MEDDOCS Open Access Publisher

ISSN 2641-6522

Annals of Obstetrics and Gynecology

Open Access | Research Article

Neuromuscular Electrical Stimulation for Perineal Muscle Repair Following Episiotomy: The First Preliminary Study

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Received: Aug 16, 2022

Accepted: Sep 13, 2022

Published Online: Sep 15, 2022

Journal: Annals of Obstetrics and Gynecology

Publisher: MedDocs Publishers LLC

Online edition: http://meddocsonline.org/

Keywords: Neuromuscular electrical stimulation uses; Episiotomy; repair of episiotomy; complications of episiotomy.

Abbreviations: SVD: Spontaneous Vaginal Delivery; NMES: Neuromuscular Electric Stimulator; CS: Caesarian Section.

Abstract

Introduction: The aim of this study was to present our experience in utilizing Neuromuscular Electrical Stimulation (NMES) during primary repair of perineal muscles following episiotomy and, and to assess its benefits and outcomes.

Methodology: This first preliminary study involved18patientswho were indicated for episiotomy during spontaneous vaginal delivery at King Abdulaziz University Hospital, Jeddah, Saudi Arabia between January 2020and June 2021. All patients provided informed consented for using NMES during episiotomy repair "NMES was applied transcutaneously to localize and approximate the perineal muscles, with electrical current adjusted according to muscular response." All procedures were performed under epidural analgesia. The follow-up period was one year.

Results: Among the 18 patients, 12 and 6 underwent midline and mediolateral episiotomy, respectively. Eleven were primigravida, while 7 were multigravida with no history of perineal trauma or episiotomy before. all patients regardless type of episiotomy reported no infection, dehiscence, perineal laxity, and extensive narrowing or stenos is of the introitus with less pain and no dyspareunia.

Conclusion: This first preliminary study demonstrated the feasibility of NMES in the localization and approximation of perineal muscles during episiotomy repair, which allowed for ease, complete surgical closure, and satisfactory surgical outcomes without complications in all patients. NMES may play a novel role in the field of obstetrics and gynecology, and improve the surgical outcomes of episiotomy, particularly those of the mediolateral type.

Cite this article: AlJahdali E, AlBasri S. Neuromuscular electrical stimulation for perineal muscle repair following episiotomy: The first preliminary study. Ann Obstet Gynecol. 2022; 5(2): 1039.

Introduction

Episiotomy is the surgical incision of the perineumto widen the vaginal introitus and facilitate the passage of the fetus [1]. The practice of episiotomy was first described in the 10th century and became one of the most practiced obstetric procedures worldwide [2]. It gained popularity in the 1920sfollowing the publication by DeLee JB [3], who supported routine episiotomy and prophylactic forceps delivery. The necessity of routine episiotomy was, however, questioned by Thacker et al. in 1983 [4], based on evidence that this associated with greater trauma and higher risk of postpartum complications. This gave rise to restrictive episiotomy policies. A meta-analysis by the Cochrane Library 2009involving 8 studies showed that selective episiotomy was preferable over routine practice, as the latter associated with a greater risk of posterior perineal trauma and more severe perineal lacerations (third and fourthdegree), with no benefits with regards to other aspects such as Apgar score. Such controversies resulted in the downward trend of routine episiotomy rates worldwide [5].This further introduces the current landscape of episiotomy revolving around the debate between routine and selective/restrictive practice.

