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Obturator Refleksi Devre Kesicisi: Obturator Refleksini Önlemek İçin Bir Fikir

Obturator Reflex Circuit Breaker: An Idea to Avoid Obturator Reflex

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ÖZ

Giriş: Obturator refleks, mesane perforasyonu ile sonuçlanabildiği için transüretral mesane cerrahisinin en korkulan komplikasyonlarından biridir. Obturator jerk olarak da bilinen refleks, cerrahi sırasında kullanılan elektrokoter ile obturator sinirin uyarılması sonucu ortaya çıkar. Biz komplikasyonu önlemek için refleksin tespit edilebileceği ve elektrokotere giden gücün kesilebileceği fikrini ortaya attık. Bu çalışmada obturator refleksin tespitinde elektromiyografi sensörlerini kullanmayı amaçladık.

Yöntem: Spinal anestezi altında transüretral mesane tümörü rezeksiyonu operasyonu geçiren iki erkek hasta çalışmaya dahil edildi. Operasyon sırasında elektromiyografi ölçümleri yapıldı ve elektrokoterizasyona bağlı bazalden sapma yanıtları da kaydedildi. Gözlenen obturator refleksler ve bu durumdaki elektrofizyolojik yanıtlar da kaydedildi.

Bulgular: İlk hastada üç dakika içinde 10 kez gözle görülür obturator refleks gelişti. Ancak bunların hiçbiri artefaktlar nedeniyle elektromiyografi kayıtlarına yansımadı. İkinci hastada obturator refleks gelişmedi.

Sonuç: Akut Transüretral mesane cerrahisinde oluşabilecek obturator refleksin değerlendirilmesinde elektromiyografi ile yapılan elektrofizyolojik ölçümlerin koterizasyon işlemi sırasında oluşan yoğun artefaktlar nedeniyle değeri yoktur. Elektrokoter artefaktlarını önleyecek sistemlerin kullanılması bu ölçümleri daha kullanışlı hale getirebilir.

Anahtar Kelimeler: mesane perforasyonu, komplikasyon, obturator jerk, transüretral, TURBT

ABSTRACT

Objective: Obturator reflex is one of the most feared complications of the transurethral bladder surgery, as it can result in bladder perforation. Also known as obturator jerk, the reflex occurs as a result of the stimulation of the obturator nerve by electrocautery used during surgery. We put forward an idea that the reflex can be detected and the power to the electrocautery can be cut off to prevent the complication. In this study we aimed to use electromyography sensors in the detection of the obturator reflex.

Method: Two male patients who had transurethral resection of bladder tumor operation under spinal anesthesia were included in the study. During the operation, electromyography measurements were made, and the responses of deviation from baseline due to electrocauterization were also recorded. Obturator reflexes observed and electrophysiological responses in this situation were also recorded.

Results: The first patient developed a visible obturator reflex 10 times within three minutes. However, none of these were reflected in the electromyography recordings due to artifacts. The second patient did not develop the obturator reflex.

Conclusion: Electrophysiological measurements made with electromyography in the evaluation of the obturator reflex that may occur in transurethral bladder surgery are of no value due to the intense artifacts that occur during the cauterization procedure. The use of systems to prevent electrocautery artifacts may make these measurements more useful.

Keywords: bladder perforation, complication, obturator jerk, transurethral, TURBT

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INTRODUCTION

Bladder cancer is the ninth most common cancer among all cancers. Although more common in men, age is an independent risk factor, and more than half of cases are over 75 years of age. Surgery is the main form of treatment and is performed in two ways. The first is complete surgical removal of the bladder by cystectomy; the second is the removal of the tumor with the transurethral resection of bladder tumor (TURBT) (1).

Although the transurethral approach is more conservative and less invasive, it is unfortunately not without risks. In addition to the general complications of surgery and anesthesia, perhaps the most feared complication specific to this procedure is bladder perforation. Perforation occurs when the electrocautery blade used to resect the tumor completely pierces the bladder wall during surgery. This complication may lead to complications such as TURP syndrome (transurethral resection of prostate syndrome), tumor dissemination, and may need to proceed to laparotomy (1).

