

# Role of a skin bridge incision and prophylactic incisional negative-pressure wound therapy in the prevention of surgical site infection after inguinal lymph node dissection

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**Background:** Modification of the surgical technique to a 2-incision technique with skin bridge from the traditional lazy S (LS) incision, as well as use of prophylactic incisional negative-pressure wound therapy (iNPWT), are theorized to reduce the risk of surgical site infection (SSI) after inguinal lymph node dissection (ILND). We sought to investigate the role of a perioperative ILND bundle on adverse events after ILND and lymph node harvest.

**Methods:** We performed a retrospective review of patients who underwent ILND before and after implementation of the ILND bundle (September 2016) at 1 centre in southeastern Ontario between 2013 and 2018. The ILND bundle included a skin bridge incision, running subcuticular skin closure and NPWT. Previously, an LS incision was used, with stapled skin closure and conventional dressing. Development of SSI was the primary outcome, and dehiscence and seroma and hematoma formation were secondary outcomes. We estimated the associations using multivariable logistic regression.

**Results:** Thirty-four ILNDs in 33 patients were included, 15 in the LS incision group and 19 in the perioperative bundle group. The baseline demographic characteristics of the 2 groups were similar. The perioperative bundle was associated with a reduction in the SSI rate (11 [73%] v. 6 [32%],  $p = 0.02$ ) and elimination of wound dehiscence (0 [0%] v. 5 [33%],  $p = 0.006$ ). On multivariable logistic regression, it was associated with a 5.9-fold reduction in the SSI rate (odds ratio 0.17, 95% confidence interval 0.03–0.74).

**Conclusion:** The results suggest a decrease in SSI rates with use of a perioperative bundle compared to the LS incision and a standard dressing. Randomized controlled trials are required to better understand the associations among the skin bridge incision, iNPWT and SSI.

**Contexte :** Les infections du site opératoire (ISO) sont courantes après un curage ganglionnaire inguinal (CGI). L'ISO après l'intervention est associée à une réduction de la qualité de vie et à des retards dans le traitement oncologique adjuvant. Le remplacement de la technique d'incision de Blair modifiée par la technique à double incision avec pont cutané en association avec la thérapie par pression négative en prophylaxie pour le traitement des plaies entraînerait théoriquement une réduction du risque d'ISO à la suite d'un CGI.

**Méthodes :** Une étude rétrospective a comparé les patients ayant subi un CGI entre 2013 et 2018, soit avant ou après la mise en place du protocole de CGI en septembre 2016. Ce protocole incluait l'incision avec pont cutané, le surjet intradermique et l'application de la thérapie par pression négative pour le traitement des plaies. Avant la mise en place de ce protocole, l'intervention consistait en une incision de Blair modifiée suivie d'une suture cutanée par agrafes chirurgicales et de l'application d'un pansement classique. La comparaison de la fréquence des ISO constituait le paramètre principal. Les apparitions de déhiscences, de séromes, et d'hématomes étaient les paramètres secondaires. Les associations ont été estimées à l'aide d'un rapport de cotes (RC) établi au moyen d'un modèle de régression logistique multivariée.

**Résultats :** Trente-quatre CGI réalisés sur 33 patients durant la période de l'étude ont été inclus ( $n = 15$  pour les CGI réalisés avant la mise en place du protocole [incision de Blair modifiée] et  $n = 19$  pour les CGI réalisés après sa mise en place). Les

2 cohortes étaient similaires sur le plan démographique. La mise en place du protocole a été associée à une réduction des ISO (31,6 % c. 73,3 %,  $p = 0,016$ ) et à une élimination des déhiscences de la plaie (0 % c. 33,3 %,  $p = 0,006$ ). La régression logistique multivariée a permis de montrer que l'application du protocole était associée à une réduction des ISO d'un facteur de 5,9 (RC 0,17, intervalle de confiance de 95 % 0,03–0,74,  $p = 0,024$ ).

**Conclusion :** Cette étude de cohorte rétrospective monocentrique semble indiquer que l'application d'un protocole périopératoire permet de réduire la fréquence des ISO, comparativement au recours à une incision de Blair modifiée et à un pansement classique.