Nonetheless, selective episiotomy remains a common obstetric procedure, the indications of which may include non-reassuring fetal cardiotocography in the second stage of labor, preterm delivery, vaginal breech delivery, shoulder dystocia, maternal exhaustion, prolonged second stage of labor, and operative vaginal delivery [6]. Midline and mediolateral incisions represent the 2 main approaches of episiotomy **(Figure 1A)**. The selection of either technique depends on factors such as clinical preference, perineal body length, baby size, and the use of instruments. Selective episiotomy aims to avoid uncontrolled perineal laceration that may lead to more damage and complications, which include lacerations extending into the anal sphincter, damage to the Bartholin's gland, edema, hemorrhage, hematoma, infection, a symmetry or excessive narrowing of the introitus, rectovaginal fistula, long hospital stay, delay in resumption of sexual activity, chronic perineal pain, , and wound dehiscence [7] Furthermore, the risk of psychological trauma, dyspareunia, and fecal or urinary incontinence may subsequently negatively impact the quality of life of patients [2]. Other rarer complications include endometriosis due to scarring, and non-healing [8]. Most of the a forementioned complications can be avoided with the proper localization and repair of perineal muscles. The identification of muscles immediately after birth may be challenging due to bleeding, edema, and asymmetry of the muscles, specifically with mediolateral episiotomies. NMES was previously employed in our institute for rectocele repair, and satisfactory structural and functional outcomes were achieved [9]. This technique has also been extensively used in other medical and surgical specialties, including the management of bladder dysfunction in conjunction with pelvic floor muscle training and biofeedback therapy [10], the NMSE also used in strengthinig facial nerves in stroke patients [11], and in anorectal surgery for the intraoperative mapping of sphincter muscles. Based on the aforementioned studies, we postulated that NMES may also be useful in the localization and approximation of retracted perineal muscles during episiotomy repair.

As such, we aimed to conduct a preliminary study to evaluate the use of NMES during the primary repair of both midline and mediolateral episiotomies, to facilitate in the identification of perineal muscles, achieve better anatomical restoration, and reduce the risk of complications related to improper closure.

Material and method

Patient inclusion

Eighteen patients who were indicated for episiotomy during spontaneous vaginal delivery at King Abdulaziz University Hospital, Jeddah, Saudi Arabia between January 2020, and June 2021 were included. The study was approved by the Research Ethics Committee of the institution, andwas performedaccording to the Declaration of Helsinki. All included patients provided informed consent for participation in our study.

The inclusion criteria included patients planned for delivery with epidural analgesia, primi- and multigravida patients with no history of perineal trauma during childbirth, and those indicated for episiotomy during the current delivery. The exclusion criteria included any patients who did not consent for epidural, those requiring caesarian section, those with history of perineal trauma, and patients with previous genital reconstructive surgery. All patient included in the study were consented after study aim, and procedure explained to them.

Total of thirty patients were identified for the study, among whom twenty-two were excluded due to indications for caesarean section (n= 9), delivery with intact perineum (n=17).

Episiotomy and NMES

Episotomy was performed under epidural analgesia. The incision madecommonly involved the vaginal epithelium, superficial transverse perineal muscles, bulbocavernosus muscle,perineal body, superficial fascia,as well as the subcutaneous tissue and skin **(Figure 1B)**.

During repair of the episiotomy,transcutaneous perineal and intravaginal NMES was applied using bipolar probes "Pena Muscle Stimulator, model PS-2, Radionics Inc., Burlington, MA, USA" to locate the perineal muscles. The electrical current was gauged according to muscular response and ranged between 60 -100 mill amperes **(Figure 2)**. Suturing of the muscles, vaginal mucosa, and skin was subsequently performed using Vicryl 2-0, 3-0, and 4-0, respectively.

All patients were followed-up for one year for pain, healing period, dehiscence, infection, stenosis, dyspareunia, and patient satisfaction.

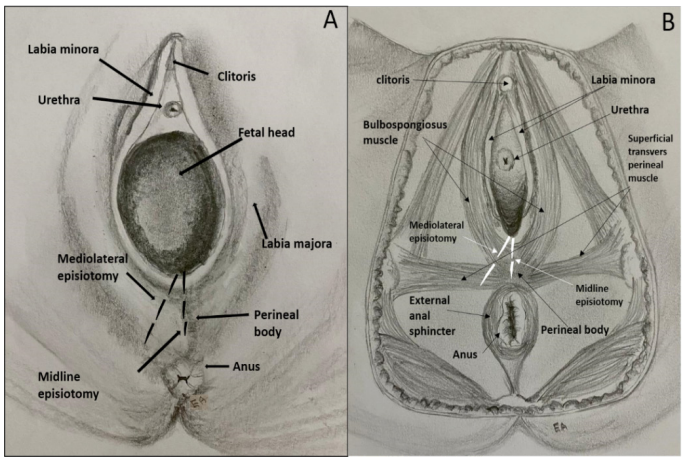

Figure 1: The 2 common types of episiotomies - midline episiotomy **(A)** and mediolateral episiotomy **(B)**.

