Original article

Videoscopic ilioinguinal lymphadenectomy for groin lymph node metastases from melanoma

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Background: Groin lymph node dissection for melanoma is burdened by high postoperative morbidity. Videoscopic lymphadenectomy may lower the incidence of complications, including infection, dehiscence and lymphoedema. This pilot study aimed to investigate the feasibility and postoperative outcomes of videoscopic ilioinguinal lymphadenectomy in patients with inguinal nodal melanoma metastases.

Methods: Patients with inguinal nodal metastases, with either a positive sentinel lymph node biopsy or clinically positive nodes from melanoma, were enrolled. Inguinal dissection was performed via three ports. Iliac dissection was obtained through a preperitoneal access. Intraoperative and postoperative data were collected.

Results: Of 23 patients selected for 24 procedures, four needed conversion to an open procedure. Median duration of surgery was 270 (i.q.r. 245–300) min. Wound-related postoperative complications occurred in four patients, although only one needed further intervention. The median number of excised lymph nodes was 21 (i.q.r. 15–25). After a median follow-up of 18 months, regional lymph node recurrence was observed in two patients.

Conclusion: Videoscopic ilioinguinal lymphadenectomy for melanoma groin lymph node metastases is technically feasible, safe, and associated with acceptable morbidity and oncological outcome.

Paper accepted 3 February 2016
Published online 5 May 2016 in Wiley Online Library (www.bjs.co.uk). **DOI:** 10.1002/bjs.10140

Introduction

Lymphadenectomy is recommended for patients with melanoma who have a positive sentinel lymph node (SLN) biopsy or clinically positive nodal metastasis[1,2].

Groin lymph node (LN) dissection always involves the inguinal field, whereas the performance of pelvic LN dissection is widely debated[3,4]. Some surgeons conduct pelvic LN dissection routinely but others restrict this surgery to those with risk factors, such as clinically positive nodes, three or more positive inguinal nodes, suspicious iliac LNs on CT, positive Cloquet's LN, or lymphatic drainage to the pelvis seen at lymphoscintigraphy performed for SLN biopsy[5].

Groin lymphadenectomy is associated with a high incidence of wound complications, including wound infection, dehiscence/necrosis and seroma/lymphocele[6,7]. Lower limb lymphoedema affects about 20 per cent of patients[8], with severe impairment in quality of life[9]. These complications have led to a reduction in the extent of surgery, confining this to inguinal LNs and incomplete dissection in around 50 per cent of patients when there is SLN positivity[10,11].

Videoscopic inguinal lymphadenectomy has been proposed recently for treating LN metastases from genitourinary and skin cancers to reduce morbidity[12]. It is based on the rationale that avoiding a large incision might reduce postoperative wound-related morbidity. In pilot experiences, this seemed to be true, with similar numbers of excised nodes and similar regional recurrence rate compared with open groin dissection[13,14]. Videoscopic lymphadenectomy has not been assessed for both inguinal and pelvic nodes at the same time (videoscopic ilioinguinal lymphadenectomy).

This prospective pilot study was designed to explore the technical feasibility and postoperative outcome of videoscopic ilioinguinal lymphadenectomy in patients with inguinal LN metastases from melanoma.

