



Assessment of neophallus length following metoidioplasty

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Background: An increasing number of gender diverse individuals are presenting for gender affirming care. An option for genital gender affirming surgery (gGAS) in transmasculine individuals is metoidioplasty, creating a small neophallus from enlarged clitoral tissue following prolonged testosterone exposure. The goal of this study is to understand factors which contribute to greater exposed neophallus length following metoidioplasty.

Methods: We performed a retrospective chart review on patients presenting to a single academic institution who underwent a metoidioplasty. All operations were performed using the Belgrade technique with or without urethral lengthening depending on patient preference.

Results: Twenty-seven patients underwent metoidioplasty from 2017–2022. Sixteen had recorded stretched clitoral length (pre-operatively) and exposed neophallus length (post-operatively). The median length of time on testosterone therapy was 4.6 years. The median stretched clitoral length was 5.8 cm, and exposed neophallus length was 6 cm. There was a strong correlation between pre-operative length and post-operative length ($\rho=0.9$; $P<0.0001$). There were no correlations between pre-operative length or exposed neophallus length and BMI ($\rho=-0.02$, $P=0.93$; $\rho=0.05$, $P=0.83$, respectively). Time on testosterone does not correlate with stretched clitoral length nor exposed neophallus length ($\rho=-0.28$, $P=0.15$; $\rho=-0.35$, $P=0.18$, respectively).

Conclusions: Patients considering metoidioplasty often wonder how large their neophallus will be. We found that patients can expect exposed neophallus length to be about 0.6 cm longer than their pre-operative stretched clitoral length. No evidence of association of time on testosterone nor BMI with exposed neophallus length was found. This information is crucial for gender diverse patients to make informed decisions about gGAS.

Keywords: Transgender; nonbinary; metoidioplasty; neophallus length

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Introduction

A growing number of individuals are identifying as gender diverse, and are presenting for gender affirming healthcare services (1,2). Gender affirming efforts ranging from hormonal medical therapy to gender affirming surgical

techniques to non-medical interventions are shown to improve quality of life, social functioning, mental health outcomes, and overall wellbeing for gender diverse patients (3-7).

In patients who are assigned female at birth that self-identify as transmasculine or nonbinary, and desire

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masculinizing features there are several options for genital gender affirming surgery (gGAS). The two most common operations for creation of a neophallus are traditional phalloplasty and metoidioplasty (8). Traditional phalloplasty utilizes a large donor tissue flap, typically the radial forearm, to create a neophallus which can be combined with urethral lengthening and/or penile prosthesis placement (9). The final result is an anatomically-sized neophallus with erectile function, which allows for penetrative intercourse and voiding in the standing position. Metoidioplasty is the creation of a small neophallus from enlarged clitoral tissue following prolonged exposure to testosterone (10). Metoidioplasty can be performed with or without urethral lengthening. Benefits of metoidioplasty when compared to traditional phalloplasty include lower risk of complications, fewer surgeries and better sexual sensation. Disadvantages include shorter length of the resulting neophallus that typically does not allow for penetrative intercourse, and may or may not allow for a patient to void in the standing position (10).

According to the 2015 US Transgender Survey, a roughly equal number of transmasculine or nonbinary patients elect to undergo metoidioplasty when compared to phalloplasty. Additionally, it showed a greater percentage of transmasculine or nonbinary individuals who want

metoidioplasty “someday” when compared to those who desire phalloplasty (11). However, there is an imbalance between phalloplasty and metoidioplasty literature. A 2022 meta-analysis of phalloplasty research analyzed 37 original research studies, including 1,731 patients in analysis (12). Meanwhile, a 2021 meta-analysis of metoidioplasty research included only 7 studies and 403 patients (13). Furthermore, when searching terms on PubMed for the last five years [2018–2023] the term “phalloplasty” provides 300 results, while the term “metoidioplasty” provides only 91 results.

Existing metoidioplasty research has focused on surgical techniques, complications, and outcomes including post-operative patient satisfaction and neophallus length (14–16). For example, one review article evaluating gender-affirming surgeries noted that 80% of patients were satisfied with sexual function and 77% were satisfied with aesthetics post-metoidioplasty (17). With respect to neophallus length, the 2021 metoidioplasty meta-analysis by Jolly *et al.*, showed that the average neophallus length varied from 5.7–8.7 cm, with ranges ranging from 2–5 to 6–12 cm (13). While metoidioplasty research often reports neophallus length, there are few reports examining patient-specific factors contributing to neophallus length post-metoidioplasty.

