



# Robotic-assisted inguinal lymphadenectomy: a systematic review

Ioannis D. Gkegkes<sup>1</sup> · Evelyn Eleni Minis<sup>1</sup> · Christos Iavazzo<sup>2</sup>

Received: 9 December 2017 / Accepted: 30 April 2018 / Published online: 5 May 2018  
© Springer-Verlag London Ltd., part of Springer Nature 2018

## Abstract

**Background** Lymphadenectomy represents the standard treatment for various types of cancer. The introduction of robotics in lymph node dissection may have an important impact on post-lymphadenectomy complications.

**Methods** A systematic literature review was performed.

**Results** In our review, robotic inguinal lymphadenectomy was performed on 51 patients. Penile squamous cell carcinoma was the most common histological type of the primary neoplasia. No intra-operative complications were reported. One case of conversion to open was reported. The mean duration of hospitalization was 2 days. The duration of drainage ranged from 7 to 72 days. The most common postoperative complications were lymphocele (13.7%), lymphedema (7.8%), cellulitis (7.8%), seroma (3.9%), abscess (3.9%), wound breakdown/wound infection (3.9%), sepsis (1.9%), prolonged lymphorrhea (1 out of 51 patients, 1.9%) and skin necrosis (1 out of 51 patients, 1.9%).

**Conclusions** Until now there has not been sufficient evidence regarding the role of robotics in groin lymph node dissection, though this approach appears to be safe and oncologically effective, with morbidity rates relatively lower compared to open surgery.

**Keywords** Robotics · Da Vinci® · Lymphadenectomy · Inguinal · Groin dissection

## Introduction

Lymphadenectomy combined with radical resection of primary neoplasia represents the standard treatment for various types of tumors [1–3]. Nevertheless, lymph node dissection may have an important impact on the patient's quality of life. The incidence of post-lymphadenectomy complications ranges between 50 and 90% [1, 4]. Among the most common complications are lymphedema, lymphoceles, skin necrosis, surgical site infection and wound dehiscence [1]. In addition, modifications to the open surgical technique have further decreased morbidity rates [5]. The introduction of minimally invasive techniques, especially to groin lymph node dissection, may potentially reduce post-lymphadenectomy complications. In 2003, Bishoff et al. reported the first video endoscopic groin lymphadenectomy [6]. Following this, small

case series demonstrated decreased complication rates and similar oncological outcomes [7, 8]. In 2009, Josephson et al. performed the first robotic groin lymph node dissection [9]. The main advantages introduced by the robotic-assisted technique are three-dimensional vision, increased magnification, allowing greater precision as well as dexterity due to the 360-degree range of motion in a limited working space [10].

The purpose of this study is to review the up until recently available literature on the use of robotic technology on patients that require inguinal lymphadenectomy.

## Methods

### Data sources

A systematic, electronic, search was performed by the authors (I.D.G. and C.I.) in PubMed (21 November 2017) and in Scopus (21 November 2017), respectively, in order to retrieve studies that fit the predefined inclusion criteria. The literature search was performed in accordance with the preferred reporting items for Systematic Reviews and

✉ Ioannis D. Gkegkes  
ioannisgkegkes@gmail.com

<sup>1</sup> First Department of Surgery, General Hospital of Attica "KAT", 141, Oropou Str., Nea Ionia, 14232 Athens, Greece

<sup>2</sup> Gynaecological Oncology Department, Northampton General Hospital, Northampton, UK

Meta-Analyses (PRISMA) guidelines [11]. The adopted search strategy, in the searched databases, included the combination of the key words: (robot OR robotic OR telesurgery) AND inguinal AND lymphadenectomy. The references of the included articles were also searched for additional studies.

