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Surgery Illustrated – Surgical Atlas
Transurethral resection of bladder tumours

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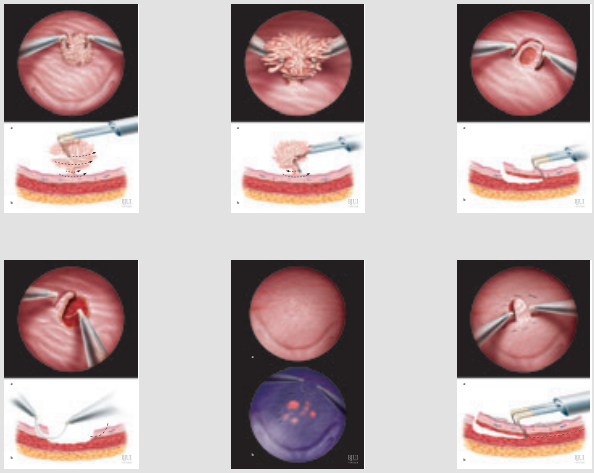

INTRODUCTION

About 45 000 new cases of bladder cancer (BCA) are diagnosed annually in the European Community, and >500 000 patients with BCA are under surveillance for early detection of a possible tumour recurrence [1]. Approximately 90% of bladder tumours are urothelial carcinomas and 75–85% initially present with a non-muscle invasive (pTa, pTis, pT1) growth pattern. The remainder either invade the detrusor muscle (pT2) or even the perivesical fatty tissue (pT3) [2]. Transurethral resection of bladder tumours (TURBT) is the current standard for initial diagnosis of all kinds of BCA and can be curative in non-muscle invasive tumours.

There is a significant risk for tumour recurrence after TURBT, which depends on various clinical risk factors such as tumour size, tumour grade, multifocality and associated carcinoma *in situ* (CIS). Recurrence rates range between 15% and 60% at 1 year and increase to 30–78% at 5 years. To exclude residual tumour after TURBT, a second re-staging TURBT is indicated 6–8 weeks after the initial resection, especially in very large and/or multifocal tumours and in 'high-risk' tumours [3,4]. Several studies have shown a residual tumour rate of 28–78% and an up to 25% tumour upstaging at re-staging TURBT. Despite an accurately performed TURBT, the risk of tumour progression during follow-up is well known, at 1–17% at 1 year and up to 45% at 5 years depending on clinical risk factors [5,6]. Today, photodynamic diagnosis (PDD)-guided TURBT using hexaminolevulinate is an accepted additional diagnostic tool for detection of lesions, which are macroscopically hardly visible by white-light cystoscopy only. The guidelines of the

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European Association of Urology recommend PDD especially in cases of positive urine cytology but negative findings at white-light cystoscopy, in the assessment at the time of tumour recurrences in patients, who were not previously staged with hexaminolevulinate and for initially diagnosed CIS [7]. During PDD, suspicious lesions are visualized by emitted red fluorescence when exposed to blue light.

The main goals of TURBT are:

1) To obtain adequate tissue specimens for pathological evaluation of the histological tumour type and tumour grade.
2) To determine absence/presence and depth of tumour invasion into the lamina propria and detrusor muscle (pT stage).
3) To achieve a complete resection with removal of all macroscopic visible tumour tissue and of associated CIS, if present.

PLANNING AND PREPARATION

IVU is performed to exclude tumour growth in the upper urinary tract. Urine analysis with or without urine culture is performed preoperatively to exclude UTIs. TURBT is performed under general or spinal anaesthesia. The patient is placed in a low lithotomy position.

SPECIFIC EQUIPMENT/MATERIALS

- 24 F resectoscope sheath with obturator
- Resectoscope with video camera attached to a 30° lens
- Sterile, pyrogen-free, nonhaemolytic irrigation solution (e.g. Glycine 1.5%), reservoir 60–70 cm above level of symphysis (irrigation pressure 60–70 cmH_2O)
- Monopolar point electrocautery set at 120 W, coagulation set at 80 W
- Ellik evacuator filled with glycine

SURGICAL TECHNIQUE

The 24 F resectoscope sheath is lubricated with a conductive jelly. The obturator is placed through the sheath to provide a blunt tip for easy urethral passage. In case of resistance during the urethral passage, any force is strictly avoided. Instead, the procedure is then continued under vision using an optic with 30° lens to which a video camera is attached. Once the bladder is entered, all regions are examined carefully through the resectoscope with the 30° lens before TURBT. Urine ejaculation from both ureteric orifices is to be observed. In cases of ureteric haematuria, a separate urine sample is collected from the concerned ureter and sent for cytopathological evaluation. An additional retrograde ureterography is useful in cases of preoperatively diagnosed kidney dilatation or suspicion of upper urinary tract tumours by IVU. The bladder capacity is measured, which is of importance in cases of a repeat resection. TURBT is performed with the bladder about half full. Each visible tumour is in general resected completely and submitted separately for histopathological evaluation. The tumour specimens may be sent as one sample including surrounding urothelium and underlying bladder wall tissue or in fractioned samples. Finally, separate resection specimens are taken from the ground of resection including detrusor muscle and additionally from the lateral resection margins.

Figure 1

The resection is typically performed in an antegrade fashion. Therefore, the loop of the resectoscope is placed behind the tumour and is then gently retracted towards the shaft of the resectoscope. Smaller pedicled tumours may be resected *en bloc* by cutting the pedicle. Larger papillary tumours are resected in fractions starting from the upper aspect and moving towards the pedicle of the tumour (broken arrows).

