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FROM BODY TO BRAIN

considering the neurobiological effects of female genital cutting

GILLIAN EINSTEIN

ABSTRACT Female genital cutting (FGC) is an ancient tradition unbounded by religion and practiced primarily in Africa and the regions to which Africans have immigrated. All types of FGC involve cutting neural innervation to the vulva: the clitoris, labia majora and minora. Most types include excision of the clitoris. Since the tissue of the vulva is highly innervated by nerves and their endings, I postulate here that the brain and spinal cord will respond to FGC as it would to any loss of neural targets or inputs: by rearranging neural networks. This, in turn, would affect neural signaling to target structures and modify sensory perception. Most scientific investigations of FGC have focused on its reproductive consequences. To fully appreciate its effects on the lives of women, however, an understanding beyond the reproductive system is necessary. Exploring the potential neural changes of FGC may help explain the mixed responses of the women themselves and identify new directions for research to understand their lives. A neurobiological analysis may also help us understand how cultural practices inscribe meaning on central nervous system structures, affecting mind as well as body.

Department of Psychology and Department of Public Health Sciences, University of Toronto, 100 St. George Street, Toronto, ON M5S 3G3 Canada.

E-mail: gillian.einstein@utoronto.ca.

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MOST HUMAN CULTURES have practices that vary the appearance of the periphery of the body. Some of these have been medicalized (cosmetic surgery, male infant circumcision, excisions of tissue due to cancer or infection) and some not. Because these practices are not consciously meant to act on the central nervous system (CNS), we rarely consider their effects on the brain and spinal cord. To a greater or lesser extent, however, all practices that cut the body involve cutting nerve and muscle, which, from a neurobiological perspective, will lead to modification of neural circuits. An example of such a Western practice—radical mastectomy for cancer of the breast—even though medically indicated, can lead to rewiring of neural circuits, resulting in neuropathic pain in approximately 40% of patients (Smith, Bourne, and Squair 1999). Likewise, limb amputation may result in phantom sensations (Ramachandran and Blakeslee 1998).

The last 20 years have seen a growing awareness in Western medicine, feminist studies, and the popular press of the traditional practice of altering women's genitalia among the peoples of northern Africa, a practice variously referred to as *female genital circumcision* (by those who practice it), *mutilation* (FGM, by organizations that are trying to eradicate the practice), or *cutting* (FGC, increasingly adopted by non-aligned researchers; Cook, Dickens, and Fathalla 2004, pp. 262–75).¹ This practice has stirred enormous controversy in the worlds of nongovernmental organizations (NGOs), medicine, and feminist scholarship, where it has been variously viewed as an abrogation of a woman's right to sexual pleasure or an abrogation of a culture's right to carry out the traditions that bind it. Biomedical research on this practice has focused on women's reproductive health and, to a lesser extent, on their psychosexual health (Obermeyer 2005).

I suggest here that we move away from viewing FGC as a practice that primarily affects the genitalia and the reproductive health of women and begin to consider also its potential effects on the CNS. This is a previously unexamined perspective on this rite of passage, which may be informative both to scientists/clinicians as well as to the women themselves. From this perspective it may be possible both to acknowledge FGC's cultural importance to the women who have had it as well as to recognize that as a traditional practice, it may affect the entire body via neural rewiring. This perspective may, in turn, evoke the curiosity of scientists as well as women with FGC, stimulating further research to understand how women with FGC experience the world as well as to elucidate a biology of human difference.

¹I shall use *FGC*, because the issues I discuss are relevant to any procedures that cut nerve and muscle of the vulva, including radical vulvectomy, cosmetic vulvar surgery, and modification of infants born with ambiguous genitalia.

THE PRACTICE OF FEMALE GENITAL CUTTING

Although censored by early missionaries to Africa as well as by contemporary NGOs, FGC is currently practiced in 29 countries—primarily in northern East and West African countries, parts of Arabia, Yemen, Oman, and the United Arab Emirates; secondarily in Indonesia, Malaysia, and India; and more recently in the regions of Europe and North America to which people from these regions have immigrated (Momoh 2005; WHO 1998). It is estimated that approximately 2 million girls undergo FGC every year, with the total population of women who have undergone the procedure standing at approximately 140 million (including over 90% of the women in Djibouti, Egypt, Eritrea, Guinea, Mali, Sierra Leone, and Somalia). In some cultures the rite takes place in a girl's infancy; in some, at the onset of puberty; in others, not until the young woman is ready to marry. It is a rite that often requires some financial resources, and thus whether or not it is carried out also reflects the family's financial circumstances (Shell-Duncan and Hernlund 2000).

