Monopolar and bipolar energy in transurethral resection of the prostate: histopathologically analyzed tissue necrosis


ABSTRACT

The prevalence of lower urinary tract symptoms is high and increases with age. The principal cause of these symptoms in men is benign prostatic growth. Standing out among the numerous techniques for treating these patients is transurethral resection of the prostate, using either bipolar or monopolar current.

Objective: To analyze whether the type of current and resulting tissue damage had an influence on the final histopathological analysis of the resected tissue.

Methods: Twenty-nine cases of patients undergoing transurethral resection of the prostate were analyzed. Sixteen of those patients underwent the procedure with monopolar current and thirteen with bipolar current.

Results: Monopolar resection results showed 20.1% necrosis versus bipolar resection results of 40.71% necrosis (p = <0.01).

Conclusions: The difference in tissue damage percentage can alter the final pathological result and cases of cancer potentially requiring radical treatment could be overlooked.

Keywords: Transurethral resection of the prostate (TURP), bipolar, histopathological, Mexico.

RESUMEN

La prevalencia de síntomas del tracto urinario bajo es alta y se incrementa con la edad. En hombres, la principal causa de estos síntomas es el crecimiento prostático benigno. Existen numerosas técnicas para tratar esta población, dentro de las que destaca la resección transuretral de próstata, ya sea con corriente bipolar o monopolar.

Objetivo: Analizar si el tipo de corriente influye en el análisis histopatológico final del material resecado, de acuerdo al daño que ocasiona.

Métodos: Se analizaron 29 casos de RTUP, 16 de ellos realizados con corriente monopolar y 14 con corriente bipolar.

Resultados: Detectamos que las muestras obtenidas por resección monopolar, presentaron 20.1% de necrosis, contra 40.71% de aquellas realizadas con equipo bipolar (p = <0.01).

Conclusiones: La diferencia en el porcentaje de daño tisular, puede alterar el resultado final de patología, pudiendo pasar por alto casos de cáncer que potencialmente requerirían tratamiento radical.

Palabras clave: RTUP, bipolar, histopatológico, México.
INTRODUCTION

The prevalence of lower urinary tract symptoms (LUTS) is approximately 50% in men over 60 years of age and goes up to 90% in men reaching 85.1 Throughout history, multiple techniques for managing benign prostatic growth (BPG) have been developed that are basically divided into medical and surgical treatments. Among the latter, transurethral resection of the prostate (TURP) stands out as the most widely used surgical management worldwide. This technique was developed in the 1920s and today is the preferred treatment modality in minimally invasive management of prostatic growth. It has a low complication rate and high patient satisfaction rate. The main problem with conventional TURP with monopolar current is the need to use non-conducting solutions such as glycine for carrying out resection. The use of these fluids entails the potential risk of producing TURP syndrome.

Resection with bipolar technique has recently emerged as an attractive alternative to traditional TURP. Bipolar current was initially used for electrovaporization of prostate tissue,2 but in 2005 Wendt-Norhal et al. published the first evaluation of transurethral resection using bipolar current.3 The principal advantage of this type of current is that it can be used with saline solution, thus avoiding risk of absorption and consequent TURP syndrome.

METHODS

An analytical cross-sectional study was carried out. Transurethral resection of the prostate (TURP) carried out at the Instituto Nacional de Ciencias Médicas y Nutrición “Salvador Zubirán” from January 2008 to February 2010 was analyzed. Thirty-five patients were identified and 29 of those cases had stored paraffin block.

Procedure: All patients underwent routine preoperative evaluation. Presurgical transrectal biopsy of the prostate was carried out in those patients with prostate specific antigen (PSA) above 4 ng/mL and no comorbidities of importance. Prophylactic antibiotic was given to all patients prior to surgical procedure. Epidural block and superficial sedation were necessary in all cases. TURP was carried out in all patients with the Nesbit technique.