Inguinal lymph node dissection (ILND) is considered in nodal metastases of penile cancer, vulvar cancer, and cutaneous cancers of the trunk and lower extremities.<sup>1,2</sup> The most common use of ILND is in the management of nodal involvement in malignant melanoma.<sup>1,2</sup> Considerable morbidity has been associated with this procedure, with high rates of complications, particularly surgical site infections (SSIs), wound dehiscence, skin necrosis and lymphedema.<sup>3</sup> Large variability exists in reported SSI rates in patients with melanoma after ILND, with rates as high as 77%.<sup>2,4-7</sup> Postoperative SSI is associated with decreased quality of life, substantial use of health care resources, delays to initiation of adjuvant oncology treatment and increased risk of death.<sup>8-11</sup> Previously, SSI prevention focused on managing SSI risk factors, such as decreasing the blood glucose level in patients with diabetes mellitus and preoperative smoking cessation.<sup>8,12-14</sup> Given the high incidence of SSIs after ILND and the associated burden on patients and health care systems, efforts must be made to reduce their occurrence. Two aspects of ILND that have received little investigation yet may have the potential to reduce SSI development are choice of skin incision and use of negative-pressure wound therapy (NPWT).<sup>15,16</sup>

A variety of incisions have been described for ILND. Incisions can be classified broadly into 2 categories: those that cross the inguinal fold and those that do not. The more traditionally described approach is the lazy S (LS) incision, which, as the name suggests, is shaped like an “S” and crosses the inguinal fold. A vertical incision over the femoral vessels, extending superiorly through the fold, has also been described.<sup>15</sup> Incisions that spare the inguinal fold include an oblique incision that courses parallel to the inguinal fold, just superior to it, and a skin bridge incision, which comprises the oblique incision with the addition of a vertical incision below the inguinal fold to facilitate ILND (Figure 1). There is a paucity of data on how incision type may affect wound infection and dehiscence. We hypothesize that excluding the inguinal fold from the incision would decrease the risk of wound infection and dehiscence. We also hypothesize that another potential limitation of incisions that do not transect the inguinal fold is that they may be associated with reduced access, resulting in reduced lymph node harvest; however, this has not been directly evaluated and is examined in this study. This may

translate to inadequate disease staging and inferior local control, resulting in worse oncologic outcomes.

Although NPWT has been used since the mid-1990s for the management of complex wound infections, it has been investigated only recently for the prevention of postoperative complications.<sup>17-20</sup> It is thought that NPWT prevents postoperative wound complications such as infection by stimulating fibroblast migration and proliferation, angiogenesis and tissue growth while removing wound exudate and reducing wound edema.<sup>17,19</sup>

Asciutto and colleagues<sup>21</sup> recently reported the use of incisional NPWT (iNPWT) for groin lymphadenectomy in vulvar cancer, with 11 (55%) of 20 patients developing a wound complication (wound rupture, lymphocele or SSI); however, 9 of the 11 complications were considered mild. Those authors argued that use of iNPWT may reduce the severity of SSIs when they occur. More recently, a prospective randomized controlled trial (RCT) of 242 patients undergoing infrainguinal revascularization showed no difference in SSI rates between iNPWT and standard gauze (11% v. 12%,  $p = 0.6$ ).<sup>22</sup> However, several meta-analyses, which included meta-analyses of previous RCTs, showed reductions in SSI rates with the use of iNPWT.<sup>16,23,24</sup> Antoniou and colleagues<sup>23</sup> conducted a meta-analysis of 6 RCTs involving 733 patients and found a reduction in the SSI rate with iNPWT (odds ratio [OR] 0.36, 95% confidence interval [CI] 0.24–0.54). Semsarzadeh and

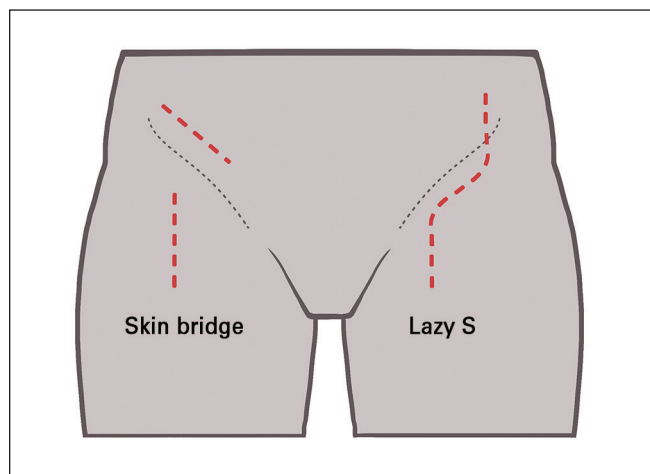


Fig. 1. Incisions in inguinal lymph node dissection.

colleagues<sup>16</sup> looked at 14 studies, 3 of which focused on groin incisions, and found a reduction in SSI rates with iNPWT (groin-specific OR 0.19, 95% CI 0.089–0.42); the effect measure was stronger for groin incisions than for any other anatomic location studied (including abdomen, chest/back and lower extremity). Svensson-Björk and colleagues<sup>24</sup> identified 7 RCTs with 1049 incisions and reported a reduced rate of SSI with iNPWT (OR 0.35, 95% CI 0.24–0.50).

