



Enbloc Resection of Bladder Tumor in Treatment of Non–Muscle Invasive Bladder Cancer

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ABSTRACT

Background: Bladder cancer is still the most common cancer of the bladder tract and the ninth most common cancer in the world. Most people who get bladder cancer have nonmuscle invasive bladder cancer (NMIBC), which has a much lower death rate than muscle invasive bladder cancer. Urologists are now more interested in enbloc removal of bladder tumor (ERBT), but there are only a few small studies that look at hydrodissemination during ERBT. ERBT gives a lot of detrusor muscle samples (more than 95%) and good samples for figuring out what's wrong. So far, it hasn't been looked into whether second resections can be avoided. All energy tools, like lasers and electric cautery, have been used to do ERBT with the same positive effects on the patient and the cancer. **Conclusions:** The numbers show that there isn't a big difference between normal and perioperative morbidity transurethral resection of bladder tumors, but only a few of the papers used a structured way to group them. There are no conclusions that can be made about how ERBT affects recurrence.

Keywords: Enbloc Resection; Bladder Tumor ;Non–Muscle Invasive Bladder Cancer

INTRODUCTION

Concerns have been raised about en bloc transurethral resection of bladder tumors (ERBT) in recent years. It has been shown to have a good outcome by removing the whole tumor and keeping the condition of specimens with the detrusor muscle intact. Tissues without the detrusor muscle are believed to were linked to disease that persisted,

recurrence early on, and tumor understating [1].

Urologists in Japan played a big role in creating and developing early stages of ERBT. In 1980, the first report on ERBT using a transurethral resectoscope and a polypectomy catch was made public. Rectal polyps were the original reason for creating the polypectomy wire-loop snare. It was then changed to work with ERBT, which lets

bladder tumors up to 3 cm in diameter be taken out all at once [2].

In 1997, a custom-made arched electrode for ERBT was used for resection. The bladder tumor was cut out at the neck by rotating the arched resection electrode 180 degrees and swinging the sheath [3].

A set of systematic steps for the first few steps of ERBT were created in 2000. These steps are still used as the basis for the ERBT process today. Five millimeters in from the tumor's margin, a circular incision is made with a short, curved needle electrode. A cut at the level of the detrusor muscle is then made beneath the bladder tumor. After that, the tissue from the bladder tumor was pinned to a foam board and sent for pathological analysis [4].

In 2001, a holmium laser was used for the en bloc excision of malignancies in the bladder neck and a knife electrode for cancers in the bladder wall. Both of these approaches are widely employed in the modern world. Additionally, this was the first report to demonstrate T1 substaging in specimens from en bloc resected bladder tumors. Eventually, T1 substage was a powerful predictor of the course of the disease and ERBT might increase the accuracy of T1 substage diagnosis [5].

The thulium laser was first presented in 2005, and it was thought to have better cutting and blood-clotting properties than the holmium laser [6].

When waterjet hydrodissection was initially utilized for endoscopic submucosal dissection in gastroenterology [7]. Later, it was accepted and used in urology, and in 2011 it was shown to be safe and effective for performing ERBT [8].

The study from 2020 showed that for high-risk non-muscle-invasive bladder cancer, en bloc re-resection was an effective treatment (NMIBC). There were no bladder perforations, and just 3.85% of patients returned after three months [9].

Tumor size is the largest obstacle in ERBT. ERBT has never made it easy to get rid of a large bladder tumor. In their writings, Teoh and Mostafid et al. talked about how they regularly used ERBT in their clinical settings. ERBT had a technical success rate of 84.3% for bladder tumors that were less than 3 cm and 29.6% for those that were more than 3 cm. No matter how big the tumor was, 73.3% of people who had ERBT had a technical success rate [10].

Several ways to make it easier to remove big bladder tumors have been described. The tumor was removed with a nylon retrieval bag, while some urologists advise using a morcellator telescope instead. It is possible to fit a 5 mm laparoscopic forceps inside the 5 mm working path, which can be used to grab and remove the tumor specimen. [11].

