]	6	n/a	n/a	100% satisfied	n/a
	Murariu et al., 2010[21]	14	n/a	n/a	95% satisfied	0%
W-shaped resection	Maas and Hage, 2000[22]	13	n/a	2 wk (pain, discomfort), 4 wk (swelling)	100% satisfied	n/a
	Solanki et al., 2010[23]	12	Polymyxin B/bacitracin ointment applied to the suture lines, area dressed with Jelonet and sterile sanitary pad; postoperative treatment consisted of simple analgesia, an oral antibiotic for 5 days and regular application of polymyxin ointment to the suture lines for 1 wk	n/a	100% satisfied	0%
Wedge resection	Rouzier et al., 2000[10]	163	1 day stay postoperatively, perineal hygiene, analgesics, removal of stitches at 1 mo	1 day stay postoperatively	96% satisfied	7% (11 patients) because of wound dehiscence
	Alter, 1998[24]	4	Topical antibiotics	n/a	100% satisfied	n/a
	Munhoz et al., 2006[11]	21	Discharged day of operation; rest, maintain good hygiene, keep the surgical wounds dry, and apply antibiotic ointment for approximately 10 days	n/a	95% very satisfied, 5% satisfied	n/a
	Ellsworth et al., 2010[13]	3	According to Alter	According to Alter	100% very satisfied	0%
	Kelishadi et al., 2013[25]	22	Wash the surgical area with soap and water, pat dry and application of antibiotic ointment twice daily until the suture lines healed; patients were placed on cephalexin for 7 days; if any patient was allergic to penicillin or cephalosporins, clindamycin was prescribed instead; patients were instructed to avoid sexual intercourse for 6 wk	No sexual activity for 6 wk	n/a	n/a

(*Continued*)

Table 4. (*Continued*)

Technique	Reference	No.	Postoperative Care	Recovery Time	Satisfaction Rate	Reoperation
	Alter, 2008[26]	407	n/a	n/a	98% respondents would undergo the operation again; average satisfaction 9.2 of 10 (with 10 being happiest)	2.9% (12 patients): 3 dehiscence, 7 stretching, 1 labial fistula, 1 clitoral hood dog-ear
	Murariu et al., 2010[21]	10	n/a	n/a	95% at 6 wk	0%
Composite reduction	Gress, 2013[27]	812	n/a	n/a	9.4 of 10 satisfaction rate; 92.3% resolution in functional problems	6.4% because of wound healing complications, 7% for postoperative bleeding, 2.3% for asymmetry, 4.2% for additional resection
Z-plasty	Giraldo et al., 2003[14]	15	Personal hygiene of external genitalia after urinating, maintaining vulva and surgical wounds dry, topical application of iodine on the wounds with cotton bud, placement of dry sterile gauze between labia minora for 2 wk	n/a	100% satisfied, 100% improvement in functional outcomes	n/a
Laser	Pardo et al., 2006[12]	55	IV ketoprofen, plus 10 mg of oral valdecoxib per day the first 4–5 postoperative days for pain; intermittent use of ice pads during the first 4–5 days for management of postoperative pain and inflammation	Discharged 3 hr after surgery	Aesthetic: 91% very satisfied, 9% satisfied Functional: 100% very satisfied (very satisfied, satisfied, not satisfied)	n/a
	Smarrito, 2014[28]	231	n/a	n/a	100% satisfied	4.32% (1 patient) immediate bleeding, 4.77% (11 patients) for dehiscence

n/a, not applicable; IV, intravenous.

Table 5. Complications, Including Dehiscence, Hematomas, Infection, and Miscellaneous, for Each Study