Monopolar resection technique: Valleylab electrocauterizer was used and parameters were 100 watts for cutting and 80 watts for coagulation. A 26F Olympus Iglesias resectoscope was employed and 1.5% glycine solution was used during resection.

Bipolar resection technique: Gyrus Medical Systems equipment was used and was programmed at 130 watts for cutting and 160 watts for coagulation. A 26F Olympus resectoscope was employed and 0.9% saline solution was used during resection.

Sample processing: All specimens were fixed in formaldehyde and then embedded in paraffin to be conventionally processed for light microscopy. Paraffin blocks were later obtained from the remaining tissue and 3 µm-thick slices were cut and processed according to Masson’s technique. This type of staining allows for thermal or electric damage identification since its staining affinity changes according to the degree of damage. A blinded, expert staff pathologist from the hospital’s Department of Pathological Anatomy evaluated the slides. Microscopic analysis was carried out at 20x objective and processed with the Leica Qwin 1997 program (Leica Imaging Systems Ltd. Cambridge, England). The total area of analyzed tissue and the area with thermal damage were measured with this application and the proportion of damaged tissue was then calculated.

Mean measurements of thermal damage in 10 consecutive fields of each biopsy were calculated to produce the final quantification.

Statistical analysis: Comparative analysis of the monopolar and bipolar resection groups was carried out using the chi-square test to identify significant differences. Correlations between necrosis proportion and the rest of the variables were made using Spearman’s rank correlation coefficient.

RESULTS

Sixteen monopolar TURP patients and 13 bipolar TURP patients were included in the study. Mean age was 72.3 years ± 7.8 vs 74.5 years ± 7.4 and mean sample weight was 20.3 g ± 14.5 vs 28.4 g ± 15.6, respectively. There were no statistically significant differences between groups. Thermal damage observed was 20.1% (± 21.9) for the monopolar group vs. 40.71% (± 23.3) for the bipolar group and P <0.01 (Image 1).

Cancer was diagnosed in 10.3% of cases, all in the monopolar TURP group, P=0.04 (Image 2). Of those cases, 2 patients had PSA under 4 and another patient had PSA of 4.46. However, due to general conditions of the patient no previous biopsy was carried out.

DISCUSSION

Today TURP is the most widely used surgical treatment for management of LUTS in patients whose condition is suggestive of benign prostatic growth (BPG). It was first described around 1920 and then popularized and standardized by Nesbit in 1943.4 The most widely used modality is TURP with monopolar current. The
main disadvantage of this technique is the so-called post transurethral resection syndrome that develops when the amount of irrigation solution necessary to produce systemic symptoms is absorbed. Incidence of this syndrome varies from 0.5-8% and mortality varies from 0.2-0.8%. In modern series, there has been a 0.78-1.4% decrease in frequency. Syndrome components are excess of fluids, hypotension, hypo-osmolarity, and hyperammonemia. Numerous maneuvers have been described in an attempt to reduce its incidence, such as using solutions different from water (glycine or cyteal solution), reducing resection duration to less than 60 minutes, avoiding large gland resection, and reducing hydrostatic pressure of the irrigation solution.5,6

Resection with bipolar current avoids this syndrome because it allows for the use of saline solution, eliminating the risk of hypotension, which is the principal cause of critical condition and death from the syndrome.7

This has sparked much interest since it allows for resection of large prostates and it is also useful in teaching residents by not having a surgery duration time limit.7-9

Other techniques have been described for managing BPG patients such as Holmium laser enucleation (HOLEP), Holmium laser ablation (HOLAP), green laser ablation (Green Light), or ablation through electrovaporization. A study by Hoekstra et al. showed similar results for all these treatment modalities.9-11 The main disadvantage of the techniques using ablation or electrovaporization is the absence of tissue for histopathological analysis. Meeks et al.12 reported one such case of a patient that underwent HOLAP in whom neuroendocrine tumor of the prostate was overlooked because histopathological analysis could not be carried out. Symptomatology persisted and diagnosis was finally made through bipolar TURP.