Although factors such as the patient's pathology and the surgeon's experience increase the risk of perforation, the most common cause is obturator reflex. This reflex, also called obturator jerk, occurs as the patient moves his leg due to the contraction of the leg adductor muscles innervated by this nerve as a result of the stimulation of the obturator nerve by the electrocautery used in surgery. During its anatomical course, the obturator nerve continues caudally after exiting the spinal cord, travels along the lateral wall of the bladder and reaches the adductor muscles of the legs (obturator externus, adductor longus, adductor brevis, adductor magnus), which are the last organs it innervates. With this reflex the sudden movement of the leg causes the bladder to be pressed against the electrocautery tip which is still working, and this results in perforation.

Obturator reflex can occur under both general and spinal anesthesia. With the cessation of the effects of muscle relaxant drugs administered under general anesthesia, the adductor muscles can regain their functions and contract. Under spinal anesthesia, although the peripheral nerves from the spinal cord are blocked, the peripheral nerves remain intact and preserve their functions; therefore, since the obturator nerve is stimulated peripherally around the bladder, it completes the reflex arc and causes obturator jerk.

In order to prevent the obturator reflex, interventions that can be performed by both the surgeon and the anesthesiologist have been suggested. Approaches such as using various irrigation solutions surgically, using bipolar diathermy for electrocauterization, keeping away from the bladder side wall during cauterization have been used (2,3). In terms of the anesthesiologist, the application of muscle relaxants or peripheral block of the obturator nerve are used to prevent this reflex (3,4).

We think that, unlike the methods mentioned above, we can protect ourselves from the harmful effects of this reflex instead of preventing it. The resulting reflex can send a signal to the electrocautery with a feedback mechanism and cut off the power supply of the cautery. Thus, bladder perforation can be avoided even if a reflex occurs. The sensor of the mentioned feedback signal can be the invisible small movements of the leg muscles or the action potentials that occur in these muscles.

Electromyography (EMG) can be used as a sensor to see action potentials in muscles. Electromyography continuously measures the action potentials of the muscles by means of needle probes placed on the muscles (5). These responses are often obtained from the upper and lower extremity muscles and are used to measure the integrity of the nerve pathways in vertebral surgery.

In this study, we aimed to measure the applicability of the above-mentioned EMG sensors in transurethral bladder surgery. By applying these sensors to the leg adductor muscles of the patients, we aimed to make baseline measurements on two patients. It was expected that the measurements to be obtained would provide information about the basal physiological responses of the leg adductor muscles during bladder surgery.