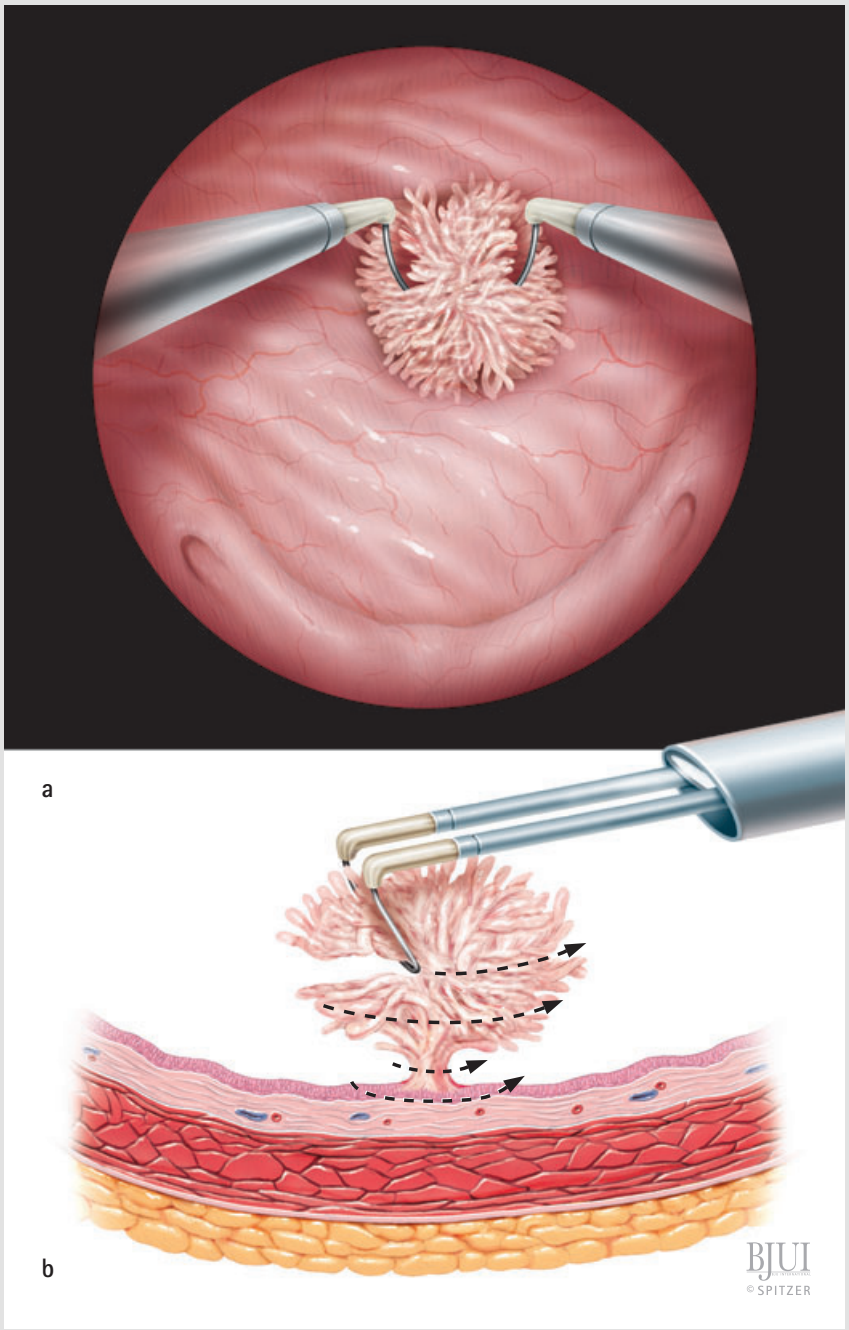


Figure 2

Retrograde TURBT has a higher risk of bladder wall perforation. However, it may ease *en bloc* resection of some larger papillary tumours with a small pedicle. The loop is placed above the level of bladder urothelium in front of the pedicle. The tumour pedicle is transected (upper broken arrow) by gentle retrograde movement of the loop. The resection is completed by a separate resection specimen of the tumour base, which is then performed in an antegrade fashion (lower broken arrow).

