

## Surgical Approach with High Frequency Radio Wave Electrosurgery for Excision Procedures in Gynecology

Dzotsenidze Stella<sup>1\*</sup>, Zurmukhtashvili Marika<sup>2</sup> and Kristesashvili Jenaro<sup>1</sup>

<sup>1</sup>Department of Obstetrics, gynaecology and reproductology, Ivane Javakhishvili Tbilisi State University, Georgia

<sup>2</sup>Scientific-Research Institute of Medicine, Ilia State University, Georgia

**\*Corresponding Author:** Dzotsenidze Stella, Department of Obstetrics, gynaecology and reproductology, Ivane Javakhishvili Tbilisi State University, Georgia.

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### Abstract

**Introduction:** There are several approaches to management of patients with low-grade abnormal smear results and different benign gynecologic disorders. Surgery with cold-knife, laser or cryodestruction have been described to remove these lesions. However, these surgical procedures have certain disadvantages. Radiofrequency has been used for a long time in surgery and different studies demonstrated the benefits of this method.

**Method:** The effectiveness of loop excision procedure using high frequency radiosurgery has been evaluated in this prospective, non-comparative case series analysis. 92 female patients underwent radiosurgery using Ellman Surgitron device in 2016 - 2018 years on outpatient care in single visit. Excision procedure was done with different loops using rectified waves for simultaneous cut and coagulation (50%/50%). For coagulation ball electrodes and partially rectified waves (90% coagulation) were used. Duration of procedure, resection margin status, intraoperative and postoperative complications, postoperative pain and recurrence of disease have been assessed.

**Results:** Only 2 specimens (2.17%) obtained after radiosurgery were insufficient for histologic evaluation. Clear resection margins were observed in 86 cases (93.47%). Duration of operation was in mean 12.4 minutes. No complication such as intraoperative bleeding has occurred during the LEEP procedure. Smooth post-operative recovery period was observed.

**Discussion:** Our case analysis demonstrated thin thermal damage zone in cervical tissues as well as in the specimen and they were sufficient for histology evaluation and proper diagnose. No evidence of intraoperative complication and only one case (1.087%) of postoperative hemorrhage, minimal quantity of postoperative analgesics used indicate the smooth postoperative period and rapid healing. Procedure can be performed on an outpatient basis, in a single visit.

Radiosurgery in patients with different gynecological pathologies makes the surgery procedure more simple and time- and cost-saving.

**Keywords:** Gynecology Lesions; High Frequency Radiosurgery; Loop Excision

### Abbreviations

CIN: Cervical Intraepithelial Neoplasia; LEEP: Loop Electrosurgical Excision Procedure

### Introduction

The Cervical intraepithelial abnormalities and different gynecologic lesions such as vaginal and vulvar condyloma and papillomatous diseases of vulva most frequently undergo surgical procedures on outpatient basis [1]. Cervical intraepithelial neoplasia (CIN) of different grades has been traditionally defined as a continuum of intraepithelial squamous abnormalities with nuclear atypia in all epithelial

layers. If not removed these lesions can possess some potential for progression to invasive carcinoma [2]. There are different approaches to management of patients with low-grade abnormal smear results [3,4]. Surgery with “cold-knife”, laser or cryodestruction have been described to remove these lesions. However, these surgical procedures have certain disadvantages, including prolonged operating time, bleeding, postoperative pain and discomfort, and suture-related complications. Furthermore, these destructive methods cause deep thermal damage to tissues and it is difficult to obtain specimens sufficient for histologic evaluation.

Radiofrequency has been used for a long time in oral, ophthalmic, plastic, and gynecologic surgery. Different studies demonstrated that radio-wave technology enables good surgical control and safety during procedure, high-frequency radio waves minimize heat dissipation and thus cellular alteration [5-8,12].

In our clinical study we evaluated the efficiency of a new simple surgical approach in gynecologic surgery with the use of high-frequency radio-waves.

### Materials and Methods

#### Radiofrequency surgery principles

Radio wave surgery uses the frequency of 3.8 - 4.0 MHz. The operating principle of the special radiosurgery unit is as follows: it uses ordinary alternating current and converts it by means of rectifier to a direct current; It then passes through a coil, which generates radio waves [9]. The Ellman Surgitron (Ellman International, Oceanside, NY, USA) has 4 waveforms, which will be described below in the section of Patients and methods. According to the literature reviewed, pure cutting setting (90% cutting and 10% coagulation) produces less lateral thermal damage compared with incisions made with laser [10].