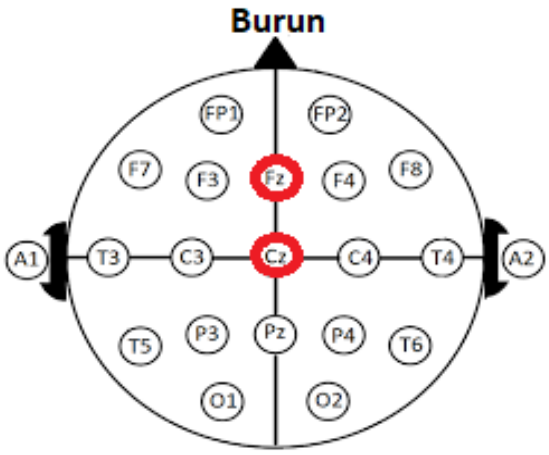
MATERIALS AND METHODS

After the Ethics Committee Approval (09.2019.402/05.04.2019) was obtained, two male patients with bladder tumors who would undergo TURBT operation under spinal anesthesia were included in the study. The patients were given detailed information about the study after routine preoperative preparation and anesthetic evaluation. Written informed consent was obtained from the patients. On the morning of the operation, patients were re-examined in the preoperative preparation unit and their participation in the study was confirmed. After being placed on the operating table, routine perioperative monitoring of the patients including peripheral oxygen saturation (SpO_2), electrocardiography (ECG), non-invasive blood pressure and body temperature was performed. In addition, needle EMG (Xltec, Natus, USA) sensors were applied on the leg adductor muscles (adductor brevis, adductor magnus) in accordance with the study protocol. Before the sensors were applied, disinfection of the relevant area was done properly with 70% alcohol-based solution. After basal measurements were made, spinal anesthesia was applied to the patients. Sitting position was used for spinal anesthesia, and a midline puncture was made from the line connecting the anterior superior iliac spina points (Tuffier's line). Hyperbaric bupivacaine 15 mg (Bupivon 0.5%, Onfarma İlaç, Turkey), and fentanyl 15 µg (Fentaver, Haver Farma, Turkey) were applied to the subarachnoid area.

After the sensory-motor block was confirmed following spinal anesthesia, EMG measurements were taken again, and the patients were transferred to the surgical team. During the operation, EMG measurements were made with an interval of 5 minutes, and the responses of deviation from baseline due to electrocauterization were also recorded. Obturator reflexes observed and electrophysiological responses in this situation were also recorded. At the end of the operation, the electrodes were removed, and the patients were sent to the postoperative recovery unit. Obtained EMG responses and changes during obturator reflex were examined.

Somatosensory evoked potential (SSEP) measurements were additionally performed in the second patient. For this purpose, the tibial nerves in the posterior part of the right and left ankle medial malleolus were transcutaneously stimulated for peripheral nerve stimulation, whereas for central measurement, CZ active and FZ reference electrodes were used on the scalp. The positions of the electrodes on the scalp are shown in Figure 1.

Figure 1. Sensor probes applied to the scalp for SSEP measurements. The locations of the electrodes are marked in red. CZ, active electrode. FZ, reference electrode.



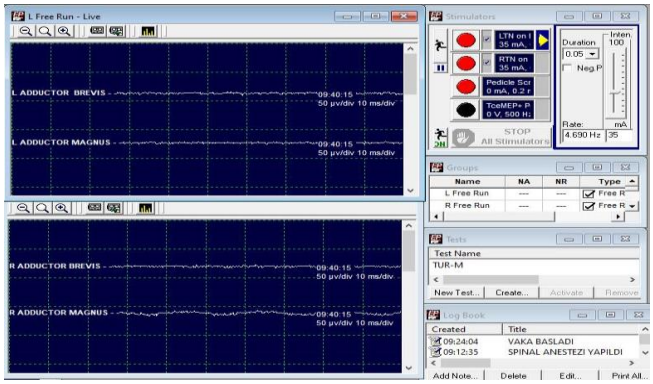
RESULTS

The first patient was an 84-year-old ASA II male patient (BMI: 29.5 kg m-^{2}) with a tumoral mass on the right bladder wall. The EMG recordings obtained from the patient before spinal anesthesia, after spinal anesthesia and during cauterization are presented in Figure 2. Electrical artifacts formed during cauterization can be noted. During cauterization, the patient developed a visible obturator reflex 10 times within three minutes. However, none of these were reflected in the EMG recordings due to artifacts. The patient's vital signs remained stable throughout the follow-up. The second patient was a 68-year-old ASA II male patient (BMI: 34.2 kg m-^{2}) with a tumoral mass on the left bladder wall. The EMG measurements of the second patient are presented in Figure 3. No obturator reflex was observed in this patient. The patient's vital signs remained stable throughout the follow-up. SSEP measurements obtained from the second patient also showed artifacts and are presented in Figure 4.

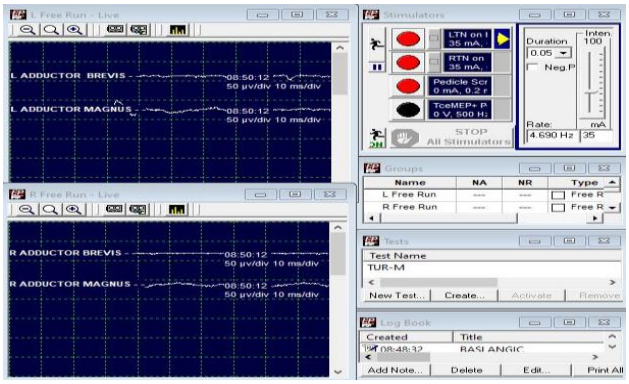
Although obturator reflex developed many times in the first patient, no complication causing clinical morbidity was observed in either patient.

