

Clinical implications of the historical, medical, and social neglect of the clitoris

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Introduction

Sexual pleasure is intrinsic to human existence and serves as an important metric of quality of life. The clitoris plays a central role in the sexual response cycle and attainment of sexual pleasure in individuals with vulvar anatomy. Despite its significance, the clitoris has remained gravely misunderstood, misrepresented, and oft neglected in medical literature and social consciousness. There exists a significant deficit in our fundamental knowledge of the basic anatomy and physiology of the clitoris. In contrast, the penis, the anatomic homologue of the clitoris, has fared much better in its assigned importance in human sexuality and scientific discovery. Published research dedicated to the glans penis is 20 times that focused on the clitoris (Table 1 and Figure 1). This has resulted in the accumulation of medical knowledge and innovation in the treatment of penile conditions that far surpasses our understanding of the clitoris and the management of its associated conditions.

Historical neglect of the clitoris

It is only quite recently that sex has been recognized to encompass physical and intimate acts well beyond penile penetration. For many people, sex does not involve a penis at all. This traditional and overly narrow definition of sex as “penile penetration only” has contributed to the erasure of the clitoris as an organ of pleasure and ultimately limited the ability of the field of sexual medicine to serve all people.

When reviewing the history of the clitoris, one would be remiss not to address societal attitudes and their resulting dogma associated with “female sexuality” within the gendered binary framework of the human sexual experience. This dogma is powerful and has dictated the objectivity of scientific discovery, especially in the field of sexual health. The binary lens of gender and sexuality that has been used throughout history has regarded all forms of sexual pleasure other than the pleasure of a cisgender male to be associated with shame, control, and oppression. Ultimately, historical neglect and socially constructed controversy surrounding the existence and function of the clitoris have delayed its medical

Table 1. PubMed search query: clitoris.

Year	No.
2022	97
2021	100
2020	96
2019	72
2018	87
2017	87
2016	103
2015	93
2014	93
2013	93
2012	71
2011	82
2010	76
2009	91
2008	103
2007	72
2006	63
2005	53
2004	60
2003	63
2002	46

and surgical advancement. This has greatly affected advancement of vulvar sexual health, which has undoubtedly harmed patients.

Although references to the clitoris can be found in ancient Greek, Persian, and Arabic texts, it was not until the 16th century that Italian anatomists Realdo Colombo and Gabriele Falloppio described the clitoris and its relation to sexual pleasure.¹ After this point, the clitoris would then undergo “discovery and rediscovery” throughout history as the structure and its function were censored by various anatomists due to the societal and social stigma associated with female sexuality.

In the 16th century, Vesalius, who is considered the “father of modern anatomy,” claimed that the clitoris did not exist in healthy cisgender women and was found only among “hermaphrodites”.² This widely accepted misinformation

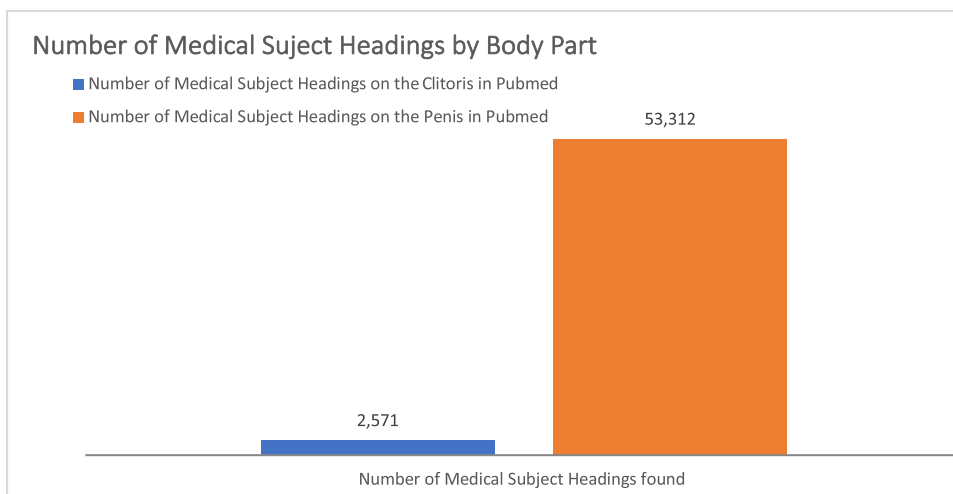


Figure 1. Number of Medical Subject Headings by Body Part.

