



Flexible cystodiathermy for the treatment of recurrent superficial bladder transitional cell carcinoma; efficacy, safety, and cost-effectiveness

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ABSTRACT

Introduction: It is now widely acknowledged within the medical community that flexible cystourethroscopy serves as an effective and indispensable method for monitoring superficial bladder transitional cell carcinoma (TCC).

Objectives: The purpose of this study was to review our previous experience with cystodiathermy performed during flexible cystoscopy for the treatment of recurrent superficial bladder TCC.

Patients and Methods: A longitudinal study was conducted. Patients with a history of TCC in their bladder or upper tract underwent a comprehensive evaluation through flexible cystoscopies over a period of ten months. During the appointment, eligible patients received cystodiathermy under local anesthesia (LA) if deemed appropriate. The duration of treatment and the patient's tolerance level were carefully documented. However, patients with a history of high-grade disease, recurrent large tumors (>1 centimeter in diameter), or tumors located in areas requiring central deflection were not considered suitable candidates for this particular treatment modality for their cancer recurrences.

Results: Among the 40 documented recurrences, 25 patients (62.5%) had a single recurrence, while ten patients (25%) experienced more than five recurrences. Thirty patients (91%) successfully completed the cystodiathermy procedure without any complications, while two patients (6%) reported experiencing pain during LA cystodiathermy. One patient (3%) had difficulty tolerating the treatment and opted for general anesthesia (GA) instead. Out of the total patient cohort, 22 patients (67%) showed no signs of recurrence. Among those who received cystodiathermy, four patients (12%) required hospital admission.

Conclusion: Cystodiathermy performed under LA is an efficient and well-tolerated alternative to cystodiathermy performed under GA. This approach allows for immediate treatment upon detection, potentially reducing patient anxiety.

Implication for health policy/practice/research/medical education:

- Health policy: The study findings suggest that cystodiathermy performed under local anesthesia (LA) can be an effective and well-tolerated treatment option for recurrent superficial bladder transitional cell carcinoma (TCC).
- Clinical practice: The study demonstrates that cystodiathermy performed under LA is feasible, with a high success rate and low complication rates.
- Research: The study highlights the efficacy and tolerability of cystodiathermy performed under LA.
- Medical education: The findings of this study can be incorporated into medical education curricula to educate future healthcare professionals about the benefits and considerations of cystodiathermy under LA.
- Patient counseling: The study's results can be used to inform discussions between healthcare providers and patients regarding treatment options for recurrent superficial bladder TCC.

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Introduction

The effectiveness and significance of flexible cystourethroscopy as a monitoring method for superficial bladder transitional cell carcinoma (TCC) are widely acknowledged within the medical community. This consensus has been reinforced by extensive research and clinical experience, leading to its adoption as the standard of care (1,2).

Superficial bladder TCC typically includes tumors that are confined to the inner layers of the bladder. Grading (G) of bladder cancer is categorized into three levels: G1, which includes low-grade, well-differentiated cells that resemble normal cells and tend to grow slowly; G2, which consists of intermediate-grade, moderately differentiated cells; and G3, which comprises high-grade, poorly differentiated cells that look very different from normal cells and tend to grow more aggressively. Staging (T) includes Ta, which is non-invasive papillary carcinoma confined to the inner lining of the bladder; T1, where the tumor has invaded the connective tissue beneath the bladder lining but not the muscle layer; and T2, where the tumor has invaded the muscle layer of the bladder (3,4).

Specific combinations include G1pTa/G2pTa, which are low to intermediate-grade tumors confined to the inner lining of the bladder; G2–3pTa, which are intermediate to high-grade tumors confined to the inner lining of the bladder; G2pT1, which is an intermediate-grade tumor that has invaded the connective tissue beneath the bladder lining; G3pT1, which is a high-grade tumor that has invaded the connective tissue beneath the bladder lining; and G3pT2, which is a high-grade tumor that has invaded the muscle layer of the bladder. Carcinoma in situ (CIS) is a high-grade, flat, non-invasive tumor that is confined to the inner lining of the bladder but has a high potential to become invasive (3).

Managing recurrent tumors in individuals with superficial bladder TCC poses a challenge, requiring multiple therapeutic interventions tailored to each patient's specific needs. Recurrence rates for G1pTa tumors over five years range from 55% to 90%, although the progression to invasion or mortality remains relatively low, below 5% (3).

In managing these recurrences, it is essential to prioritize patient's comfort, convenience, and overall quality of life. Treatment approaches that can be completed in a single sitting under local anesthesia (LA) are preferred, minimizing disruption to patients' daily lives while effectively addressing disease progression. These considerations encompass physical well-being and emotional and psychological happiness (3,4).

