

Do Turkish gynecologists have sufficient knowledge on the basic principles of electrosurgery?

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Abstract

Aim: The aim of the current study was to evaluate the level of the basic knowledge of the Turkish gynecologists regarding electrosurgery.

Materials and Methods: A survey was undertaken to evaluate the level of basic knowledge and attitudes regarding electrosurgery use among gynecology specialists and residents. The questionnaire used comprised of two parts: a) questions evaluating the participants' professional experience, whether they had received formal electrosurgery training, and their course of action concerning the use and safety precautions of the electrosurgery unit, and b) questions designed to evaluate the knowledge level of the participants on the basic electrosurgical principles.

Results: One hundred seventy-three gynecologists were included in the study and their mean knowledge score was 49.1 %. No difference was detected between the mean scores of specialists and residents. The mean score of participants who had read articles/papers on electrosurgery was significantly higher compared with uninformed participants ($p=0.001$). The mean score of participants who had previously attended electrosurgery training seminars was significantly higher compared with participants who had not attended seminars ($p=0.013$).

Conclusion: Gynecologists in Turkey do not have sufficient basic knowledge regarding the reliable and efficient use of electrosurgery. HIPPOKRATIA 2017, 21(1): 8-12.

Keywords: Electrosurgery, knowledge, Turkish, gynecologist, training, questionnaire

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Introduction

The healing effect of heat applied on tissues has been known for centuries. Egyptians treated tumors using cauterization in 3000 B.C. Bovie developed the modern electrosurgery unit in 1920, and Cushing was the first to use it in the operating room in 1926¹. The electrosurgery unit enabled cutting or coagulation in the human body using high-frequency alternating current. This incredible invention, which is currently used worldwide, is a fundamental and irreplaceable device of the operating room.

All surgical specialties have benefited from the positive effects of this useful device regarding duration of the surgical procedures, reduction of blood loss, and surgical technique; however, the current generated by the electrosurgery unit may also cause undesirable adverse effects on patients if not applied appropriately. Therefore, efficient and safe use of electrosurgery is crucial. Surgeons must be well-informed about its basic principles to achieve this goal.

The present questionnaire study was designed to evaluate the level of basic knowledge and attitudes regarding electrosurgery use among gynecology specialists and residents.

Material and Methods

The questionnaire used comprised of two parts; the first part (questions 1 to 10) evaluated the participants' professional experience, whether they had received formal education regarding electrosurgery, and their course of action concerning the use and safety precautions of the electrosurgery unit (Table 1). The second part (questions 11 to 20) (Table 2) was designed to evaluate the knowledge level of the participants on the basic electrosurgical principles, including the electrical circuit (questions 12, 18), forms of current (questions 15, 20), return electrode (question 13), effects on tissue (questions 16, 17), surgical hazards (questions 11, 19), and the mode of its application during the gynecology procedure (question 14). This purpose-designed electrosurgery questionnaire initially consisted of 15 questions. A statistician, who is expert on questionnaire construction, checked it for confusing and misleading questions. Subsequently a pilot study was conducted, involving 43 obstetrics and gynecology residents at the Kanuni Sultan Suleyman Training and Research Hospital. Principal components analysis were used to identify the underlying components. The internal consistency of questions was checked by using

Table 1: Questions 1 to 10 of the questionnaire used to evaluate the level of the basic knowledge of the Turkish gynecologists regarding electrosurgery; these questions evaluated their professional experience, whether they had electrosurgery training, and their practice with electrosurgery.

Question	Answer	n	%
1. Have you ever read any article or paper on electrosurgery?	Yes	96	55.5 %
	No	77	44.5 %
2. Have you ever participated in any training seminar on electrosurgery?	Yes	52	30.1 %
	No	121	69.9 %
3. Do you know the difference between electrocautery and electrosurgery?	Yes	92	53.2 %
	No	81	46.8 %
4. What is your professional title?	0-1 year experienced resident	1	0.6 %
	1-2 year experienced resident	1	0.6 %
	2-3 year experienced resident	3	1.7 %
	3-4 year experienced resident	13	7.5 %
	Specialist, Asst. Prof, Assoc. Prof., Professor	155	89.6 %
5. Do you check the region of the return electrode (cautery plaque) placed before the surgery?	Yes	159	91.9 %
	No	14	8.1 %
6. Could you exactly describe the difference between monopolar surgery and bipolar surgery?	Yes	154	89.0 %
	No	19	11.0 %
7. You noticed a subcutaneous bleeding vein and held it using forceps. Which button would you press?	Yellow button	11	6.4 %
	Blue button	162	93.6 %
8. Do you know what return electrode monitoring (REM) is?	Yes	71	41.0 %
	No	102	59.0 %
9. Do you know what desiccation means?	Yes	80	46.2 %
	No	93	53.8 %
10. Do you know the set up and features of the electrosurgery unit (generator) in the operating room?	Yes	96	55.5 %
	No	77	44.5 %

n: number of answers, %: percentage of each answer.