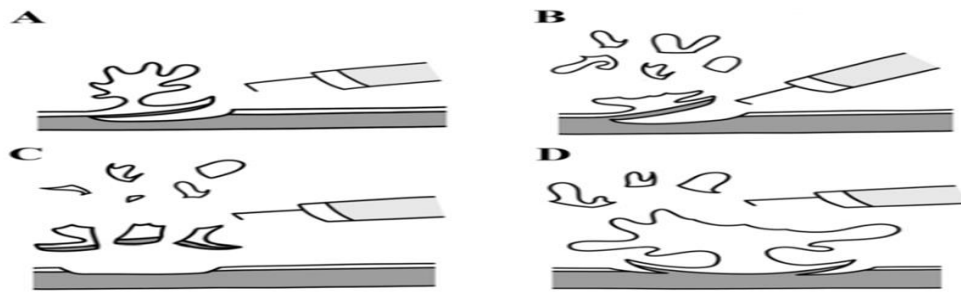
The ERBT suggested cutting out the part of the tumor that sticks out from the body by morcellation and then cutting out the whole tumor base. There will be no modifications made to the histological assessment of the tumor invasion depth and resection margins because the tumor base specimen will still be whole. There may be a higher chance of tumor spreading after morcellation, though, and this should be carefully thought through. It has not yet been possible to make retrieval tools that are especially made for removing large bladder tumors without morcellation [12].

ERBT's developing ideas and future directions

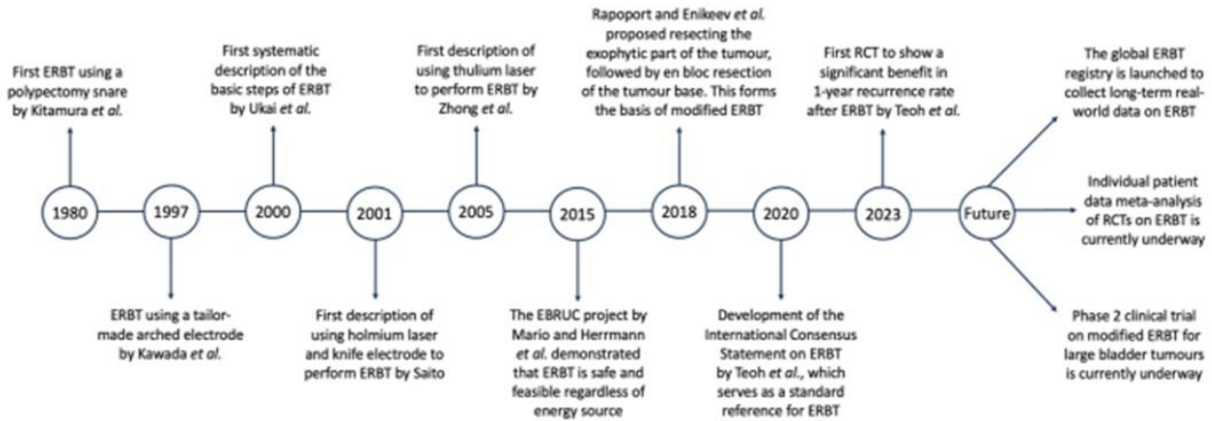
The majority of urologists state that ERBT has two primary objectives and potential benefits: (1) ensuring total removal of the bladder tumor; and (2) reducing the danger of tumor seeding by removing the bladder tumor intact. While "en bloc" sounds nice, its literal meaning of "removal in one piece" does not adequately convey the potential advantages of the procedure. Large NMIBC patients are more likely to experience persistent disease following TURBT, so ensuring total bladder tumor removal is probably more crucial than merely removing it. When dealing with muscle-invasive bladder cancer (MIBC), the most important thing is to make sure that the disease is properly staged locally. Whether the bladder tumor is removed in one piece or several pieces doesn't have a big effect on how the disease is managed afterward. ERBT may also be able to achieve maximum transurethral resection, which could help make further treatments like radical cystectomy and trimodality therapy more effective [13].