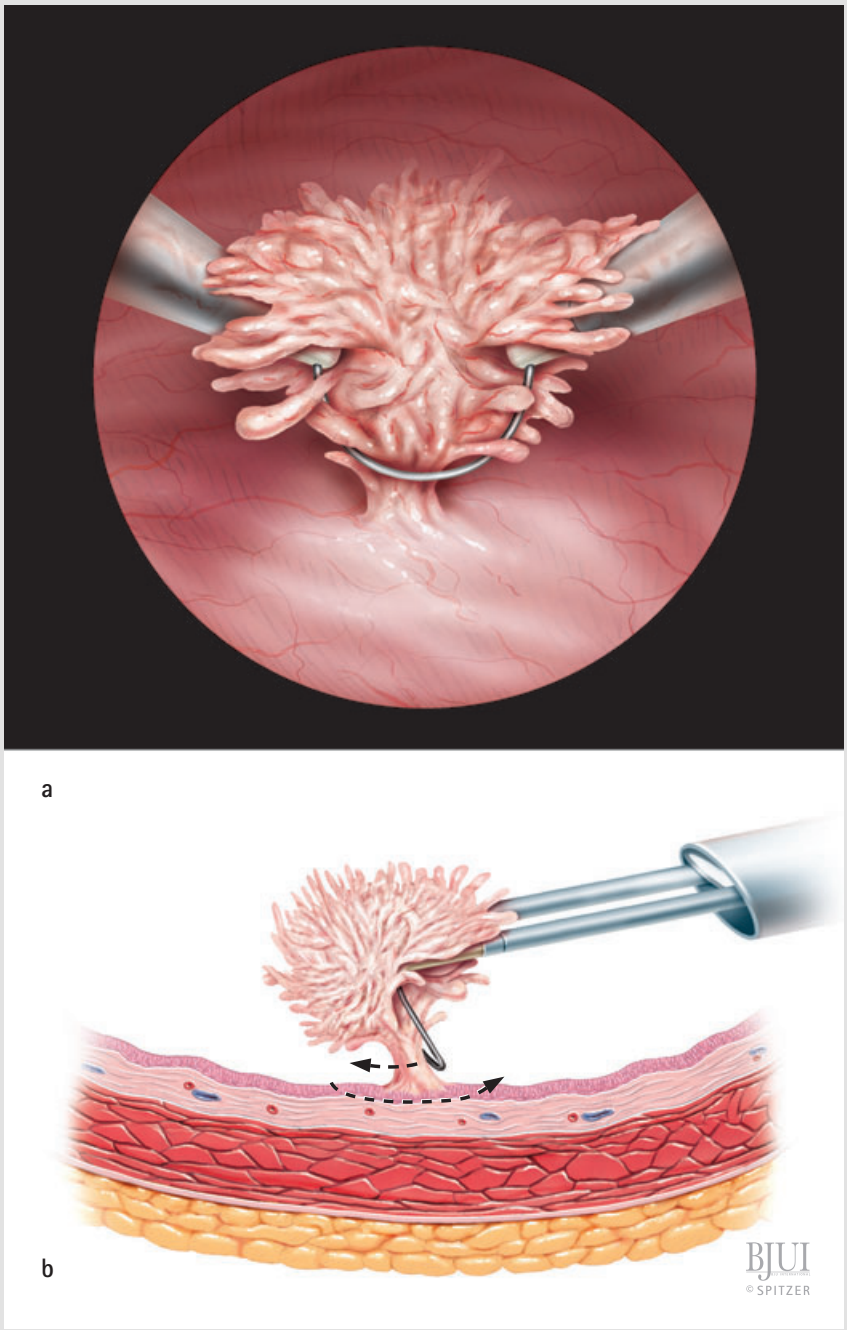


Figure 3

Once the base of the tumour has been completely resected, additional samples are taken from the ground of resection including detrusor muscle to allow precise pathological evaluation of presence/absence and depth of tumour invasion into the lamina propria and detrusor muscle (pT stage).

