

Comparison of the harmonic scalpel with scissors in women who experience obturator nerve injury during lymph node dissection for gynaecological malignancies

Emsal Pinar Topdagi Yilmaz¹, Yunus Emre Topdaği², Nuray Bilge³, Yakup Kumtepe¹

¹Atatürk University Medical Faculty, Atatürk University Medical Faculty, Department of Obstetrics and Gynecology, Erzurum, Turkey

²Sanko University School of Medicine, Gaziantep, Turkey

³Department of Neurology, Atatürk University School of Medicine, Erzurum, Turkey

ABSTRACT

Objectives: Lymphadenectomy is crucial for accurate staging in most gynecological malignancies. Serious complications can occur during the surgery. The present study aimed to present the early and late findings associated with obturator nerve injury, which is rarely observed during lymphadenectomy but can result in serious sequela if not noticed.

Material and methods: The files of the patients who underwent lymphadenectomy at our clinic between 2012 and 2018 were examined. Patients with obturator nerve incisions were identified retrospectively.

Results: In total, 287 women patients underwent lymphadenectomy at our clinic between 2012 and 2018. Examination of surgical notes revealed that nine patients underwent obturator nerve incisions using a scissor or a harmonic scalpel (energy-activated ultrasonic scissors). With respect to management of obturator nerve damage, no significant difference was found between the use of a harmonic scalpel and scissors ($p < 1.000$) and the trendelenburg and lithotomy positions ($p < 0.167$). In addition, no significant difference was found between laparoscopy and laparotomy in terms of surgical type ($p < 0.167$). At 6 months post-operatively, sensory-motor examinations and EMG findings of the patients were completely normal.

Conclusions: Surgeries performed for gynaecological malignancies have high mortality and morbidity rates. Moreover, in the event of a complication such as nerve damage during laparoscopy, successful management of the complication before the patient undergoes laparotomy allows the patient to continue benefitting from the advantages of the laparoscopy. The results of our study show that these high-risk surgeries should be performed in advanced and well-equipped medical centres by teams experienced in gynaecological oncology.

Key words: obturator nerve; lymphadenectomy; harmonic scalpel

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INTRODUCTION

Lymphadenectomy (LN) is crucial for accurate staging in most gynecological malignancies [1]. Therefore, surgical management regarding lymphadenectomy worldwide is very heterogeneous. Systemic pelvic and para-aortic lymphadenectomy does not improve overall or progression-free survival in patients with advanced ovarian cancer with both intra-abdominal resection and clinically negative LN [1].

In endometrial cancer, lymphadenectomy is considered to be a staging component that does not improve prognosis but is only used for proper adjustment of adjuvant therapy [2]. However, these radical surgeries can also lead to certain

complications. Prolonged surgical duration and the associated vascular and nerve injuries can significantly increase the morbidity risk of patients [3].

Obturator nerve (ON) injury is one of these rare complications. It usually occurs during lymphadenectomy or during excessive retroperitoneal obturator fossa manipulations [4]. In addition, they are also observed in obturator hernia or endometriosis surgeries, bilateral oophorectomy and aorto-femoral bypass surgeries [3]. Furthermore, ON injury reportedly occurs more frequently during radical prostatectomy [5]. During pelvic surgery, obturator nerve damage can be seen in gynecologic oncologic procedures

Corresponding author:

Yunus Emre Topdaği

Sanko University School of Medicine, İncilipınar Mah. Ali Fuat Cebesoy Bulvarı No:45 Özel Sani Konukoğlu Hastanesi Kadın Hastalıkları ve Doğum Polikliniği, 27090 Gaziantep, Turkey

e-mail: emr-topdagi@hotmail.com

with wide pelvic side wall dissection. Nerve injuries may occur as a result of compression, shearing and stretching [6]. When noticed, such injuries can be repaired with early surgery via end-to-end anastomosis. Through proper nerve repair, patients can continue their daily lives without any loss of function.