Table 2: Questions 11 to 20 of the questionnaire used to evaluate the level of the basic knowledge of the Turkish gynecologists regarding electrosurgery; these questions evaluated their knowledge on the basic electrosurgical principles.

Question	Answer	n	%
11. The electrode cable constantly tangles in your hand during surgery. What would you do?	I would proceed with surgery and will not do anything.	55	32.0%
	I would fix the cable using a clamp as shown on above illustration	117	68.0%
12. Return electrodes provide the earth for the electric current.	True	139	81.8%
	False	31	18.2%
13. Which is the most appropriate place for return electrodes during gynecologic surgeries?	Wrist	2	1.2%
	Under shoulder	11	6.4%
	Hip	69	40.4%
	Ankle	20	11.7%
	Thigh	69	40.4%
14. When should the yellow button be pressed to obtain a cutting effect?	Before touching the tissue	104	61.2%
	After touching the tissue	66	38.8%
15. Which wave form is used in bipolar surgery?	Continuous-nonmodulated wave	58	34.9%
	Interrupted-modulated wave	108	65.1%
16. Which of the tissues is more resistant against the electric current?	Fatty tissue	91	53.5%
	Muscle tissue	79	46.5%
17. Dessicated tissue looks black.	True	95	60.5%
	False	62	39.5%
18. Electric current returns to the generator through the return electrode in bipolar surgery.	True	58	35.2%
	False	107	64.8%
19. Which modality should be used in patients with a pacemaker?	Monopolar	17	10.4%
	Bipolar	147	89.6%
20. High-voltage interrupted waveform is used in fulguration.	True	122	76.3%
	False	38	23.8%

n: number of answers, %: percentage of each answer.

Cronbach's Alpha test. From the test of this pilot study, we developed a revised and simplified 10-question final version of the electrosurgery questionnaire, for use in the current study. All questions were based on the text of the 'Principles of electrosurgery' booklet by Valleylab². Each

question had one correct answer and weighed equally (% score: total number of correct answers/10 × 100). These final questions were answered by five physicians who are experts in minimally invasive surgery, after been informed about electrosurgery, and their mean score was

calculated as 78 %.

Local ethics board approval was granted for this study (Istanbul Medipol University, No: 10840098-604.01.01-E.4628, date: 14/12/2015). Specialists and residents in gynecology were invited to participate in the study by sending requests via e-mail or social media. We aimed to increase the number of participants by repeating the requests at periodic intervals. Responders who were willing to participate were automatically forwarded to the online questionnaire website (www.surveey.com). They confirmed their participation by clicking the 'accept' button on the confirmation page. This web page avoids repeated participation by identifying the Internet Protocol (IP) addresses and using cookies. The study was conducted from July 2016 to January 2017. Completing the first part of the questionnaire was mandatory and the second part was optional. Terminology frequently used by physicians was specified in brackets in the questionnaire, in addition, to the official terminology so as to avoid misunderstandings (e.g., return electrode, cautery pad). The sample size needed was calculated, with a level of 99 % confidence interval and 10 % margin of error, at 163 participants that could soundly represent the whole population of gynecologists in Turkey, which is approximately 7,000 physicians.

The categorical variables are presented as absolute numbers and percentages. Testing of normal distribution was performed using the Kolmogorov-Smirnov test when the numeric variables provided the condition $n > 50$. The independent samples t-test was used for the comparison of the independent groups with a normal distribution and provided the condition $n > 30$. Pearson's Chi-square test was used on 2×2 tables, and Fisher-Freeman-Halton test was used in $R \times C$ tables for the comparison of the difference between the categorical variables. Statistical analyses were performed using R 3.3.2v (free software for statistical computing, <https://www.r-project.org>), and p-value of significance was regarded as < 0.05 .