Because of this, when there is a big bladder tumor, it might still be better to do the standard en bloc resection techniques to get the best results, even if the tumor can't be taken out in one piece. This is what the idea of modified ERBT for big bladder tumors is based on. As a general rule, modified ERBT

aims to remove big bladder tumors as completely as possible. The bladder tumor should be able to be cut out and taken out all at once if possible (**Fig. 1A**). Modified ERBT, on the other hand, can be used when a real ERBT can't be done, and there are several ways to do this (**Fig1B–D**). The bladder tumor's exophytic portion can be removed piecemeal at first, and then the tumor base can be removed all at once (**Fig. 1B**). In the same way, we can cut out the main part of the bladder tumor's exophytic part and remove it by morcellation. This is followed by removal of the tumor base as a whole. For even bigger tumors where removing the tumor base all at once is not possible, the tumor base could be removed in several pieces. (**Fig. 1C**). Even if conventional TURBT is the only choice and it is very hard to do, Attempts should still be made to adhere to the en bloc resection guidelines. (**Fig. 1D**). Define the resection lines and trim the surrounding tissue down to the usual layer of the detrusor muscle. From the sides to the center and from normal to abnormal, make your way toward the center of the tumor base. Lastly, remove the bladder tumor piecemeal, always keeping in mind the natural layer of detrusor muscle that you have established around the margins. (**Fig. 1D**). Modified ERBT is currently being tested in a phase 2 study for people with bladder tumors bigger than 3 cm (**Fig 2**)[14].



Figure(1): Modified ERBT in large tumor mass in non muscle invasive bladder cancer [14].



Figure(2): ERBT development and progression over time [14].

Modules of Enbloc Bladder Tumor Resection

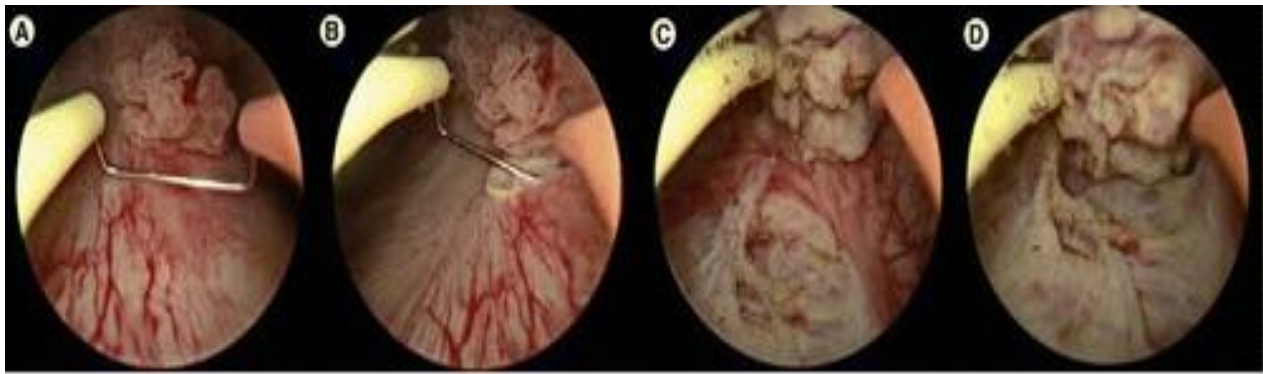
A new method called en-bloc surgery makes it possible to remove tumors bigger than 1 cm in one piece. Among the techniques that have been discussed are a modified "J-loop," a knife electrode, a holmium laser, and a water jet. The mucosa surrounding the tumor is sliced in a circular before any of the techniques are used. The tumor is then excised in its entirety, including the layer of muscle [15].

In certain circumstances, the en-bloc resection approach appears to be feasible and widely recognized. The specimen is well-oriented and of high quality, which helps the pathologist figure out what state the tumor is in. Based on the seeding theory, en-bloc removal might lower the number of recurrences. But there aren't any long-term studies yet, and RCTs should be conducted to determine which procedure yields a superior oncologic outcome: routine TURB tumor or en-bloc resection [16].

Electrocautery ERBT

Most surgeons can do ERBT with equipment that is already set up in the room for cTURBT because they use electrocautery. Electrocautery with one pole or two poles has been used successfully. The most common type of electrode is a normal loop, which can be angled to form a 45-degree bend with the bladder mucosa [17].

At least one author has found that In ERBT, a flat loop is helpful. Certain individuals discuss the use of a loop electrode alone or in conjunction with a plasma button, Collin's knife, or needle electrode like in (Fig.3). A new method using Zedd excision scissors for cold excision and only a little electrocautery has been recently reported. The biggest tumor that can be treated with electrocautery ERBT is 2 to 6 cm. However, bigger tumors (those bigger than 3 cm) might need to be cut up inside the bladder first [18].