Figure 2. EMG images obtained from the left/right leg adductor muscles of the first patient.

a) Before spinal anesthesia



b) After spinal anesthesia



c) During the electrocautery application

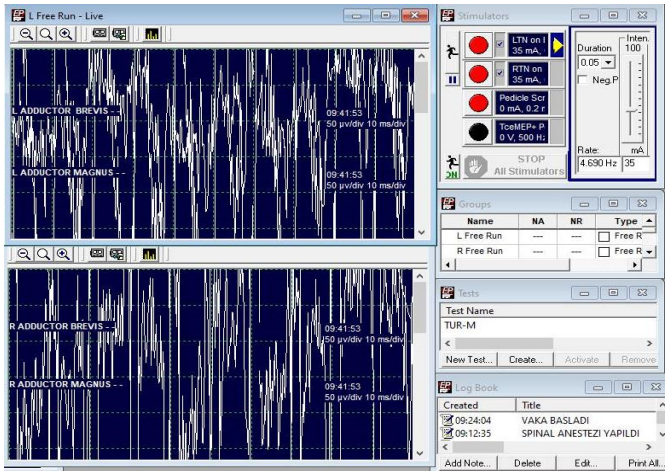
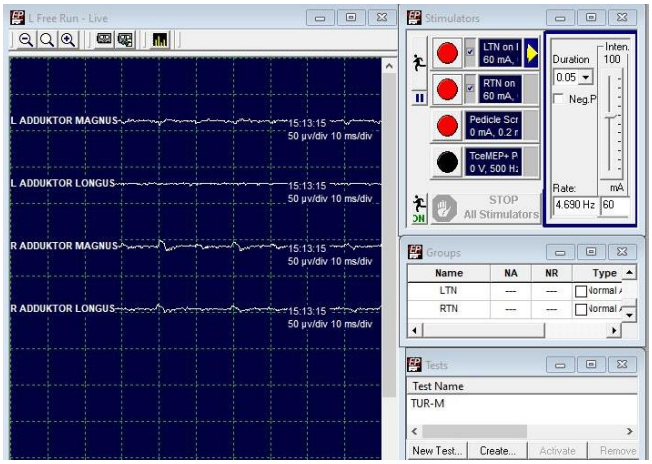
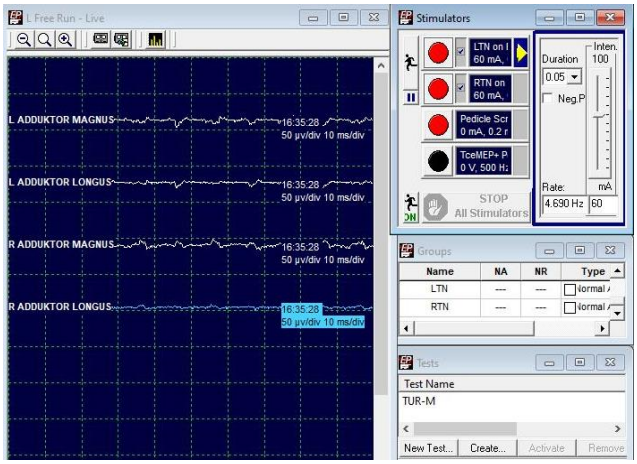


Figure 3. EMG images obtained from the left/right leg adductor muscles of the second patient.