Technique	Reference	No.	Dehiscence	Hematomas	Infection	Miscellaneous
Deepithelialization	Choi and Kim, 2000[15]	6	0	0	0	n/a
	Cao et al., 2012[16]	167	0.6% (1)	0	0	1.2% (2) underreduction
	Ellsworth et al., 2010[13]	5	20% (1)	0	0	n/a
Direct excision	Felicio Yde, 2007[17]	229	n/a	n/a	n/a	n/a
	Hodgkinson and Hait, 1984[2]	3	n/a	n/a	n/a	n/a
	Ellsworth et al., 2010[13]	4	25% (1)	0	0	25% (1) overreduction
	Girling et al., 2005[18]	"Several"	n/a	n/a	n/a	n/a
	Jothilakshmi et al., 2009[19]	6	0	0	0	n/a
	Murariu et al., 2010[21]	14	36% (5)	7.1% (1)	36% (5)	29% (4) discoloration/poor aesthetic result, 21% (3) discomfort with walking/running, 14% (2) reduced sensitivity/sexuality, 21% (3) dyspareunia, 21% (3) pruritus/dryness, 0% urinary
W-shaped resection	Maas and Hage, 2000[22]	13	7.7% (1)	7.7% (1)	0	n/a
	Solanki et al., 2010[23]	12	0	8.3% (1)	0	8.3% (1) urinary retention
Wedge resection	Rouzier et al., 2000[10]	163	6.7% (11)	0	0	45% (73) discomfort
	Alter, 1998[24]	4	0	0	0	n/a
	Munhoz et al., 2006[11]	21	9.5% (2)	4.8% (1)	4.8% (1)	4.8% (1) distal flap necrosis
	Ellsworth et al., 2009[13]	3	33% (1)	0	0	n/a
	Kelishadi et al., 2013[25]	22	4.5% (1)	4.6% (1)	0	n/a
	Alter, 2008[26]	407	3.0% (12)	0	0	4.2% (17) stretching, 0.3% (1) labium fistula, 1.0% (4) granulomas, 0.3% (1) clitoral hood dog-ear, 0.7% (3) discomfort
	Murariu et al., 2010[21]	10	30% (3)	10% (1)	20% (2)	0 discoloration/poor aesthetic result, 30% (3) discomfort with walking/running, 0 reduced sensitivity/sexuality, 30% (3) dyspareunia, 0 pruritus/dryness, 0 urinary
Composite reduction	Gress, 2013[27]	812	n/a	n/a	n/a	4.2% (34) underreduction, 6.4% (5) wound healing complications, 0.9% (7) postoperative bleeding, 2.3% (19) asymmetry
Z-plasty	Giraldo et al., 2004[14]	15	13% (2)	0	0	n/a
Laser	Pardo et al., 2006[12]	55	5.5% (3)	0	0	n/a
	Smarrito, 2014[28]	231	4.8% (11)	1.3% (3)	0	0.4% (1) immediate bleeding
Total		1158	4.7% (55)	0.8% (9)	0.7% (8)	

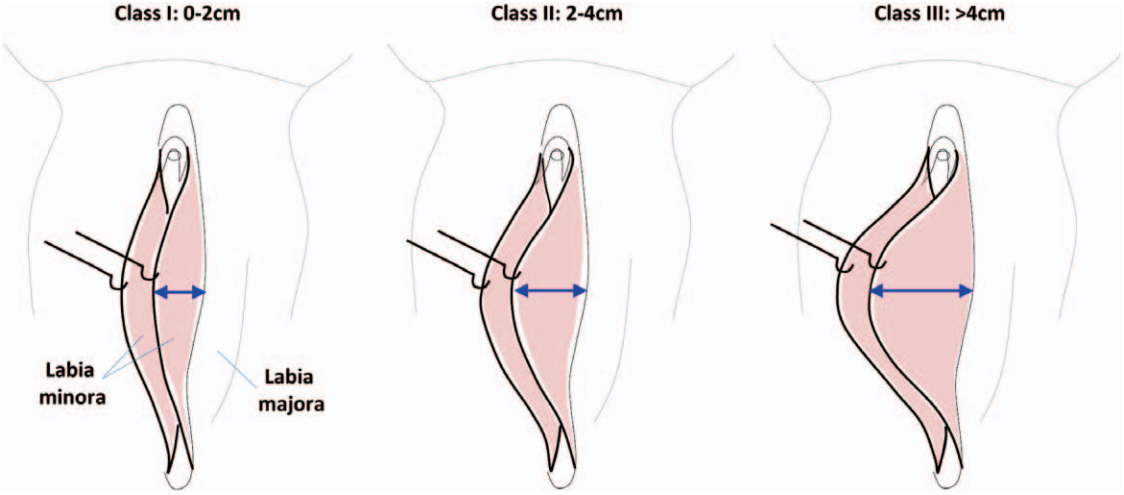

Fig. 5. Classification for labial protrusion, which classifies degree of protrusion of labia minora past labia majora. Class I (0 to 2 cm of protrusion), class II (2 to 4 cm of protrusion), and class III (>4 cm of protrusion) may be amenable to different treatment paradigms. An "A" is added for asymmetry and a "C" for involvement of the clitoral hood.