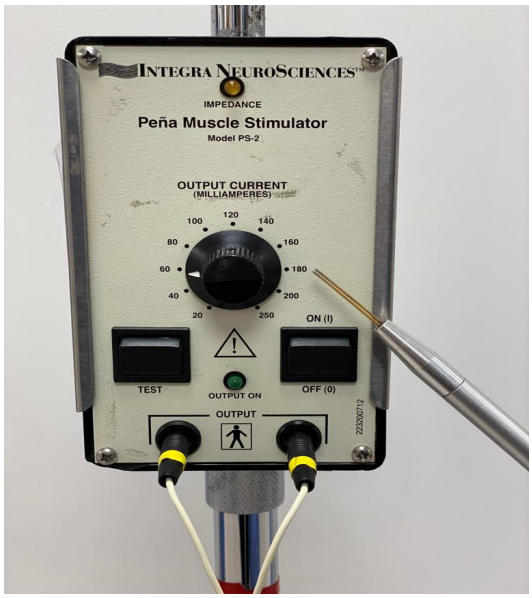

Figure 2: The NMES device used.

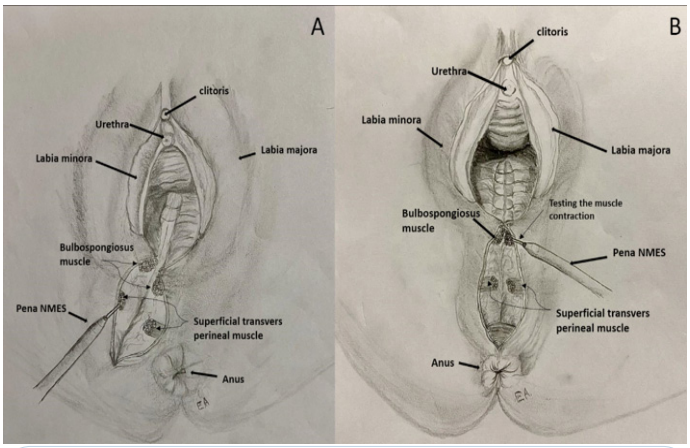

Figure 3: The use of NMES during episiotomy repair.

Results

A total of 18 patients were included in our study, 11 of whom were primigravida. Midline episiotomy was performed in 12 patients, of whom 9 were primigravida, and 3 were multigravida (gravida 2 para 1 with a history of caesarean section in all patients). Mediolateral episiotomy was performed in the remaining 6 patients, of whom 2 and 4 were primi- and multigravida, respectively. Ventose delivery was required in 5 (27.8%) patients due to poor maternal effort and prolonged second stage of labor, and due to expected macrosomia in a multigravida patient with uncontrolled late diagnosed diabetic. All delivery-related data are summarized in **Table 1**. All deliveries were uneventful, with normal blood loss (range, 150– 250mL), and good APGAR score. Besides the high birth weight observed in the patient with diabetes (4.2 kg), the average birth weight was normal (mean,3; range, 2.6 – 3.4 kg).

Table 1: The study group.

		Type of episiotomy		Delivery mode	
		Midline (n)	Mediolateral (n)	SVD (n)	Ventose (n)
Primi (n)	11	9	2	9	2
Multi (n)	7	3	4	4	3
Total (n)	18	12	6	13	5

All patients who underwent midline episiotomy associated with lower pain intensity (based on less patients need for analgesia) and shorter duration of analgesia. They were able to sit with comfort within 10 days and report no pain with defecation from the first week. Complications such as infection, dehiscence, perineal laxity, and extensive narrowing or stenosis of the introitus were not observed. Despite the lack of specific pain scores used in the study, dyspareunia was not reported among the patients.