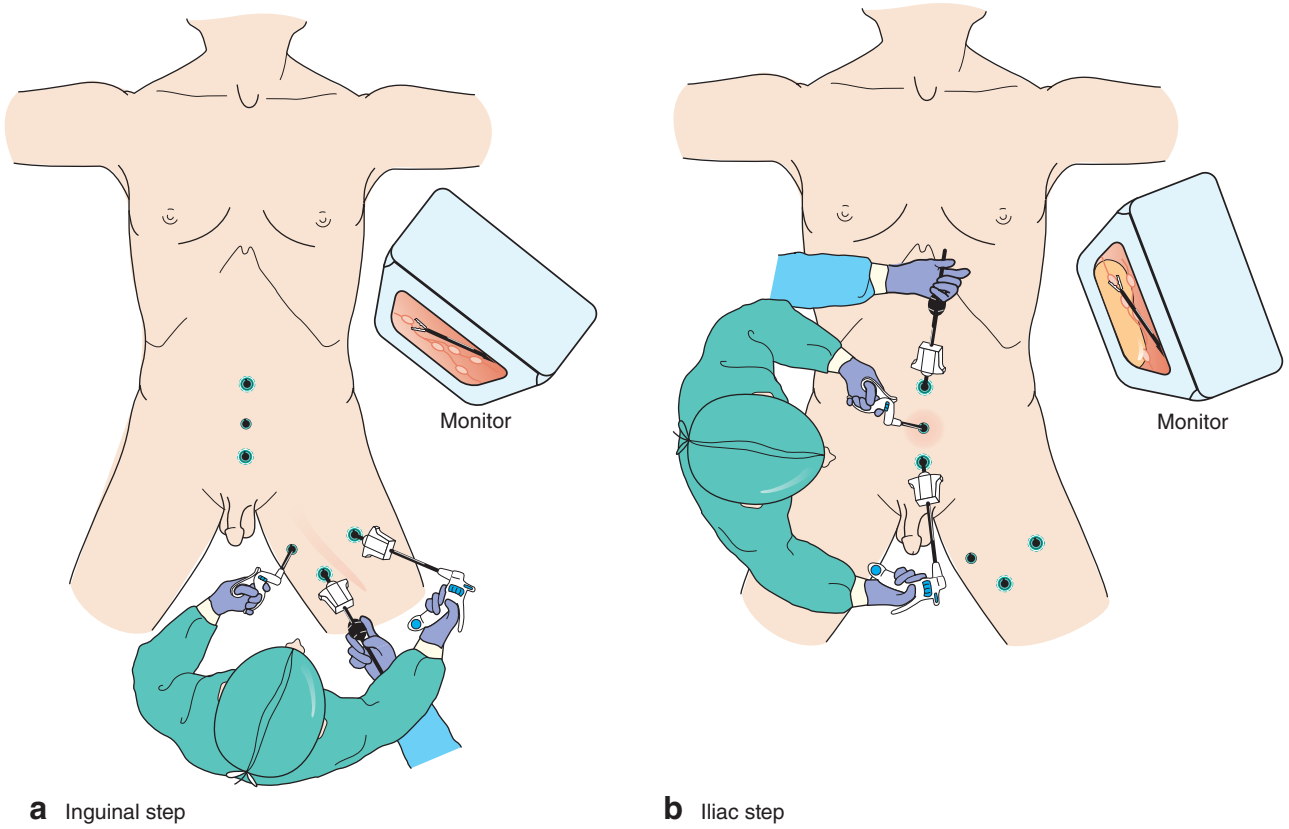

Fig. 1 Position of the operative team and trocar configuration for videoscopic ilioinguinal lymphadenectomy: **a** inguinal step, **b** iliac step

Methods

This was a prospective pilot study approved by the local ethics committee (Studio VIDEO SIIO trial, 2011/41, on 26 August 2011). The study was designed to investigate the feasibility and safety of ilioinguinal videoscopic lymphadenectomy.

Patients without distant metastasis and either positive SLN biopsy or clinically positive LNs were enrolled. All patients referred to a single surgeon were considered eligible. Exclusion criteria were: age less than 18 years, American Society of Anesthesiologists fitness grade III–IV, severe chronic obstructive pulmonary disease and other restrictive lung disease, severe ischaemic heart disease and chronic heart failure, previous cerebral abnormalities (aneurysm/arteriovenous malformations, ischaemic/haemorrhagic stroke, primary or secondary tumours), history of deep vein thrombosis, pregnancy, hip functional limitation, and previous hip/knee arthroplasty. Previous surgery in the groin region (such as hernia repair, great saphenous vein surgery, iliofemoral bypass) was considered a contraindication only to the iliac stage of lymphadenectomy.

