Bipolar vaporization – Advantages of a new technique in bladder cancer endoscopic treatment

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Abstract

Objectives: We aimed to evaluate the surgical efficacy and safety as well as the tumoral staging capabilities of a new technique in large bladder tumors, the bipolar plasma vaporization (BPV).
Description of the technique: The main stages of the procedure consisted of tumor biopsy of a tissue specimen including the underlying muscle layer performed with a thin resection loop, followed by plasma vaporization of the tumoral bulk until clearly exposing the muscular layer of the bladder wall. The last steps were represented by the bipolar resection of the center and margins of the tumoral bed and the coagulation of the resection area and its margins.
Results: BPV was performed in 80 consecutive patients with bladder tumors larger than 3 cm. The mean tumoral volume was 14.8 ml. The mean operative time was 19.2 minutes, the mean postoperative hemoglobin decrease was 0.2 g/dl and the rate of obturator nerve stimulation was 2.5%. The mean catheterization period was 2.5 days and the mean hospital stay was 3.5 days.
Conclusions: BPV seems to represent a promising endoscopic treatment alternative for NMIBC patients, with good efficacy and reduced morbidity in cases of large bladder tumors. The technique provided the advantages of excellent visualization during surgery and remarkable maneuverability.

Key words: non-muscle invasive bladder tumors, bipolar plasma vaporization, monopolar transurethral resection

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Introduction

Transurethral resection of bladder tumors (TURBT) using a wire loop still remains the gold-standard treatment for non-muscle invasive bladder cancer (NMIBC). The goal of any bladder tumor endoscopic approach is to make the correct diagnosis and to remove all visible lesions [1].

On the other hand, the unacceptably high early recurrence rates after first resection [1] as well as the significant complications of standard monopolar resection, consisting of bladder wall perforation, intra- and postoperative bleeding, urinary retention by clots, obturator nerve stimulation, tumoral spilling and urethral strictures also demanded the search for new alternatives.

Improvements to standard resection techniques, new surgical modalities and various technological advances are among the alternatives evaluated while aiming to optimize the outcome of NMIBC treatment.

Bladder tumors characterized by specific features such as their location in places that are difficult to access (bladder dome, anterior bladder wall) or subject to obturator nerve stimulation (lateral bladder walls) as well as their size (larger than 3 cm) particularly imposed the search for surgical improvement.

Bipolar electrosurgical techniques gathered increasing acknowledgement during the recent years, providing significant advantages in terms of improved hemostasis, decreased obturator nerve stimulation rate and good safety in patients with certain specific conditions such as anticoagulant therapy, cardiac pacemakers etc. The studies published during the recent years' demonstrated the advantages of bipolar vaporization both in BPH and bladder tumors' endoscopic procedures. [2-4]

Based on our experience with the bipolar plasma vaporization (BPV) in BPH treatment using the TURis (transurethral resection in saline) system, we started to apply this approach in bladder tumor' cases as well, consequently modifying the technique in order to obtain a reliable tumor staging, compulsory while treating malignant urinary tract carcinoma.

We described a rather simple but yet interesting concept of vaporizing large tumors while reducing the technical complications including bleeding, obturator nerve stimulation and bladder wall perforation.

Description of the technique

Patients with tumors larger than 3 cm were selected for this method, as maybe one of the most important benefits of BPV is represented by the rapid ablation of large quantities of tumoral tissue with minimal blood loss and, subsequently, a reduced complication rate.

All patients underwent a standard investigation protocol which included general clinical examination, blood tests, urine culture, abdominal ultrasonography, intravenous pyelography or CT-scan and flexible cystoscopy.

BPV was performed using the Olympus SurgMaster OES-40 bipolar generator (Olympus, Tokyo, Japan), the special "button" type vapo-resection electrode (Olympus, Hamburg, Germany) and saline continuous flow irrigation.