FGC is an ancient tradition, dating back to at least fifth century BCE and perhaps as far as the 16th century BCE (Chalmers and Omer-Hashi 2003; Momoh 2005). Trained or untrained midwives, traditional healers, and barbers have performed this procedure in its various forms for centuries. FGC is not the provenance of any particular religion: in the regions in which it is practiced, women of the Muslim, Christian, and Jewish faiths may participate in the ritual (Chalmers and Omer-Hashi 2003; Momoh 2005). It has many meanings amongst the different cultures that practice it: in some, FGC is meant to purify and protect sexuality; in others, FGC is viewed as cosmetic, meant to instantiate an aesthetic in which smooth is beautiful. It is commonly the case that the uncut female genital area is viewed as ugly and too closely resembling that of a man. In the town of Douroshab in Sudan, there is the belief that as a woman ages, her clitoris becomes as large as a penis, which is highly unsightly as well as toxic to the baby as it passes through the birth canal. In some cases, the clitoris is viewed as dangerous to both husbands and babies (Abusharaf 2001). Because of the perceived potential for endangering loved ones—including unborn infants—it is shocking to women who have had FGC that married women from the West have not (Shell-Duncan and Hernlund 2000). Given this perspective, one might well ask why any one would remain uncut?

FGC consists of cutting portions the vulva, which comprises the mons pubis, clitoral hood, the glans clitoris, the vaginal opening, and the labia minora and majora. The World Health Organization (1998) classifies FGC into four forms according to how much of the vulva is cut and whether the labia are sutured together: Type I (sunna) involves removal of just the hood of the clitoris or the hood, suspensory ligament, and glans of the clitoris. Type II (excision) involves the removal of all of the glans clitoris and the labia minora. Type III (Pharaonic, so-called because it may have been carried out during the time of the Pharaohs)

involves the removal of the glans clitoridis, the labia minora, the medial portion of the labia majora, and infibulations, or joining the two sides of the remaining labia majora with sutures to make a smooth surface. A small opening is preserved to allow the flow of urine and menstrual blood. At the time of penetrative sex and delivery, the sutures are often cut by husbands or midwives, but traditionally women are reinfibulated if their husbands travel or after having given birth. For these reasons reinfibulation may occur many times during a woman's life.² Type IV consists of various patterns of cutting the clitoris or vulva, including some aspects of the above three procedures. It includes pricking, piercing, or incision of the clitoris or labia, stretching of the labia or clitoris, scraping the vaginal orifice, cutting the vagina, or any introduction into the vagina of substances thought to cause tightening or narrowing. In all but Type IV, the clitoris is excised.

In most cases the results of this procedure do not fall neatly into the WHO categories. Since the procedure is most often carried out by local women with whatever sharp instruments are at hand and without the aid of anesthesia, a wide range of variations in the actual form of the cutting occur. There may be much more or much less cutting than intended. There may be scarring from the eventual healing of the cuts. While there are a few countries in which it is possible to engage medical personnel to carry out FGC, medicalization is officially banned by the WHO. Thus, even in cultures that practice the Pharaonic form of cutting, many actual variations of that type occur.

Reported adverse physical outcomes of FGC include: septic shock, including death during or just after the procedure; formation of rectovaginal or vesicovaginal fistulae; formation of neuromas (profusions of exposed, free nerve endings); urinary and menstrual pain; vaginal infections, potentially leading to infertility; and scarring, leading to difficult births, which are frequently thought to necessitate Caesarian section. These potential adverse consequences are used to support the view of the practice as a mutilation of female genitalia that is extremely dangerous for infants, girls, and women (Almroth et al. 2005; Chalmers and Omer-Hashi 2003; Momoh 2005; WHO 1998).