MATERIAL AND METHODS

Patients who underwent lymphadenectomy at our clinic for ovarian and endometrial cancers between 2012 and 2018 were included in our study. Patient records were retrospectively examined, and it was confirmed that all the patients underwent pre-operative tests for complete blood count, hepatitis markers, coagulation and tumour markers in addition to other biochemical investigations. All patients underwent electrocardiography, posterior–anterior chest X-ray and pre-operative evaluation by the anaesthesia clinic. All patients were admitted to the ward two days pre-operatively and the appropriate surgical procedure for each patient was determined based on the pre-operative examinations. Abdominal and laparoscopic methods were found to be preferred by the patients. Nine patients underwent iatrogenic ON incisions during the surgery and the two nerve ends were completely separated. Four and five patients were operated for endometrial and ovarian cancers respectively. Electromyography (EMG) was performed during the follow-up period, and the records, which were examined by the neurology clinic, revealed that patients underwent two examinations during the follow-up period as short- and long-term examinations. The first examination was performed 1 month post-operatively, whereas the second examination included evaluation at 6 and 12 months post-operatively.

All analyses were performed using the IBM SPSS 20 statistical analysis software. Data were presented as mean, standard deviation, median, minimum, maximum, percentage and number. The Shapiro–Wilk test was used to analyse the normal distribution of continuous variables. The independent samples t-test and the Mann–Whitney U-test were used compare two independent groups with normally and non-normally distributed variables, respectively. The 2×2 comparisons between categorical variables were made using the Pearson's chi-square test if the expected value was > 5 ; the Yates chi-square test if the expected value was between 3 and 5 and the Fisher's exact test if the expected value was < 3 . P values < 0.05 were considered to be statistically significant.

RESULTS

A total of 287 patients underwent lymphadenectomy at our clinic between 2012 and 2018 due to malignancy. Surgery reports revealed that nine patients had complete ON incisions during surgery. Of these nine patients, four were

Table 1. The demographic and clinical characteristics of the patients

Variables	Pathological Diagnosis		P
	Endometrial Ca (n = 4)	Ovarian Ca (n = 5)	
Age [years]	55.25 ± 3.10	65.60 ± 9.91	0.142
BMI [kg/m ²]	27.62 ± 6.57	25.07 ± 0.86	0.106
Parity	2.95 ± 2.3	3.04 ± 1.1	0.128
Diabetes mellitus	2 (0.18)	1 (0.50)	0.143
Hypertension	4 (0.32)	3 (0.43)	0.128
Neurological abnormalities	0 (0)	0 (0)	—
Smoking	1 (0.04)	1 (0.04)	0.317
Menopause age	55 (0.43)	54 (0.43)	0.215
Previous surgery	1 (0.42)	2 (0.61)	0.143
Previous caesarean	1 (0.23)	2 (0.07)	0.106

operated for endometrial cancer, and five for ovarian cancer. Table 1 shows the comparison of the demographic and clinical characteristics of the patients. Two of the patients who were operated for endometrial cancer were treated through laparoscopic approach, whereas the other two were treated with abdominal approach. The abdominal approach was used in all patients who were operated for ovarian cancer. Four of the patients underwent ON incision using a harmonic scalpel, and five underwent dissection with scissors. Nerve damage was found to be complete, and no resection of nerve endings was performed in any patient. Nine patients underwent end-to-end anastomosis using 6/0 Prolene sutures. Anastomosis could not be performed in one patient as the patient's nerve endings could not be found. This patient was excluded from the study because the repair could not be performed. With respect to the short- and long-term neurological and EMG examinations, no significant difference was found between the use of harmonic scalpels and scissors to make ON incisions. Six patients had a right ON incision, whereas three a left one. We found no statistically significant difference in terms type of surgery, device used and surgical position between the groups ($p > 0.05$) (Tab. 2). The percentage of the injury during lymphadenectomy in our cohort was 3.4%.