Co-morbidity was graded according to the Charlson index[15].

Surgery

This was a two-stage procedure (*Fig. 1*). Dissection was performed using an ultrasound dissector. The inguinal step was performed via three ports (the first 2–3 cm above the apex of the femoral triangle, the second 2 cm medial to the adductors, and the third 2 cm lateral to the sartorius muscle). The anatomical boundaries of the dissected inguinal LN field were cranially the external oblique muscles fascia, laterally the sartorius muscle and medially the adductors. The working space was obtained after a skin incision and blunt dissection of the area under the superficial fascia. After initial high-pressure carbon dioxide inflation (25 mmHg), the space was maintained at 12 mmHg, permitting formal inguinal LN dissection. This involved removal of the contents of the femoral triangle, with incision and removal of the femoral fascia, and proximal and distal ligation of the saphenous vein with vascular endostaplers and endoclips. The specimen was

extracted using an endobag by excising the incision used for SLN biopsy, or by enlargement of the incision of the apex trocar for patients with clinically positive LNs.

The iliac step started with open insertion of a Hasson trocar in the preperitoneal space, followed by positioning of two additional trocars (5 and 10 mm) just lateral to the abdominal midline. After creation of a working space with a carbon dioxide pressure of around 12 mmHg, the iliofemoral vessels were identified, isolated, and all external iliac LNs removed. This was followed by clearance of the nodes from the obturator nerve. LNs were again retrieved with an endobag or directly through the 10-mm trocar after insertion of a protective endotrocar. Two drains were positioned at the end of procedure in the obturator fossa and the inguinal space. All dissections were performed by the same surgeon.

Conversion to an open procedure was defined as the performance of a skin incision larger than the one from a previous SLN biopsy for inguinal dissection, or when any abdominal muscle division was necessary for the iliac–obturator lymphadenectomy.

Patients received antibiotic prophylaxis with cefazolin 1000 mg administered intravenously 30 min before skin incision, with two additional doses after 8 and 16 h. Patients were discharged when fully recovered, pain-free and no longer requiring more than one drain.

Measurements and outcomes

Monitoring during anaesthesia included invasive arterial measurement of blood pressure and recording of body temperature, urinary output, heart rate, oxygen saturation and carbon dioxide levels. Duration of surgery, blood loss, intraoperative transfusion and need for open conversion were also recorded. Postoperative length of stay and drain duration were recorded. Postoperative complications were graded according to the Clavien–Dindo classification[16]. Numbers of excised and positive LNs for each anatomical compartment were recorded.

Patients were re-evaluated 1, 3, 6, 9 and 12 months after surgery, and every 6 months thereafter. Whole-body CT and inguinal ultrasonography were performed every 6 months. Local, in-transit, regional and distant recurrences were recorded. Lymphoedema was defined according to Spillane and colleagues[8], and measured before surgery and at 3, 6 and 12 months after the procedure.

Quality of life was evaluated with the European Organization for Research and Treatment of Cancer (EORTC) QLQ-C30 questionnaire[17], which was administered before operation and at 3–6 and 9–12 months after surgery.

Table 1 Clinical and pathological data of patients selected for videoscopic ilioinguinal lymphadenectomy

	No. of patients*
Age (years)†	50·5 (38–63)
Sex ratio (M : F)	8 : 15
BMI (kg/m^2)†	27·2 (23·5–30·9)
ASA fitness grade	
I	9
II	14
Charlson co-morbidity index score†	7 (6–8)
AJCC T category	
Tx	5
T1 (≤ 1·00 mm)	4
T2 (1·01–2·00 mm)	2
T3 (2·01–4·00 mm)	6
T4 (> 4·00 mm)	6
Site of primary tumour	
Lower limb	14
Trunk	6
Anus	1
Unknown	2
LN tumour burden	
Positive SLNB	19
Clinically positive LNs	5
Size of clinically positive LNs (mm)†	35 (17·5–42·5)

*Unless indicated otherwise; †values are median (i.q.r.). BMI, body mass index; ASA, American Society of Anesthesiologists; AJCC, American Joint Committee on Cancer; LN, lymph node; SLNB, sentinel lymph node biopsy.