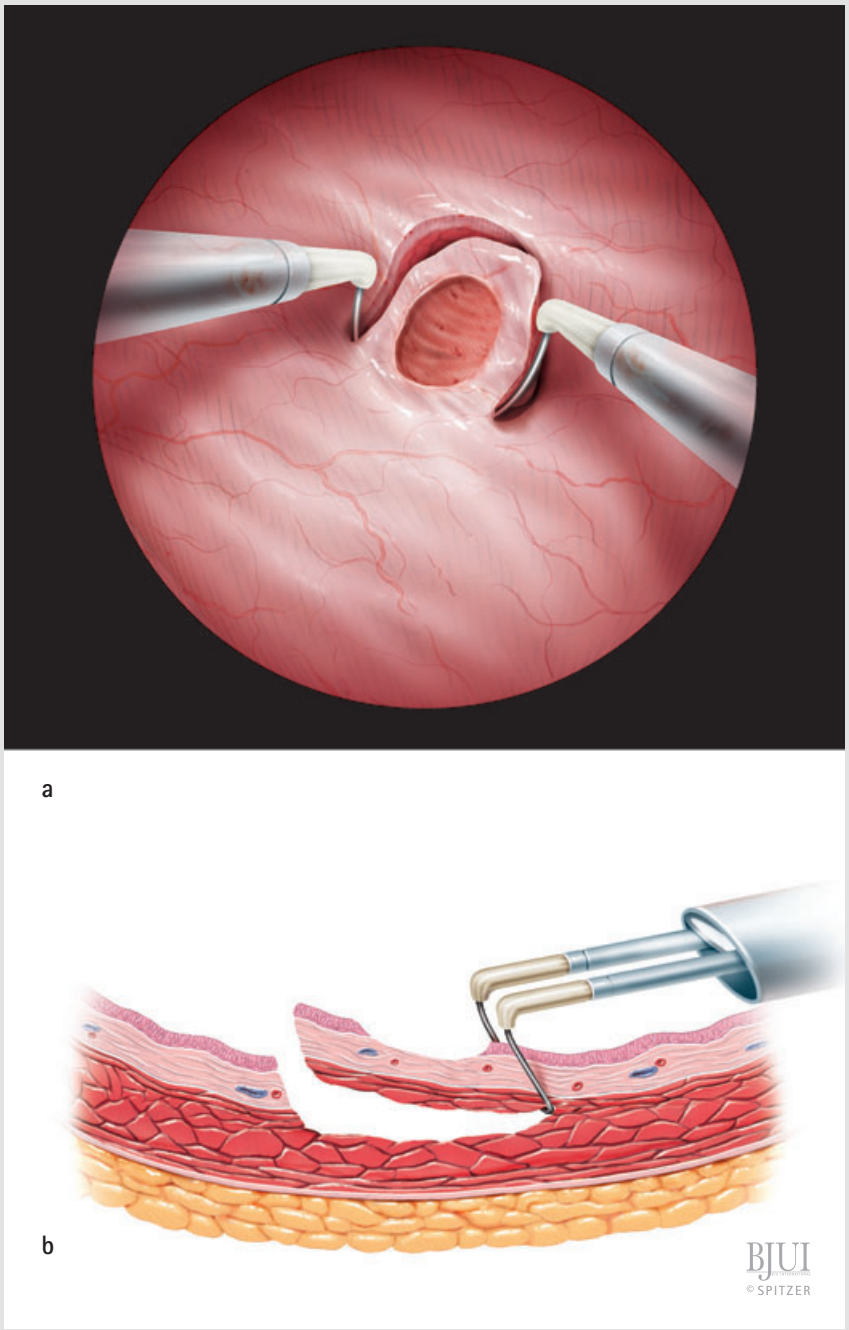


Figure 4

TURBT is completed by additional resection of normal-looking urothelium from the lateral margins of the resection to assure complete resection on histopathology (broken line).

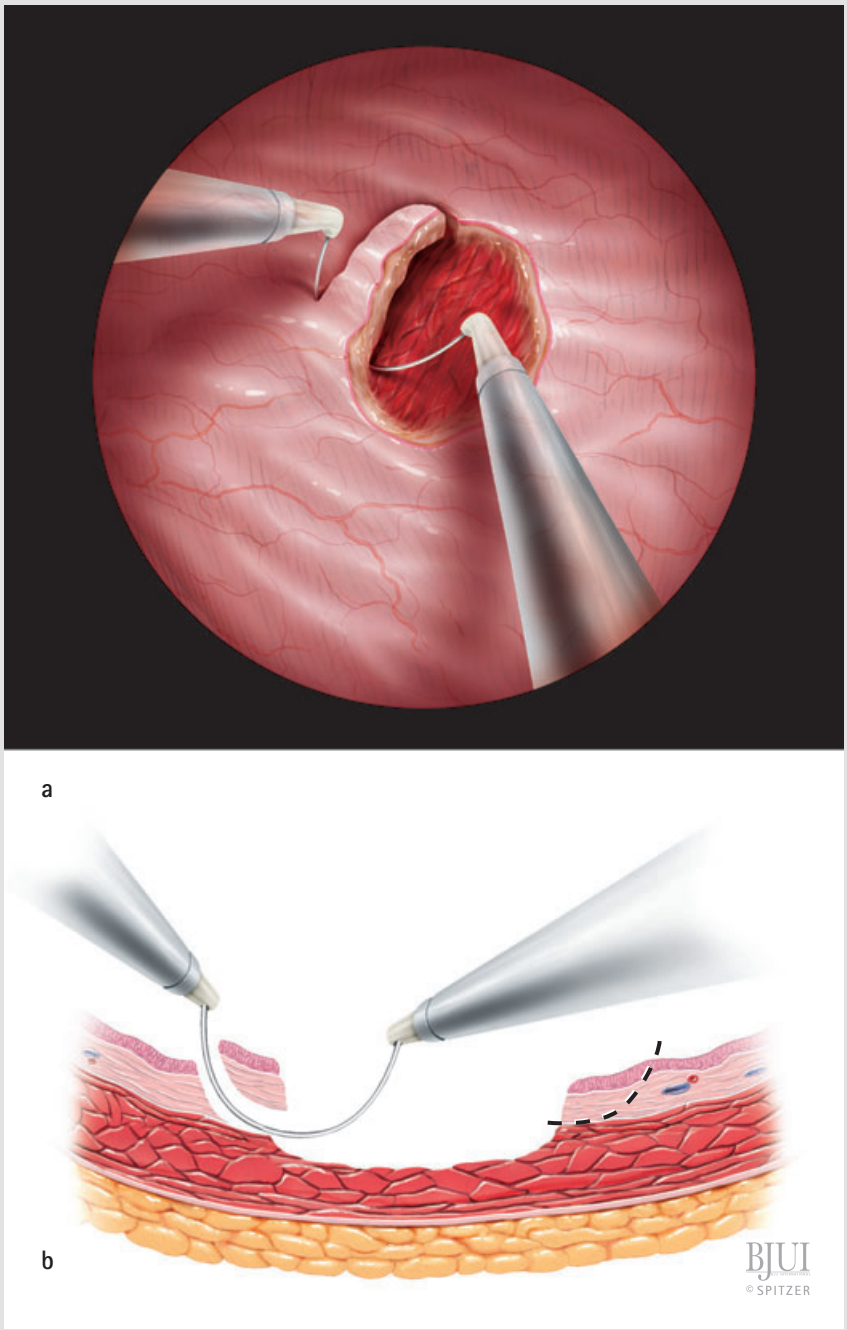


Figure 5

When PDD-guided TURBT is planned, the bladder is examined first by white-light cystoscopy and afterwards by blue-light cystoscopy. During blue-light cystoscopy, any lesions that are suspicious for cancer appear red against a blue background of normal urothelium. The boundaries of a planned resection area are marked by coagulation.