### Study selection criteria

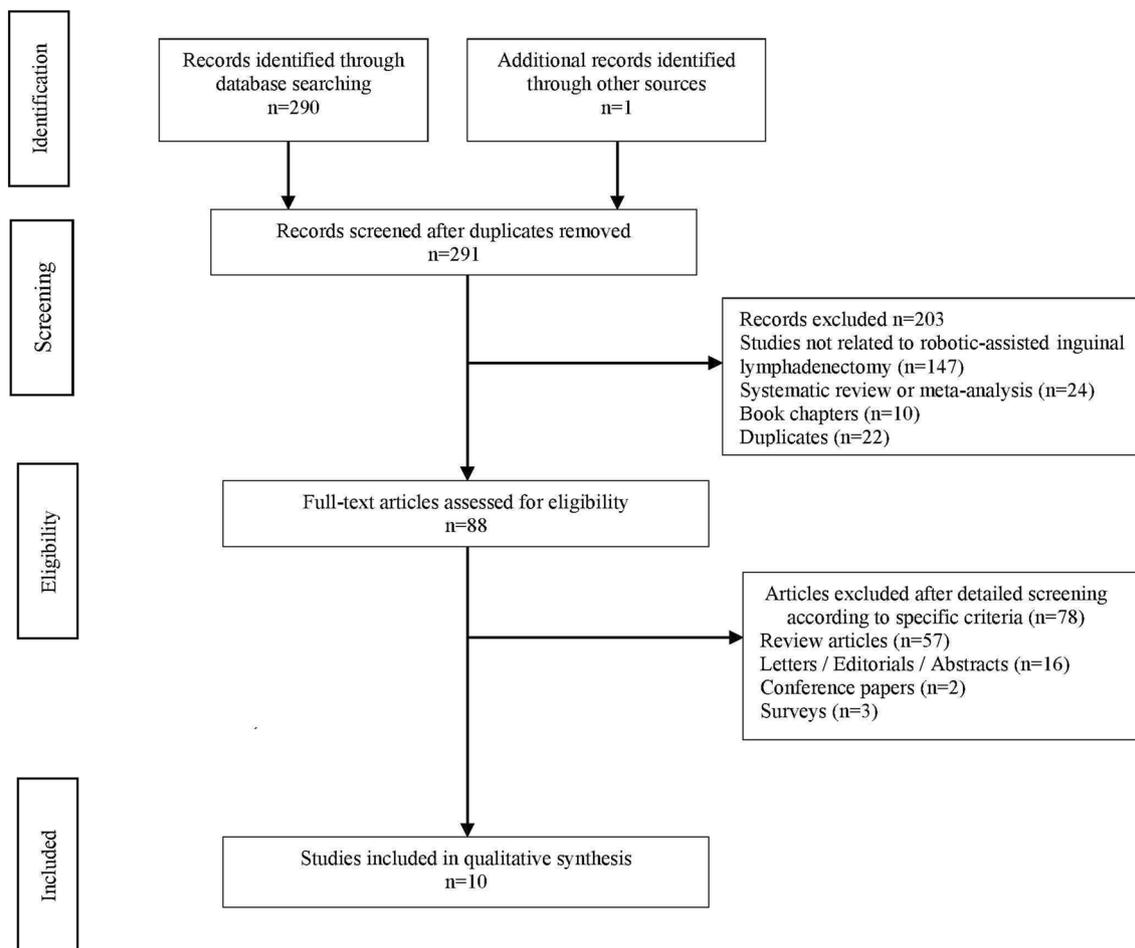
Studies that reported data on robotic-assisted inguinal lymphadenectomy were included in this review. Abstracts in scientific conferences, editorials, letters to the editor and studies published in languages other than English, French, German, Italian and Spanish were excluded from this review. The data collected from these studies included the type of publication, the number of patients in each study, the age of the patients, the histological type of the primary neoplasia, the duration of the operative time, the estimated blood loss during robotic-assisted inguinal lymphadenectomy, the recorded intra-operative complications, the conversion rate

to open technique, the number of dissected lymph nodes, the duration of hospital stay, the duration of drainage, the referred post-operative complications, the follow-up period and the presence or not of disease recurrence.

### Results

The performed search in the PubMed and Scopus databases revealed a total of 32 and 258 search results, respectively, among which 10 studies (4 case series and 6 case reports) were identified as eligible for inclusion in this review, according to the inclusion criteria [1, 9, 12–19]. One additional study was identified through the search of references of the included studies [19]. The selected studies for inclusion are presented in Fig. 1, (flow diagram).

The principal characteristics of the studies included in our review such as, number of patients included, age, histological type of primary neoplasia, operative time (minutes), estimated blood loss (ml), intra-operative complications,



**Fig. 1** Flow diagram of the selection process of articles included in the review

conversion rate to open, number of dissected lymph nodes, duration of hospital stay (days), permanence of drainage (days), presence of post-operative complications, follow-up period (months) and existence of post-operative (both local and distal) recurrence of cancer are presented in Table 1.

