

# Neurovascular bundle-sparing ventral clitoroplasty in adult patients: description of the technique and long-term outcome on clitoral functions

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## Abstract

**Objective:** To describe the technique and assess long term effects of neurovascular bundle-sparing adult clitoroplasty on clitoral functions in patients.

**Material and Methods:** A case series study enrolling three patients diagnosed with adult clitoromegaly who underwent neurovascular bundle-sparing ventral clitoroplasty operation. All of the patients were examined at the first, third, sixth, twelfth and twenty-fourth months post-operatively to evaluate clitoral functions.

**Results:** Three patients diagnosed with adult clitoromegaly, aged 17, 21 and 24 years, were enrolled in the study. The primary complaint of all patients was unpleasant enlarged appearance and hypersensitive clitoris. Mean calculated clitoral index was 143 mm<sup>2</sup>, 150 mm<sup>2</sup>, and 120 mm<sup>2</sup>. Operation time was 90, 140 and 120 minutes, respectively. No major complication occurred during the operation but moderate ecchymosis and edema of the vulva occurred in all patients, lasting up to three weeks. On follow up examination, partial sensorial loss was noted at the first month in one patient, which completely resolved by the third month and beyond. Two patients who were sexually active reported that they were very comfortable with intercourse and cosmetic appearance. No clitoral enlargement or pain were reported by patients through the 24-month follow up period.

**Conclusion:** Neurovascular bundle-sparing ventral clitoroplasty is a safe and cosmetically acceptable procedure, which effectively preserves the neurovascular bundle and long-term clitoral functions. (J Turk Ger Gynecol Assoc 2023; 24: 109-13)

**Keywords:** Clitoromegaly, nerve sparing clitoroplasty, clitoral function

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## Introduction

Compared to penile anatomy, clinical interest and focus on clitoral anatomy has long been underestimated by clinicians. The clitoris is a multiplanar structure, deep in the labia minora fat and vasculature, with a broad attachment to the pubic arch and via its supporting tissue to the mons pubis and labia. The clitoris has a paramount functional role in female sexual pleasure and orgasm, and is composed of paired bulbs, and corpora that are continuous with the crura, and glans. It is attached to the urethra and vagina centrally (O'Connell et al.).

The clitoris and the penis are homologous in much of their anatomy, and they share similar embryological origins from the genital tubercle. However, since there is no fusion of the urogenital folds the urethra does not pass through the body of the clitoral gland. Another difference from the penis is that the glans of the clitoris is encircled by a fibrous tunica albuginea which is not anatomically observed in glans penis (1). Clitoromegaly is defined as abnormal enlargement of the clitoris and may present either congenitally or can be acquired due to increased androgen exposure. There is a limited number of clinical entities that result in clitoromegaly. The



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most prevailing etiology is congenital adrenal hyperplasia which is mainly caused by 21 hydroxylase or and 11 beta hydroxylase enzyme deficiencies. Virilizing ovarian or adrenal neoplasms and inadvertent excessive androgen exposure during pregnancy are other etiological factors responsible for congenital clitoromegaly. High dose long-term use of androgen-bearing drugs or injections, polycystic ovary syndrome, and excessive clitoral stimulation secondary to masturbation can also cause acquired clitoromegaly. In rare circumstances, neurofibromatosis, epidermoid cysts, hemangiomas and some nevi can cause clitoromegaly.

The leading complaints in patients with clitoromegaly are unpleasant appearance, shape, excessive stimulation and irritation, and sexual dysfunction causing psychological consequences. The primary surgical aim is to reconstruct a pleasant clitoris without damaging neurovascular functions. In this study we assessed the long-term outcome of neurovascular bundle-sparing clitoroplasty in three patients diagnosed with adult clitoromegaly.