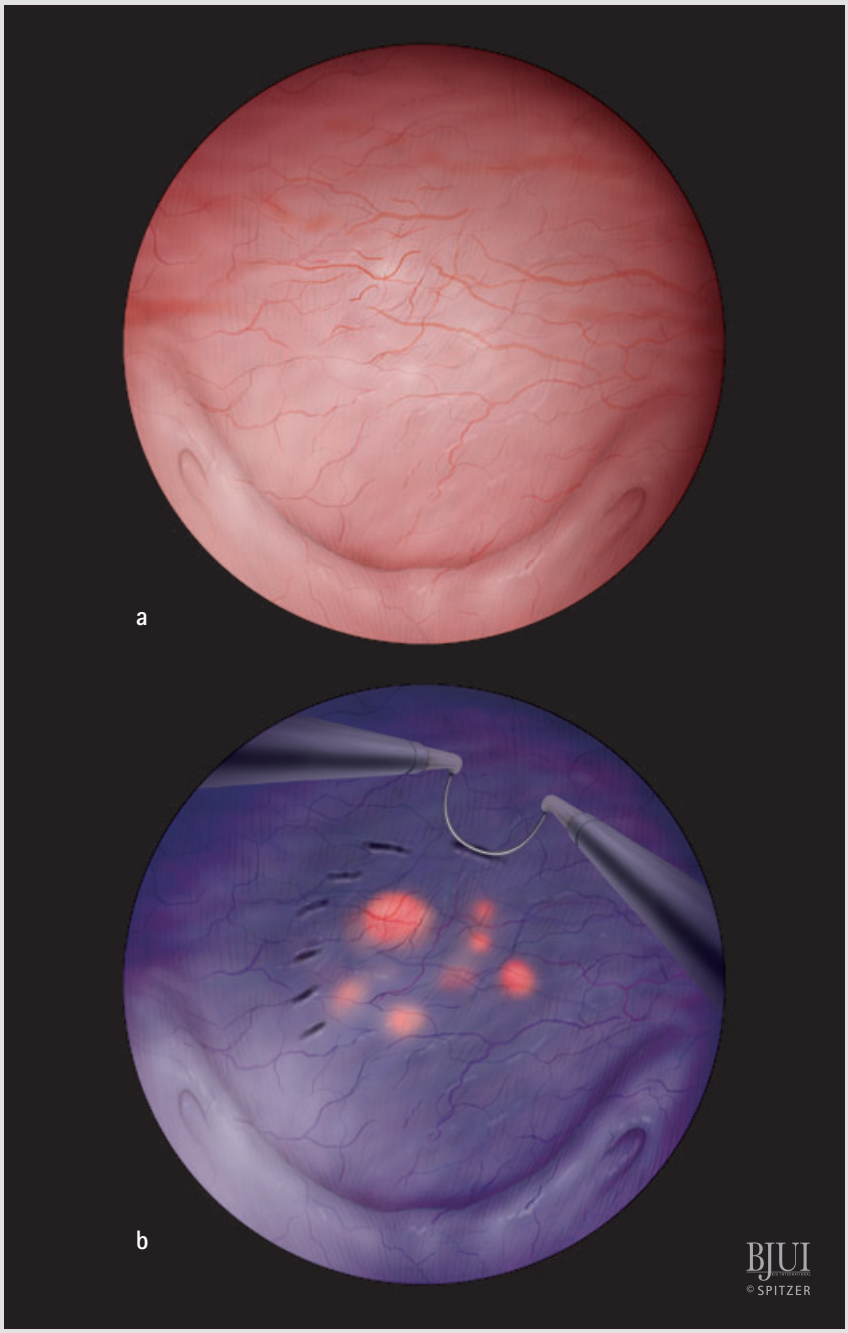


Figure 6

TURBT of the marked area of the flat lesions (CIS) is performed under white-light cystoscopy. Again resection depth must include detrusor muscle either in the specimen itself (picture) or in a fractioned resection (Fig. 3). Lateral margins of resection must be taken as above (Fig. 4).