a) Before spinal anesthesia



b) After spinal anesthesia



c) During the electrocautery application

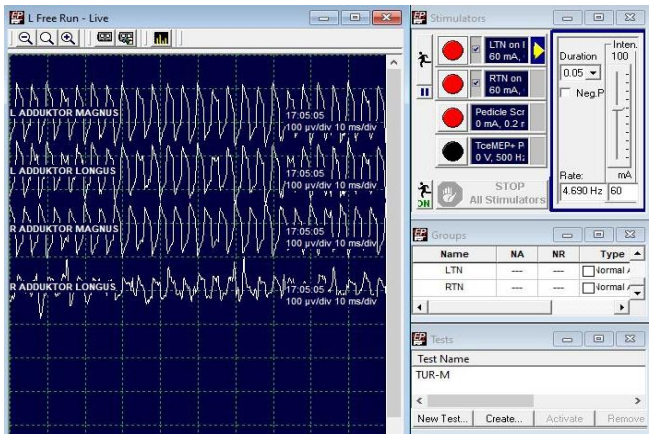
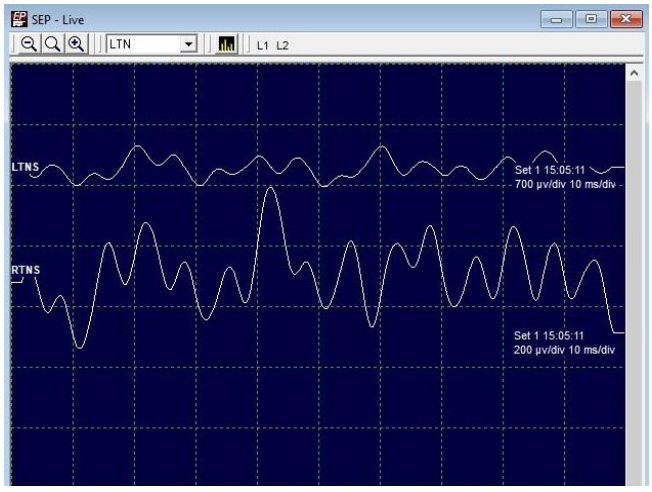


Figure 4. Somatosensory evoked potentials from the left/right tibial nerves of the second patient.



DISCUSSION

In this study, we examined the effects of the obturator reflex, which occurs due to cauterization, on EMG measurements in two patients who underwent transurethral bladder surgery. Our main conclusion from the study was that EMG measurements were worthless due to heavy cauterization artifacts.

The way our study emerged was the idea of creating a mechanism to prevent the obturator reflex. It must have had a sensor indicating that the reflex was occurring. This sensor should either detect the contractions in the leg adductor muscles or the action potentials after the obturator nerve is stimulated. In our study, EMG monitoring was used to measure action potentials.

Various methods have been used in the literature to prevent the obturator reflex. Miki et al.(6) developed a new transurethral resection system operating in a saline environment. In their study of 55 patients, only one patient experienced a clinically insignificant thigh movement. However, bladder perforation has been reported in a patient who was operated with this system in the literature (7). The use of Thulium laser instead of monopolar diathermy was recommended by Yarandi et al.(8) and obturator reflex was observed to a lesser extent with this method. Obturator nerve block is another effective method to prevent the obturator reflex. In the literature, both transvesical and classical obturator nerve blocks have been described with both blind and ultrasound-assisted techniques (9-11). The use of muscle relaxants can be considered as the gold standard in preventing the obturator reflex. Duration of action of the applied agent should be taken into consideration. Both depolarizing and nondepolarizing muscle relaxants have been used to prevent the obturator reflex, and it has been reported that they are very effective in preventing the reflex (12,13).

Limitations of the Study

The limitation of our study was that we were unable to have more measurements because of the restricted number of the kits. Moreover, we did not observe obturator jerk in the second patient, which limited our data even more.

CONCLUSİON

In conclusion, electrophysiological measurements made with EMG in the evaluation of the obturator reflex that may occur in transurethral bladder surgery are of no value due to the intense artifacts that occur during the cauterization procedure. The use of systems to prevent electrocautery artifacts may make these measurements more useful.

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Authors' Contributions: Study concept-design: RA, TL, YT; Data collection: RA, TL, YT; Data analysis and interpretation: RA, TL, YT; Manuscript drafting: RA, TL, YT; Critical review of content: RA, TL, YT; Final approval and responsibility: RA, TL, YT

Conflict of Interest: None

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Informed Consent: Written informed consent was obtained from the participants.

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