Transrectal sentinel lymph node biopsy for early rectal cancer during transanal endoscopic microsurgery

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Transrectal sentinel lymph node biopsy for early rectal cancer during transanal endoscopic microsurgery

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Abstract

Background: Local excision of invasive cancer by transanal endoscopic microsurgery (TEM) entails the risk of lymphnode metastases that obliges to radical surgery. A determination of metastatic lymph-nodes would avoid major surgery in the vast majority of cases. We applied the concept of sentinel lymphnode (SLN) biopsy to suspected invasive rectal cancers treated by TEM. **Methods:** Indocyanine green (ICG) is injected in the submucosa underneath the lesion. The tumor is dissected full-thickness until the perirectal fat. A near infra-red (NIR) optic provides a map of mesorectal lymphatics, on which guide the perirectal fat is dissected and lymph-nodes are excised. **Results**: The technique was tested in three patients. In all cases the pathologist confirmed presence of lymphnodes in the excised tissue, no case showed metastasis. In all cases final pathology of the rectal neoplasm did not indicate radical surgery. **Conclusion:** In suspected invasive cancers, SLN mapping could be a useful technique to identify the first lymph node receiving drainage from the tumour, whose accurate pathological examination could predict the status of the remaining nodes and indicate further radical surgery. An ongoing study on a prospective case series will assess sensitivity and negative predictive value of SLN biopsy.
Keywords: Rectal neoplasm, transanal endoscopic microsurgery, sentinel lymphnode

Introduction

Minimally invasive treatment of large rectal adenomas and early rectal cancer by transanal endoscopic microsurgery (TEM) has become a common procedure during the last 25 years (1). About 20% of sessile adenomas of the rectum preoperatively assessed as benign are in fact malignant. This is evidently more frequent among those biopsed as high grade dysplasia (HGD). Fortunately it has been shown that “en bloc” excision of up to T1sm1 cancer of the Kikuchi classification (2), as revised in the so-called Paris Classification (3), is oncologically curative, with a low recurrence rate (4–7). Therefore, preoperative staging is critical to assess a correct indication to local excision, but, due to its scarce reliability, post TEM histology can be unexpectedly unfavourable. If a cancer more advanced than T1sm1 stage is found, radical surgery consisting of rectal anterior resection (RAR), total mesorectal excision (TME) or abdomino-perineal resection (APR), is indicated within four to eight weeks. The oncological outcome after radical surgery is comparable to that of radical surgery performed as a primary treatment (8,9). This is supposed to be due to the fact that this two-step procedure respects one of the principles of oncologic appropriateness for rectal cancer treatment, that is to maintain the integrity of the mesorectal fascia. Metastatic lymph nodes for early rectal cancer are present in a relatively low rate, which increases with submucosal invasion: 1–3% for sm1, 8% for sm2 and 23% for sm3 (10). As a consequence, a reliable determination of lymph-node positive for metastasis would avoid major surgery in the vast majority of cases. In order to do this, we tried to apply the concept of sentinel lymph node biopsy to suspected early rectal cancers treated by TEM, by developing a new technique.

Material and methods

Before the beginning of the intervention, under general anesthesia, indocyanine green solution (ICG) is injected submucosally underneath the lesion, at the four cardinal points (1 ml/cardinal point of a 5 mg/ml ICG solution) by means of flexible endoscopy (Figure 1, video 1). Then a TEM rectoscope 7 or 15 cm in length (Karl Storz GmbH, Tuttlingen, Germany) is inserted into the rectum. The rectal tumor is dissected by means of an en-bloc full-thickness rectal wall excision until the perirectal fat (Figure 2, video 2). Once the primary neoplasm is excised and the perirectal fat widely exposed from the inside, a dedicated 10 mm near infra-red (NIR) optic is inserted into one of the working channels and its illumination is switched to fluorescence-guided image (D-Light p System, Karl Storz GmbH, Tuttlingen, Germany). NIR fluorescence emitting ICG previously injected designs a map of mesorectal lymphatic vessels and nodes, that is visualized by this system. The perirectal fat is dissected searching for lymph-nodes (Figure 3, video 3). Lymph-nodes are then excised and sent to the pathologist for final examination (Figure 4).

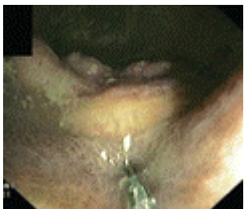

Figure 1. Just before surgery, indocyanine green solution (ICG) is injected submucosally underneath the lesion, at the four cardinal points (1 ml/cardinal point of a 5 mg/ml ICG solution) by means of flexible endoscopy.