With both growing interest and options for masculinizing gGAS, there is a need for increased evidence and data for patients to make informed decisions regarding their care. The expected length of a neophallus post-metoidioplasty or other masculinizing gGAS is a factor that may impact patient decision-making (18). One study developing a genital affirmation surgical priorities scale concluded that, when compared to patients interested in metoidioplasty, patients interested in phalloplasty endorsed significantly greater concerns about neophallus length, as well as with activities requiring sufficient length such as standing to urinate and penetration (18). A 2023 mixed methods study from Butcher *et al.* demonstrated, however, that transmasculine patients may experience decisional conflict when choosing what type of gGAS to pursue, highlighting the need for continued research to help aid patients in their decision making (19).

It is understood that the neophallus created from metoidioplasty is smaller than that of traditional phalloplasty. However, patients may not have a reference for how much smaller the neophallus may be, nor for the magnitudes of bottom growth and subsequent impact on neophallus length. Patients often desire to know with more precision what the expected length of their neophallus may be. However, penile length post-metoidioplasty, specifically

Highlight box

Key findings

- Patients who undergo metoidioplasty can expect their exposed neophallus length to be about 0.6 cm longer than their stretched clitoral length.
- After 2 years of testosterone therapy, a longer time on testosterone was not significantly associated with clitoromegaly or post-operative neophallus length following metoidioplasty.

What is known and what is new?

- Metoidioplasty is a genital gender affirming operation which creates a small neophallus from enlarged clitoral tissue following exposure to testosterone.
- While providers and patients anecdotally know that the neophallus after metoidioplasty is small, this study describes how much length one can expect to gain to their neophallus based on their pre-operative clitoromegaly.

What is the implication, and what should change now?

- Providers should use this information when counseling patients on all the types of neophallus creation.
- Future studies with larger sample sizes should be conducted to characterize further what alters neophallus length following metoidioplasty.

how much length a patient can expect to gain based off of their pre-operative clitoromegaly or “bottom growth”, is not well studied. As such, the goal of this study is to examine the relationship between pre-operative stretched clitoral length and post-operative exposed neophallus length, which may aid physicians in pre-operative counseling and help patients who are deciding on their gGAS. We also examine the association of other patient specific characteristics such as length of time on testosterone therapy and body mass index (BMI) on post-operative neophallus length. We present this article in accordance with the STROBE reporting checklist (available at <https://tau.amegroups.com/article/view/10.21037/tau-23-155/rc>).

Methods

This study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). The study was approved by an Institutional Review Board (No. HUM00204108) and individual consent for this retrospective analysis was waived. Charts of patients who underwent metoidioplasty with or without urethral lengthening between 2017 and 2022 at a single academic medical center were retrospectively reviewed.

Metoidioplasty was performed using the Belgrade technique (10,20). This technique uses a buccal mucosal graft and overlapping labia minora flaps to lengthen the urethra. After releasing the dorsal suspensory ligament which helps to optimize exposed neophallus length, a strip of vestibular mucosa (urethral plate) is marked from the clitoral glans to the urethral meatus. A transverse incision is made at the level of the glans and the flap is raised off the ventral aspect of the corporal bodies, releasing the chordee and maximally exposing the clitoris. This leaves a defect on the ventral aspect of the corporal bodies that is covered with a strip of buccal mucosa, creating the dorsal portion of the urethra. The ventral urethral aspect is created using overlapping labia minora flaps in a double-breasted fashion, to avoid overlapping suture lines (10,20). The vast majority of metoidioplasty patients benefit from monsplasty, and this technique is often performed concurrently.

All patients had taken testosterone therapy for at least one year prior to metoidioplasty, as recommended by the World Professional Association of Transgender Health’s (WPATH) Standards of Care (21). Vaginectomy was also performed at least 3 months pre-operatively. Patients were not required to utilize pre-operative topical treatment or

vacuum assisted erection devices prior to metoidioplasty. The majority of patients elected to undergo monsplasty at the time of metoidioplasty. A single surgeon measured both stretched clitoral length and exposed neophallus length in a standardized fashion intra-operatively, with a stay suture placed through the glans. Clitoral length was measured from the base of the clitoris to the tip of the glans, with the patient in the lithotomy position and the clitoris on stretch. Exposed neophallus length was measured from the base of the neophallus to the tip of the glans with traction pulled straight out from the body at a 90-degree angle, again with the patient in lithotomy. The phallus is flaccid as this measurement was obtained in the OR under anesthesia.