Fifty-one patients were included in this study, while the number of robotic-assisted inguinal lymphadenectomies performed was 98. The age of the selected patients ranged from 28 to 84 years. Penile squamous cell carcinoma was the most common histological type of primary neoplasia (7 out of 10 studies). Thirty-seven out of 51 patients presented with penile squamous cell carcinoma, 12 patients presented with vulvar cancer, while urethral squamous cell carcinoma and melanoma were the diagnoses of the remaining two patients. The operative time ranged between 45 and 490 min, however this may be impacted by one study (that included 3 out of 51 the patients) where pelvic lymph node dissection was performed simultaneously. However, no further information could be found on these patients regarding the operative time. When these patients were excluded from our analysis the operative time ranged between 45 and 230 min. The estimated blood loss ranged between 10 and 200 ml. No intra-operative complications were reported in the robotic-assisted group, while one case of intra-operative hemorrhage which necessitated the conversion to open surgery was present in the video endoscopic group. Only one case of conversion to open technique was reported (1 out of 51, 1.9%). The number of dissected lymph nodes ranged between 5 and 34, while the mean number of lymph nodes where the disease had spread was 4. The mean duration of hospitalization was 2 days. The duration of drainage ranged from 7 to 72 days. The most common post-operative complications were lymphocele (7 out of 51 patients, 13.7%), lymphedema (4 out of 51 patients, 7.8%), cellulitis (4 out of 51 patients, 7.8%), seroma (2 out of 51 patients, 3.9%), abscess (2 out of 51 patients, 3.9%), wound breakdown/wound infection (2 out of 51 patients, 3.9%), sepsis (1 out of 51 patients, 1.9%), prolonged lymphorrhea (1 out of 51 patients, 1.9%) and skin necrosis (1 out of 51 patients, 1.9%). The follow-up period of the patients included ranged between 2 and 67 months. Recurrence of disease was described in only 4 out of 51 (7.8%) patients included in this review.

## Technique

In this section we attempt to present our suggestions regarding the surgical steps for a safe robotic-assisted inguinal lymphadenectomy, based on our experience. This is not an actual result of the systematic review; however we believe that it could offer some insights to this approach. Positioning the patient in a low lithotomy position, with the robot located at 45° lateral to the patient's side could facilitate the access of the robot to both inguinal areas. The bladder is

catheterized in sterile mode. The groin areas are prepared and draped. The assistant can be positioned either laterally to the side of the dissection or between the legs of the patient. Anatomic landmarks are marked on the skin as per the open approach, creating an inverted scalene triangle in order to facilitate the triangulation of the robotic instruments. The boundaries of the formed triangle are: laterally the sartorius muscle angling towards the apex, medially the adductor longus muscle that extends towards the apex and the base of triangle by a line along the course of the inguinal ligament, which connects the anterior superior iliac spine to the pubic tubercle. A 2-cm incision is made 3 cm below the inferior angle of the previously created anatomic triangle until Scarpa's fascia is identified. Blunt-finger dissection forms the necessary space in order to insert the endoscope and then is then extended by sweeping with the lens with the purpose of creating a tunnel under Scarpa's fascia. CO<sub>2</sub> is insufflated at a pressure of 15 mmHg so as to create the necessary surgical field. Two 8-mm trocars and a 10-mm trocar are placed through the abdomen. Lymph node dissection is completed mainly with the utilization of bipolar Maryland and monopolar scissors. The limits of the lymphadenectomy are similar to that of the open approach. The dissected lymph nodes are always removed in a laparoscopic bag. In order to extend the dissection to the deep pelvic lymph nodes, the fascia lata is opened medially to the saphenous arch, exposing the saphenofemoral junction (Fig. 2). Consequently, hemostasis is checked and a suction drain is positioned in the most caudal area of the dissection. The trocars are removed and the skin incisions are closed.

## Discussion

Open groin lymph node dissection is the standard approach in the treatment of patients with melanoma or penile cancer [9, 20]. The traditional open approach is associated with a great number of complications, among which are local edema, seroma formation, wound dehiscence, flap necrosis, deep vein thrombosis and most important lymphoceles (in 2 out of 6 patients, 33%) [21, 22]. Consequently, in an attempt to minimize post-lymph node dissection operative complications as well as to improve post-operative quality of life with the same oncologic outcome, various surgical modifications have been proposed. The sentinel lymph node technique, skin flaps with blood supply superficially to Scarpa's fascia and the preservation of the saphenous vein are some of the suggested surgical modifications [20]. Even after the introduction of these modifications in the oncological treatment of melanoma or penile cancer, the rate of complications can still remain relatively high [9].