In the nine patients who underwent ON repair, the sensory–motor examinations conducted 1 month post-operatively were normal for both lower extremities. Nerve conduction studies were normal in the EMG examinations, whereas sparse acute denervation potentials and regeneration motor unit potentials were monitored 1 month post-operatively in ON-innervated muscles via needle EMG examination. In the long-term follow-up of the patients (at 6 months post-operatively for four patients, at 8 months post-operatively for one patient and at 12 months post-operatively for four patients),

Table 2. Comparison of the type of surgery, device used and surgical position between the different types of pathological diagnosis

		Pathological diagnosis				p
		ENDOMETRIAL CA		OVARIAN CA		
		Count	Column N %	Count	Column N %	
Type of surgery	Laparotomy	2	50.00	5	100.00	0.167
	Laparoscopy	2	50.00	0	0.00	
Device used	Harmonic scalpel	2	50.00	2	40.00	1.000
	Scissors	2	50.00	3	60.00	
Surgical position	Trendelenburg	2	50.00	0	0.00	0.167
	Lithotomy	2	50.00	5	100.00	

Table 3. Characteristics of the cases

Cases	Age	Pathological diagnosis	Surgery type	Device used	Surgical Position	Surgery duration	Post-operative Sensory–motor examination (month 1)	EMG Findings (Post-operative month 1)	Long-term sensory–motor and EMG findings
1	51	End CA	Laparoscopy	Harmonic scalpel	Trendelenburg	3 h	Normal	*	Normal
2	55	End CA	Laparoscopy	Harmonic scalpel	Trendelenburg	2 h 50 min	Normal	*	Normal
3	58	End CA	Abdominal	Scissors	Lithotomy	2 h 30 min	Normal	*	Normal
4	57	End CA	Abdominal	Scissors	Lithotomy	4 h 20 min	Normal	*	Normal
5	65	Ovarian CA	Abdominal	Harmonic scalpel	Lithotomy	6 h	Normal	*	Normal
6	72	Ovarian CA	Abdominal	Harmonic scalpel	Lithotomy	3 h 50 min	Normal	*	Normal
7	68	Ovarian CA	Abdominal	Scissors	Lithotomy	8 h 30 min	Normal	*	Normal
8	74	Ovarian CA	Abdominal	Scissors	Lithotomy	3 h 30 min	Normal	*	Normal
9	49	Ovarian CA	Abdominal	Scissors	Lithotomy	3 h 20 min	Normal	*	Normal

*Sparse acute denervation potentials and regeneration mup; CA — cancer

the lower extremity sensory–motor examinations and EMG examinations were found to be normal (Tab. 3).

In one patient who could not undergo ON repair, examinations conducted 1 and 6 months post-operatively showed restriction in the flexion and adduction of the right thigh, and sensory deficits in the medial of the thigh. In the EMG examination conducted 1 month post-operatively, intense and acute denervation potentials were observed in the ON-innervated muscles on the right side, whereas EMG examinations conducted 1 and 6 months post-operatively did not reveal any voluntary muscle activity. EMG examinations were consistent with complete ON damage on the right side.

DISCUSSION

Pelvic lymph node evaluation is extremely important in the management of gynaecologic malignancies [4]. However, certain undesirable conditions may arise during dissection. A rare example of these conditions is ON injury. ON originates from lumbar 2–4 spinal nerves and innervates the adductor muscles [7]. After originating from the lumbar plexus, it descends downwards by passing from the posterior surface of the psoas muscle to its medial end, and then

exits the pelvis from the obturator canal [8]. It is divided into the anterior and posterior branches. The anterior branch innervates the inner thigh skin [9], and complete, incomplete or heat-related injury of this nerve can lead to numbness and pain in the thigh and can cause weakness in the adduction of the thigh possibly resulting in gait disorders [3].

In the event that an urgent repair becomes necessary during surgery, the nerve usually recovers without problems. Case presentations in the literature report that following urgent repair during surgery, the patients showed no motor deficits or loss of sensation when examined 6 months post-operatively [3]. In our case series, the ON incisions of nine patients were urgently repaired during surgery, and no deficit was identified in neurological examinations and long-term EMG evaluations. However, ON repair could not be performed in one of the patients because the ON ends could not be found. This developed a restriction of adduction and a loss of sensation in the innervated thigh area. The patient's EMG examination was consistent with ON injury. In our study the percentage of the injury during lymphadenectomy was 3.4%. In a similar study, this rate was given as 2.4% [10].