Recent reviews of the literature, however, reveal a major cultural divide on this issue that leads to a lack of understanding in both designing and interpreting experiments. Clinicians and NGOs seem to believe that demonstrating reproductive health hazards associated with FGC in the medical literature will lead to eradicating the practice (Shaaban and Harbison 2005). However, there is little replication of the studies that are carried out to investigate these well-accepted outcomes, and the findings themselves may not have saliency within the communities that practice FGC (Momoh 2005; Obermeyer 2005). Indeed,

²The inability to be reinfibulated by medical personnel after delivery in Western hospitals is often disturbing for women with Type III FGC. It is viewed as discrimination, since surgeons will take "an extra stitch for their husbands" to the episiotomies of Western women (Manderson 2004).

this biomedical focus on the sexual and reproductive consequences of the FGC has led African women to wonder why the world is so focused on their genitals (Omoigui 2001). Why, indeed, when there is an entire body beyond?

There has to date been no acknowledgment in the biomedical literature—beyond reporting neuromas at the site of cutting—that there may be neurobiological consequences of FGC. This omission is startling when one considers that the vulva is highly innervated by both sensory and motor nerves. Cutting the vulva must include cutting nerve and muscle, components of the nervous system. As well, the clitoris itself is not a unitary structure but includes the suspensory ligament, which attaches the clitoris to the underlying muscle; the glans, or external portion of the clitoris; the prepuce or hood, which is the covering of skin on the glans; the corpus cavernosum, part of the internal portion of the clitoris which contains erectile tissue; and the crus, or the continuation on each side of the corpus cavernosum. Thus FGC—to a greater or lesser extent depending on the type of procedure and the skill of the practitioner—has the potential for both damaging neural innervation directly, by the cutting itself, and indirectly, by cutting branches of the nerves that innervate the skin and muscle. A surgical treatment for cancer of the vulva, radical vulvectomy, although carried out under anesthetic, cuts much the same neural innervation as FGC, and it is well-accepted that this procedure has neurological outcomes—including a type of neuropathic pain called vulvodynia (Wesselman, Burnett, and Heinberg 1997). The similarity of tissue damage between Type III FGC and radical vulvectomy would support the proposal that some women with Type III FGC might also have neurological outcomes.

FIRST-PERSON ACCOUNTS OF FGC

Women's own accounts of the cultural and embodied repercussions of FGC suggest a diversity of responses that include both the psychological and the biological. Even women who have had the same type of FGC recount unique memories of the event, as well as varied experiences of it after the initial cutting (Abusharaf 2001; Chalmers and Omer-Hashi 2003; Manderson 2004; personal conversations). Highlighting the diverse responses are the following first-person accounts from women who would be classified by WHO as having Type III FGC. These accounts reflect pride, vanity, personal strength, and sexual pleasure, as well as dyspareunia and the quenching of sexual desire.

Circumcision is what makes one a woman because by removing the clitoris, there is no way that her genitals will look like a man's. The woman with a big clitoris is just like a man. How can a woman carry such a long organ between her legs and pretend that things are normal? That is why we say that Pharaonic is good because after it is done the girl's genital area becomes very beautiful and smooth. (Abusharaf 2001, pp. 123–24)

This response is underscored by that of a woman from the Rendille community of northern Kenya, upon learning that the interviewer, in spite of not having been circumcised, was a wife and mother: “In your place this might be fine, but for Rendille women, circumcision is the only thing that separates us from animals” (Shell-Duncan and Hernlund 2000, p. 115). The importance of purity, and not necessarily virginity, in the meaning of FGC is highlighted by the fact that in the Rendille society, which is a non-Muslim, nomadic society, excision takes place at the marriage ceremony itself, before which girls are expected to be sexually active but to not get pregnant (Shell-Duncan and Hernlund 2000).³

The focus on purity—with purity providing an edge on self-reliance and self-respect—is also represented by the Sudanese as highlighted by the report of one elderly woman: “If you are circumcised, your emotions [sexual desires] are reduced, and you don’t have to sleep around and lose respect” (Abusharaf 2001, p. 130). This same woman explained how having better control over one’s sexual emotions gives the wife leverage in the family power structure, because she can hold out against the sexual advances of her husband until he sees things her way:

I want to say to everyone who does not prefer circumcision that it gives women a lot of power in the household. For example, if she has a fight or if she wants her husband to do something for her, her circumcision will allow her to take control and be able to refrain from sex for a long time until she brings him to see the problem exactly from her view. I don’t think that uncircumcised women can do that; those women, when they fight with men, maybe two days later after a fight, if the man touches them, they become aroused and immediately forget the problems just to have sex. That is why in Sudanese families, women are very, very strong. I swear that in some houses the woman is so strong that her husband can’t breathe without her consent. I think this is true because of her power over her sexual desire. Men are weak, weak, and weak. They will do everything to appease a woman for sex. And the circumcised woman understands how to take advantage of the problem and turn it around for her own ends. (Abusharaf 2001, p. 130)

Of course, women who have undergone FGC can show ambivalence about the procedure. When polled, Nigerian women said they didn’t particularly support it but that they would ensure that their daughters were circumcised (Mandara 2000). This is not based on wanting to do their daughters harm; in fact, personal reports, even of women who would not put their own daughters through FGC, emphasize that they feel their mothers were doing something very loving for them. Furthermore, when polled, a majority of Somali-Canadian women reported being excited before the event, looking forward to it, and feeling special

³If they become pregnant it is a shame on the family, as well as considered dangerous for the baby during delivery because the clitoris is intact. Unmarried, and hence uncut, girls who are pregnant are forced to undergo an abortion.

afterward. Most reported that they do not consider it something that is done to increase their husbands' sexual pleasure, but rather something that they do for themselves to feel clean, more beautiful, and pure (Chalmers and Omer-Hashi 2003). Interestingly, in spite of often dire immediate health consequences, the practice was so important to the girls themselves that when the government of Kenya banned the procedure from 1920 to 1930, girls went into the bush to circumcise themselves. As well, it has been argued that a decline in the value and status of school education for girls has led FGC to become a way of increasing social standing and insuring marriage prospects—even against the wishes of uncircumcised mothers (Thomas 2000).

Women with FGC, including types in which the external portion of the clitoris is excised, report a variety of sexual experiences. As stated earlier, for some it allows (or produces) an ability to control desire and hence, sexuality. For others, desire and orgasm are still very present facts of their lives:

My infibulation did not eliminate my desire to have sex even at this age. People say that if you cut the clitoris you don't enjoy sex, but we can say to the same people: do you think if your tongue is removed you will stop feeling hungry? The same with sex. These people need to know that if a woman has a good husband, sex can be good even if she is circumcised, and can be very bad if she is uncircumcised and has a selfish husband. The issue is a good marriage. Now I have sex almost five times a week. It is very enjoyable and I know too about orgasm . . . that indescribable sense of pleasure that gives one the feeling of touching the sky. It makes one shiver. (Abusharaf 2001, p.128)

In contrast to this account is the following: "I have to tell the truth: circumcision does not allow women to want sex" (Abusharaf 2001, p. 125).

Thus, first-person accounts disclose highly varied responses, differing even within a single culture as well as from region to region, in meaning and physicality. These discrepancies in individual accounts may be due not only to the skills and instruments of the various practioners or local meanings of the rite. Such discrepancies may also arise out of the likelihood that different individuals have different experiences of FGC because of a uniqueness of neuronal rewiring of each individual. Thus, a better understanding of possible neurobiological outcomes may reconcile many positive reports of the women themselves with the negative medical descriptions of genital pain and reproductive difficulty.

In order to underscore potential neurobiological outcomes of FGC, what follows is speculation based on current evidence—when possible from human studies, and when not possible, from animal models—about some of the neural structures that might be affected by the tissue cut in Type III FGC, and the potential accompanying changes in sensation or function. My goal is to concretize the possibility that the ramifications of FGC are body-wide. The approach is to start at the genitals where cutting takes place and most research on FGC focuses, and to follow potential repercussions into the pelvic viscera, spinal

cord, brain stem, forebrain, and cerebral cortex, speculating on the possible effects at various levels of the CNS. The significance of a consideration by body region is to remove the spotlight from the genitals of women with FGC and to model how its effects may be body-wide by showing the way—as it were—from the genitals to other body regions. For some of this discussion, I have had to rely on what is known about the male genitalia and brain, since much of the biology of female sexuality has yet to be studied directly. However, by tracing the CNS circuits of three major nerves—pudendal, pelvic, and hypogastric—it is possible to grasp the potential wide-ranging effects of FGC. With these provisos in mind, what follows is an attempt to think through some of these body-wide ramifications of FGC.

