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Description of a reproducible anatomically based surgical algorithm for detection of pelvic sentinel lymph nodes in endometrial cancer

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HIGHLIGHTS

- Reinjection of tracer resulted in a 96% bilateral detection rate of pelvic SLNs.
- The anatomically-based surgical algorithm is reproducible and feasible.
- All node positive patients had at least one metastatic pelvic SLN.
- Isolated presacral lymph node metastases were detected.
- No patient had isolated paraaortic metastases.

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ABSTRACT

Objective. To describe and evaluate a reproducible, anatomically based surgical algorithm, including reinjection of tracer to enhance technical success rate, for detection of pelvic sentinel lymph nodes (SLNs) in endometrial cancer (EC).

Methods. A prospective study of 102 consecutive women with high risk EC scheduled for robotic surgery was conducted. Following cervical injection of a fluorescent dye, an algorithm for trans- and retroperitoneal identification of tracer display in the lower and upper paracervical pathways was strictly adhered to. To enhance the technical success rate, this included ipsilateral reinjection of tracer in case of non-display of any lymphatic pathway. The lymphatic pathways were kept intact by opening the avascular planes. To minimize disturbance from leaking dye, removal of SLNs was first performed along the lower paracervical (presacral) pathways followed by the more caudal upper paracervical pathways. In each pathway, the juxtauterine node with an afferent lymph vessel was defined as an SLN. After removal of SLNs, a complete pelvic and, unless contraindicated, infrarenal paraaortic lymph node dissection was performed.

Results. The bilateral detection rate including tracer reinjection was 96%. All 24 (23.5%) node positive patients had at least one metastatic SLN. Presacral lymph node metastases were discovered in 33.3% of the node positive patients. One patient (4.2%) had an isolated presacral lymph node metastasis.

Conclusions. The described cranial-to-caudal anatomically based surgical SLN algorithm, including a presacral dissection and reinjection of tracer, results in a high SLN detection rate and identified all patients with lymph node metastases.

1. Introduction

The clinical significance of a full pelvic and paraaortic lymphadenectomy in women with endometrial cancer (EC) is still controversial, leading to a widespread variation in clinical practice [1–3]. Minimizing morbidity related to a full staging procedure, avoiding the consequences of an erroneous preoperative risk staging and the possibility to identify metastases in low-risk patients has led to increased interest in lymphatic mapping and the detection of sentinel lymph nodes (SLNs) in EC patients [4–19]. In addition, immunohistochemistry and pathological ultrastaging increase the detection rate of metastatic disease [20].

A variety of mapping agents and injection sites has been described. Indocyanine green (ICG) (Pulsion Medical Systems, PICG0025SE, Feldkirchen, Germany) has emerged as the most commonly used tracer in recent years [4,13,19,21,22]. ICG enables the identification of both lymph vessels and lymph nodes. Tracers disperse through the lymphatic

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vessels mapping several nodes along a pathway. The SLN should be defined as the juxtauterine lymph node with an afferent lymph vessel in each lymphatic pathway. Contrary to ICG, radiotracers do not allow SLNs to be defined accordingly. Several studies have shown cervical injection of tracers to result in representative display of pelvic SLNs in EC thereby avoiding a technically complex hysteroscopic peritumoral or a transabdominal fundal injection [19,22–24].

Ideally, an SLN concept should be anatomically based, lead to low false negative rates, and have a high technical success rate. The surgical approach should be standardized, reproducible and consider lymphatic anatomy to optimize outcome and minimize leaking of dye during dissection.

Our recent study on uterine lymphatic anatomy confirmed previous publications' description of two consistent lymphatic pathways with pelvic SLNs in women with EC; an upper paracervical pathway (UPP) with draining medial external and/or obturator lymph nodes and a lower paracervical pathway (LPP) with draining internal iliac and/or presacral lymph nodes (Fig. 1) [19,25–27]. These pathways communicate with finer lymphatics at the level of the cardinal ligaments, thereafter dividing into separate non-communicating courses lateral and medial to the common iliac arteries with further drainage to the paraaortic area.

According to most publications, lymph node dissection (LND) along the UPP constitutes a full pelvic lymphadenectomy [6,9,28]. Although presacral lymph node metastases (LNM) have been described in 10–15% of node positive patients, an LND along the LPP is not routinely performed [29–31]. Most authors describe SLNs as occurring along the UPP and although referred to by some, no previous publications have described an algorithm including bilateral SLN identification along both the UPP and LPP [4,13,32,33].

The aim of this study is to describe and evaluate a reproducible, anatomically based surgical algorithm, including reinjection of tracer to enhance the technical success rate, for detection of SLNs in EC.

2. Material and methods

Between June 2014 and December 2016, consecutive patients with high-risk EC (at least one of following risk factors: FIGO grade 3, non-endometrioid histology, non-diploid flow cytometry, myometrial invasion > 50% or cervical invasion, the two latter assessed transvaginally by an expert ultrasonographer) scheduled for robot-assisted surgery using a da Vinci® Si or Xi Surgical System (Intuitive Surgical Inc., Sunnyvale, Ca, USA) were included in the study. A preoperative CT scan of the thorax and abdomen was performed. All women gave their preoperative written informed consent.