At a low frequency (less than 3 MHz) operated standard electrosurgery units provide electrical resistance on their active electrodes, which consequently generate heat and cause thermal damage of tissues. The mechanism of radio waves action on tissues is different and is based on phenomenon of intracellular volatilization: the impedance to the passage of radio waves through the tissues generates heat within the cells, heat boils water in the cells and generated steam increases the pressure inside the cell and the cell explodes [9]. During the use of high frequency radio wave unit like Sugitron, the tissue provides resistance, not the electrode tip. Heat generation does not occur and this fact is significant advantage for less lateral thermal damage. Hence, the higher the frequency, the less lateral tissue damage [11-14].

#### Patients and Methods

Our study was designed as prospective, non-comparative, interventional case series analysis. Patients were recruited over two years from outpatient service of Department of Gynecology Ltd Amtel Hospital First Clinical Hospital, Tbilisi, Georgia. After application of the exclusion criteria, the study was discussed with 92 female patients, with a mean age of 36 with a clinical diagnosis of cervical epithelial abnormalities (64 patients), Condyloma (5), Papilloma (21), Bartholin's Cyst (2). Females underwent surgery consecutively in years 2016 - 2018. The exclusion criteria included pregnancy and lactation, significant psychological problems, inability to comply with the study protocol, being aged below 18 years, other medical and/or surgical treatments influencing the study.

All patients underwent following preprocedural examinations: full medical and gynecological history, total blood cell count and Rh; Vaginal discharge bacteriological analysis; PAP-test, Blood tests for HIV, HBs-Ag, HCV-Ag; Tests for detection of STD. Simple or expanded colposcopy using 3% acetic acid and 3% Lugol's iodine staining was also performed in all patients. Interventions were planned in I phase of menstrual cycle (on 10-15<sup>th</sup> day). Surgery was performed in outpatient care basis. In 88 cases, procedure was carried out under local anesthesia using 2% Lidocaine with epinephrine 1:100 000. In 4 cases upon patients requests intravenous sedation was done. Surgery procedure was performed with high frequency radio wave electrosurgical unit Ellman Surgitron® (Ellman International Inc., Hewlett, New

York, USA) using filtered waves 3.8 - 4.0 MHz. Radiosurgery unit has 4 working modes: FILTER/CUT - filtered waves for pure cut (90% cut, 10% coagulation); CUT&COAG/RECTIFIED - rectified waves for simultaneous cut and coagulation (50%/50%); COAG/PART.RECTIFIED - partially rectified waves for hemostasis (90% coagulation), FULGURATE- high frequency alternating current. For excision, we used different loops and for coagulation, we used a ball electrode. Radiosurgery cut is done with light motions without pressure and therefore, causes minimal mechanical and thermal damage of tissues. Single cervical epithelial lesions were removed with different loops sized between 5 to 25 mm according to the size of lesion in CUT/COAG mode and power setting at 2 - 4 depending on size of excision zone and individual electro conductivity of patient's tissues. After excision, coagulation hemostasis was performed with ball electrode and working mode COAG/PART.RECTIFIED power setting 3 - 5. Finally, wound surface was coagulated with ball electrode in working mode CUT/COAG and COAG/PART.RECTIFIED with power setting 3 - 4.

Papilloma of vagina and vulva were removed with loop electrode in mode CUT/COAG power setting 2 - 4. If removal was not possible with one cut, the body mass was removed first with one cut and then the remaining margins were flattened out with light motions of electrode. Finally, the wound surface was coagulated with ball electrode in COAG/PART.RECTIFIED mode with power setting 2 - 4.

For postoperative pain, control patients were offered analgesic suppositories (50 mg Diclofenac Natrium) depending from the level of pain. The number of received analgesics was used to indirectly measure the severity of postoperative pain. Patients were examined postoperatively after one week and then were followed up with three-month intervals during next 2 years to check the evidence of recurrent disease.

After LEEP, we evaluated duration of procedure, resection margin status, intraoperative complications, postoperative complications (hemorrhage), severity of postoperative pain and recurrence of disease.

### Results and Discussion

90 specimens obtained by loop excision were suitable for histological evaluation. Only thin thermal damage zone was detected. Only 2 specimens (2.17%) were insufficient for histology. Clear resection margins were observed in 86 cases (93.47%). Mean Duration of operation was 12.4 minutes. Mean number of analgesic suppositories used by patients after LEEP procedure was 2.1.