The robotic approach offers evident advantages compared to the open approach including improved ergonomics

**Table 1** Studies referring to robotic inguinal lymphadenectomy

First author, year, country [Ref]	Publication type	Nr of patients (Nr of R-VEILs) <sup>b</sup>	Age of patient (in y.o.)	Histological type	Operative time (in min)	Blood loss (in ml)	Intra-operative complications	Conversion to open (Y/N)	Nr of dissected lymph nodes (involved)	Hospital stay (in days)	Duration of drainage (in days)	Post operative complications (%)	Follow-up (in mo)	Recurrence
Jain, India, 2017 [12]	Case series	12 (22)	Mean (range): 61 (32–78)	Vulvar cancer	Mean (range): 69.3 (45–95)	Mean (range): 30 (15–50)	–	N	Mean: 11 (2)	Mean (range): 4.5 (4–7)	Mean (range): 13.9 (8–38)	Lymphocele: 4/12 (33.3) lymphedema: 4/12 (33.3) prolonged lymphorrhea: 1/12 (8.3) cellulitis: 2/12 (16.6)	Median (range): 40.5 (7–67)	1/12 (8.3)
Russell, USA, 2017 [13]	Case series	14 (27)	Median (IQR): 72.4 (61.7–76.2)	Penile cancer	Median (IQR) <sup>d</sup> : 136.8 (122.9–152.5)	Median (IQR): 50 (15–50)	–	N	Median (IQR): 8 (6–12)	Median (range): 1 (1–2)	Median (IQR): 36 (24.5–48.5)	Wound infection: 1/14 (7) abscess: 1/14 (7) lymphocele: 1/14 (7)	Median (IQR): 5.5 (3–10.8)	NM
Ahlawat, 2016, India [14]	Case report	3 (6)	58	Penile SCC	Median (IQR) <sup>d</sup> : 490 <sup>a</sup> (420 <sup>a</sup> –450 <sup>a</sup> ) p=0.71	Median (IQR): 70 (50–80) p=0.17	Bleeding: 1/4 (25)	Y: 1/4 (25)	Median (IQR): 32 (10)	Median (range): 3 (1–3)	Median (IQR): 72 (34–28)	Flap necrosis: 1/4 (25) Lymphedema: 1/4 (25) DVT: 1/4 (25)	15	1/3 (33)
Sanchez, 2016, Venezuela [3]	Case report	1 (1)	42	Melanoma	130	70	–	N	8 (0)	2	8	–	NM	NM
Andreou, 2015, Greece [15]	Case series	6 (12)	NM	Penile SCC	Range: 90–110	NM	–	N	Range: 10–17	2	Range: 15–30	Seroma: 2/10 (20) Sepsis: 1/10 (10)	Range: 6–24	2/10 (20)

Table 1 (continued)

First author, year, country [Ref]	Publication type	Nr of patients (Nr of R-VEILs) <sup>b</sup>	Age of patient (in y.o.)	Histological type	Operative time (in min)	Blood loss (in ml)	Intra-operative complications	Conversion to open (Y/N)	Nr of dissected lymph nodes (involved)	Hospital stay (in days)	Duration of drainage (in days)	Post operative complications (%)	Follow-up (in mo)	Recurrence
Corona-Montes, 2015, Mexico [19]	Case report	1 (2)	73	Penile SCC	230	50	–	N	NM	1	10	–	NM	NM
Matin, 2013, USA [17]	Case series	10 (20)	Median (range): 62 (28–84)	Penile SCC	Range: 90–120	Median (range): 100 (10–200)	–	Y: 1/10 (10)	185 (11)	NM	NM	Cellulitis: 2/10 (20) Abscess: 1/10 (10) Wound breakdown: 1/10 (10) Skin necrosis: 1/10 (10)	NM	NM
Sotelo, 2013, Venezuela [16]	Case report	1 (2)	64	Penile SCC	Mean: 180	Median: 100	–	N	33 (3)	3	21	Lymphocele	NM	NM
Dogra, 2011, India [18]	Case report	2 (4)	38 46	Penile SCC	Range: 90–110	Range: 50–100	–	N	(4) (2)	Mean: 2	10 7	–	NM	NM
Josephson, 2009, USA [9]	Case report	1 (2)	37	Penile SCC	Mean: 125	Mean: 75	–	N	19 (0)	Mean: 1	Mean: 12	–	2	NM