We sought to investigate the role of a perioperative ILND bundle on adverse events after ILND and lymph node harvest. The bundle included, among other things, a skin bridge incision, running subcuticular skin closure and NPWT. Our primary objective was to compare the rate of SSI between the perioperative bundle group and patients who received an LS incision with conventional dressing. Secondary objectives included comparing rates of dehiscence and of seroma and hematoma formation, as well as use of health care resources, including readmission and consultation with a wound care advanced practice nurse.

## METHODS

### *Study design*

We performed a retrospective cohort study of all patients who underwent ILND for an oncologic disorder between 2013 and 2018 at 1 centre in southeastern Ontario. All procedures were performed by 1 fellowship-trained surgical oncologist who oversaw the care of all patients with melanoma or nonmelanoma skin cancer requiring ILND. Patients younger than 18 years were excluded. Given that we were interested in comparing the perioperative bundle with the LS incision alone, we excluded any patient who received individual components of the bundle. Ethics approval was obtained from the Ottawa Health Science Network Research Ethics Board.

### *Procedures*

From 2013 to mid-2016, most patients underwent an LS incision with conventional dressing. After this, patients received a skin bridge incision with an iNPWT device applied to the incision under sterile conditions. For the purposes of this study, we defined an ILND as a superficial inguinal nodal dissection (femoral nodes), with or without a deep inguinal (pelvic) nodal dissection (iliac and obturator nodes). Patients with palpable disease in the groin (femoral) underwent a superficial inguinal node dissection. A deep inguinal (pelvic) nodal dissection was added if there were suspicious iliac/pelvic nodes on computed tomography or positron emission tomography. In patients with sentinel-node-positive disease, a superficial inguinal node dissection was performed, and a deep inguinal (pelvic) nodal dissection was added if the original lymphoscintigraphy image

also mapped to the pelvis (iliac and obturator nodes). Most of the patients in this cohort were treated before the Multi-center Selective Lymphadenectomy Trial II (MSLT-II) was published.<sup>25</sup> Many of the sentinel-node-positive patients had more than 1 positive sentinel node or extra-nodal extension, or both.

Patients in the perioperative bundle group received a dose of prophylactic antibiotic (cefazolin, or vancomycin if allergic to cefazolin) 15–60 minutes before skin incision, as well as upper body forced-air warming blankets. They underwent an ILND with a skin bridge incision or a single vertical incision below the inguinal crease. When the skin bridge incision was used, the purpose of the oblique incision above the crease was to perform the deep inguinal/pelvic node dissection by means of a retroperitoneal approach, with all iliac and obturator nodes being removed. The vertical incision below the crease allowed for the superficial inguinal node dissection, with all the nodes in the femoral triangle being removed, and the femoral artery and vein being cleared up to the inguinal ligament. The incisions were closed with interrupted intradermal sutures (Polysorb polyfilament absorbable sutures, Medtronic) and a running subcuticular suture (Biosyn monofilament absorbable suture, Medtronic). While sterile conditions were maintained, a single Prevena incision management system device (3M+KCI) was applied over the full incision. One or 2 Jackson–Pratt drains were inserted at the end of all cases. Patients received teaching by the nursing team in the postanesthesia care unit. Patients remained overnight in the unit and were discharged the following morning. Home nursing visits were provided through the Community Care Access Centre program, a service that is covered by provincial health care to residents of Ontario. The iNPWT device was kept for 7 days and then removed by the home care nurse.

Patients in the LS incision (control) group received a prophylactic antibiotic and forced-air warming blankets as per the perioperative bundle group. They underwent an ILND with an LS incision that crossed the inguinal crease. Similar to the perioperative bundle group, the superficial inguinal node dissection removed all the nodes in the femoral triangle, with the femoral artery and vein being cleared up to the inguinal ligament. The surgeon did not cut through the inguinal ligament to dissect the deep inguinal/pelvic nodes; rather, the deep inguinal/pelvic node dissection was performed by means of a retroperitoneal approach similar to that used in the perioperative bundle group, with all the iliac and obturator nodes being removed. The incisions were closed with interrupted intradermal sutures (Polysorb polyfilament absorbable sutures) and skin staples. While sterile precautions were maintained, a conventional self-adhesive dressing was applied; patients were instructed to remove the dressing after 72 hours. One or 2 Jackson–Pratt drains were inserted at the end of all cases.