Statistical analysis

Continuous data are presented as median (i.q.r.) and were compared using the Wilcoxon test. Categorical variables were analysed by means of χ^2 or Fisher's exact test, as appropriate. All P values were two-sided, and $P < 0{\cdot}050$ was considered statistically significant. The statistical analyses were performed using MedCalc version 9.2.1.0 (MedCalc Software, Ostend, Belgium) and Stata® SE version 11.0 for Windows® (StataCorp, College Station, Texas, USA).

Results

Between September 2011 and June 2014, 39 patients met the inclusion criteria for participation. Of these, seven were excluded because they were unfit (severe chronic pulmonary disease/chronic heart failure), and two had a history of deep venous thrombosis, one of hip arthroplasty, one of cerebral meningioma and one of transient ischaemic attacks. The study was therefore offered to 27 patients, of whom four refused to participate and underwent open ilioinguinal lymphadenectomy. Some 23 patients consented to take part in this study. One underwent two procedures at different times, giving a total of 24 videoscopic ilioinguinal lymphadenectomies (*Table 1*).

Table 2 Operative data during videoscopic ilioinguinal lymphadenectomy

	No. of patients*
Duration of surgery (min)†	
Ilioinguinal	270 (245–300)
Inguinal	132·5 (106–154)
Conversion	
Inguinal	2
Iliac	2
Intraoperative blood loss (ml)†	75 (50–100)
Intraoperative complications	
Open peritoneum	4
Femoral vein lesion	1
Trocar bleeding	1
End-tidal CO_2 level > 50 mmHg	3

*Unless indicated otherwise; †values are median (i.q.r.).

Table 3 Frequency, type and severity of postoperative complications after videoscopic ilioinguinal lymphadenectomy according to the Clavien–Dindo classification

	Grade I	Grade II	Grade IIIa–b	Total
Infection	3	0	1	4
Seroma	2	5	0	7
Wound dehiscence	0	0	0	0
Postoperative bleeding	2	0	0	2
Subcutaneous emphysema	2	0	0	2
Postoperative headache	1	0	0	1
Severe postoperative pain*	1	0	0	1

*Outside the normal postoperative analgesia protocol. Grade I, no intervention required; grade II, medical therapy resolved the complication; grade IIIa, intervention without general anaesthesia; grade IIIb, intervention under general anaesthesia.

Table 4 Pathological details after videoscopic ilioinguinal lymphadenectomy

	No. of patients*
No. of LNs†	
Total	21 (15–25)
Inguinal	9·5 (8–14·5)
Pelvic	8·5 (6–12)
No. of positive LNs†	1 (1–2)
No. of patients with positive pelvic LNs	2 of 24
No. of patients with additional positive LNs after SLN biopsy	1 of 19

*Unless indicated otherwise; †values are median (i.q.r.). LN, lymph node; SLN, sentinel lymph node.

Videoscopic ilioinguinal lymphadenectomy was completely video-assisted on 17 occasions. Seven patients had a mixed procedure. Three patients underwent a videoscopic inguinal and an open iliac lymphadenectomy because of previous surgery in the groin region (2 groin hernia repairs, 1 appendicectomy).

Operative data are summarized in *Table 2*. There was significant shortening of operating time between the first 12 procedures and the last 12 for the inguinal phase (median 150 (i.q.r. 104–180) *versus* 130 (114–150) min; $P = 0{\cdot}005$). Pelvic operating time also decreased, although this was not significantly different (median 160 (120–180) *versus* 120 (105–149) min; $P = 0{\cdot}059$).