Discussion

Episiotomy is an obstetric surgical procedure involving the controlled incision of the perineum to enlarge the vaginal introitus and decrease the risk of severe perineal trauma during labor. It is often performed based on clinical judgment of the obstetrician. Regardless of the angle of incision, proper repair of episiotomies is essential to reduce the risk of subsequent complications. Perineal and intravaginal NMES was employed in our study with the aim to optimize the surgical repair of episiotomies. Similar to our previous use of NMES in rectocele repair, and to other studies on the use of NMES for muscle identification and repair, satisfactory surgical outcomes were observed [9].

NMES involves the transmission of electrical impulses to selected muscle groups by means of electrodes. Electrodes may be placed directly on the overlying skin (transcutaneous), or may be implanted (percutaneous, epimysial, epineural, intraneural, and cuff). There are 2 broad indications for the use of NMES-(1) to treat muscle atrophy, by stimulating muscles in their resting state, and (2) to enhance the functional activity of muscles in neurologically impaired patients. NMES systems are either voltage- or current-regulated, and an optimal system involves the utilization of minimal stimulus frequency that produces a fused response [12].

In the field of obstetrics, NMES has only been used as an adjuvant in biofeedback therapy for several pelvic floor disorders. To our knowledge, the current study represents the first in applying NMES during the primary repair of episiotomies. Following our previous success in the use of NMES for rectocele repair [9], NMES was employed in the current study for perineal repair based on the rationale of restoring the normal anatomical structure as best as possible. We found that NMES was of greater benefit in the repair of mediolateral episiotomies, due to the greater degree of asymmetry, the retraction of deeper muscle layers to upper position towards its insertion points, which may led to difficulty in surgical closure **(Figure 3A)**. Midline episiotomies are often easier to repair due to the symmetry in the separated perineal muscles; nonetheless, NMES remains useful in the identification of muscles to improve surgical outcomes **(Figure 3B)**.

Common complications of episiotomy include extension of the incision deeper into the perineum or the anal sphincter complex, postpartum pain, delayed sexual activity, and dyspareunia [13]. Such complications may be attributable to fibrosis and scar formation associated with the procedure, which may be more prominent following incomplete closure of episiotomy site [14]. NMES has shown to be useful in muscle identification [9]. This may be of particular importance in episiotomies associated with third- or fourth-degree perineal tears, and in those patients with limited surgical view, bleeding and muscle retraction in some cases. Our findings showed that NMES allowed for ease during episiotomy repair, while allowing for good surgical closure and the lack of surgical-related complications.

This study had several limitations, including the small sample size, the single center design, and the lack of a control group. Objective measures for pain and dyspareunia were also lacking. In addition, an assessment on the cost effectiveness of NMES compared to current methods of episiotomy repair should be considered in future studies.

Conclusions

Our study demonstrated that NMES may be a promising tool in the primary surgical repair of perineal muscle following episiotomy. Large sample randomized controlled trials are warranted to verify the surgical outcomes of NMES in episiotomy, and to further evaluate the cost effectiveness of this procedure. Importantly, NMES may play a novel role in the field of obstetrics and gynecology, and improve the surgical outcomes of episiotomy, particularly those of the mediolateral type.

Funding: None.

Ethical approval: This study was approved by the institutional review board of the hospital, and informed consent was obtained from all included patients.

Acknowledgments: We are very thankful to Professor Yasir Jamal, professor and consultant plastic and pediatric surgeon, for his great support and help.

Conflict of interest: No conflict of interest to disclose.

Authors contributions: Ettedal AlJahdaliwas involved in study conception, literature review, study design, and manuscript drafting. Samera AlBasriwas involved in lietrature review, manuscript review, editing, and submission for publication.

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