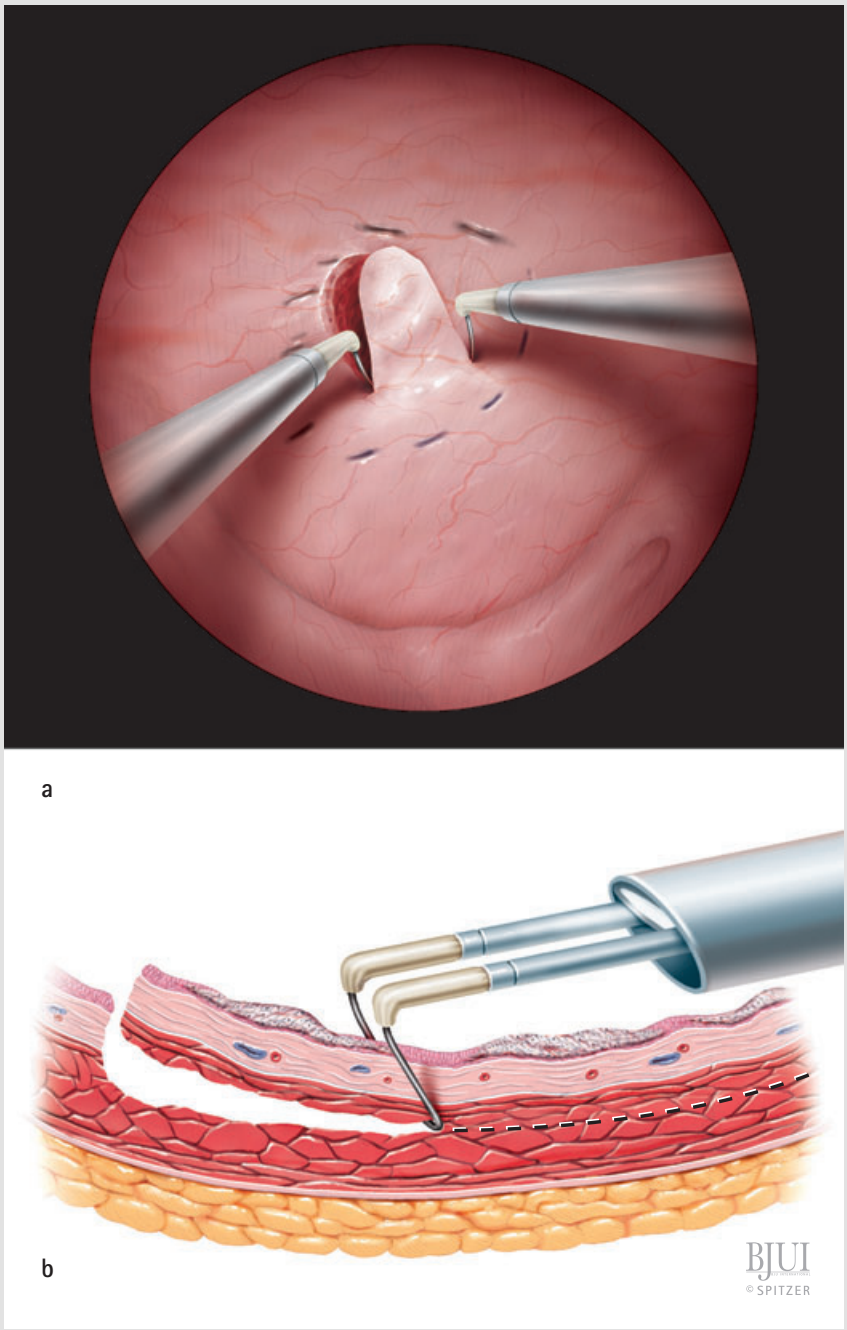


Figure 7

Broadly based solid tumours are likely to be invasive. TURBT starts again at the tip ('tip of the iceberg') of the tumour and is extended into the depth of the bladder wall depending on the surgical concept:

1) Staging only before cystectomy still requires presence of detrusor muscle in the specimen
2) Attempted cure (pT1) tumours must remove all macroscopic tumour and then assure complete resection by taking margins from the ground of the resection (Fig. 3) and the lateral urothelium (Fig. 4)
3) Palliative resection in patients, in whom complete TURBT is impossible and cystectomy cannot be performed either aims at debulking from tumour and haemostasis. In consequence, the exophytic parts of the tumour are resected to achieve a flat surface at the bladder wall level to ease coagulation for haemostasis.