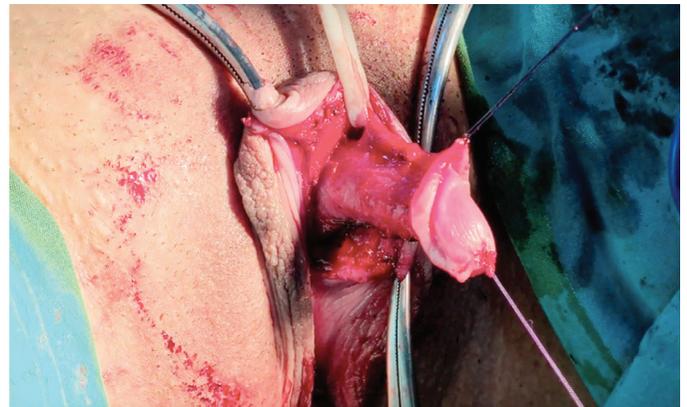
## Material and Methods

In this retrospective case series study, 24-month follow up data of three patients diagnosed with adult clitoromegaly who underwent neurovascular bundle-sparing ventral clitoroplasty was evaluated. All of the patients were examined at the first, third, sixth, twelfth and twenty-fourth months post-operatively to evaluate clitoral function and cosmetic healing. The impact of operation on sexual outcome was assessed in two patients who were sexually active. Clitoral index was calculated by multiplying the length and width of the clitoral glans, and a diagnosis of clitoromegaly was established when the clitoral index was  $>35 \text{ mm}^2$ .

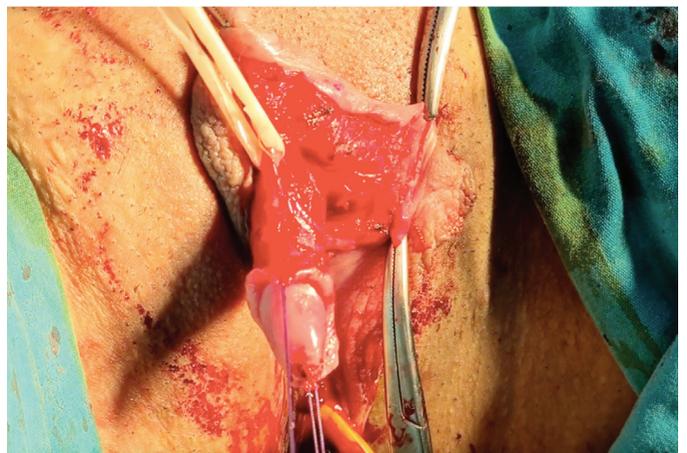
**Description of the procedure:** First, the excess skin of the clitoral hood was marked, a foley catheter placed in the bladder, and a circumferential incision was made 3-5 mm behind the corona on the inner prepuceal layer. Second, by means of parallel incisions made on the skin covering the body of clitoris, Byars' flaps were formed, and clitoral shaft was circumferentially denuded of the overlying skin cover to the clitoral body roots. Third, Buck's fascia of the clitoral body was mobilized, and neurovascular bundle coursing on the dorsolateral aspects was identified. Then, this was dissected, starting as ventral as possible up to the level of bifurcation and then suspended (Figure 1). During this step special care was taken to avoid any inadvertent injury to the neurovascular package. Fourth, following entering the avascular plane that exists between tunica albuginea and the first layer of Buck's fascia, the clitoral shaft was separated from the neurovascular package, and removed as much as possible 1 cm distal to their proximal bifurcation. Fifth, while the glans clitoris was pulled

forward using a 4/0 polyglactin suture (Figure 2), a triangle shaped incision was made on the glans clitoris, glans size was reduced and reconnected using 5/0 absorbable polyglactin. Sixth, the reduced clitoral glans, which was connected with a thin Bucks fascia, was repositioned on the remaining end of the erectile bodies, close to the crural convergence, using 2/0 absorbable polyglactin suture material. Seventh, subcutaneous tissue along the clitoral hood was reapproximated, leftover skin of the labia minora were trimmed away and reconstructed appropriately next to the glans clitoris.

The surgical procedures were performed under general anesthesia in the high dorsal lithotomy position. All of the patients were fully informed regarding the possible risks and benefits of surgery, especially a possible risk of loss of clitoral sensation was emphasized, and a written informed consent was provided from all patients. All of the procedures were performed using microsurgical instruments, when required with the use of magnification. A Foley catheter was left in place overnight and all the patients were discharged healthy, on the first postoperative day.