Data were collected using an Institutional Review Board approved database. Demographic factors including gender identity, age, BMI, and total length of time on testosterone were recorded. Measurements including pre-operative stretched clitoral length and post-operative exposed neophallus length were also collected as described above. The main outcomes of interest were post-operative exposed neophallus length and total neophallus length gained following metoidioplasty. Given prolonged exposure to exogenous testosterone causes clitoromegaly which directly impacts final neophallus length after metoidioplasty, length of time on testosterone was studied to understand if increased exposure to testosterone would alter post-operative exposed neophallus length. Additionally, since patients with more adipose tissue may experience less neophallus exposure, we also collected data on patient BMI to assess its impact on post-operative exposed neophallus length.

Statistical analysis

Patients who had values recorded for pre-operative stretched clitoral length and post-operative exposed neophallus length (cm) were included in the final analysis. Values for length of time on testosterone therapy (years) and BMI were also collected for all patients in the final analysis. Quantitative variables were not categorized. A descriptive analysis was performed and reported per the Guidelines for Reporting of Statistics for Clinical Research in Urology (22). Bivariate statistical relationships were described using Pearson’s correlation coefficient, and compared with a paired *t*-test. Correlations between the final exposed neophallus length and total time on testosterone, BMI, and pre-operative stretched clitoral length were assessed.

Table 1 Demographic data (N=16)

| Variable | Median (IQR) or N (%) |
|-------------------------------|-----------------------|
| Age, years | 29.4 (27.3–33.7) |
| Gender identity | |
| Male | 14 (87.5) |
| Non-binary | 2 (12.5) |
| BMI, kg/m ² | 25.9 (23.3–29.5) |
| Time on testosterone, years | 4.6 (3.7–7.1) |
| Stretched clitoral length, cm | 5.8 (5.0–6.0) |
| Exposed neophallus length, cm | 6.0 (5.5–7.0) |
| Urethral lengthening | 9 (56.3) |
| Monsplasty | 14 (87.5) |

IQR, interquartile range; BMI, body mass index.

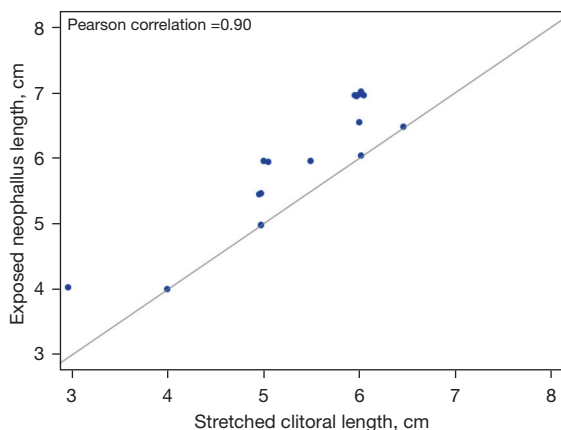


Figure 1 Relationship between stretched clitoral length and exposed neophallus length.

Results

A total of 27 patients underwent metoidioplasty between 2017 and 2022. Of those, 16 had values recorded for both pre-operative stretched clitoral length and post-operative exposed neophallus length and were included in the final analysis. Patients excluded from analysis did not have formal measurements before and after surgery. Demographic data for patients included in analysis can be found in *Table 1*. The median length of time on testosterone was 4.6 years (IQR: 3.7–7.1). The median stretched clitoral length was 5.8 cm (IQR: 5–6), and the median exposed neophallus length was 6 cm (IQR: 5.5–7). 14 out of the 16 patients included in analysis underwent monsplasty. Nine patients

had urethral lengthening, and 7 underwent simple release. On average, patients gained an additional 0.625 cm (95% CI: 0.4–0.85) of length post-operatively, compared to stretched clitoral length.

There was a strong, positive correlation between pre-operative stretched clitoral length and post-operative exposed neophallus length ($\rho=0.9$; $P<0.0001$) (*Figure 1*). There was no evidence of correlations between stretched clitoral length or exposed neophallus length with patient BMI ($\rho=-0.02$, $P=0.93$; $\rho=0.05$, $P=0.83$, respectively). Time on testosterone had weak and not significant correlation with stretched clitoral length, nor exposed neophallus length ($\rho=-0.28$, $P=0.15$; $\rho=-0.35$, $P=0.18$, respectively).