Four patients required conversion to an open procedure. Conversion occurred in two patients during inguinal dissection, as a consequence of femoral vein damage in one and raised carbon dioxide levels in the other. Two patients required conversion to open surgery during the iliac dissection as a result of loss of the working space owing to inadvertent opening of the peritoneum, including a suspected ureteral injury. There was no conversion in the last ten operations.

Overall, blood loss was minimal and blood transfusion was never required. The most frequent intraoperative complication was opening of the peritoneum during iliac lymphadenectomy, which occurred in four procedures. The peritoneum was successfully closed primarily in two of these patients, allowing video-assisted lymphadenectomy to be completed. Peritoneal closure failed in the other two and loss of pneumoretroperitoneum led to conversion to open surgery. Median length of stay and drain duration were 7 (5–8) and 10 (7–21) days respectively. Ten procedures were associated with no complications. Grade I–II complications were observed in 13 procedures. Only one patient required reintervention for an infected seroma (grade IIIb) (*Table 3*).

The number of excised LNs (median 21, i.q.r. 15–25) as an indicator of surgical quality is shown in *Table 4*.

Patients were followed up for a median of 18 (6–30) months. Five patients developed tumour recurrence. Local in-transit and regional recurrences occurred in two patients, both with clinically positive nodes. One patient had nodal recurrence associated with in-transit metastases. The second developed a bulky metastasis infiltrating the sartorius muscle associated with in-transit metastases in the groin. Only two patients developed lower limb lymphoedema.

Scores in the global health status scale of EORTC QLQ-C30 at 9–12 months were better than those at 3–6 months ($P = 0{\cdot}054$) and similar to scores at baseline. Role function also deteriorated at 3–6 months ($P = 0{\cdot}014$), returning to baseline levels at 9–12 months. Physical functioning was significantly worse than the baseline level at both 3–6 months ($P < 0{\cdot}001$) and 9–12 months ($P = 0{\cdot}031$).

Discussion

Videoscopic inguinal[13,14] and iliac[18–21] dissections have already been described for patients with melanoma, whereas this study evaluated both approaches in a single operation. The results suggest that videoscopic ilioinguinal LN dissection is feasible in most patients with either a positive SLN biopsy or clinically positive nodes. Complications related to the surgical wounds appeared favourable compared with those after open surgery. Surgical-site infections and seroma occurred in about one-sixth and one-third of patients respectively. No patient experienced complete wound breakdown. Lymphoedema was observed in only two of 23 patients. The numbers of excised LNs and regional recurrences were similar to those seen in open lymphadenectomy[22–25]. Although patients experienced a significant reduction in physical functioning, their global health status had returned to baseline by 1 year after surgery.

In the present study, peritoneal opening was the most frequent intraoperative complication (4 patients), requiring conversion to open surgery in two. A similar situation exists in laparoscopic extraperitoneal inguinal hernia repair, where peritoneal leakage of carbon dioxide in the abdominal cavity and subsequent compression of the preperitoneal space can occur in up to 50 per cent of procedures, with a conversion rate ranging between 2 and 17 per cent[26].

An excessive end-tidal carbon dioxide level occurred in three patients, always during the inguinal phase of dissection, leading to conversion to open surgery in one patient. The origin of this complication is probably multifactorial. The high pressure used at the beginning of the procedure to create the working space in the inguinal area is a possible contributory factor as well as the overall length of surgery. The space created during inguinal and iliac insufflation is surrounded only by fibrous–fatty tissue, which can ease systemic carbon dioxide absorption[27]. To reduce this problem, minute ventilation was increased[28], so that increased end-tidal carbon dioxide was never observed after the first ten procedures.

Open groin dissection is burdened by a high postoperative morbidity rate, largely due to troublesome wound healing[6]. Around 50–60 per cent of patients experience wound infection, dehiscence and seroma after open groin lymphadenectomy. Previous attempts aimed at lowering complication rates were mainly directed at limiting the length and type of skin incisions[4,29], preservation of the great saphenous vein, or muscle transposition to fill the dissected area and cover the femoral bundle[30–32]. The benefits of these techniques remain uncertain and none has become routine. The greatest advantage of videoscopic inguinal lymphadenectomy is the virtual elimination of skin incision and flaps, and avoidance of cutting the oblique muscles to enter the preperitoneal pelvic space.

