Bilateral endoscopic inguinofemoral lymphadenectomy using simultaneous carbon dioxide insufflation: an initial report of a novel approach

Lindsey A. Herrel, MD,[1] Ryan M. Butterworth, MD,[2] Syed M. Jafri, MD,[1] Carl Ying, MD,[1] Keith A. Delman, MD,[3] David A. Kooby, MD,[3] Kenneth E. Ogan, MD,[1] Daniel J. Canter, MD,[1] Viraj A. Master, MD[1]

[1]Department of Urology, Emory University, Atlanta, Georgia, USA
[2]Department of Anesthesiology, Emory University, Atlanta, Georgia, USA
[3]Division of Surgical Oncology, Winship Cancer Institute, Atlanta, Georgia, USA

HERREL LA, BUTTERWORTH RM, JAFRI SM, YING C, DELMAN KA, KOOBY DA, OGAN KE, CANTER DJ, MASTER VA. Bilateral endoscopic inguinofemoral lymphadenectomy using simultaneous carbon dioxide insufflation: an initial report of a novel approach. The Canadian Journal of Urology. 2012;19(3):6306-6309.

Inguinal lymphadenectomy plays a critical role in the diagnosis and treatment of several neoplastic diseases. Frequently, bilateral lymphadenectomy is undertaken for staging and/or treatment of genitourinary cancers. Our objective was to determine if bilateral endoscopic lymphadenectomy could be performed simultaneously, in an effort to decrease overall anesthetic and operative time. This was accomplished by utilizing two carbon dioxide insufflators concurrently. This approach requires careful positioning of the patient, surgical team, and instrumentation, as well as special anesthetic considerations necessary to avoid severe hypercarbia. Simultaneous bilateral endoscopic inguinal lymphadenectomy is a technically feasible and efficient surgical approach.

Key Words: simultaneous bilateral inguinofemoral endoscopic lymphadenectomy

Introduction

Inguinofemoral lymphadenectomy is performed for a variety of malignancies including metastatic melanoma, certain gynecologic cancers, as well as neoplasms of the penis, urethra, and scrotum. Bilateral procedures are sometimes indicated, and these can be staged or performed using a single anesthetic. We present the first description of a simultaneous bilateral endoscopic inguinofemoral lymphadenectomy.

Open inguinofemoral lymphadenectomy has a complication rate in the 50% to 85% range, much of which is related to the incision.[1-3] In an effort to minimize wound complications, Tobias-Machado and Sotelo described the first successful endoscopic groin lymphadenectomies in 2006,[4,5] although earlier reports in cadavers were published as early as 2003.[6] Recently, we extended this technique with a template that is applicable for a variety of cancers, including the more extensive template used for melanoma, which includes routinely resecting deep inguinal nodes en bloc with the contents of the femoral triangle, including fascia lata. We have previously reported both technique and feasibility.[7,8]

Accepted for publication April 2012

Address correspondence to Dr. Viraj Master, Department of Urology, Emory University, 1365 Clifton Road NE, Suite B, Atlanta GA 30322 USA

We observed that some patients, especially those with multiple comorbid conditions (particularly pulmonary), and who had lengthy operative times, developed significant hypercarbia with end-tidal partial pressures of carbon dioxide (EtCO2) above 60 mmHg during bilateral procedures. In an effort to decrease the time needed for a bilateral approach, we undertook a simultaneous bilateral inguinofemoral lymphadenectomy and report, to the best of our knowledge, the first description.

Case report

The patient was a 61-year-old male with pT3 squamous cell penile cancer who previously underwent a total penectomy and perineal urethrostomy. The patient was morbidly obese with a body mass index of 37.1 kg/m^2. Following urologic guidelines, we performed a bilateral inguinal lymphadenectomy. There were no palpable masses in his groin on physical exam, and his inguinal and pelvic nodal basins were negative on preoperative imaging.