**Figure 1. Neurovascular bundle coursing on the dorsolateral aspects was dissected, and suspended**



**Figure 2. Glans clitoris is pulled forward using a 4/0 polyglactin suture**

## Results

Three patients, aged 17, 21 and 24 years were enrolled in the study (Table 1). The main underlying etiology was late onset adrenal hyperplasia in two patients and anabolic steroid use in one patient. The primary complaints of the patients were hypersensitive clitoris, unpleasant appearance, and clitoral embarrassment. Mean calculated clitoral index was 143 mm<sup>2</sup>, 150 mm<sup>2</sup>, and 120 mm<sup>2</sup> (Figure 3a-c). Operation times were 90, 140 and 120 minutes. No major complication occurred during the operation. However, moderate ecchymosis and edema of the vulva occurred in all patients, lasting up to three weeks (Figure 4a,b). No major blood loss, hematoma formation or ischemic tissue loss occurred. Clitoral index calculated at the sixth month post-operatively was <30 mm<sup>2</sup> in all patients (Figure 5a-c). A complete healing was observed in all patients by the third month of follow-up. However, partial clitoral sensorial loss was noted at the first month in one patient, which completely resolved by the third month and did not recur during follow-up. All patients were satisfied with the new appearance of the clitoral glans throughout follow up, and the two patients who were sexually active reported that they were quite comfortable during intercourse. Moreover, none of the patients reported clitoral pain or enlargement during follow-up. To prevent any further clitoral enlargement appropriate steroid suppression, titrated against serum 17-alpha-hydroxyprogesterone levels, was implemented in two patients diagnosed with late onset adrenal hyperplasia.

## Discussion

In this case series study, it was demonstrated that neurovascular bundle-sparing ventral clitoroplasty was an effective and safe surgical technique, both in terms of cosmetic appearance and long-term sexual function.

The most crucial aspect of clitoral surgery is to preserve neurovascular functions, which entails a thorough knowledge of clitoral anatomy and its relevant structures. The clitoris is a multiplanar structure with a broad attachment to the pubic arch, mons pubis and labia (2). Centrally it is attached to the urethra and vagina. It includes erectile bodies which are

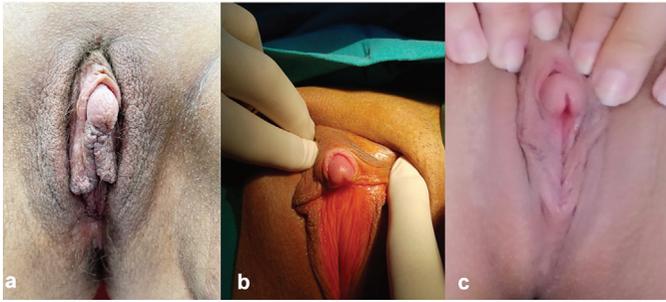
composed of paired bulbs and paired corpora, and continuous with the crura and the glans clitoris. Although it has clearly been demonstrated that clitoral body and crura have erectile tissue components, some studies argued the existence of erectile tissues in glans clitoris, vestibular bulbs and labia minora (2).

An enlarged clitoris that appears as a small penis is extremely disturbing, causing both sexual and psychological problems that have profound impacts on self-esteem. When establishing a diagnosis of clitoromegaly, the most commonly used criteria is the clitoral index, which is calculated by multiplying the length and width of the clitoral glans. It was also reported that the clitoral index increases with advancing age. The length and the width of the clitoral body can only be calculated following a through dissection. In a detailed anatomical dissection study, the mean clitoral index was 30 mm<sup>2</sup> and ranged between 16 and 100 mm<sup>2</sup>, which is consistent with the classical definition of clitoromegaly as a clitoral index of >35 mm<sup>2</sup> (3). In their study, the mean measured length and width of the glans, body and crus were 8 mm and 4 mm, 29 mm and 8 mm, and 50 mm and 9 mm, respectively. In our case series, the calculated clitoral index was >35 mm<sup>2</sup> in all three and this reduced below 30 mm<sup>2</sup> following the operation in all patients.

Historically, there have been three main types of operation performed for enlarged clitoris; partial or total clitorectomy, recession clitoroplasty, and ventral neurovascular bundle-sparing clitoroplasty. Proper anatomic reconstitution of all clitoral structures is of paramount importance for an optimal surgical outcome. Since irreversible loss of clitoral sensation, decreased ability to achieve orgasm or painful erections are among the most fearful complications of clitoral surgery, partial or total clitorectomy has mostly been abandoned. A search for a more conservative approach has led to novel "function preserving" surgical techniques. Neurovascular bundle-preserving clitoroplasty has become the most widely accepted surgical technique for the treatment of clitoromegaly. To preserve clitoral functions, a thorough knowledge regarding the anatomical course of the neurovascular bundle is of paramount importance. The main innervation pathway of the clitoris, dubbed as the dorsal nerve of the clitoris, stems from the pudental nerve. Jackson et al. (3) eloquently demonstrated