The severity of symptoms is associated with the extent of ON damage. Grafts can be used in nerve incisions where end-to-end anastomosis is not possible. Ghaemmaghami et al. [11] reported the case of a patient in whom a graft was used successfully in ON injury that occurred during radical hysterectomy and bilateral pelvic lymphadenectomy and reported that there was no neurological or functional loss observed 6 months post-operatively. However, although there was full incision along with thermal damage in our case series, no grafts were used, and successful repair was achieved with end-to-end anastomosis without nerve stretching. In one patient, nerve endings could not be found and repair could not be performed.

Most ON injuries occur as a result of pelvic procedures. It has been reported that most patients are kept in the lithotomy position for a long time [12]. In our case series, seven patients were operated while they were in the lithotomy position, whereas two were operated while they were in the Trendelenburg position. However, a review of the literature shows that surgical intervention in the lithotomy position for extended periods of time increases nerve damage risk [13].

To minimise complications during pelvic lymphadenectomy, it is necessary to have knowledge of anatomically important localisations, and to bear in mind that there can be variations. Studies have shown that anterior and posterior separation of the ON is intrapelvic in 23.22% of the cases, inside the thigh in 25% of the cases and in the obturator channel in 51.78% of the cases [14]. This shows that the nerve may show variation as it travels through the obturator canal. In our study, all of the patients had nerve incision in the obturator fossa.

Noticing an ON injury during surgery and its subsequent rapid repair is very important for post-operative recovery. Timely detection of the nerve damage ensures rapid repair and prevents long-term permanent damage. Song et al. [15] have successfully performed laparoscopic repair of nerve damage in a patient with cervical cancer using an electrosurgical instrument. An electrosurgical instrument was used in five of the patients in our patient group and rapid repair was performed during surgery with no pathological findings being observed 1 and 6 months post-operatively. However, Gocmen et al. [3] reported that the total recovery period of incomplete ON injury was approximately one year. It is very important to protect the nerves in laparoscopic interventions requiring precise dissection and to safely provide haemostasis without damaging the surrounding tissues [16]. Owing to the advances in technology, it is now possible to use laparoscopic instruments relying on energy to perform lymphadenectomy and simultaneously ensure haemostasis [17]. The increase in heat generated in the lateral tissues by this energy can cause thermal damage to the surrounding tissue, as a prolonged surgical dura-

tion increases the temperature ultimately causing greater damage. Although new laparoscopic instruments utilising ultrasonic energy are considered to be safer and more reliable than monopolar cautery systems, reliable information on their effects is limited. There are studies in the literature showing that the thermal damage to tissues by ultrasonic scissors is safe [18]. Emam and Cuschieri [19] demonstrated that dissection using ultrasonic energy is effective and safe, but also reported that activation periods of over 10 seconds could increase lateralised thermal damage. It was observed in our study that, in cases with nerve damage, incisions performed using ultrasonic energy or with the aid of scissors both resulted in negligible lateral tissue damage. There was no requirement of grafts in both groups, and nerve ends were repaired without stretching. There was no significant difference between short- and long-term neurological and EMG examinations. Although the number of cases in our series was less, it is considered that energy-activated ultrasonic scissors can be used safely, even in complications such as ON incision.

CONCLUSIONS

Noticing complications during surgeries and rapidly and completely managing them is one of the fundamental principles of surgery. In our case series, we discussed the management of nerve damage that may occur during lymphadenectomy, a surgical procedure with a high complication rate. Based on our findings, we conclude that this micro-surgical procedure, which was performed by experienced hands to remedy a situation noticed during surgery, yielded rather satisfactory long-term results.

Statement of ethics

Research involving human participants and/or animals; All procedures performed in these studies that involved human participants were conducted in accordance with the ethical standards of our institutional ethics review committee and adhered to the 1964 Helsinki declaration and its later amendments or comparable ethical standards. This study was approved by our institutional ethics review board. Informed consent; All patients were notified about the use of their deidentified medical data in our retrospective analysis.

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