allowed for the widespread acceptance and adoption of inhumane practices in medical history, including clitoridectomy for conditions ranging from masturbation, nymphomania, menorrhagia, depression, epilepsy, and mental illness (eg, hysteria, catatonia).³ Dissemination and reinforcement of this misinformation allowed these practices to continue into the 1960s, finally slowing with the rise of the feminist movement to bring forth challenge and change. The feminist movement, coupled with the invention of birth control, led to the uncoupling of sex from reproduction, vastly changing the social landscape and societal attitudes toward sexual pleasure. This radical uncoupling ultimately laid the framework for the clitoris to be respected and reclaimed—and therefore studied.

It ultimately took until 2005 for clitoral anatomy to be accurately described.⁴ This delay in correct anatomic description of an organ possessed by half the world's population is profound, especially considering that the penis had been fully described as early as 35 BCE by Hippocrates.⁵ Australian urologist Dr Helen O'Connell published the groundbreaking study first describing our current understanding of clitoral anatomy, using cross-sectional imaging to assess the anatomy of the clitoris in healthy, premenopausal, nulliparous, cisgender women. In this piece, Dr O'Connell addresses some key factors intrinsic to the clitoris, beyond social and societal considerations, that made anatomic definition challenging. She notes that the 3-dimensional and predominately internal anatomy of the clitoris contributed to the difficulty of cadaveric dissection in comparison with the linear and external nature of the penis. Thus, utilizing cross-sectional imaging would account and adjust for these challenges and provide an accurate depiction of clitoris.⁴ Notably, cross-sectional imaging was first invented in the 1970s. Thus, it was still almost 40 years after the invention of the necessary imaging technology before it was utilized to define modern clitoral anatomy.

What we know about the anatomy and physiology of the clitoris

The clitoris is a multiplanar structure made up of the internal paired clitoral bulbs, corporal bodies, and crura, which are

all composed of erectile tissue. They are surrounded by a fibrous sheath: the tunica albuginea. The glans clitoris is the only external structure, and it consists of nonerectile tissue that is rich with neural innervation. The clitoris is anchored superiorly to the pubic bone via the suspensory ligament, laterally to the labia minora and mons pubis, and centrally to the urethra and vagina. The vascular supply of the clitoris is derived from the dorsal clitoral arteries, which arise from the pudendal artery, a branch of the internal iliac artery. The venous drainage derives from the superficial and deep clitoral vein. The superficial clitoral vein feeds into the external pudendal vein, which then drains into the great saphenous vein, and the deep clitoral vein drains into the vesical plexus into the internal iliac vein.⁶

The clitoris has dual innervation—somatic and autonomic. The dorsal nerves of the clitoris (DNCs) supply the somatic innervation, and the cavernous nerves supply the autonomic innervation. The DNCs supply the primary source of clitoral sensation.⁷ The DNCs are branches of the pudendal nerve, which arise at the pelvic sidewall and travel below the inferior pubic ramus along the posterior edge of the clitoral crus.⁷ The DNCs then enter the deep component of the suspensory ligament inferior to the pubic symphysis, critical anatomy to understand when surgery is performed in this area.^{8, 9} The DNC continues its descent inferiorly along the clitoral body and then converges at the neurovascular bundle close to the midline.⁹ At this level, the DNCs measure approximately 2 to 3.2 mm, traveling at the 10- to 11- and 1- to 2-o'clock positions as they travel down innervate the glans clitoris. Once at the glans, the terminal nerve fibers disperse widely and end in sensory receptors that lie beneath the clitoral epithelium.