Informed consent was obtained and once in the operating room, the patient was positioned on a split leg table, which allowed the legs to be abducted widely. A safety belt was placed securely around his waist just above the surgical field. This positioning allowed two members of the surgical team to stand between the legs simultaneously while the assisting team members stood on the outside as illustrated in Figure 1.

Once appropriately positioned, ASA monitoring devices were applied and an arterial line was placed to allow meticulous monitoring of blood pressure and acid base status through arterial blood gas sampling. A new carbon dioxide absorption canister was used for the case, based on previous experience that these canisters become exhausted quickly during the procedure. After adequate preoxygenation, the patient was induced with lidocaine, propofol, rocuronium and fentanyl. An endotracheal tube was placed and muscle relaxation was maintained throughout the case. General anesthesia was maintained with 1 MAC of sevoflurane at 2 liters of fresh gas flow and pressure controlled ventilation. Prior to carbon dioxide insufflation, the patient was hyperventilated to attain an EtCO2 of 30 mmHg in anticipation of hypercapnia. Upon insufflation the EtCO2 gradually rose and compensatory increases in minute ventilation were undertaken. This was accomplished with increased tidal volume (6 cc/kg-8 cc/kg) and respiratory rate (20-25). The patient was maintained at the lowest attainable EtCO2. Clinical signs of hypercapnia that were monitored for included respiratory acidosis, tachycardia, arrhythmias, peripheral vasoconstriction, stimulation of sympathetic nervous system and depression of the central nervous system. Once insufflation was discontinued, hyperventilation was continued until EtCO2 returned to normal levels and smooth emergence from general anesthesia with an uneventful extubation followed. In the recovery room, the patient was mentating appropriately with no signs or symptoms of CO2 narcosis, hemodynamic instability, or subcutaneous emphysema.

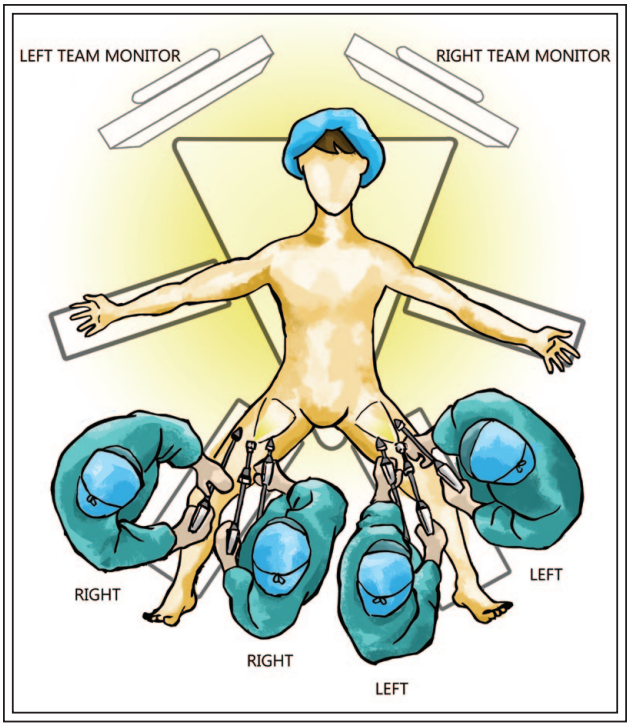

Figure 1. Schematic of patient, surgeon and operating room set up. Note that the viewing screens are placed at the contralateral shoulder.

Separate equipment set ups were used for each leg. This included a 12 mm Origin balloon port trocar (Origin Medsystems Inc, Menlo Park, CA, USA), two 10 mm Ethicon Endopath Bladeless trocars, a zero degree laparoscope, a video tower, laparoscopic instruments and carbon dioxide insufflation equipment. Port placement in each of the groins is identical to that which we have previously reported[7] and demonstrated in Figure 2. Insufflated pressure was maintained at 25 mmHg for the first 5 minutes then remained at 15 mmHg for the duration of the case.