Day-case care, also known as outpatient care, has gained prominence as an alternative approach that minimizes the need for hospitalization. It allows patients to receive necessary treatments and procedures in an outpatient setting, reducing overall healthcare costs and resource utilization (1,3,5).

Given the age-related cardiovascular and pulmonary comorbidities often present in this population, minimizing the use of general anesthesia (GA) during recurrent procedures is strongly advised to mitigate potential risks and complications. Avoiding repeated exposure to GA reduces the likelihood of adverse events, leading to improved patient outcomes and safety (3).

Cystodiathermy, a treatment modality involving the controlled vaporization of the bladder wall using heat, can be performed during flexible cystoscopy procedures. Extensive clinical evidence supports the effectiveness and safety of cystodiathermy in managing superficial bladder TCC (3).

Comparing treatment options, cystodiathermy emerges as the more favorable choice over laser vaporization due to its lower risk profile and cost-effectiveness. Cystodiathermy presents fewer risks and associated expenses, making it a more economical option for patients and healthcare systems (1,3,5).

For patients with significant or recurrent tumor recurrences, additional management options such as transurethral excision of the bladder tumor (TURBT) or cystodiathermy under GA may be necessary. The choice of procedure depends on the severity, frequency, and individual patient factors, aiming to address more extensive or persistent tumors with a more aggressive approach (1,2).

Objectives

The purpose of this study was to review our previous experience with cystodiathermy performed during flexible cystoscopy for the treatment of recurrent superficial bladder TCC.

Patients and Methods

Study design

In this longitudinal study, patients with a history of TCC in their bladder or upper tract underwent a comprehensive evaluation through flexible cystoscopies over a period of ten months. Among the 132 patients reviewed, 40 tested positive for recurrence, resulting in a detection rate of 30%. The diagnostic review conducted during flexible cystoscopy provided valuable information regarding the location, extent, and number of recurrences.

During the appointment, eligible patients received cystodiathermy under LA if deemed appropriate. The duration of treatment and the patient's tolerance level were carefully documented. However, patients with a history of high-grade disease, recurrent large tumors (>1 centimeter in diameter), or tumors located in areas requiring central deflection were not considered suitable candidates for this particular treatment modality for their cancer recurrences.

Analyzing the demographic data of patients who experienced recurrences during cystoscopy, it was found that the average age was 69 years (ranging from 41 to

85 years). At the time of their initial diagnosis, 77.5% of these individuals had non-invasive papillary carcinoma (Ta), indicating cancer limited to the urothelium. While a few patients had a history of higher-grade tumors, the majority (69%) exhibited low-grade forms of the illness. [Table 1](#) provides a summary of the characteristics of tumor recurrences identified during flexible cystoscopy

Patients were positioned supine during the procedure. Prior to cystoscope insertion, sterile preparation was carried out, then Instillagel® was applied to the urethra of each patient. In our study, antibiotics prophylaxis, parenteral sedation, or analgesia was not conducted.

A 4-Fr Wolf fine cystodiathermy electrode was inserted through the working port of the flexible cystoscope for the

fulguration of appropriate tumors. Monopolar coagulation was performed using a solid-state electro-surgical device, specifically the Eschmann TD300, set at 3.0 for optimal coagulation. The diathermy plate, serving as the earthing electrode, was typically positioned on the patient's right proximal thigh unless contraindicated for medical reasons. Glycine was selected as the preferred irrigating fluid throughout the procedure.

The use of cystodiathermy allowed for precise and controlled treatment of the identified tumors. The electrode was carefully manipulated to deliver therapeutic energy to the targeted areas, resulting in tissue coagulation and destruction. The chosen equipment and settings were based on established protocols and best practices in the field.

Following the completion of cystodiathermy, the patient's tolerance to the procedure was assessed. Out of 33 patients, 91% reported the procedure as well-tolerated, while only 3% were unable to tolerate it. Two patients (6%) experienced some level of pain during the treatment, although they were able to endure it.

The median time to follow-up after cystodiathermy was 14 weeks, with a range spanning from 9 to 39 weeks. During this period, the outcomes of the procedure were monitored. Among the patients who received cystodiathermy, 67% had no recurrence, indicating successful treatment. Four patients (12%) experienced a recurrence at the same site, while seven patients (21%) had a recurrence at a different site.