No complications such as intraoperative bleeding has occurred during the LEEP procedure. Only one of total operated 92 patients had postoperative complication - posttreatment bleeding during 2 postoperative days.

Two years' follow-up showed no evidence of recurrent disease for CIN 1, two cases of residual disease for CIN2, and two cases of recurrent disease of condyloma.

Optimization of treatment methods of patients with cervical epithelial lesions is determined by results of clinical and morphological examination. Final diagnose of cervical lesions is made after histological examination. The main goal of this examination method is to justify or specify the diagnose made with colposcopy and cytology. Preciseness of histology is greatly depending on the quality and quantity of morphology specimen and the use of right technique to obtain the material. During diathermosurgical excision, material is exposed to thermal damage, the structure of tissues is changed and informativity of histologic evaluation decreases. Conchotome also changes the structure of tissues, makes their consecutive expertise more difficult. The most widely used method to obtain the specimens for histology is cold-knife biopsy, but this method also has significant side effects such as intraoperative bleeding and dissemination of process in cases of cervical cancer [14,17].

Olivar, *et al.* compared degree of tissue damage produced by the microelectrocautery, the CO<sub>2</sub>, the KTP-532, the Nd-YAG lasers and the radiofrequency surgical instrument, utilizing different power densities in human oviducts. Transmission electron microscopy sections at the cellular level showed that the electrosurgical radiofrequency surgical instrument produces the least damage to surrounding healthy tissue. The CO<sub>2</sub> laser with intermittent super-pulse mode showed the second lowest amount of damage. The most damage was observed

with the Nd-YAG laser at high power densities [19]. In previous studies it was also described that when cone biopsy specimens were obtained with the radiofrequency surgical unit at a pure cut setting, the resultant tissue margins lack of artifact and thermal damage was comparable to those of cone biopsies obtained by the cold knife [17].

In our study we used radio waves at a frequency of 3.8 - 4.0 MHz with Surgitron radiosurgery unit. This allows the low grade of lateral heat spread during the cutting procedure [15]. Consistent with the results of previous studies our case analysis demonstrated therefore thin thermal damage zone in cervical tissues as well as in the specimen. In 97.8% of specimens there were no deep thermal damage detectable and they were sufficient for histologic evaluation and proper diagnose.

In Georgia one of the main goals of recent reformation of healthcare system in the field of gynecology is to minimize the need of hospitalization and its duration. This can be possible by means of implementation of less invasive technologies in surgical practice. Georgian population's income level is lower middle, so affordable costs in healthcare is of great importance. According to the findings of our case series analysis, there is no need of general anesthesia for radiosurgical excision. Procedure can be performed on an outpatient basis, in a single visit. Duration of operation is well tolerated by patients. This Facts reduce number of visits to a single-visit and give opportunity to make cost-savings for patients. So, the findings of our study suggest, that radiosurgery as only single visit procedure, can be supposed to replace conventional biopsy method and consequent treatment in separate procedures.

As mentioned above in our case series analysis duration of operation was also well tolerated by patients. Some previous comparative studies report that the radiofrequency surgery groups show a decrease in the mean operative time when compared with the cold knife group [18,20]. According to Sammeh., *et al.* one of the reasons of tendency to a shorter operating time may be the longer hemostatic time needed to control bleeding in some cases in the cold knife group, whereas the radiosurgical probe had an excellent hemostatic effect [18].

In our study we observed the minimal bleeding during procedure, what supported good visibility for operating doctor. In our opinion good visibility of operating field can be considered as another reason for reduced procedure time. Minimal blood loss is also big benefit for patient and promotes overall healing conditions.

In number of studies is made comparative analysis of healing process after applying different treatment methods such as cold-knife, laser and radio wave excision procedures. Their results demonstrated benefits of radiosurgery [10,11,15,16]. In contrast with the results of these studies Mathevet., *et al.* showed that during postoperative follow-up, the number of complications was the same in the three groups of cold knife, laser, and LEEP [20]. In our study minimal quantity of postoperative analgesics were used and only one case (1.087%) of postoperative hemorrhage was observed. This facts can indicate the smooth postoperative period.

### Conclusion

Radiosurgery in patients with different gynecological pathologies makes surgery procedure more simple and time- and cost-saving. Due to the use of high frequency, radio waves thermal damage of tissues is minimal, obtained specimens are sufficient for histology. Radiosurgery causes minimal intraoperative and postoperative complications and promotes healing process. The wide implementation of radiosurgery will increase the effectiveness of gynecological surgical procedures.

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