The procedures started with a comprehensive cystoscopy, determining the presence, size and location of all existing tumors. (Fig. 1)

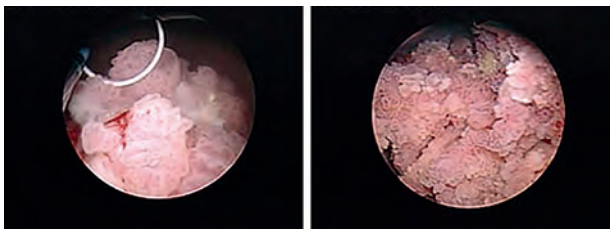


Fig. 1. Large bladder tumors

The next step consisted of tumor biopsy performed with the same bipolar resectoscope and a thin resection loop, aiming to obtain a pathological specimen that would include tumoral tissue and the underlying muscle layer, in view of a complete pathological analysis. (Fig. 2)

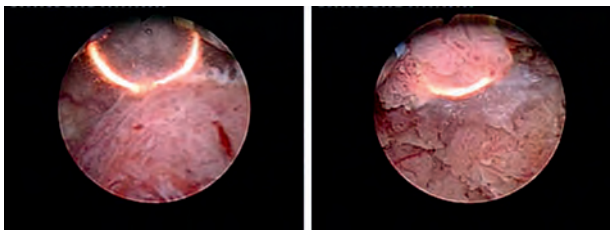


Fig. 2. Bipolar resection of tumoral tissue for pathological analysis

The main stage was represented by the actual plasma vaporization, during which the hemispherical shaped new type of electrode displaying a plasma corona on its surface was gradually moved in direct contact with the tumoral tissue. (Fig. 3)

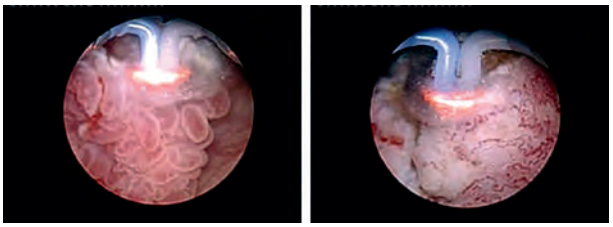


Fig. 3. Bipolar plasma vaporization of tumoral tissue – initial aspects

This so-called "hovering tehnique" performed almost no bleeding vaporization of tumors, layer by layer, from the outside to the depth, with a power generator set at 280-320 W. (Fig. 4)

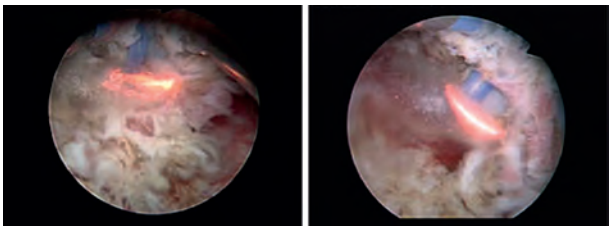


Fig. 4. Large bladder tumor plasma vaporization

The coagulation of the majority of the bleeding sources was performed in the same time as the vaporization process. To coagulate larger blood vessels the generator power was turned down to 120 – 140 W, and the same button electrode was used.

Tumor vaporization was applied until the muscular layer of the bladder wall was clearly exposed.

Subsequently, the bipolar resection of the center and margins of the tumoral bed was performed for pathological confirmation of the complete tumor removal. (Fig. 5)



Fig. 5. Bioptic bipolar resection of tumoral bed

Concerning safety, we applied the coagulation of the resection area and its margins also using the "button" electrode respecting a safety margin of at least 0.5 cm at the periphery of the tumor bed. (Fig. 6)

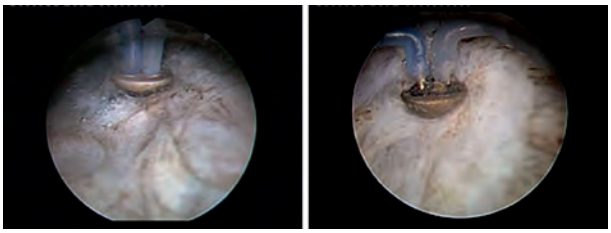


Fig. 6. Bipolar coagulation of tumoral bed

At the final of procedure it has emphasized a clear image of the muscular fibers of the bladder with no restant tumoral tissue, irregularities or debris. (Fig. 7)