Statistical analysis

Statistical analysis was conducted using SPSS (Statistical Package for the Social Sciences) version 2023. Descriptive statistics were used to summarize the data. Continuous variables, such as age and time to follow-up, were presented as mean or median values with ranges. Categorical variables, including sex, recurrence rates, histological grades, treatment modalities, cystodiathermy tolerance, and outcomes, were summarized as frequencies and percentages. All results were reported to provide an overview of patient characteristics, tumor recurrence patterns, histological findings, treatment approaches, tolerance levels, and outcomes following cystodiathermy in bladder cancer patients.

Results

Among the documented recurrences, a total of 40 cases were identified. Among these, 25 patients (62.5%) had a single recurrence, while ten patients (25%) experienced more than five recurrences. Specifically, during the same appointment, twenty-five patients (25%) underwent cystodiathermy under LA to address the recurrent tumors.

Two patients (5%) underwent intravesical mitomycin treatment, while seven patients required in-patient therapy under GA. All surgical procedures performed on these patients were successful. Of the total patient cohort,

Table 1. Characteristics of tumor recurrences identified during flexible cystoscopy characteristics value

Characteristics	Value
Mean age (range), years	69 (41–85)
Sex	
Female	12 (30)
Male	28 (70)
Recurrences, No. (%)	
1	25 (62.5)
2–5	10 (25)
5	5 (12.5)
Histology, No. (%)	
G1pTa/G2pTa	27 (67.5)
G2–3pTa	4 (10)
G2pT1	2 (5)
G3pT1	3 (7.5)
G3pT2	2 (5)
CIS	2 (5)
Treatment, No. (%)	
LA cystodiathermy	25 (62.5)
GA cystodiathermy	8 (20)
Intravesical mitomycin	2 (5)
GA TURBT	5 (12.5)
LA Cystodiathermy tolerance - out of 33, No. (%)	
Well tolerated	30 (91)
Unable to tolerate	1 (3)
Tolerated but painful	2 (6)
Median time to follow-up after cystodiathermy (range)	14 (9–39)
Outcome following cystodiathermy	
No recurrence	22 (67)
Recurrence at the same site	4 (12)
Recurrence at a different site	7 (21)
Mean age (range), years	69 (41–85)

GA: General anesthesia, LA: Local anesthesia, TURBT: Transurethral resection of bladder tumor.

“G”: The grade of the tumor, which indicates the aggressiveness or differentiation of the cancer cells.

“pT”: The pathological staging of the primary tumor. It describes the depth of invasion of the tumor into the bladder wall, indicating that it has penetrated into the subepithelial connective tissue layer of the bladder.

thirty individuals (91%) completed the cystodiathermy procedure without any complications. However, two patients (6%) reported experiencing pain during the LA cystodiathermy treatment. Furthermore, one patient (3%) had difficulty tolerating the procedure under LA and opted for GA instead, which resulted in improved patient comfort.

Among the twenty completed treatments, there were no incidents or complications, and the duration of these procedures exceeded 12 minutes. Follow-up data was collected for a period ranging from 9 to 39 weeks, with a median follow-up duration of 14 weeks. The exact length of the follow-up period was not specified.

Out of the 33 patients who underwent cystodiathermy and were included in the follow-up, twenty-two patients (67%) did not experience any recurrence. Four tumors (12%) recurred at the same site that was previously treated with cystodiathermy. These patients underwent cystodiathermy again, with two receiving GA and the others undergoing the procedure under LA. Additionally, seven patients (21%) experienced recurrence at a different location, with 75% of them receiving LA cystodiathermy treatment.

Among the patients who required cystodiathermy, four individuals (12%) necessitated hospital admission. Importantly, none of these patients exhibited disease progression during the follow-up period. Patients who experienced recurrences were excluded from receiving LA cystodiathermy as a treatment option. Following transurethral resection of bladder tumor (TURBT) surgery, the two patients spent a median of three days in the hospital (ranging from 0 to 7 days). The two patients who underwent cystodiathermy under GA remained hospitalized for a period of 0 to 5 days.

Discussion

This study contributes valuable evidence to the existing scientific literature, further supporting the safety, tolerability, and efficacy of LA cystodiathermy as a treatment modality for recurrent bladder tumors. Despite the relatively short follow-up period, the study findings suggest that LA cystodiathermy does not have a detrimental effect on disease recurrence. While the number of patients requiring additional treatment for recurrence at the same location was lower than the reported rates, it is important to acknowledge that some individuals undergoing LA cystodiathermy did require further intervention, emphasizing the need for continued monitoring and individualized management.