Case length was 179 minutes. The number of inguinal nodes harvested was 10 and 12 nodes, respectively for the right and left groins. His peak end tidal carbon dioxide level during the case did not exceed 38 mmHg. No sequelae related to positioning were encountered, including neuropraxias. The

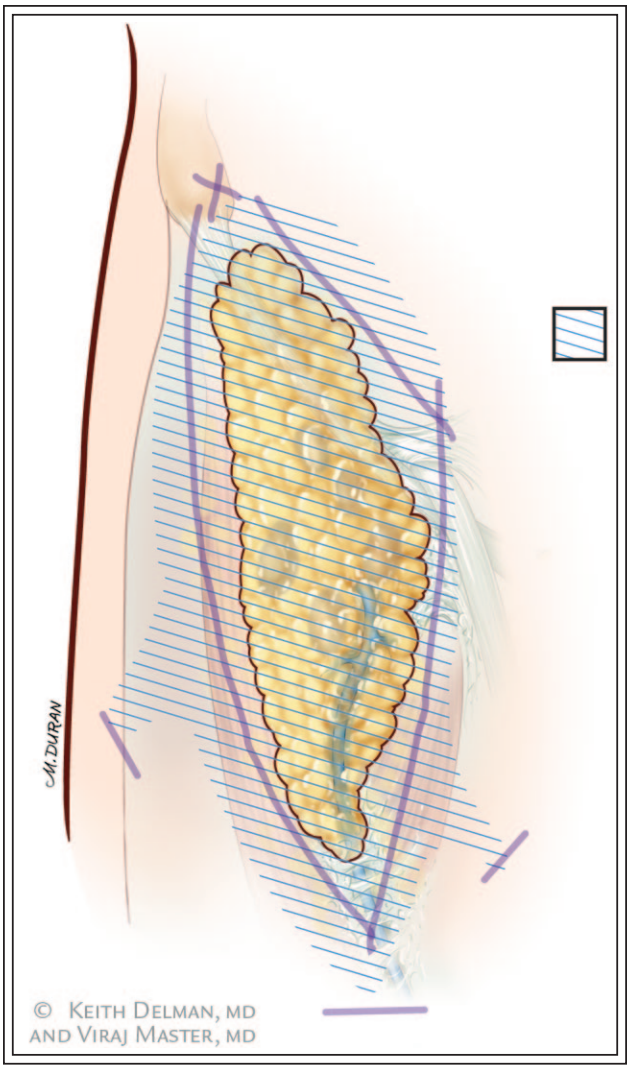

Figure 2. Trocar placement, anatomic landmarks and borders of inguinal lymph node dissection.

patient spent less than 24 hours in the hospital and was discharged with drains in place that were continued until output was left with 50 cc per 24 hours per drain site. Pathologic examination of the lymph node packets revealed a single lymph node on the right with evidence of squamous cell carcinoma.

Postoperatively, the drains remained in place on the left for 106 days and on the right for 61 days. These were managed with weekly instillation of dehydrated alcohol to treat lymphorrhea. No flap necrosis, cellulitis or wound break down occurred. The patient ultimately went on to radical penectomy after local recurrence in his penile stump, as well as excision of a persistently enlarged ilioinguinal lymph node on the left. Pathologic examination of this lymph node revealed no evidence of metastatic disease, while the penile specimen showed recurrent squamous cell carcinoma with negative margins. Adjuvant radiation and chemotherapy were administered. Currently, the patient is living with no evidence of disease 24 months after his simultaneous bilateral endoscopic inguinofemoral lymphadenectomy.