THE NEUROBIOLOGY OF FGC

The nervous innervation of the vulva is rich and overlapping. The pudendal, pelvic, hypogastric, and vagal nerves send and receive information to and from the vulva, perineum, pelvic viscera, and pelvic floor. The pudendal nerve innervates the clitoris, perineum, and inner thigh; the pelvic nerve innervates the vagina, cervix, and perineal skin; the hypogastric nerve innervates the cervix and proximal three-fifths of the uterus; and the vagus nerve innervates the cervix and deep pelvis (Heaton and Adams 2003). Considering the potential effects of cutting the efferents and afferents carried in these nerves is necessary in order to understand how FGC might affect the rest of the body as well as the mind via the central nervous system.

Effects at the Vulva

Cutting nerves that carry the input and output of the vulva will first and foremost have local consequences. Excision of the glans clitoris literally removes an extremely sensitive focus of sensation. As well, cutting the nerves of the glans may affect sensation to the internal portions of the clitoris, further altering sensation. Even simply nicking or cutting (but not excising) the glans may change sensation noticeably, since the glans penis (and presumably its homologue, the glans clitoris) has a 10:1 ratio of free-to-encapsulated nerve endings which establish a unique relationship of threshold sensitivity to pleasurable touch, temperature, and pain (Bessou and Perl 1971; Halata and Munger 1986; Kumazawa and Perl 1977; Olausson et al. 2002). Cutting the clitoris will damage these nerve endings extensively, which, as mentioned before, sometimes leads to the formation of painful neuromas at the site of cutting (Fernandez-Aguilar and Noel 2003).

In spite of the cutting and subsequent rewiring, excising the external portion of the clitoris and cutting portions of the pudendal, hypogastric, and pelvic nerves does not necessarily eliminate orgasm. While the most common explanation offered for this is that perhaps the glans clitoris was not actually cut, this explanation relies on the idea that the only source for female orgasm is the glans clitoris.

This is by analogy to male anatomy and from studying male sexual behaviors—mounting, intromission, and ejaculation—which are understood to be under reflexive control of spinal circuits (Truitt and Coolen 2002). Recent studies have suggested, however, that this analogy may give an inaccurate view of female sexuality. First, the clitoris actually extends extensively internally, suggesting that there is erectile tissue that could mediate orgasm independently of the glans (O’Connell et al. 1998; Whipple and Komisaruk 2002). Second, in contrast to males, females may have more than one neural pathway to orgasm, one of which is via the vagus nerve (Komisaruk, Beyer-Flores, and Whipple 2006). This pathway has been described in experimental animals as bypassing the spinal cord, communicating perineal stimulation to the brainstem nucleus, the nodose ganglion (Collins et al. 1999; Ortega-Villalobos et al. 1990). Female orgasm not uncommonly occurs through stimulation of the breast or of other “non-traditional” erogenous sites (Komisaruk, Beyer-Flores, and Whipple 2006). That 63% of women with Types I and II FGC report that their breasts are the most sensitive region of their body compared to 43% of uncut women suggests that there may be referred sensation and thus a shift in sites of pleasure (Okonofua et al. 2002).