Figure(3):Enbloc resection of bladder tumor using monopolar electrocautry [18].

A study of ERBT feasibility shows that its effectiveness decreases as tumor size rises with present technology, especially above a 3 cm threshold. It is not known if controlled intravenous tumor division takes away any of the possible benefits of ERBT when it comes to tumor spread. [14].

Some writers, on the other hand, say that ERBT shouldn't be used on tumors that are in certain places, like over the ureteric orifices, on the anterior wall, or on the dome. Banana GX et al. (2018) Alternatively, one study suggests that ERBT may be better than cTURBT around the openings of the ureter because it may be easier to control blood clotting. This was shown by testing the ureteric patency after ERBT with indigo carmine [19].

The obturator nerve response has been seen in 0.2 to 23% of electrocautery ERBT studies that have been talked about. It's hard to come to a firm conclusion about this figure without more thorough, comparable information about where the lateral wall tumor is located and the anesthesia [20].

Electrocautery ERBT is linked to a bladder puncture rate of 0.5 to 5 percent and a bleeding rate of 0.7 to 7.3 percent, with different definitions of "significant bleeding." In three non-randomized comparison studies, bladder perforation rates are not statistically different from those of cTURBT groups[21].

More than 80% of detrusor muscle samples were taken during electrocautery ERBT in all of the research that made this claim. Thirteen out of sixteen studies (one utilizing propensity score matching) rates of 90% or more were recorded. Four out of five papers that

compared electrocautery ERBT to cTURBT controls found that ERBT led to higher rates of muscularis identification ($p < 0.01$). In one study, sampling rates for the detrusor were the same in both cTURBT and ERBT. But in both arms, 100% sampling rates were attained[22]. Some studies found that ERBT had less cautery damage than controls, and other studies found that ERBT improved T1 substaging. The length of time for irrigation and the tube varies from study to study and is probably affected by how things are done in each area. There does not seem to be a clear difference between ERBT and cTURBT [23]. At 12 to 18 months, relapse rates for low-risk bladder cancer were 0 to 11.5% and for high-risk bladder cancer they were 25.5 to 29.86%. At 3–39 months, three small studies found that recurrence rates were lower with ERBT compared to cTURBT. At 3–18 months, three other studies found that there was no change in recurrence rates. Different risk classifications, reporting, intravenous treatment plans, and follow-up methods make it hard to figure out if a recurrence has happened[24].

Laser ERBT

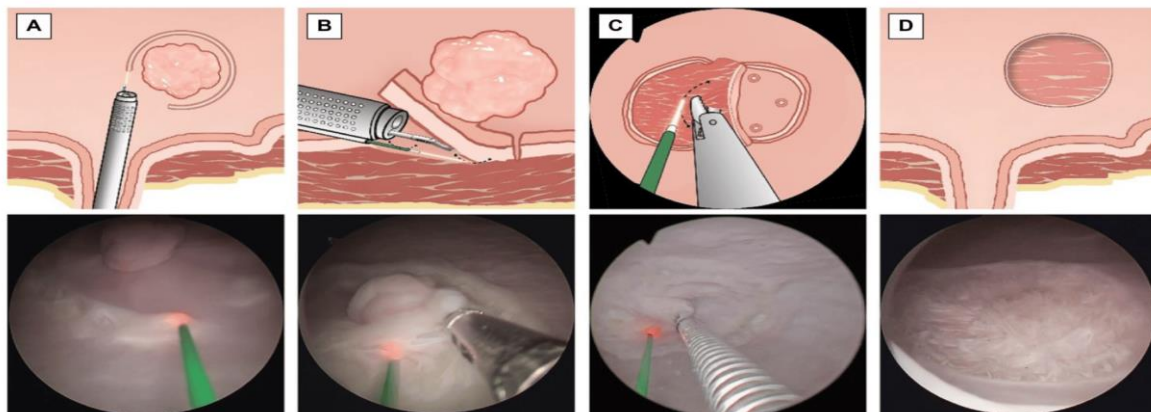
Lasers are also sometimes used to treat people who have tumors in their urinary system. In 1979, Staehler and Hofstetter wrote about their first efforts to use lasers to treat bladder cancer (BC). However, Beer's 1989 paper was the first large-scale study on the use of lasers in CBT. Even though the results looked good, this process was abandoned for many years. This may be due in part to the fact that the deep penetrating Nd:YAG laser could hurt the bowels [25].