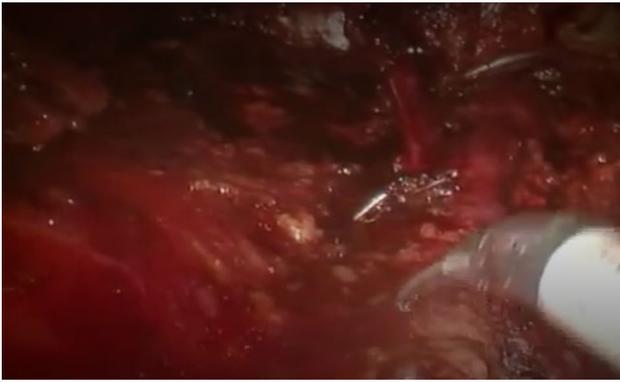
USA United States of America, R-VEIL robotic-assisted video endoscopic inguinal lymphadenectomy, y.o. years old, Nr number, NM not mentioned, N no, Y yes, SCC squamous cell carcinoma, mo months, IQR interquartile range, DVT deep venous thrombosis

<sup>a</sup>Referred to bilateral inguinal and pelvic lymphadenectomy

<sup>b</sup>Number of treated groins

<sup>c</sup>Referred to video endoscopic inguinal lymphadenectomy (VEIL)

<sup>d</sup>Referred to operative time/limb



**Fig. 2** Robotic inguinal lymphadenectomy

especially when working in a confined space, three-dimensional vision, an increased magnification of the image, greater precision, as well as dexterity and freedom of movement. In our review, we included 51 patients where penile cancer, vulvar cancer, urethral cancer and melanoma were the primary diagnoses in 37, 12, 1 and 1 patient, respectively. The age of the selected patients ranged from 28 to 84 years old. The operative time ranged between 90 and 230 min while the estimated blood loss was minimal. No intra-operative complications were reported. The rate of conversion to open surgery was 1.9%. Moreover, lymph node yield is an important parameter of an oncologically correct operation. Both Josephson et al. and Matin et al. demonstrated a similar number of dissected lymph nodes with the robotic-assisted technique [9, 17]. In our review, we found that the lymph node yield achieved was oncologically safe, ranging from 5 to 34 lymph nodes. The mean hospital stay was 2 days, however a question could be raised regarding the long duration of drainage ranging from 7 to 72 days. The main advantages of the robotic approach included minimal post-operative complications including lymphocele (13.7%), lymphedema (7.8%), cellulitis (7.8%), seroma (3.9%), abscess (3.9%), wound breakdown/wound infection (3.9%), sepsis (1.9%), prolonged lymphorrhea (1 out of 51 patients, 1.9%) and skin necrosis (1 out of 51 patients, 1.9%). Our findings could indicate that the overall risk of lymphatic related complications might be decreased, having an impact on post-operative quality of life as well as on body image while also reducing the total costs of post-operative care

for each patient. Even though the follow-up period of the patients included in our review is low ranging from 2 to 67 months, the recurrence rates are 13.7%. Consequently, we believe that results considering long-term follow-up are sparse, and conclusions about oncological efficacy should await further follow-up and larger series. Last but not least, till now there has only been one comparative study [13]. Russell et al. compared the operative and post-operative outcomes of robotic-assisted video endoscopic inguinal lymphadenectomy and video endoscopic inguinal lymphadenectomy, in penile cancer patients [13]. Overall, none of the included techniques showed significant superiority over the other. Even though this study is the largest case series (18 patients) available till now in the literature, the small number of patients included represents the most important limitation that prevent us from drawing any safe conclusions on the safety and post-operative results of robotic-assisted inguinal lymphadenectomy.

