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Original article

Monopolar vs. bipolar transurethral resection for non–muscle invasive bladder carcinoma: A post-hoc analysis from a randomized controlled trial

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Abstract

Purpose: Traditionally, transurethral resection of bladder tumors (TURB) is performed using monopolar technique. Bipolar resection has been postulated to reduce complications. In this study we compare safety and efficacy between monopolar TURB (mTURB) and bipolar TURB (bTURB) for patients with primary non-muscle invasive bladder cancer (NMIBC).

Materials and methods: Data were obtained from an international multicenter randomized clinical trial that compared the use of white light cystoscopy with narrow band imaging-assisted TURB using the Olympus system between 2010 and 2014. Main outcomes of interest were operative time, perioperative, and postoperative complications, and 12-month recurrence-free survival.

Results: In total, 716 patients were treated for primary NMIBC with mTURB (310 patients) or bTURB (406 patients). The use of white light cystoscopy or narrow band imaging was equally distributed between the 2 resection techniques. Multilevel logistic and linear regression corrected for possible confounders showed no significant difference between mTURB and bTURB for postoperative complications (OR = 1.76, $P = 0.180$), postoperative bleeding (OR = 1.27, $P = 0.722$), and the combination of intra + postoperative bleeding (OR = 1.992, $P = 0.108$). Additionally, no significant difference was found between mTURB and bTURB concerning operative time (1.05 min. longer for bTURB, $P = 0.536$), intraoperative bleeding requiring intervention (OR:1.38, $P = 0.809$), incidence of obturator reflex (OR = 0.93, $P = 0.854$), and bladder perforation (OR = 3.05, $P = 0.195$). In total, 185 patients (25.8%) developed a recurrence (mTURB = 88, bTURB = 97). Recurrence-free survival at 12 months in the mTURB and bTURB group was 70% and 74% ($P = 0.410$), respectively.

Conclusion: Based on these results, bTURB is as safe and effective as mTURB in treatment of primary NMIBC. bTURB seems to have no evident advantages over mTURB with respect to operation time, perioperative and postoperative complication rates, and recurrence rates at 12 months.

Keywords: Urothelial carcinoma; Non–muscle invasive bladder cancer; Transurethral resection bladder tumor (TURB); Monopolar; Bipolar

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1. Introduction

With 430,000 estimated new cases in 2012, bladder cancer is the ninth most common cancer worldwide. [1] Transurethral resection of the bladder tumor (TURB) is the gold standard in diagnosis and treatment of non–muscle invasive bladder cancer (NMIBC) [2,3]. Traditionally, TURB is performed with monopolar electrocautery. During monopolar TURB (mTURB) the current flows from the resection electrode through the patient's body to the electrode located on the skin. High voltage is used for cutting and coagulation of tissue, and a nonconductive, hypotonic fluid for irrigation is required. A risk of using nonconductive hypotonic fluid for irrigation during transurethral procedures is a TUR-syndrome, though this is more relevant during transurethral resection of the prostate. The last decade, bipolar current for transurethral procedures has been introduced. Favorable safety outcomes for bipolar transurethral resection of the prostate were demonstrated, e.g., better hemostasis due to the "cut and seal" effect [4,5]. Additionally, for bipolar resection, normal saline can be used for irrigation, minimizing the risk of TUR-syndrome. During bipolar resection the current flows between 2 electrodes on the resection loop. A high initializing voltage spike creates a vapor or plasma layer in the conductive saline, and less power is required to resect tissue [6,7]. Therefore bipolar TURB (bTURB) may reduce the risk of obturator nerve reflex. Several clinical trials, mostly with small sample sizes, were conducted to compare mTURB to bTURB for NMIBC. However, solid evidence is still lacking to demonstrate the superiority of bTURB compared to mTURB. The aim of the present study was to compare safety and effectiveness of mTURB with bTURB for treatment of primary NMIBC in a large cohort. We hypothesize that bTURB will show more favorable outcomes (i.e., shorter operative time, less complications) compared to mTURB in treating NMIBC.

2. Materials and methods

2.1. Data acquisition

Data were obtained from the Clinical Research Office of the Endourological Society (CROES) narrow band imaging (NBI) study [8]. In this international multicenter randomized clinical trial (RCT) the use of NBI was compared to white light (WL) TURB using the Olympus system. The medical ethics review committee of each participating center approved the study. The trial was conducted in accordance to the Good Clinical Practice standards, and was registered in the "Nederlands Trial Register" (NTR3645). In all participating 26 centers data were collected via an online electronic data management system (http://www.croes-dms.org). Written informed consent was obtained of all participating patients.

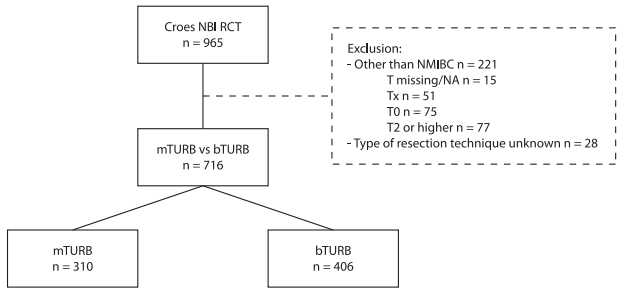

Fig. 1. Flow chart of study design.

2.2. Patients

Between 2010 and 2014, 965 patients participated in the CROES NBI study [8]. Patients eligible for this post-hoc analysis had primary NMIBC treated with mTURB or bTURB (Fig. 1). A reTURB was performed T1 tumors, in case of absence of muscle in the initial specimen, or incomplete resection. All patients were scheduled for WL cystoscopy 3-, and at least 12-months after TURB. In case a recurrent lesion was visible, TURB was performed to histologically confirm recurrence.

2.3. Outcomes

Main outcomes of interest for this analysis were to assess safety, operative time, intraoperative complications (e.g., intraoperative blood loss requiring intervention, incidence of obturator nerve reflex, bladder perforation), and postoperative complications. Outcomes of interest to assess effectiveness were tumor recurrence at first follow-up (3 mo following TURB), and recurrence-free survival at 12 months. Recurrence was defined as a new histologically proven bladder cancer. Perioperative complications were scored using the Clavien-Dindo classification [9].

2.4. Statistical analysis

All analyses were performed using Stata 13.1. Descriptive statistics were used to describe patient and tumor characteristics. Differences between mTURB and bTURB were considered significant if $P < 0.05$. Chi-square test, *t*-test, or their nonparametric equivalent was used to describe differences in descriptive tables. Multivariate multilevel linear and logistic regression were used to analyze the different main outcomes. We corrected for possible confounding and effect modification including age, sex, BMI, comorbidity, surgery time, focality, tumor size, and tumor stage. Furthermore, we corrected for the fact that patients are clustered within different centers by adding a random intercept at the center level for the multilevel part of the model. Recurrence-free survival was calculated using the Kaplan Meier method and differences between subgroups assessed with the Wilcoxon test.