**Table 1. Characteristics of the patients**

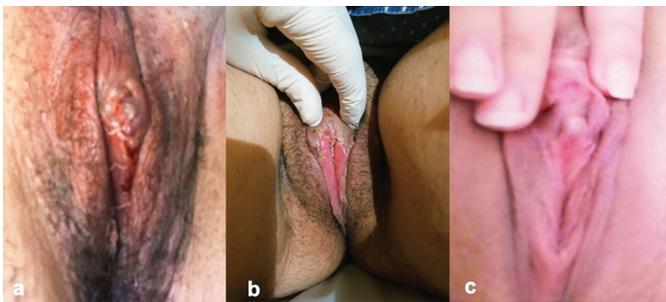
Patient no	Age	Clitoral index (mm <sup>2</sup> )	Operation time (min)	Etiology	Complaints	Follow-up
A	17	143	90	Late onset adrenal hyperplasia	Unpleasant appearance, clitoral embarrassment	Edema, ecchymosis
B	21	150	140	Synthetic anabolic steroid use	Unpleasant appearance and hypersensitive clitoris	Edema, ecchymosis, sensorial loss at 1 <sup>st</sup> month
C	24	120	120	Late onset adrenal hyperplasia	Unpleasant appearance and hypersensitive clitoris	Edema, ecchymosis



**Figure 3. Preoperative clitoral images of the patients (a-c)**



**Figure 4. Postoperative ecchymosis and edema (a,b)**



**Figure 5. Postoperative clitoral images of the patients: patient (a) at 1<sup>st</sup> week, patient (b) in 1<sup>st</sup> month, and patient (c) in 3<sup>rd</sup> month**

that the dorsal nerve of the clitoris emerged onto the superficial pouch of the anterior perineal triangle by piercing the pubic ramus adjacent to the medial surface of ischiopubic ramus.

Pippi Salle et al. (4) described a corporal-sparing technique dubbed “corporeal sparing dismembered clitoroplasty” in eight consecutive patients. In this technique, initially the glans and its neurovascular bundles are degloved from the corpora. Instead of resecting and reducing corporal tissue, following complete dividing of corpora starting at the bifurcation, each separated hemicorpus is rotated inferiorly and laterally, and placed inside the labial scrotal folds. These authors reported that all patients were well, without early complications during the follow up performed at six and twelve months. Additionally, “Tunica Albugenia-sparing clitoroplasty” techniques were described by some others, arguing that despite neurovascular bundles being well preserved, stripping these structures of the Tunica Albugenia leaves them unsupported and vulnerable to damage in the long term (5). However, some surgeons may

find these techniques complicated and that they can prolong the duration of surgery. Notably, the duration of the operation decreased from 140 minutes in the first case to 90 minutes in the third case, with increased experience. Moreover, none of our patients experienced irreversible loss of clitoral sensation, mostly due to applying microsurgical dissection techniques and using 4/0 and 5/0 absorbable sutures.

Another crucial step, as was performed in all our cases, is starting the separation of neurovascular bundle as ventrally as possible to prevent any possible injury to dorsal arteries and nerves of the clitoris (6). Only one patient reported partial loss of clitoral sensation at the first postoperative follow-up and normal sensation returned completely thereafter. A major remark to discuss here is that many of surgery related complaints are associated with vaginoplasty rather than clitoral surgery, since labia minora and majora are profoundly innervated structures (3). Another essential part of clitoral surgery is to reconstitute a pleasant appearing clitoris, especially the glans, provided that all anatomical structures are evenly redistributed in the perineum. Failure to do so would definitely have a profound impact on long-term psychological well-being of the patient. It has also been reported that clitoral pain or enlargement can occur following clitoral recession or incomplete reduction of erectile bodies, mostly due to entrapment of erectile tissues underneath the pubis (7). Since most of the erectile corporal tissues were removed, no episode of painful erection or clitoral enlargement was reported by any of the patients through two years of follow-up in our series. All of our patients were quite satisfied with the reconstructed new appearance of the clitoris.

## Conclusion

In conclusion, neurovascular bundle-sparing ventral clitoroplasty is a feasible, safe, and cosmetically acceptable operation that improves engagement in sexual activity in the medium term. Starting dissection as ventral as possible to minimize the risk of injury and using microsurgical instruments under magnification when required, can help performance of an optimal surgery that ensures favorable outcome in terms of clitoral function. Even though various surgical techniques have been described for surgical treatment of enlarged clitoris, the optimal mode of surgery should be selected according to patients' wishes and surgical experience with the applied technique through an individualized approach.

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**Ethics Committee Approval:** *This current study was approved by the Institutional Review Board (approval number: E.2943, date: 15/02/2023).*

**Informed Consent:** *The patients have given their informed consent to be published.*

**Peer-review:** *Externally peer-reviewed.*

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