In the present study statistically significant difference in relation to greater tissular damage caused by the use of bipolar current was found. This can result in a decrease in detection of incidental tumors due to difficulty in carrying out histopathological analysis and can potentially keep patients from receiving adequate treatment.

A study by Merrill et al. found that in the PSA era, approximately 7% of patients undergoing TURP or supra or retropubic adenectomy due to benign disease suspicion presented with cancer in the final pathological result that corresponded to T1a (less than 5% of resected tissue) or T1b (more than 5% of resected tissue) in accordance with current TNM prostate classification.13 In the days before PSA screening for prostate cancer, this occurred in 39% of cases.12 A study by Jackson et al.14 analyzed patients with clinical symptoms
suggestive of BPG in whom suprapubic adenectomy was the treatment indication due to prostate volume above 75 cc and elevated PSA. Biopsy prior to surgery was performed on these patients and a 15% incidence of cancer was found with 11% T1a and 4% T1b. This demonstrates that the percentage of patients in whom potentially clinically significant tumor can be found in surgery planned for benign disease is not negligible. When obtained tissue is not analyzed or is excessively damaged, these patients can be deprived of treatment that could have a long-term effect on their survival.

Different authors have analyzed the impact the instrument used in resection can have on tissue. Das et al. reported the histological effects of Holmium laser resection compared with traditional monopolar TURP resection. They showed that the quality of tissue analyzed was significantly inferior when obtained by Holmium laser resection due to greater thermal damage. In addition, similar to the results of the present study, the cases of prostate cancer were only detected in the traditional TURP group. 15

There have been different studies in relation to type of current that have evaluated the effect on tissue in the bladder as well as in the prostate. In a study carried out on dogs in 2007, Huang et al. published the first description of the effect of bipolar current on the prostate. After resection the dogs were euthanized at different times to analyze the effect based on resected tissue at different points in time. They showed that the depth of tissue burn in dogs euthanized immediately after procedure was significantly greater in the bipolar group. In dogs euthanized 7 days after procedure, the coagulation zone was discreetly greater in the monopolar group while in those euthanized at 14 and 60 days there was no difference between the two groups. 16

In another study carried out on a canine model, Ko et al. analyzed temperature elevation produced by each type of current in the area of and inside the prostate, in addition to the depth of thermal burn produced by each system. They found that bipolar instruments caused a significantly lower temperature increase in the area of the prostatic tissues compared with the use of monopolar current. Likewise they found that the depth of thermal burn produced by the bipolar system was significantly less than that created by monopolar current. These authors concluded that the use of bipolar current resulted in less thermal damage and periprostatic temperature elevation. These results were measured differently from and are contradictory to the results of the present study. 17

In 2004 Wang et al. analyzed the quality of tissue samples obtained from transurethral resection of the bladder (TURB) with monopolar and bipolar resectors. The degree of “artifact” produced by cauterization was subjectively defined by the pathologist and was considered severe when it covered more than 50% of the tissue. They concluded that 36% of samples obtained with monopolar resector had severe cauterization “artifact” and samples obtained with bipolar resector had 55%. The subjective opinion of the pathologist was that it did not interfere with adequate sample diagnosis despite the important difference in the degree of “artifact”. 18

To the best of the authors’ knowledge, the present study is the first carried out on humans that analyzes the effects of types of current on prostatic tissue. In addition it is the only study that has objectively determined through morphometric analysis the percentage of necrosis produced by each type of current. A limitation to the present study was the small number of patients analyzed, but despite that fact, statistical significance was achieved.

# CONCLUSIONS

The use of bipolar current causes greater tissue damage than monopolar current, which can result in suboptimum histopathological analysis of samples sent to the pathologist with the consequent risk of overlooking patients with clinically significant prostate cancer who could require some type of intervention.

BIBLIOGRAPHY