There are several advantages to using the robotic approach including three-dimensional view of the limited operating field, reduced surgical trauma, precision of movements due to elimination of surgeon tremor, use of wristed instruments that improve dexterity and facilitate suturing and improved ergonomics for the surgeon (Table 2). The main disadvantages include the high cost of the robotic equipment and the initial learning curve for the surgeon. Robotic technology is associated with elevated costs of acquisition and maintenance. Nevertheless, large numbers of cases per robot and industry competition could reduce the overall costs, making robotic technique a more cost-effective surgical approach [23]. According to Matin et al. one potential risk might be the possibility of leaving behind positive lymph nodes especially if part of those nodes is elevated at the start of the blunt dissection of the potential surgical field [17].

Various limitations should be taken into consideration in the analysis of our review. The small number of patients, the limited number of studies and the absence of randomized trials in order to offer more concrete evidence on the use of robotic technique in inguinal lymphadenectomy. Moreover, there is heterogeneity regarding a group of the included patients, who underwent simultaneous tumor excision and lymphadenectomy, influencing the post-operative outcomes. The robotic technique has been used up till now by a small group of surgeons and

**Table 2** Possible advantages and disadvantages in the application of robotics in groin lymph node dissection

Advantages	Disadvantages
3-dimensional vision	High costs
Improved dexterity due to wristed instrumentation	Need of large operative room
Tremor filtration	Absence of haptic sensation
Improved ergonomics for the surgeon	Large learning curve
Good geometric accuracy	
Less surgical trauma	

the short- and long-term advantages and disadvantages need to be clarified, as well as the learning curve, in a larger cohort of patients. For example, we identified a recurrence rate of 7.8%. However, the follow-up period is only reported for 36 out of the 51 patients included in the review, which would actually make the recurrence rate 11.1% (4 out of 36 patients). For this reason, no clear conclusions could be reached regarding the possible recurrence rate based on studies that have minimal follow-up time. Moreover, it is unclear from the included studies whether the recurrences reported were in the inguinal region or represented local or distant recurrences. Prospective studies with a standardized technique are required with larger cohorts and long-term follow-up to assess the results of the robotic procedure in comparison to the open and laparoscopic techniques. In addition, a further limitation of our review is the absence of studies (retrospective or prospective) comparing patients undergoing robotic-assisted lymphadenectomy to patients undergoing open lymphadenectomy, due to the absence of such studies in the currently available literature. The adopted search strategy could also be considered a limitation due to the exclusion of review articles, abstracts in scientific conferences, letters to the editor and editorials, while the restriction on the languages of the excluded articles could also be considered as another weak point of this study.

## Conclusion

There is currently no sufficient evidence, regarding the role of the da Vinci® robot in groin node dissection. However, our review showed that such an approach for patients with melanoma or penile cancer appears to be safe and oncologically effective, while the morbidity rates seem to be lower compared to that open surgery.

**Funding** None.

## Compliance with ethical standards

**Conflict of interest** Christos Iavazzo has no conflicts of interest or financial ties to disclose. Evelyn Eleni Minis has no conflicts of interest or financial ties to disclose. Ioannis D. Gkegkes has no conflicts of interest or financial ties to disclose.