The cavernous nerves originate from the vaginal plexus, which is a component of the pelvic plexus. They contribute to the urethral sphincter complex and clitoris.¹⁰ They travel at the 2- and 10-o'clock positions along the anterior vaginal wall and then at the 5- and 7-o'clock positions along the urethra. The branches of the cavernous nerves then join the DNC at the hilum of the clitoral bodies. These studies highlight the need to further study the cavernous nerves in adults to better define this anatomy and accurately preserve their integrity in surgical cases.¹¹

Gaps in the research and education

Little is still known regarding the anatomic course of the autonomic innervation of the clitoris via the cavernous nerve due to its microscopic nature.¹² Most of our understanding is derived from animal models and fetal cadaver specimens.¹⁰ In terms of clitoral physiology, we are at the nascent stages of discovery and understanding. Until recently, it was incorrectly disseminated that the clitoris had 8000 nerve fibers innervating its glans. This statistic came from a bovine model but was widely adopted and disseminated as fact regarding the human clitoris. Uloko et al in an upcoming publication by the authors debunked this by defining the number of myelinated axons innervating the human glans clitoris to be >10 000. Considering current limitations in axon (nerve fiber) count techniques—specifically, an inability to account for the autonomic (cavernosal) or unmyelinated nerve fibers—it is clear that the clitoris is actually innervated by far more than 8000 nerve fibers. This now debunked statement that the “clitoris has 8000 nerves” had become a rallying cry and in many ways the focal point of growing advocacy efforts to draw attention to the neglect of the clitoris as a critical organ for erogenous function and sexual pleasure. That this uniting statement was in itself misinformation about the clitoris that was accepted as fact speaks to and illustrates the impact that the historical treatment and acceptance of dogma about the clitoris have had on our modern understanding of sexual health. To date, there is minimal information regarding the physiology of clitoral orgasm as well as the role of hormones on clitoral health.

Significant gaps exist in our medical and surgical education of the vulva in general. Historically, even as depictions of vulvar anatomy became more accurate, the clitoris was often still omitted from medical and surgical figures. To this day, accurate depictions of the clitoris and the vulva are not consistently well documented or discussed in medical and surgical textbooks. In a recent needs assessment study, Codispoti et al found significant variation in the anatomy and physiology curriculum regarding “female sexual health”.¹³ Even though >50% of the population has a vulva, it is not yet standard practice for a medical trainee to be instructed on a comprehensive vulvar examination, including examination of the clitoris. This involves all medical trainees, even those in specialties that frequently deal with and operate on vulvar and clitoral anatomy (ie, gynecology, plastic surgery, dermatology, and urology). Because of this, many conditions of the vulva often go unexamined, undiagnosed, and untreated. As a result, many vulvar conditions are blamed on emotional and life stressors, typically framing the person as somehow “responsible” for one’s medical condition. A key example of this is clitorodinia associated with clitoral adhesions. Recent data by Myers et al showed a prevalence of clitoral adhesions in up to 25% of the population. The authors found that clitoral adhesions are associated with pain, difficulty with arousal, and orgasm dysfunction and are vastly improved by a simple treatment of lysis of the adhesions.¹⁴ Despite the prevalence, lysis of clitoral adhesions does not have a CPT code for billing purposes, unlike lysis of penile adhesions. Due to this, practitioners are not even able to bill appropriately for treating these conditions. This further disincentivizes practitioners to diagnose and treat these conditions and invest in research that can advance the treatment and diagnosis of these conditions. As a field, the current structure of medicine communicates that we do not value vulvar sexual health. That message is heard, and its impact continues to be felt.

Direct implications for patients

Much of medicine has viewed the vulva as a portal of access to the cervix and uterus, focusing on reproduction and neglecting the external vulvar structures. Clitoral and vulvar neglect has led to significant diagnostic and financial burdens for the patient. It has been estimated that the annual economic burden of a common vulvar condition, vulvodynia, in the United States is \$31 to \$72 billion.¹⁵ This cost includes direct health care costs, indirect health care costs (eg, transportation to hospital), and indirect societal costs (eg, sick leave). Considering the numerous anatomic components of the vulva and various associated conditions, that number is expected to be much higher.