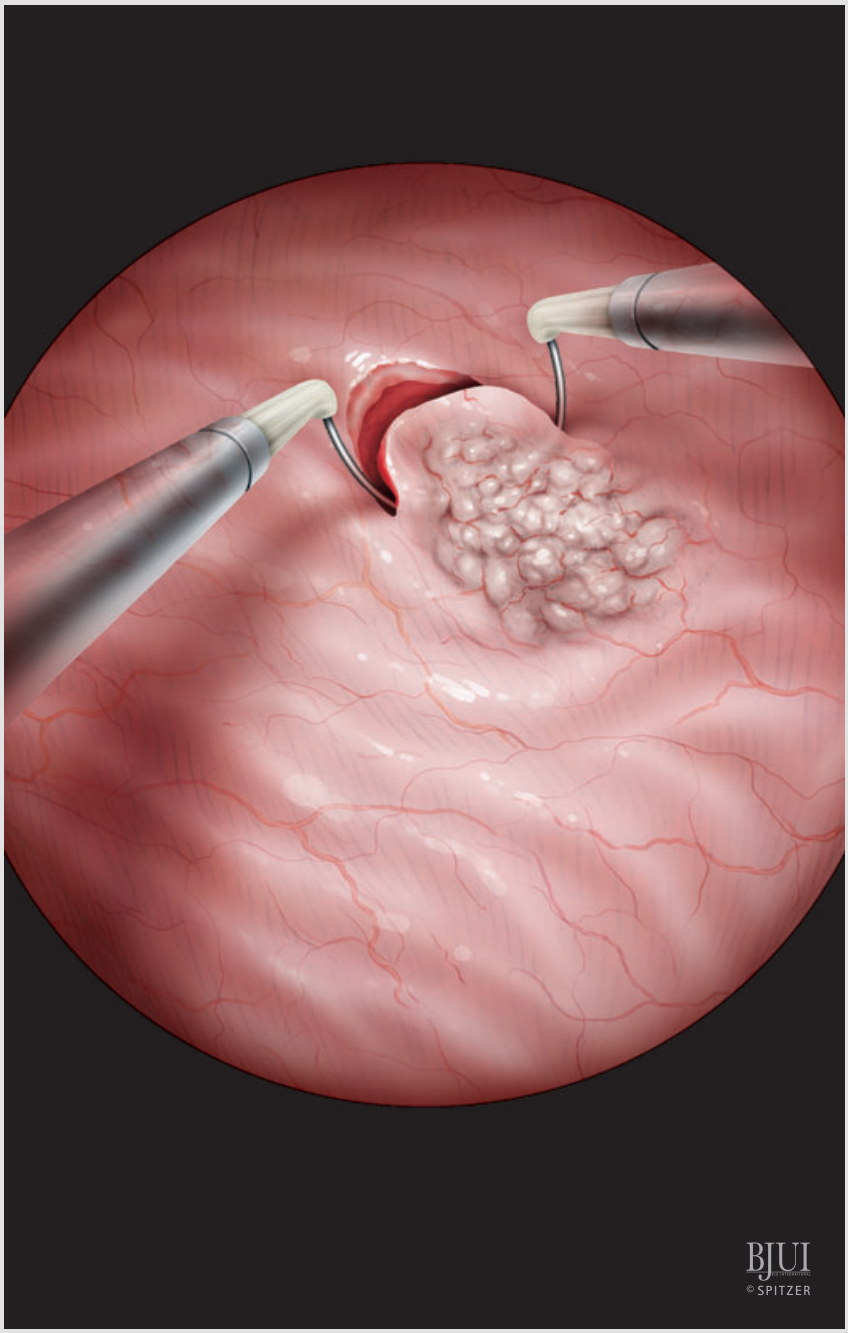


Figure 8

T1 tumours invading the lamina propria (Fig. 8a) are treated preferably by complete resection and separately taken biopsies from the detrusor (Fig. 3). In any case, a second TURBT is usually indicated after 6–8 weeks to assure local tumour control and accurate tumour staging unless primary cystectomy is elected for a pT1 high-grade tumour disease.

T2 muscle-invasive tumours (Fig. 8b) are usually not cured by TURBT. Usually, a diagnostic resection biopsy including detrusor muscle is adequate when radical cystectomy is planned (upper broken line). Aggressive radical tumour resection (lower broken line) in a second TURBT after 6–8 weeks may be indicated in elder patients, who are not suitable for radical cystectomy to achieve best possible local tumour control or in cases of bladder-sparing multimodal therapies. In these cases the resection is performed in the second TURBT into the perivesical fatty tissue (lower broken line).

T3 locally advanced nonbladder-confined tumours (Fig. 8c) when treated for palliative reasons (debulking and haemostasis), are resected down to the detrusor level without attempting complete resection. The main goal of resection is a flat surface, which allows effective coagulation for haemostasis.