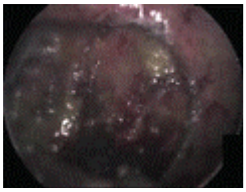

Figure 2. After marking by cautery the free margin encircling the lesion at least 5 mm apart, the rectal tumor is dissected by means of an en-bloc full-thickness rectal wall excision until the perirectal fat, widely exposing the perirectal fat from the inside and keeping the mesorectal fascia integer.

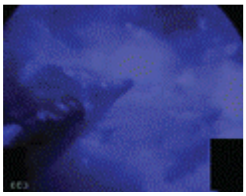

Figure 3. A dedicated 10 mm near infra-red (NIR) optic is inserted into one of the working channels and its illumination is switched to fluorescence guided image (D-Light p System, Karl Storz GmbH, Tuttlingen, Germany). NIR fluorescence emitting ICG previously injected designs a map of mesorectal lymphatic vessels and nodes, that is visualized by this system. The perirectal fat is dissected searching for lymph-nodes. Lymph-nodes are then excised and sent to the pathologist for final examination.

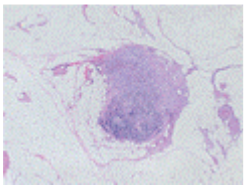

Figure 4. Lymph-node pathology examination showing no metastases.

Results

The technique was used in three consecutive patients, all with a posterior neoplasm of the mid rectum, extending for less than half of the circumference. Lesions were uT0/uT1 at endoscopic ultrasound examination, with a preoperative bioptic histology assessment of high grade dysplasia in two cases and adenocarcinoma in one case.

In all three cases a lymphatic map and possible lymph-nodes were identified by NIR optic through the defect in the rectal wall created by the excision of the rectal neoplasm with 5 mm lateral free margins. Once excised the specimens containing the suspected sentinel lymph-nodes were sent for definitive pathology examination. In all cases the pathologist confirmed the presence of lymph-nodes (Figure 4). Three nodes were identified in one case, one node in the further two cases. In no case the examen of the perirectal fat containing the lymph-nodes was altered by the injection of the dye. All lymph-nodes retrieved were <5 mm in maximum diameter and were dissected within the depth of 1 cm in the mesorectal fat, due to the power of the NIR optic. The examen of the lymph-nodes did not show malignant tissue in any of the cases observed.

Final pathology of the rectal neoplasm did not indicate radical surgery in any of the cases, being the neoplasm confirmed as a high grade dysplasia in two cases and a pT1sm1 cancer in one case.

Discussion

The accepted oncological treatment of invasive rectal cancers is radical abdominal surgery, which has been replaced along the years by TEM for benign lesions and intramucosal adenocarcinoma, since this procedure has higher efficacy and lower morbidity.

In suspected invasive cancers, SLN mapping could be a useful technique to identify the first lymph-node receiving drainage from the tumour, whose accurate pathological examination could predict the status of the remaining nodes (11–18). Near-infrared fluorescence (NIR) emitting dye indocyanine green (ICG) has been used in SLN mapping for breast, gastric and colon cancer (19–24). This kind of dye emits fluorescence in the invisible spectrum (700–900 nm) with the following advantages: Deep penetration in living tissues, low natural fluorescence of living tissues and no visible alterations of the surgical field.

Hutteman et al. (25) applied this technique *ex vivo* using a NIR fluorescence emitting dye (HSA800) and a new optical system (FLARE) able to display simultaneously and combine visible and NIR image. Dye was injected in the submucosa; mean time of identification of SLN in rectal cancer was 27 seconds.

In accordance to these results, we are conducting a study to assess the feasibility and accuracy of SLN mapping and sampling in preoperatively staged T1 rectal cancers and HGD adenomas resected by TEM using a NIR light emitting dye injected in the peritumoral mucosa. This type of technique preserves the integrity of mesorectal fascia, so that patients with positive SLN will undergo completion surgery without worsening of the prognosis. At the same time in patients with pT1sm2-3 or pT2 tumours but negative SLN, TME could be considered not mandatory and the patient will be strictly followed up.

The study is designed as a prospective case series controlled study. Success rate of SLN biopsy will be reported, to determine the feasibility of the technique. Patients with positive SLN will undergo completion surgery; mesorectal lymph nodes will be then analyzed to establish the specificity and positive predictive value of SLN.
Aim of the study, now that feasibility is verified, is to assess sensitivity and negative predictive value of SLN biopsy. Recurrence rate will be then compared with a historical series of patients with rectal cancer treated by abdominal surgery (RAR/APR with TME) who will be matched for stage. By assessing presence of metastases in the SLN we intend to define the subgroup of patients with invasive rectal cancer removed by TEM who do not deserve radical surgery. The possibility to extend the indications of TEM in all T1 and potentially some T2 rectal cancers, oncologically legitimized by SLN biopsy, could offer a significantly lower morbidity, mortality and a better quality of life.

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