Preoperatively, and according to study protocol, patients were scheduled for an SLN biopsy, infrarenal paraaortic (unless in cases of severe comorbidity or advanced age) and full pelvic LND in addition to a hysterectomy and bilateral salpingooophorectomy and in case of a non-endometrioid histology, even an infracolic omentectomy.

For the injection, 25 mg Indocyanin green (ICG) powder was diluted in 10 mL sterile water, achieving a 2.5 mg/mL solution. Using a 0.6 × 38 mm 23G × 1 1/2 needle and 1 mL syringes, 0.25 mL of this solution (0.625 mg) was slowly injected into the cervix at each of four injection sites (2, 4, 8 and 10 o'clock respectively); half the volume submucosally and half 3 cm into the cervical stroma before a tube was fitted around the cervix to present the fornices. The bilateral uptake of ICG in the UPP and the LPP was assessed through an intact peritoneum, where a clear ICG uptake both lateral and medial to the common iliac artery indicates filling of the respective pathways (Figs. 2, 3A).

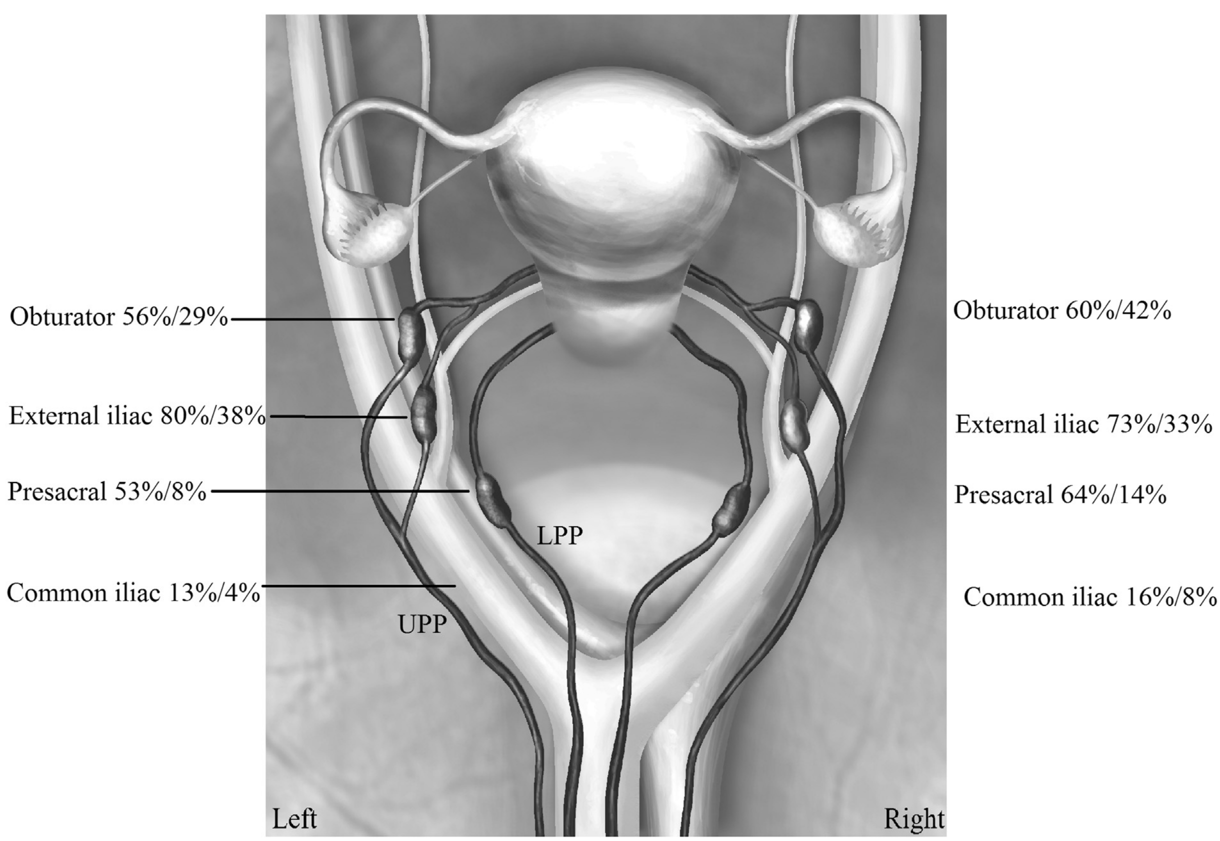

Fig. 1. Schematic overview of the pelvic uterine lymphatic pathways with typical localization of sentinel lymph nodes and percentage of non-metastatic/metastatic sentinel lymph nodes per lymph compartment in endometrial cancer (percentages refer to the total number of patients/node positive patients, patients can have more than one non-metastatic/metastatic sentinel lymph node). UPP = upper paracervical pathway. LPP = lower paracervical pathway.