The history of clitoral neglect raises serious concern regarding the past and present safety of vulvar surgery. There have been long-standing and fundamental gaps in our knowledge of vulvar anatomy and physiology. The most notable example is the macroscopic anatomic course of the DNC. It was just within the last decade that the anatomic course of the DNC was well elucidated, while even more recently that this anatomy has been taught in medical and surgical education. Procedures that intimately involve the clitoral area have been performed for many years, across many specialties, well before the full appreciation and understanding of clitoral anatomy were apparent. As the DNCs emerge from underneath the pubic ramus, they come to lie at the 10- to 11- and 1- to 2-o’clock positions on the clitoral body, just deep to the superficial clitoral fascia.¹⁶ They remain in this position as they travel underneath the clitoral hood toward the glans of the clitoris. As the clitoral hood skin is quite thin, surgery in this area without an intimate appreciation for the location of the DNC can result in inadvertent iatrogenic injury to clitoral innervation and function. This is without a doubt a devastating complication with a profound impact on sexual function and quality of life.¹⁶ In contrast, our understanding of the innervation of the glans penis by the dorsal nerve of the penis is robust, with a large volume of studies published regarding its anatomic course and the avoidance of injury during surgical procedures of the penis and prostate.¹⁷⁻¹⁹ The role of the dorsal nerve of the penis in penile sexual function was never overlooked; it was, in fact, a central area of study. This stands in stark contrast to the importance and necessity of understanding clitoral nerve anatomy, which is necessary to safely perform clitoral and vulvar surgery. This is an active issue that must be widely addressed throughout medical practice. Until this is done, people will continue to be harmed.

Many additional questions remain regarding the hormonal regulation of clitoral tissue. There is limited information on the impact of hormones on the clitoris, not only estrogen but also testosterone. There also continues to be deficiency in these topics as the medical community, influenced by a social construct of gender, has deemed hormones within a solely gender binary model. Estrogen and testosterone exist in the human body, regardless of gender.^{20, 21} This “one hormone, one gender” model is ultimately antiscience and plays to the societal dogma that still exists today and frames and shapes our fields of practice. To advance our understanding and discover accurate information, we must begin by taking down misinformation and challenging dogma rooted in social attitudes that serve only to maintain the status quo; for many, the status quo is oppressive.

Moving forward

Clitoral neglect has resulted in a general lack of awareness and a lack of research and scientific discovery, directly contributing to poor patient outcomes. Ultimately the first step forward is to look back. We must recognize that the historical oppression of the clitoris has created harm, and we must take ownership and responsibility to do better.

Clitoral advocacy is growing and must continue to do so. The so-called orgasm gap exists for a reason.^{22, 23} The clitoris is the primary orgasm generator in those with vulvar anatomy. Neglecting it has hidden the knowledge and the tools that people need to unlock their sexual fulfillment. Erasure of the clitoris has been so profound that many people are not even aware of their own clitoris, let alone its role in their sexual wellness. There is a huge need for more rigorous research regarding clitoral structure and function. At this time, there remain fundamental gaps not only in knowledge in basic anatomy and physiology but also in disease states such as orgasm dysfunction, clitoral adhesions, persistent genital arousal, hormonally mediated vestibulodynia, neuroproliferative vestibulodynia, and clitorodinia, to name a few. As our knowledge of the clitoris increases, new treatments for difficult conditions will continue to arise. Recent examples include the possible role of neurolysis of the DNC for treatment of persistent genital arousal disorder or the treatment of clitoral phimosis to improve sexual function.^{14, 24, 25}

Importantly, this movement must be inclusive. As the clitoris has been historically neglected by the medical community, so too has the transgender and gender-diverse community. The clitoris is the primary organ involved in many transmasculine genital gender-affirming procedures such as metoidioplasty. A robust understanding of its anatomy and sexual function is critical to maintain erogenous sensation and optimize sexual health following gender-affirming phalloplasty procedures. Having a clitoris as well as a transgender or gender-diverse identity is an overlapping and intersectional oppression in medicine and society. Moving forward, it is important that the field not silo the movements emphasizing vulvar and clitoral sexual health for cisgender women and the access to gender-affirming care for transgender and gender-diverse people. Inclusivity serves us all.

It is time that we put an end to the campaigns of misinformation, neglect, and oppression that the clitoris has long faced. The clitoris is a vital organ, and we must respect its structure and function and center its role on sexual health and sexual medicine. If we do not correct course, we will continue to perpetuate harm and limit our ability to care for all people.

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