**Ethical standards** All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

**Informed consent** Not applicable.

## References

1. Kharadjian TB, Matin SF, Pettaway CA (2014) Early experience of robotic-assisted inguinal lymphadenectomy: review of surgical outcomes relative to alternative approaches. *Curr Urol Rep* 15:412
2. Iavazzo C, Gkegkes ID (2015) Sentinel Lymph Node Detection With the Use of Intradermal Microbubbles in Vulvar Cancer. *Surg Innov* 22:446–447
3. Sánchez A, Sotelo R, Rodriguez O, Sánchez R, Rosciano J, Medina L, Vegas L (2016) Robot-assisted video endoscopic inguinal lymphadenectomy for melanoma. *J Robot Surg* 10:369–372
4. Stuijver MM, Djajadiningrat RS, Graafland NM, Vincent AD, Lucas C, Horenblas S (2013) Early wound complications after inguinal lymphadenectomy in penile cancer: a historical cohort study and risk-factor analysis. *Eur Urol* 64:486–92
5. Yao K, Tu H, Li YH, Qin ZK, Liu ZW, Zhou FJ, Han H (2010) Modified technique of radical inguinal lymphadenectomy for penile carcinoma: morbidity and outcome. *J Urol* 184:546–552
6. Bishoff J, Basler J, Teichman J, Thompson I (2003) Endoscopic subcutaneous modified inguinal lymph node dissection (ESMIL) for squamous cell carcinoma of the penis. *J Urol* 169:78–81
7. Tobias-Machado M, Tavares A, Molina WR Jr, Zambon JP, Medina JA, Forseto PH Jr, Juliano RV, Wroclawski ER (2006) Video endoscopic inguinal lymphadenectomy (VEIL): initial case report and comparison with open radical procedure. *Arch Esp Urol* 59:849–852
8. Sotelo R, Sánchez-Salas R, Carmona O, Garcia A, Mariano M, Neiva G, Trujillo G, Novoa J, Cornejo F, Finelli A (2007) Endoscopic lymphadenectomy for penile carcinoma. *J Endourol* 21:364–367
9. Josephson DY, Jacobsohn KM, Link BA, Wilson TG (2009) Robotic-assisted endoscopic inguinal lymphadenectomy. *Urology* 73:167–170
10. Iavazzo C, Mamais I, Gkegkes ID (2016) Robotic assisted vs laparoscopic and/or open myomectomy: systematic review and meta-analysis of the clinical evidence. *Arch Gynecol Obstet* 294:5–17
11. Liberati A, Altman DG, Tetzlaff J et al (2009) The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate health care interventions: explanation and elaboration. *PLoS Med* 6:e1000100
12. Jain V, Sekhon R, Giri S, Hassan N, Batra K, Shah SH, Rawal S (2017) Robotic-Assisted Video Endoscopic Inguinal Lymphadenectomy in Carcinoma Vulva: Our Experiences and Intermediate Results. *Int J Gynecol Cancer* 27:159–165
13. Russell CM, Salami SS, Niemann A, Weizer AZ, Tomlins SA, Morgan TM, Montgomery JS (2017) Minimally Invasive Inguinal Lymphadenectomy in the Management of Penile Carcinoma. *Urology* 106:113–118
14. Ahlawat R, Khera R, Gautam G, Kumar A (2016) Robot-Assisted Simultaneous Bilateral Radical Inguinal Lymphadenectomy Along with Robotic Bilateral Pelvic Lymphadenectomy: A Feasibility Study. *J Laparoendosc Adv Surg Tech A* 26:845–849
15. Andreou A, Bekos A (2014) Curage ganglionnaire inguinal robot-assisté dans le cancer du pénis. *Description de technique Prog Urol* 24:897
16. Sotelo R, Cabrera M, Carmona O, de Andrade R, Martin O, Fernandez G (2013) Robotic bilateral inguinal lymphadenectomy in penile cancer, development of a technique without robot repositioning: a case report. *Ecancermedicalscience* 7:356
17. Matin SF, Cormier JN, Ward JF, Pisters LL, Wood CG, Dinney CP, Royal RE, Huang X, Pettaway CA (2013) Phase 1 prospective evaluation of the oncological adequacy of robotic assisted video-endoscopic inguinal lymphadenectomy in patients with penile carcinoma. *BJU Int* 111:1068–1074

18. Dogra PN, Saini AK, Singh P (2011) Robotic-assisted inguinal lymph node dissection: a preliminary report. *Indian J Urol* 27:424–427
19. Corona-Montes VE, Moyo-Martínez E, Almazán-Treviño L, Ríos-Dávila V, Santiago-Hernández Y, Mendoza-Rojas EE (2015) Robotic-assisted inguinal lymphadenectomy in penile cancer. *Rev Mex Urol* 75:292–296
20. Catalona WJ (1980) Role of lymphadenectomy in carcinoma of the penis. *Urol Clin North Am* 7:785–792
21. Tobias-Machado M, Tavares A, Molina WR Jr, Forseto PH Jr, Juliano RV, Wroclawski ER (2006) Video endoscopic inguinal lymphadenectomy (VEIL): minimally invasive resection of inguinal lymph nodes. *Int Braz J Urol* 32:316–321
22. Bevan-Thomas R, Slaton JW, Pettaway CA (2002) Contemporary morbidity from lymphadenectomy for penile squamous cell carcinoma: the M.D. Anderson Cancer Center Experience. *J Urol* 167:1638–1642
23. Iavazzo C, Papadopoulou EK, Gkegkes ID (2014) Cost assessment of robotics in gynecologic surgery: a systematic review. *J Obstet Gynaecol Res* 40:2125–2134