Results

A total of 173 physicians participated in the study and completed the questionnaire. One hundred seventy-two physicians participated in the second part which evaluated their knowledge on the basic electrosurgical principles. Table 1 shows that 55.5 % of participants had previously read an article/paper regarding electrosurgery. The questions about past participation in formal electrosurgery training revealed that 30.1 % of participants had attended electrosurgery training; 53.2 % of the physicians responded positively when questioned whether they knew the difference between electrocautery and electrosurgery. Regarding participants' education levels, 89.6 % were specialists, assistant professor/associate professor/professor, and the remainder was residents. Some 91.9 % of physicians responded that they checked the region of the return electrode on the body before surgery. Eighty-nine percent of participants responded affirmatively that they could correctly describe the difference between mo-

nopolar surgery and bipolar surgery. It was reported by 93.6 % that they pressed the blue button, and 6.4 % that pressed the yellow button when they noticed a subcutaneous bleeding vein and held it with forceps; while 41 % responded positively that they knew the return electrode monitorization system (REM). Participants reported in 46.2 % that they understood desiccation, and 55.5 % asserted that they knew the set up and features of the electrosurgery unit in the operating room.

In the second part of the questionnaire (questions 11 to 20) shown in Table 2, the participants were asked what they would do when the electrode cable constantly became tangled on their hand, and 68 % responded that they would wrap the cable on a metal clamp, which is an incorrect practice. Some 81.8 % of the participants responded that electric current would be earthed through the return pads, which is an incorrect answer. The physicians were asked the most appropriate place for return electrodes in gynecologic surgeries, and 40.4 % responded the 'thigh', which is the correct answer. In the question regarding the right time to press the yellow button to obtain a cutting effect, 61.2 % correctly responded 'before contact with tissue'. In questioning the correct waveform used in bipolar surgery, 34.9 % responded correctly, 'continuous-non-modulated wave'. In a multiple choice question, the most resistant tissue against the electric current was investigated, and 53.5 % gave the correct answer, being the 'fatty tissue'. More than half (60.5 %) of the participants incorrectly responded that tissue exposed to desiccation would appear black, and 35.2 % of participants falsely thought that the electric current returned to the generator through the return electrode in bipolar surgery. Bipolar surgery was correctly identified as the preferred modality for patients with a pacemaker by 89.6 % of the participants, and 76.3 % of participants correctly agreed that high-voltage interrupted waveform was used in fulguration. The percentage of correct answers is shown in Figure 1.

The mean score of 172 participants was 49.1 %. A significant difference was detected between the mean total scores of participants who had read articles/papers about electrosurgery compared with uninformed participants ($p = 0.001$). A significant difference was also detected between the mean total scores of participants who had participated in training on electrosurgery compared with nonparticipants ($p = 0.013$). No statistically significant difference was detected in the mean scores of the second part of the questionnaire between participants with regards to their professional titles (Table 3).

Discussion

The present study shows that the majority of gynecologists in Turkey do not have sufficient knowledge about the basic principles and safe use of electrosurgery. The mean score of the 172 participants in the second part which evaluated their knowledge on the basic electrosurgical principles was only 49.1 %. This value is significantly lower than the mean score of 78 % of experts in minimally invasive surgery who answered these ques-

Figure 1: Correct answer rates for each question of the second part of the questionnaire that evaluated the knowledge level of the participants on the basic electrosurgical principles.