With the help of new tools, laser removal methods for bladder tumors are making a comeback. Several studies say that the laser method is better than TURBT because cancer doesn't seem to come back more often after laser treatments than after TURBT, and there are fewer problems after modern laser procedures than after TURBT. Studies that have been done on BC laser resections so far have only talked about seven problems. Not a single study has talked about deaths or widespread bleeding. Unfortunately, most of the studies that have been written so far are not randomized. Also, there aren't any studies that look at how different methods work side by side [26].

BPH can be removed with the green-light lithium triborate (LBO) laser, which has

a wavelength of 532nm and an entry depth of 0.8 mm, has been shown to work well and be safe [27].

Several writers have come up with new en bloc resection methods over the last 15 years. Kawada et al. wrote about a rotational tumor removal that used an arched electrode. Ukai et al. extracted the growth whole from the body using a J-shaped electrode. As seen in (Fig.4), Saito [7] discussed his experience with en bloc surgery, in which tumors from the bladder neck were removed using a holmium:yttrium-aluminum-garnet (Ho:YAG) laser fiber, while tumors from other bladder regions were removed using a knife electrode [28].



Figure(4): *En bloc resection of bladder tumor with HO:YAG laser fiber* [28].

Zhu et al. [29] 212 people with primary NMIBC were used to compare bladder tumor removal with the Ho:YAG laser as opposed to the standard TURBT. There was no difference in the two groups' recurrence-free mortality. However, HoLRBT was better than TURBT when it came to complications during surgery, need for a catheter after surgery, and length of stay in the hospital. Also, HoLRBT gave enough information for a pathologic diagnosis.

Xishuang et al. [30] looked at the safety and effectiveness of TURBT, HoLRBT, and plasmakinetic resection of bladder tumors in a group of 173 people who had main NMIBC. When it came to problems, catheterization, and hospital stays, HoLRBT and plasmakinetic resection of bladder tumors

were safer than TURBT. However, there was no difference in the rate of tumor recurrence.

ERBT with hydrodissection

A high-pressure jet of fluid is used in waterjet technology to cut through tissues with hydroabrasive energy. This method is said to have a high amount of tissue selectivity. [31]

As a similar situation happened with gastrointestinal cancer treatment, The method known as endoscopic submucosal dissection (ESD) was developed. The procedure involves the following surgical steps: (i) marking the lesion; (ii) raising the tumor by injecting saline fluid into the connective tissue beneath the mucosa; (iii) making a circumferential cut; and (iv) removing and retrieving the tumor as demonstrated in the step-by-step water-jet assisted resection method (Fig.5) [28].

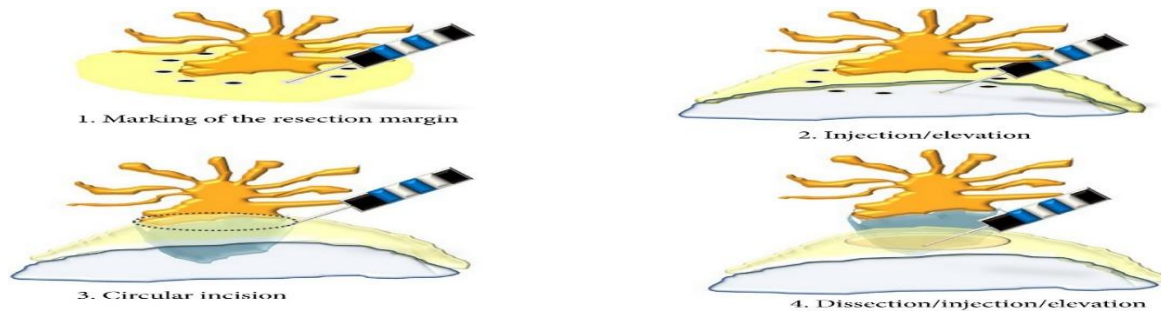


Figure (5): Diagrammatic representation of four surgical steps of endoscopic submucosal dissection technique [28].