Discussion

Patients who undergo metoidioplasty are often interested in knowing what their expected neophallus length may be, and what factors may or may not impact post-operative length outcomes. Healthcare providers may find benefit from augmenting pre-operative gGAS counseling with data regarding post-metoidioplasty neophallus length. In this study, we report the relationship between pre-operative stretched clitoral length and post-operative exposed neophallus length following metoidioplasty. The median stretched clitoral length was 5.8 cm. The median exposed neophallus length was 6 cm, in line with previous studies which reported average lengths ranging between 5.6–6.8 cm (14,15). On average, patients gained an additional 0.625 cm of length post-operatively. This was in-line with our expectations as metoidioplasty releases the attachments that normally keep the body of the clitoris as an “internal” structure, and does not do anything to make the clitoris larger (10).

Time on testosterone (beyond the at least one year recommended by WPATH) correlation with either stretched clitoral length nor exposed neophallus length was not found. The clitoromegaly that develops with exposure to exogenous testosterone typically occurs within the first 1–2 years (23,24), and surgery is not indicated before 12 months of continuous hormonal therapy (21). The timing of clitoromegaly may explain the lack of evidence of a relationship between growth of the clitoris and prolonged testosterone exposure past the one year recommendation.

Some providers utilize factors, such as BMI, to predict surgical risk and outcomes for gender affirming surgery (25). We found no evidence that BMI was correlated with either stretched clitoral length nor exposed neophallus length,

with the caveat being our measurements were obtained in the lithotomy position in the operating room and do not necessarily reflect the patient's visible neophallus length when standing.

Our study has limitations. First, our study was limited by its small sample size from a single institution. Second, our analysis is limited to a restricted number of selected parameters and characteristics, and our cohort may not represent the overall nationwide demographic of patients who choose to undergo metoidioplasty given the selection bias which can occur with retrospective studies. Third, there are no other studies to compare our findings or to validate our results, as measurement of pre-operative stretched clitoral length is not standard practice. Fourth, all measurements were obtained by a single surgeon, which may introduce bias but also may provide a degree of standardization with measurements. Finally, neophallus length was measured immediately post-metoidioplasty, and final length may be impacted by post-operative factors (e.g., adhesions and retractions during wound healing, pumping).

Even with limitations, this study adds to the growing body of literature surrounding metoidioplasty. Next steps should include conducting studies with larger cohorts across multiple nationwide sites to elucidate factors correlating with exposed neophallus length after metoidioplasty, including expanding on demographic data and selecting additional factors which may correlate with neophallus length. For example, one study concluded that utilization of a penile-traction device post-metoidioplasty was an effective step in increasing the size of the neo-phallus over 24 weeks (26). Additionally, pumping has been anecdotally correlated with increased pre-operative clitoral length. Conducting retrospective analyses using other existing metoidioplasty databases may also further substantiate our analysis.

Furthermore, a crucial future step will be to partner with transgender and gender diverse patients to better elucidate what factors may contribute to both pre-operative decision making regarding gGAS and post-operative patient satisfaction. Patient reported outcomes, while not included in this study, are paramount to better understand gGAS for the community it serves (27). Some metoidioplasty research has included patient reported outcomes. For example, in Bordas *et al.* and Stojanovic *et al.*, in addition to evaluating functioning and post-operative outcomes, the authors conducted patient surveys evaluating cosmesis and patient satisfaction post-metoidioplasty (14,15). In addition to evaluating post-operative complications and

ability to void standing, Djordjevic *et al.* evaluated overall satisfaction with length and appearance of neophallus (28,29). A more recent study by Robinson *et al.* in 2021 provided surgical outcomes and patient reported outcomes in 129 patients who underwent gender affirming penile reconstruction, reporting on neophallus length, post-operative erogenous sensation, and post-operative patient genital self-image score (30). Together, this information along with the findings related to the relationship between pre-operative stretched clitoral length and post-operative exposed neophallus length allows for better pre-operative counseling. As more patients are presenting for gender affirming care, including masculinizing gGAS, this data will be important to aid patients in their decision making when choosing which operation may be most suitable for them.

Conclusions

This study adds to the growing body of literature examining patient specific factors which may contribute to neophallus length following metoidioplasty. Post-operative neophallus length has a strong correlation with pre-operative stretched clitoral length. Our results suggest that, following metoidioplasty, patients can expect their immediate post-operative exposed neophallus length to be about 0.5 to 1 cm greater in length compared to their pre-operative stretched clitoral length, which can be obtained in-clinic with patient consent. As interest in masculinizing gGAS grows, both patients and providers require additional evidence and data to help inform decisions regarding gender-affirming care. This research is important in adding to the growing body of existing metoidioplasty literature, and providing evidence to ultimately aid patient decision-making and care.

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Footnote

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