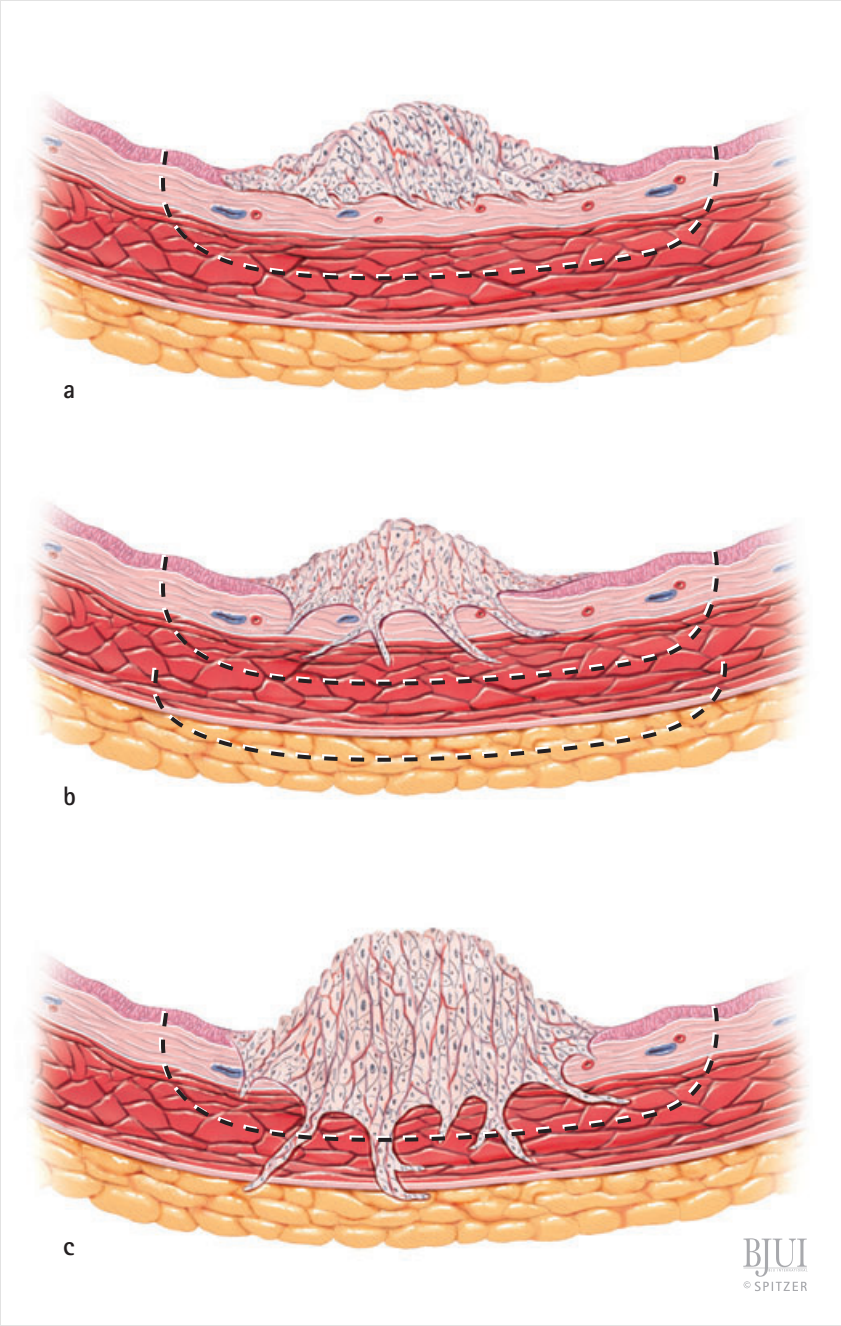
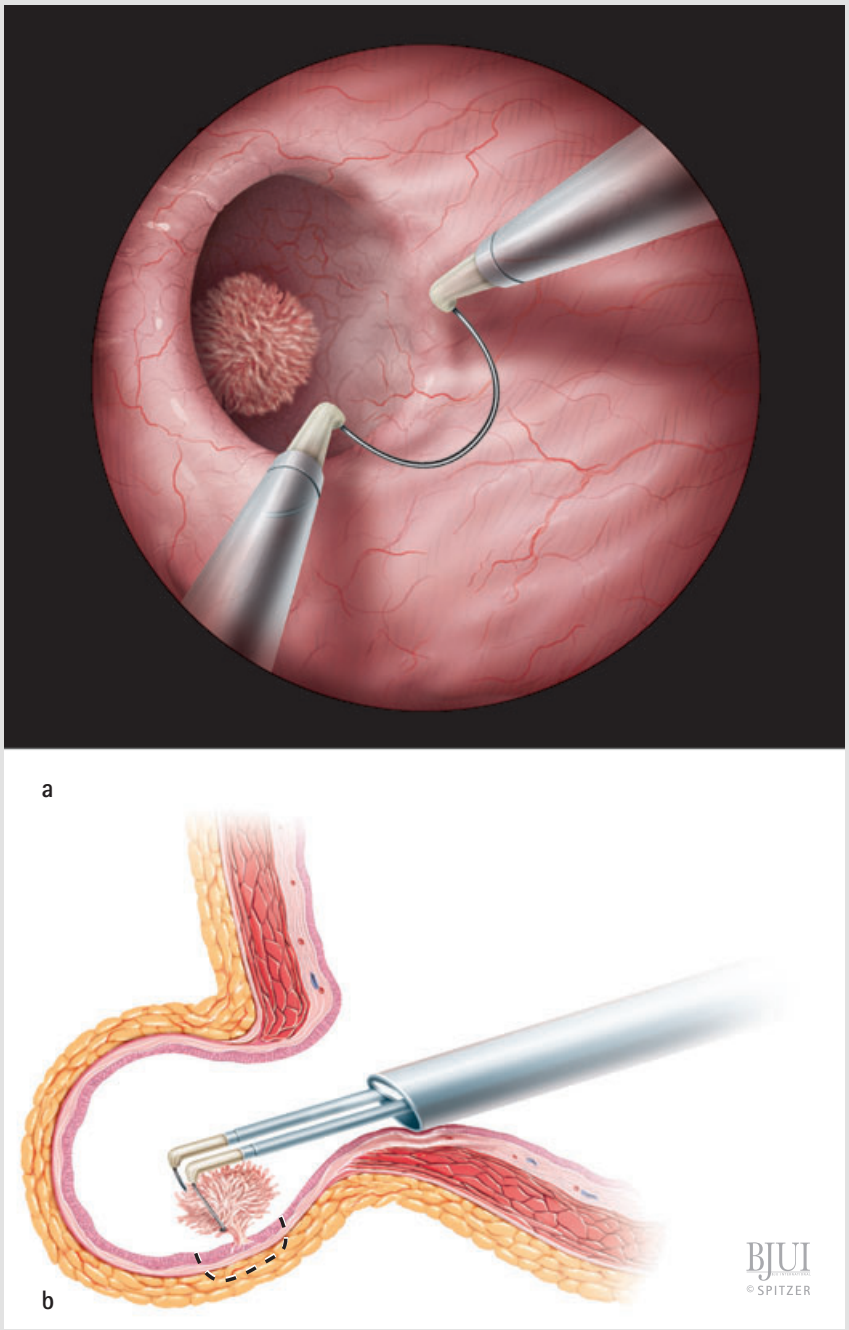


Figure 9

A tumour located in a bladder diverticulum comprises a special tumour entity, as there is no detrusor muscle present in the diverticulum wall. TURBT is performed in a similar fashion as for other bladder tumours. However, as resection is generally into the fat, the risk of perforation is high. Due to the absence of detrusor, any infiltrative growth (pT1) may equal a pT3 stage requiring more aggressive treatment.



POSTOPERATIVE CARE

Continuous irrigation through a transurethral three-way catheter (18–24 F) is usually performed for 24 h to avoid blood clotting from postoperative haemorrhage and for elimination of floating tumour cells. The catheter is removed 48–72 h after TURBT depending on the size of the resection area and of the resection depth. In cases of bladder wall perforation during TURBT, the transurethral catheter may be left in place for 7–10 days.

FROM SURGEON TO SURGEON

TURBT of lateral bladder wall tumours may cause sudden muscle contractions from stimulation of the obturator nerve with the risk of bladder wall perforation. In cases of preoperatively known tumour location at the lateral bladder wall, a pharmacological blockage of the obturator nerve before TURBT is helpful. Careful resection with at most half full bladder is recommended.

Tumour resection at the site of the ureteric orifice may result in postoperative upper tract dilatation due to edema. In those cases, placement of a ureteric double-J stent is helpful for temporary drainage. Usually the stent can be removed 7–14 days after TURBT at an outpatient base.

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Abbreviations: **BCA**, bladder cancer; **TURBT**, transurethral resection of bladder tumours; **CIS**, carcinoma *in situ*; **PDD**, photodynamic diagnosis.