Randomized ESD is a safe and efficient method of removing gastrointestinal tumors all at once, according to research. Furthermore, a sizable meta-analysis of gastric cancer patients discovered that the ESD procedure had a significantly lower recurrence rate than the conventional resection technique. In addition, it became easier to classify early invasive gut tumors and find risk factors, such as lymphovascular invasion [32].

In the hybrid knife method, the electrocautery function is used to mark the edge of the lesion that needs to be removed. This is followed by the waterjet function, which raises the mucosa that needs to be removed, making a "cushion" under it. The saline fluid's indigo-carmin color can be used to help with vision. As part of en bloc removal, the electrocautery function cuts through the tissues and coagulates the base (Fig. 6) [15, 33].

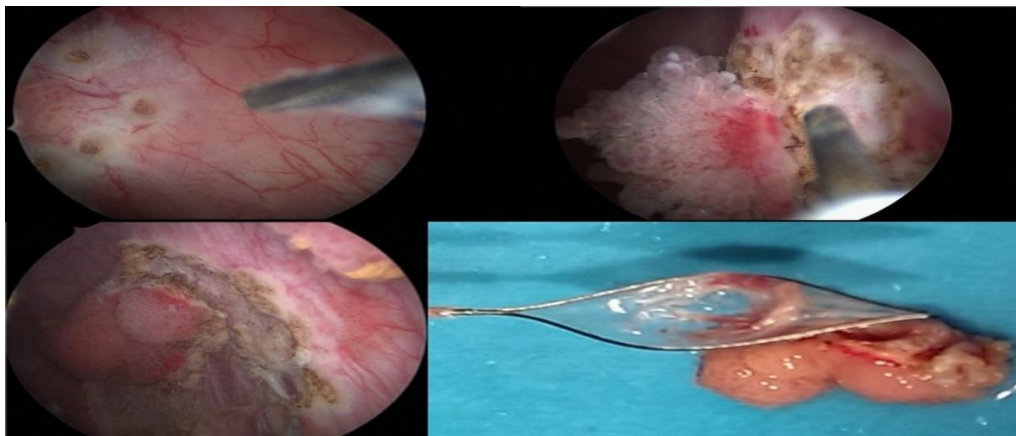
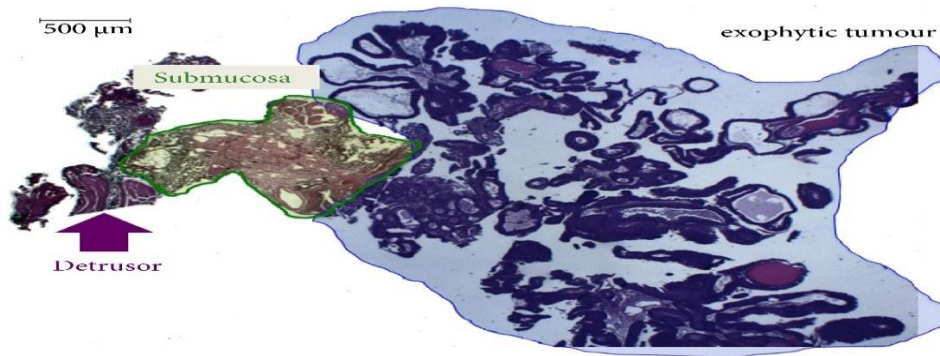


Figure (6): Intraoperative depiction of the ESD technique's surgical processes, including the use of an endoscopic bag to remove the tumor [33].

Different studies have different rates of detrusor sampling with HybridKnife ERBT, which is further confounded by the fact that some authors perform separate cold cup muscle biopsies. However, based on the 77%

rate of muscularis sampling described by Gakis et al. [33] (Fig.7), Despite the lack of evidence, statistical superiority over cTURBT in muscle sampling [34].



Figure(7):low grade bladder urothelial carcinoma that was removed using a histological slide of a bladder tumor staged pTaG2 enbloc hydrodissection[34].

Urologists have been interested in the hydrodissection recently developed technique for ERBT, but there aren't enough small prospective cohorts or retrospective studies to examine it. This randomized study's goal was to determine whether the transurethral (fluorescence-guided) en bloc submucosal hydrodissection of bladder tumor (TUEB) approach enhances resection quality and is safer for patients during surgery compared to traditional TURBT in those with NMIBC [35].

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Consent for publication

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Competing interests

The authors declare that they have no competing interest.

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