The wound infection rate in this study was 17 per cent (4 of 23 patients), the majority of infections being superficial cellulitis that responded to oral antibiotics. The incidence of wound infection here is lower than that after open surgery but higher than reported in previous retrospective studies of videoscopic inguinal dissection, estimated to be around 5 per cent[12]. This discrepancy can be explained by the prospective design of the present study, where all patients referred to the operating surgeon were enrolled and a mixed procedure (videoscopic inguinal lymphadenectomy with open iliac lymphadenectomy) was performed in approximatively one-third of patients. When the entire procedure was completed by videoscopy, the infection rate was only 13 per cent (2 of 16). Furthermore, the incidence of fluid collections in the groin seems lower (30 per cent, 7 of 23) than that seen after open surgery[6], and similar to values reported for videoscopic inguinal LN dissection alone[12].

Complete wound breakdown that results in prolonged wound care, and in some instances further surgery, was never observed in the present series. This finding, in line with a study of videoscopic inguinal lymphadenectomy[13], suggests that not only the incidence of wound problems but also their severity seems lower than after open surgery. This observation needs to be confirmed in prospective comparative studies.

One of the most unpleasant complications of groin lymphadenectomy is lower limb lymphoedema, which occurs in about one-third of patients[9]. In the present study, only two patients experienced this complication. Videoscopic lymphadenectomy appears promising in lowering the incidence of lymphoedema for at least two possible reasons. Avoiding extensive skin incisions can preserve subcutaneous lymphatic flow and, given that wound infection is a risk factor for lymphoedema, the lower frequency of wound infection with videoscopic dissection may translate into less lymphoedema[31].

Health-related quality of life after LN dissection for melanoma is poorly investigated. Patients with melanoma who underwent SLN biopsy or lymphadenectomy did not perceive a negative effect on quality of life after surgery[33]. The present study seems to reinforce this view as global scores returned to preoperative values within a year of surgery. Only physical functioning scores remained significantly lower than preoperative values, confirming data from the only available study[33].

Considering the number of excised LNs as a measure of thoroughness and quality of surgery[34,35], the median number of excised LNs seemed adequate and comparable to

benchmarks established for open surgery[34,36]. All patients in this series had at least 14 excised LNs, which might therefore represent a minimum standard to deem a dissection adequate. The local recurrence rate was similar (8 per cent, 2 of 24 procedures) to that in previous studies[24,25,37]. Inguinal recurrence developed in two patients with clinically positive LNs, both associated with in-transit metastases. In at least one of them, this could be explained by the failure of surgery to clear all LNs in the dissected field, rather than a reseeding of the regional field. Although regional recurrence after open lymphadenectomy is a relatively common event in the presence of clinically positive LNs, this is an important issue which needs to be better clarified by prospective comparative studies.

This study has limitations. It is from a single centre and all procedures were performed by a single surgeon, including a learning curve. As a pilot study, although the outcomes seem favourable, it must be acknowledged that the follow-up was relatively short. The authors are aware, however, of similar feasibility studies being undertaken elsewhere. If others can confirm that videoscopic ilio-inguinal lymphadenectomy is feasible and safe for patients with melanoma who have groin LN metastases, with favourable postoperative outcomes, a multicentre comparative study with open surgery would seem justified. Such a study is planned within the Italian Melanoma Intergroup (IMI), a national network for melanoma research in Italy. A prospective trial (NCT01526486) is also under way in the USA and results are awaited.

Disclosure

The authors declare no conflict of interest.

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Supporting information

Additional supporting information may be found in the online version of this article:

Video S1 Videoscopic ilioinguinal lymphadenectomy for melanoma video – SIIO trial (AVI file)

Table S1 Steps in videoscopic ilioinguinal lymphadenectomy (Word document)