92 percent of their patients were "very satisfied" with their surgical outcome.[13] To date, the literature lacks any comparative analysis of all reported labiaplasty techniques to establish a criterion standard for operative planning. Although the authors agree with this algorithmic approach to labiaplasty, future, larger studies should validate this approach.

As Ellsworth et al. demonstrated, each technique offers its own advantages and disadvantages. Although direct excision provides a simple technique for the excision of excess tissue, as described above, this technique removes the natural contour, coloration, and texture of the free edge of the labia minora and places a suture line at the free edge of the labia minora, which may lead to visible scar formation. Sensation may, in theory, be affected by scar formation along the border of the labia minora; however, neither of these statements regarding scar formation has been validated in any study thus far. In contrast, deepithelialization may offer many advantages by preserving the natural border of the labia minora and its neurovascular supply. However, this technique may be poorly suited for patients with a wider labial width. Wedge resection retains the natural contour and coloration of the free edge of the labia minora; however, this technique may create an abrupt contrast in the coloration of the labia minora where tissues are reapproximated. Some authors have argued that the longitudinal scar created by this technique may distort the labia, but this statement has not been validated.[22] Composite reduction is a technique that addresses both labial protrusion and clitoral hooding with excellent aesthetic outcomes. However, the complication and reoperation rate for this technique is also the highest described in the literature at 17.4 percent.[27] W-shaped resection in 25 patients (16 percent complication rate) and Z-plasty in 15 patients (13 percent complication rate) have been described in only a handful of patients. Laser labiaplasty has also been described, in a manner similar to direct excision[12] and wedge resection,[28] with excellent outcomes.

More work needs to be done to validate each of these methods, better compare the available techniques, and validate treatment paradigms. Ultimately, until validated treatment paradigms have been established, the risks and benefits for each method should be discussed with patients and the technique used should be based on patient anatomy and patient preference weighted with the desired aesthetic.[13] Most reviewed studies stated that resection should not reduce the width of the remaining labia minora less than 1 cm to avoid distortion of the urethral orifice.[2,15,22,23] The resection should not extend to the posterior fourchette to avoid distorting the vaginal introitus.[2,15] However, again, it remains unclear whether or not these statements have been validated.

Our literature review identified tremendous differences in how patients are managed in the perioperative period. Anesthetic regimens varied greatly; generally, local anesthesia was used alone or in combination with anxiolytic medications and monitored anesthesia care. Lidocaine 0.5% to 1% or 0.25% bupivacaine in combination with 1:50,000 to 1:200,000 epinephrine has been

described in the literature. A variety of means have been described to achieve closure. Alter described a three-layer closure using 5-0 Monocryl internally and 5-0 Vicryl on the skin and mucosa to avoid dehiscence.[37] A two-layer closure may be performed when using direct excision.[20]

A variety of different regimens were used for postoperative care. Use of oral and topical antibiotics for 5 days postoperatively should be considered to minimize the risk of superficial infection and reduce the risk of wound breakdown.[11,16,18,23,25] A dry sterile dressing may be used for 5 days postoperatively.[2,14,16,23] Avoidance of soaking in bathtubs and sexual intercourse was recommended for at least 40 days postoperatively.[17] Antiinflammatory medications and other analgesics may be used in the postoperative period.[2,17] Ice pads may be used for pain and swelling.[12,17,25] Ultimately, until larger, prospective studies with higher quality data are performed, recommendations for perioperative patient management cannot be made.

A limitation of this work is the absence of prospective clinical studies. Although the popularity of this procedure has increased dramatically since it was first described by Hodgkinson and Hait in 1984, the available literature is rather limited and current practices remain poorly described. There remains a tremendous lack of uniformity in current practices. Because of the lack of standardization, a meta-analysis is of limited value. This work identifies current practices defined by a systematic review of the available data. Future studies should establish or propose uniform practices to optimize patient management. Despite its limitations, this work represents the first systematic review of the available data on aesthetic labiaplasty, which is an increasingly popular procedure that is associated with exceptional patient satisfaction rates. Future, clinical studies should be performed to validate current practices and define optimal management of patients with labial protrusion.

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