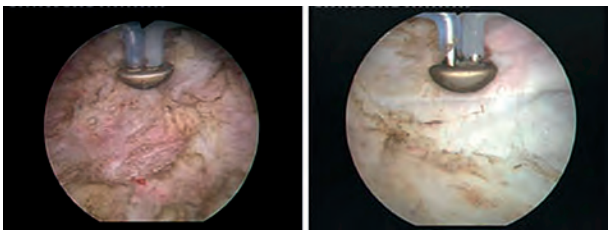


Fig. 7. Tumoral bed at the end of intervention

In cases of multiple tumors, "en bloc" bipolar resection was performed for lesions smaller than 1 cm.

Results

BPV was performed in 80 consecutive patients with bladder tumors larger than 3 cm. The mean tumoral volume was 14.8 ml.

The mean operative time was 19.2 minutes, the mean postoperative hemoglobin decrease was 0.2 g/dl and the rate of obturator nerve stimulation was 2.5%.

No cases of bladder wall perforation, postoperative bleeding requiring active measures, blood clot retention and blood transfusion necessity were encountered in this series.

The mean catheterization period was 2.5 days and the mean hospital stay was 3.5 days.

All resected specimens were valid for pathological analysis and included muscular layer in all patients, without significant cauterization artifacts. The pathological exam diagnosed 21 pTa cases, 51 pT1 cases and 8 pT2 cases.

Comment

Subjectively, this type of vaporization did not alter the visual characteristics of the anatomical layers, thus enabling the surgeon to differentiate the tumoral

tissue, the muscular fibers of the bladder wall as well as the clear boundaries of the operating area with increased accuracy.

Due to the lack of bleeding, visibility remained excellent throughout the procedure. The vaporization area emphasized a remarkably smooth surface and sharp margins, with no irregularities or debris.

As far as the intra- and postoperative features are concerned, a study involving 480 patients with similar parameters in which the bipolar loop resection was performed using the same TURis generator determined a mean operating time of 27 minutes, a mean hemoglobin decrease of 0.7 g/dl and a mean catheterization period of 3 days. [2] By comparison, our approach seemed to provide improved results in these regards.

The standard TURBT is still marked by a significant number of complications, which new treatment alternatives are due to avoid.

Bladder perforation is a frequently encountered complication, especially for tumors located on the lateral wall [5]. Most of these events occur following obturator nerve stimulation during the standard monopolar resection. The literature data emphasized a bladder wall perforation rate of 1.3%, while our experience did not include such a complication. [6]

In bipolar electrosurgery, the active and return poles are incorporated in the same electrode [7] and consequently, the electric current does not pass through the body as in monopolar endoscopic resection. Therefore, the electric energy going through the obturator nerve is reduced, thus decreasing the risk of nerve reflex.

As far as bleeding is concerned, an extensive study showed a rate of 3.4% of patients that required blood transfusions. [6] No such cases were recorded in the present series.

Another advantage of the bipolar endoscopic approach is represented by the use of saline irrigation, consequently avoiding significant complications such as hypo-natremia and the TUR syndrome. [8]

The resected specimens should include muscular layer for every tumor, so that stage and grading would be clearly determined in all cases. The final histology distribution confirmed that a significant number of muscle-invasive bladder cancer cases are still diagnosed by such approach.

Additionally, the switch from vaporization to resection after complete tumoral tissue ablation, aiming to assess the tumoral bed area, is essential to confirm the complete plasma vaporization of the tumors.

Conclusions

We may conclude that the bipolar plasma vaporization seems to represent a promising endoscopic treatment alternative for NMIBC patients, with good efficacy and reduced morbidity in cases of large bladder tumors.

This new technique provided the advantages of excellent visualization during surgery and remarkable maneuverability.

Longer follow-up periods and more extensive trials will be required in order to establish the long-term advantages and general viability of the method as a therapeutic approach in bladder cancer.

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