Discussion

To our knowledge, this report is the first description of concurrent bilateral endoscopic inguinofemoral lymphadenectomy using simultaneous carbon dioxide insufflation. There are several salient points meriting discussion. First, this technique appears to be both feasible and safe, while maintaining acceptable nodal yields.[9] Importantly, there were no complications related to externally rotating and abducting the patient's legs using the fracture or split leg table. Wide abduction of the legs allowed for working space for two teams to operate in parallel, reducing the time necessary to complete the case. Even with the legs abducted, the space between the legs is somewhat tight and not amenable to two large surgeons. It is helpful to ensure the safety belt is placed securely around the waist just above the surgical field to limit the extent of subcutaneous emphysema and even pneumomediastinum; known sequelae of extraperitoneal insufflation.[10]

Second, the patient did not have carbon dioxide levels in excess of those seen with unilateral endoscopic groin lymphadenectomy. A previous study by Wolf et al showed significantly higher levels of eliminated carbon dioxide in patients who were undergoing extraperitoneal rather than intraperitoneal laparoscopic operations.[10] Additionally, this group identified subcutaneous emphysema as a strong predictor of hypercapnia. A third factor found to impact carbon dioxide levels was duration of insufflation, which we believe can be shortened by performing the bilateral procedure simultaneously. Specific considerations to bear in mind are manipulating respiratory rate to increase minute ventilation, which will help decrease carbon dioxide levels. This must be carefully balanced however, because higher respiratory rates do not allow for adequate exhalation, which can lead to small airway collapse. Severe hypercapnia can result in central nervous system depression, respiratory acidosis, electrolyte shifts, hypoxemia, and cardiac arrhythmias.

With the help of a well prepared anesthesia team who works to prevent severe hypercapnia, the use of two carbon dioxide insufflators simultaneously is feasible and safe. This approach may be applicable to any laparoscopic or oncologic surgeon contemplating the need for a bilateral procedure for a groin lymphadenectomy. □

References

1. Bevan-Thomas R, Slaton JW, Pettaway CA. Contemporary morbidity from lymphadenectomy for penile squamous cell carcinoma: the M.D. Anderson Cancer Center Experience. *J Urol* 2002;167(4):1638-1642.
2. Spiess PE, Hernandez MS, Pettaway CA. Contemporary inguinal lymph node dissection: minimizing complications. *World J Urol* 2009;27(2):205-212.
3. Guggenheim MM, Hug U, Jung FJ, Rousson V, Aust MC, Calcagni M et al. Morbidity and recurrence after completion lymph node dissection following sentinel lymph node biopsy in cutaneous malignant melanoma. *Ann Surg* 2008;247(4):687-693.
4. Tobias-Machado M, Tavares A, Molina WR, Jr, Zambon JP, Medina JA, Forseto PH, Jr et al. Video endoscopic inguinal lymphadenectomy (VEIL): initial case report and comparison with open radical procedure. *Arch Esp Urol* 2006;59(8):849-852.
5. Sotelo R, Sanchez-Salas R, Carmona O, Garcia A, Mariano M, Neiva G et al. Endoscopic lymphadenectomy for penile carcinoma. *J Endourol* 2007;21(4):364-367;discussion 7.
6. Bishoff JT BJ, Teichman JM, et al. Endoscopic subcutaneous modified inguinal lymph node dissection (ESMIL) for squamous cell carcinoma of the penis. *J Urol* 2003;169:(Suppl 4):78.
7. Master V, Ogan K, Kooby D, Hsiao W, Delman K. Leg endoscopic groin lymphadenectomy (LEG procedure): step-by-step approach to a straightforward technique. *Eur Urol* 2009;56(5):821-828.
8. Delman KA, Kooby DA, Ogan K, Hsiao W, Master V. Feasibility of a novel approach to inguinal lymphadenectomy: minimally invasive groin dissection for melanoma. *Ann Surg Oncol* 2010;17(3):731-737.
9. Delman KA, Kooby DA, Rizzo M, Ogan K, Master V. Initial experience with videoscopic inguinal lymphadenectomy. *Ann Surg Oncol* 2011;18(4):977-982.
10. Wolf JS Jr, Clayman RV, Monk TG, McClennan BL, McDougall EM. Carbon dioxide absorption during laparoscopic pelvic operation. *J Am Coll Surg* 1995;180(5):555-560.