Even with continued experience of orgasm, the sense of what orgasm is like may vary from the uncut state due to cutting of the muscles involved. The bulbospongiosus and ischiocavernosus muscles underlie the labia minora and majora, respectively. The ischiocavernosus, which surrounds the clitoral crus, contracts during orgasm, elevating the clitoral shaft and glans. The bulbospongiosus forms a sling around the shaft of the clitoris and surrounds the vaginal opening. Contraction of this muscle tightens the vaginal opening and increases clitoral erection, potentiating erotic sensation of vaginal penetration by transferring mechanical stimulation to the clitoris. Intense contraction of the bulbospongiosus, ischiocavernosus, anal sphincter, and other pelvic floor muscles accompany orgasm. Even if the glans of the clitoris has not actually been excised, cutting these muscles may still affect the qualitative aspects of clitoral stimulation, potentially altering spasmodic tightening of the outer portion of the vagina during orgasm. The pudendal nerve also innervates the bulbs that secrete lubrication during sexual arousal (Rees et al. 2000). Cutting afferents or efferents surrounding the shaft of the clitoris, as well as, in some cases, cutting the bulbs themselves, could have the effect of producing orgasm in the absence of vaginal lubrication, which would also affect qualitative aspects of arousal and orgasm.

Effects at the Pelvic Viscera

Close association of the urethra with the clitoral body increases the likelihood that extensive clitoral cutting will affect the urethra, directly leading to problems with micturation, which are, in fact, reported often (Momoh 2005; O’Connell et al. 1998). Neurons in Onuf’s nucleus in the sacral spinal cord innervate not only the muscles underlying the vulva, but also the muscles of the urethral sphincter and bladder. Cutting the nerves at the vulva may affect their input to the bladder,

uterus, and rectum as well. Cutting with its subsequent neural degeneration and reorganization could affect tension in the bladder wall; when the pudendal nerve loses its input due to demyelination of upper motor neurons in multiple sclerosis, problems with bladder and bowel function are severe (Ghezzi 1999; Yang 2002). As well, degeneration of Onuf's nucleus in the sacral spinal cord leads to incontinence in progressive supranuclear palsy (Scaravilli 2002). Thus, degeneration of Onuf's nucleus and the subsequent rearrangement of neural innervation may be one source of the widely reported bladder difficulties in women who have undergone FGC.

Effects at the Spinal Cord

There may well be retrograde degeneration or reorganization of spinal cord circuits due to nerve damage at the site of cutting; removing muscles of the anus and external sphincter for treatment of rectal cancer leads to degeneration of Onuf's nucleus in adults (Mannen 2000). Changes of neurons in the spinal cord will have potential ramifications for both the pelvic viscera (as discussed previously) and brainstem, as well as for cortical neurons projecting to the spinal cord.

Effects at the Brain

Loss of targets may lead to further retrograde degeneration in the brain. This, in turn, may lead to modification of brain regions subserving hedonic and somatosensory response. If Onuf's nucleus degenerates, neurons in the motor cortex, hypothalamus, pontine reticular formation, paraventricular nucleus, ventral tegmentum, and periaqueductal grey will lose their target. This could have effects on micturation as well as orgasm (Holsege et al. 2003a, 2003b; Monaghan and Breedlove 1991). Paradoxically, sexual drive might increase, because to the extent that these neurons degenerate, inhibition from the brain to the spinal cord will be affected. One study that compared the sexuality of women with Types I and II of FGC with uncut women found that the women with FGC initiated sex more often than women without FGC, which might suggest increased desire (Johnsdotter and Essen 2004).

As with any other part of the body, the vulva has nerve endings that relay sensory information to cerebral cortex. While there is currently no complete map of the human female somatosensory or motor cortex of the types that Penfield produced for males, it has been reported that vulvar sensation results in neuronal excitation in the medial paracentral lobule, with the anus and vagina "mapped" together on the medial surface of the cortex between the central and precentral (marginalis) sulci. Stimulation of neurons in this region elicits sensation in the genitals but not orgasm (Penfield and Rasmussen 1945). If neural input is reorganized at the body surface, input to somatosensory cortex may be reorganized as well. Currently, there is no information about how the breasts, legs, corpus cavernosum of the clitoris, and pelvic representations are related to the external genitals in female somatosensory space or how they map in relation to each

other. Given the possibility of rewiring of the map after excision, however, it is better to think of Type III FGC as leading not to the *absence* of sensation but rather to *altered* sensation.