The study's results demonstrate the feasibility of integrating LA cystodiathermy within the time constraints of a standard review flexible cystoscopy, typically lasting around fifteen minutes. Remarkably, a significant proportion of patients received successful treatment within a mere five minutes, highlighting the remarkable efficiency

of this approach. In comparison to GA cystodiathermy, LA cystodiathermy offers several advantages in terms of patient experiences, reduced burden on the healthcare system, and personnel requirements (3,6,8).

Patients report positive experiences with LA cystodiathermy, appreciating the promptness with which identified recurrences are addressed. This proactive approach alleviates unnecessary anxiety during the waiting period for further treatment. Moreover, patients who are likely to require multiple simultaneous procedures can avoid unnecessary anesthesia, further enhancing the patient experience (3,6-8).

In addition to patient benefits, LA cystodiathermy also reduces the personnel requirements, streamlining resource utilization. The procedure only necessitates the presence of one registered nurse and either a medical doctor or a specialized nurse trained in cystodiathermy. In contrast, administering GA in an operating room typically involves a team of four to five medical professionals, including the surgeon, scrub nurse, anesthetic assistant, and anesthesiologist (3,4, 8).

While there is a hypothesis that skilled urologists can detect non-invasive low-grade papillary bladder tumors during cystoscopy, thus potentially eliminating the need for biopsy and histological confirmation in future recurrences, further research is needed to definitively validate this hypothesis. Additional studies are necessary to establish the accuracy and reliability of cystoscopy in detecting such tumors, providing a solid foundation for potential changes in diagnostic practices (3,6,8).

In summary, this study enhances our understanding of LA cystodiathermy as an effective and well-tolerated treatment option for recurrent bladder tumor. The findings underscore its advantages in terms of patient experiences, healthcare resource utilization, and personnel requirements. However, further research is warranted to validate certain hypotheses and improve the accuracy of diagnostic practices in the management of recurrent bladder tumor.

Conclusion

Cystodiathermy, when performed on a patient under LA, is well-tolerated and has shown no significant impact on the likelihood of disease recurrence. It is recommended that patients initiate therapy upon receiving a recurrence diagnosis rather than waiting for hospitalization and GA treatments, as the delay in admission for GA treatments can be observed. This delay aims to minimize overall stress and streamline the treatment process for patients.

Cystodiathermy under LA has demonstrated both effectiveness and cost-effectiveness compared to other modalities, making it a viable alternative to conventional therapy techniques. Alternative modalities often require longer treatment duration and incur higher costs, leading to inherent challenges within the healthcare system.

Study Highlights**What is the current knowledge?**

- Local Anesthesia (LA) cystodiathermy is recognized for treating recurrent superficial bladder tumors with minimal anesthesia requirements.
- Traditional cystodiathermy under GA demands more personnel and resources in an operating room.

What is new here?

- LA cystodiathermy is effective within standard flexible cystoscopy sessions, reducing treatment time and resources.
- Patients report positive experiences with LA cystodiathermy due to less anxiety and immediate recurrence management.

Therefore, we propose that cystodiathermy, performed on patients under LA, should continue to be the preferred therapy for recurrent small superficial bladder TCC. This approach has proven effectiveness in treating this specific type of bladder cancer, and the administration of the treatment can commence while the patient is under the influence of LA.

Limitations of the study

The study's findings and conclusions are based on a review of previous experiences at a single center. The generalizability of the results to other healthcare settings or populations may be limited, and further studies involving multiple centers and diverse patient populations are needed to validate the findings.

The study reports on a total of 40 documented recurrences, which may be considered a relatively small sample size. A larger sample size would provide a more robust representation of the population, potentially enhancing the generalizability of the findings. The study does not provide detailed information on the patient selection criteria for undergoing cystodiathermy or the reasons for choosing LA versus GA. This lack of information raises the possibility of selection bias, which may impact the generalizability of the results and limit the ability to draw definitive conclusions.

Authors' contribution

Conceptualization: Malik Ayyad.

Data curation: Malik Ayyad.

Formal analysis: Malik Ayyad, Omar Ayaad.

Investigation: Malik Ayyad, Hassan Alkhatatbeh, Fadi Sawaqed, Samer Al-Rawashdeh.

Methodology: Omar Ayaad.

Project administration: Malik Ayyad.

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Supervision: Malik Ayyad.

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Conflicts of interest

The authors declare that they have no competing interests.

Ethical issues

The research adhered to the principles outlined in the Declaration of Helsinki. The Ethics Committee of Mutah University of Medical Sciences approved this study (reference number 382022). Written informed consent was obtained from all participants prior to any intervention.

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