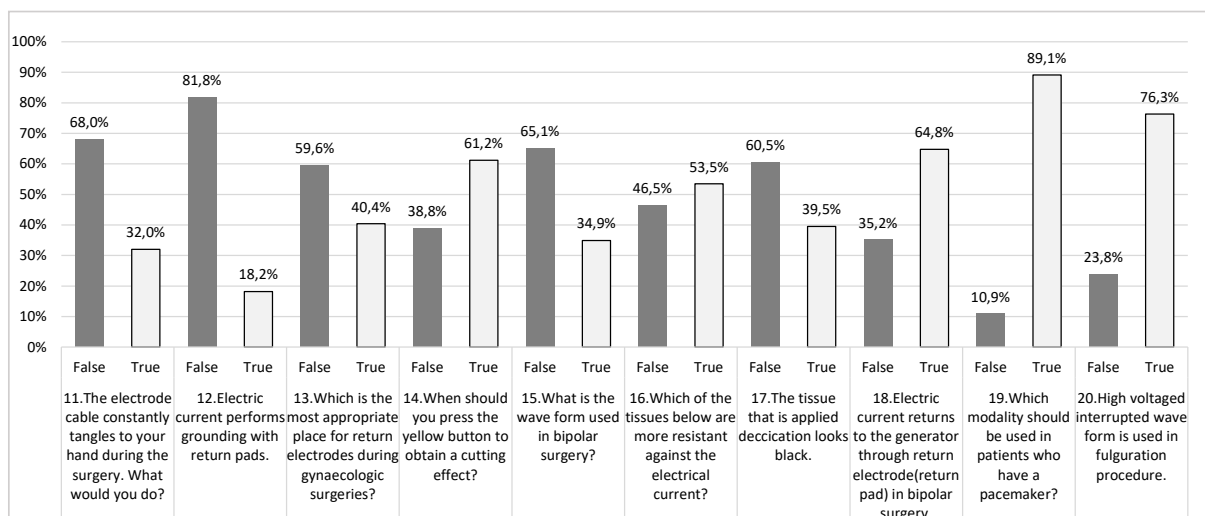


Table 3: Comparison of participants’ mean scores according to their answers regarding having previously read about electrosurgery, been trained on electrosurgery, and with regards to their professional titles.

		n	Mean	SD	p
1. Have you ever read any article or paper on electrosurgery?	Yes	96	54.27	17.15	0.001*
	No	77	42.21	19.78	
2. Have you ever participated in any training seminar on electrosurgery?	Yes	52	54.42	18.51	0.013*
	No	121	46.53	19.18	
3. What is your professional title?	Resident	18	46.11	20.90	0.518
	Specialist	155	49.23	19.12	

n: number of answers, SD: standard deviation, *: statistical significance.

tions in the preliminary validation process.

Although electrosurgery is the first technology introduced to gynecologists in the early years of their professional lives, it is not given the importance it deserves. The greater part of the training during residency is practiced through observation of the more experienced residents or specialists. Too few electrosurgery seminars are held in education clinics. In fact, only 30.1 % of the participants stated that they had previously attended a training seminar, and 55.5 % had read a relevant article or paper (Table 1).

Inadequacies of the knowledge of electrosurgery begin with the terminology; 46.8 % of participants stated that they did not know the difference between electrocauterization and electrosurgery (Table 1). Coagulation procedures are commonly and incorrectly referred to as ‘cauterization’ in Turkey. Cauterization is the procedure in which an object is heated and then applied to the tissue while in electrocauterization, an electric current heats the metal which is then applied to the tissue. However, in electrosurgery, an electric current accumulates a heating effect while passing through the tissues. An active electrode may incorrectly be described as a ‘cauterization pen’, and the return electrode may be described as a ‘cautery pad’.

In monopolar electrosurgery, the current passes

through the patient as it completes the circuit from the active electrode to the return electrode. The function of the return electrode is to unload the current from the patient, safely³. The electrosurgical units commonly used in operating rooms today are ‘isolated’ denoting that the circuit is not completed by the ground, but within the generator^{2,4}. Some 81.8 % of the participants responded that electric current would be earthed through the return electrodes, which was the most incorrectly answered question of the test (Table 2).

The most appropriate region for placing the return electrode is the nearest flat region to the surgical area where the muscle mass is intense⁵. The thigh is close to the pelvic region, has a high muscle intensity, and the area is flat. Return electrodes applied to this region are not exposed to fluids that leak due to gravity from the surgical field; therefore, the thigh is the preferred region in gynecologic and obstetric surgeries. Most (91.9 %) participants responded that they would check the place of the return electrode before surgery (Table 1); however, only 40.4 % replied correctly about the most appropriate place for the return electrode placement in gynecologic surgeries (Table 2).

REMs have been developed to prevent pad site burns due to inadequate contact of the return electrodes. These systems deactivate the generator by identifying changes

in the amplitude of the impedance of the return electrodes². Although most of the electrosurgical units contain REM systems today, only 41 % of the participants were aware of this useful technology (Table 1).

In bipolar electrosurgery, the active and return electrodes are located within the same instrument tip, only the tissue grasped in the forceps is included in the electrical circuit⁶⁻⁷. For this reason, a patient return electrode is not necessary for bipolar electrosurgery⁸. However, 35.2 % of participants falsely thought that the electric current returned to the generator through the return electrode (Table 2).

Participants thought that the yellow button was used for cutting, and the blue button was used for coagulation because it reads as ‘cut’ on the yellow button of the active electrode and ‘coag’ on blue button. However, the yellow and blue buttons only specify the forms of current. There is low-voltage continuous current on the yellow button, and high-voltage interrupted current on the blue button. Coagulation and cutting can be performed with either button. The majority (93.6 %) of participants preferred to press the blue ‘coag’ button after holding a bleeding vein with forceps (Table 1). Also, the same procedure could be performed using a lower voltage with the yellow button⁹. Low-voltage use is particularly important in minimally invasive surgery.