One form of alteration might be an increase in sensitivity in the foot and leg, since on the male homunculus they are juxtaposed to the region that leads to genital excitation (Penfield and Rasmussen 1945). Supporting this hypothesis is the case of a woman who had her leg amputated due to a farm accident and reported that whenever she felt sexually aroused she felt sensation in her phantom leg and foot in addition to her genitalia (Ramachandran and Blakeslee 1998). Depending on the age at which FGC is performed, one might also expect clitoral phantoms. This is not such a far-fetched suggestion, since penile amputation for carcinoma has been reported to result in penile phantoms with erections, as well as continued sensation of the passage of urine and pain from malignant ulcerations (Fisher 1999; Heusner 1950; Sherman and Sherman 1985). If there are clitoral or vulvar phantoms, they may result from foot or leg stimulation based on the juxtaposition of the somatosensory representation of the foot and leg to the genitals in the male brain.

Reorganization of neural circuits is hypothesized to be an underlying mechanism of chronic pain (Melzack 1989). If there is retrograde degeneration to the somatosensory or motor cortex in women after FGC, they may also experience chronic pain due to a reorganization of those circuits. In some women, there could also be referred sensation that manifests itself as pain as well as pleasure. Independent of its direct impact on the genitalia, FGC-induced chronic pain could potentially manifest itself anywhere on the body, with repercussions for psychosexual and daily function. Since sensory experience, including pain, is a complex perception depending on both neurological substrate and cultural expectation/meaning, to thoroughly understand FGC-induced sensations requires contextual study within women's lived lives.

Lived Lives May Differ

The neurobiological view of FGC moves this traditional practice and the bodies of the women on which it is practiced beyond a focus on genitalia and reproductive health to the entire body via the nervous system. When considered from this vantage point, differing reports on what it is like to live with FGC—embedded as they are in cultural allegiances, contradictory stories, and differences in bodies—may become reconcilable with biology. This perspective also aligns FGC with a myriad of other human body modifications made to differentiate the forms of female from male, such as sex assignment of infants with ambiguous genitalia, foot-binding, and breast augmentation. Like other cultural practices, FGC not only makes a woman resemble her community physically; through its actions on the CNS, it inscribes values of comportment and aesthetics. Potentially it configures the ways in which a woman carries herself, walks, and experiences the world. As the practice is carried out over centuries, the type

of body—and mind—it produces becomes instantiated and passed from generation to generation, making it difficult to imagine any other way of being.

EPILOGUE

From this thought experiment two morals emerge: (1) it is important to think of cultural practices—even those enacted on the peripheral body—as having CNS effects which in turn may affect mental states; and (2) women’s own accounts of their experience might productively shift the focus of research to a deeper understanding of women’s bodies—one that goes beyond the reproductive system.

With respect to the first point, the effect of a physically enacted cultural practice is to modify the mind via the nervous system. Changes in the body then become a mark that a modification of mind has been performed. With respect to the second point, to really understand the impact of a practice on the body, it is important to ask women themselves what they *feel*—in both a figurative and literal sense. Underlying the enduring difficulty of eradicating FGC is that the concerns of Western medicine may not address the concerns of the women themselves. This latter point is supported by the diverse and unexpected accounts of women about the effects of FGC on their bodies and minds. It is also eloquently supported by a recent study on the reproductive health of women living in disadvantaged Beirut neighborhoods, in which musculoskeletal complaints, not reproductive health concerns, emerged as the most important health problem according to the women polled. In fact, on a ranked list of general health problems, the women themselves reported respiratory, cardiovascular, and neurological problems as far more important than reproductive health problems, which only ranked ninth on a list of 10 concerns. Rather than their genitals, their whole body was of concern. As one woman reported: “poverty mounts on a person’s body from head to toe” (Zurayk et al. 2007, p. 8), suggesting powerfully that the women in this study have a whole-body view of poverty’s effects on their health. It also underscores the point that if we want to produce salient understandings of a practice like FGC—pro or con—we must look beyond the reproductive system.

This discussion of the potential neurobiological repercussions of FGC (and poverty) suggest that understanding its effects on the CNS might lend insight into a myriad of health concerns. What in fact are the effects on daily lives, sensations of pain and pleasure, as well as the sense of one’s body in space in the particular lives women lead? Once we understand this, we will be able to better understand how cultural practices instantiate neural circuit differences that lead to culturally bound responses to circumstances, people, and sensory experiences.

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