Studies conducted in other countries reported similar results about the knowledge of electrosurgery among gynecologists and other surgical specialties¹⁰⁻¹⁶. One of the striking results of the current study was that no significant difference was detected between the mean scores of residents and specialists (Table 3). However, the mean scores of the participants who attended electrosurgery training and those who had read articles/papers on electrosurgery were significantly higher (Table 3). These results reveal that formal training is a more critical factor than career stage/experience on baseline knowledge of electrosurgery.

In conclusion, the knowledge level of gynecologists in Turkey was evaluated regarding the basic principles of electrosurgery for the first time, and the results indicated that they had insufficient knowledge. Lack of knowledge may negatively affect patient safety and quality of health services and may cause medicolegal problems for the physicians. Therefore, the inclusion of formal electrosurgery training in the residency education programs, and discussion of electrosurgery at scientific meetings is crucial.

Conflict of interest

The author declares no conflict of interest.

Acknowledgment

This study was presented as an oral presentation in the ESGO endorsed Gynecological Oncology Meeting at Baskent University, Adana on 01/04/2017.

References

- O'Connor JL, Bloom DA, William T. Bovie and electrosurgery. *Surgery*. 1996; 119: 390-396.
- Principles of electrosurgery. Covidien Energy-based Professional Education. 2008. Available at: https://www.asit.org/assets/documents/Principals_in_electrosurgery.pdf, last accessed: 24/02/2017.
- Cordero I. Electrosurgical units - how they work and how to use them safely. *Community Eye Health*. 2015; 28: 15-18.
- Bisinotto FMB, Dezena RA, Martins LB, Galvão MC, Sobrinho JM, Calçado MS. [Burns related to electrosurgery - Report of two cases]. *Rev Bras Anesthesiol*. 2017; 67: 527-534.
- Ayroza P, Abdalla E. Use of electricity in laparoscopy. Mençaglia L, Minelli L, Wattiez A (eds). *Manual of gynecological laparoscopic surgery*. 2nd edition. Endopress, Tuttingen, 2013, 44.
- Alkatout I, Schollmeyer T, Hawaldar NA, Sharma N, Mettler L. Principles and safety measures of electrosurgery in laparoscopy. *JLS*. 2012; 16: 130-139.
- Wang K, Advincula AP. “Current thoughts” in electrosurgery. *Int J Gynaecol Obstet*. 2007; 97: 245-250.
- Vilos GA, Rajakumar C. Electrosurgical generators and monopolar and bipolar electrosurgery. *J Minim Invasive Gynecol*. 2013; 20: 279-287.
- Jones DB, Brunt LM, Feldman LS, Mikami DJ, Robinson TN, Jones SB. Safe energy use in the operating room. *Curr Probl Surg*. 2015; 52: 447-468.
- Mayooran Z, Pearce S, Tsaltas J, Rombauts L, Brown TI, Lawrence AS, et al. Ignorance of electrosurgery among obstetricians and gynaecologists. *BJOG*. 2004; 111: 1413-1418.
- Feldman LS, Fuchshuber P, Jones DB, Mishna J, Schwartzberg SD; FUSE (Fundamental Use of Surgical Energy™) Task Force. Surgeons don't know what they don't know about the safe use of energy in surgery. *Surg Endosc*. 2012; 26: 2735-2739.
- Pandey U, Killick SR, Lindow SW. Obstetrics and gynecology trainees' knowledge of electrosurgical equipment. *J Obstet Gynaecol*. 2007; 27: 721-722.
- Hur HC, Green I, Modest AM, Milad M, Huang E, Ricciotti H. Needs assessment for electrosurgery training of residents and faculty in obstetrics and gynecology. *JLS*. 2014; 18: e2014.00293
- McQuail PM, McCartney BS, Baker JF, Kenny P. Diathermy awareness among surgeons-An analysis in Ireland. *Ann Med Surg (Lond)*. 2016; 12: 54-59.
- Modaffari P, Panuccio E, Zimmiti G, Padilla Mozo L, Cordeiro Vidal G, Rabischong B, et al. Are gynecologists sufficiently trained and educated on electro surgery and basic laparoscopic setting? *Surg Endosc*. 2016; 30: 3327-3333.
- Watanabe Y, Kurashima Y, Madani A, Feldman LS, Ishida M, Oshita A, et al. Surgeons have knowledge gaps in the safe use of energy devices: a multicenter cross-sectional study. *Surg Endosc*. 2016; 30: 588-592.