## Outcomes

We collected patient baseline characteristics, surgical details and postoperative course data from review of the hospital electronic medical record. A Charlson Comorbidity Index score was calculated for all patients.<sup>26</sup> Surgical details collected included wound classification, creation of a sartorius flap, type of incision, number of Jackson–Pratt drains inserted, iNPWT use and number of lymph nodes harvested. The following postoperative adverse events were documented: SSI and treatments received, lymphedema, dehiscence, hematoma, seroma, death within 30 days of surgery, visits to the emergency department and hospital readmission. We defined superficial SSI as an infection occurring within 30 days after surgery involving only skin or subcutaneous tissue of the incision with the following symptoms: pain or tenderness, redness, heat or purulent discharge. We defined deep SSI as an infection occurring within 30 days after the operation involving deep soft tissues and requiring interventions such as incision and drainage, or image-guided percutaneous drainage.<sup>27</sup>

Patients diagnosed with superficial SSIs were treated with oral antibiotic therapy. This was generally a 7-day course of cefalexin; however, this varied depending on the provider prescribing the antibiotic. Deep SSIs were treated with intravenous antibiotic therapy, incision and drainage, or image-guided percutaneous drainage via interventional radiology at the surgeon's discretion.

We also captured information pertaining to use of health care resources, including need for inpatient and outpatient consultation with a registered nurse with extended training in wound care, emergency department visits and readmission to hospital for postsurgical complications.

## Statistical analysis

We compared categorical variables using the  $\chi^2$  test and means of continuous variables using the Student *t* test. We used multivariable logistic regression to control for confounding variables and generate an OR with 95% CI. We performed statistical analyses using RStudio version 1.2.1577 and SAS version 9.3 (SAS Institute).

## RESULTS

Forty-four patients underwent ILND between 2013 and 2018. After excluding patients who did not receive all components of the perioperative bundle, 34 ILNDs in 33 patients were included. There were 15 patients (15 ILNDs) in the LS incision group and 18 patients (19 ILNDs) in the perioperative bundle group. Two patients had a single vertical incision inferior to the groin crease and were included in the perioperative bundle group. One patient in the NPWT group received a running hemming stitch instead of conventional skin staples.

Baseline demographic, pathologic and treatment characteristics are listed in Table 1. The average age was 62.1 (SD 13.9) years. Eighteen patients (54%) were male. The most common histologic subtype was superficial spreading melanoma (20 cases [59%]). Nineteen ILNDs (56%) involved the creation of a sartorius flap (Table 2). In 25 cases (74%), dissection (superficial and deep ILND in all cases) was for palpable nodal disease, and in 9 cases (26%), dissection was for a positive sentinel node (superficial and deep ILND in 3 cases, and superficial ILND only in 6). Both superficial and deep groin dissection was performed in 7 cases (47%) in the

**Table 1. Patient demographic and surgical characteristics**

Characteristic	Group; no. (%) of cases*		<i>p</i> value
	Lazy S incision <i>n</i> = 15	Perioperative bundle† <i>n</i> = 19	
Age, mean ± SD, yr	61.7 ± 15.6	62.4 ± 12.8	0.9
Male sex	9 (60)	9 (47)	0.5
Comorbidities			
Diabetes mellitus	3 (20)	4 (21)	0.9
Hypertension	6 (40)	7 (37)	0.8
Chronic obstructive pulmonary disease	1 (7)	1 (5)	0.9
Coronary artery disease	2 (13)	3 (16)	0.8
Smoker			0.4
Current	4 (27)	2 (10)	
Previous	4 (27)	4 (21)	
ASA score			0.6
2	5 (33)	5 (26)	
3	10 (67)	13 (68)	
4	0 (0)	1 (5)	
Prior radiation	1 (7)	1 (5)	0.9
Prior groin surgery	0 (0)	1 (5)	0.4
Right side	10 (67)	4 (21)	0.007
Histologic subtype			0.1
Malignant melanoma			
Superficial spreading	10 (67)	10 (6)	
Acral lentiginous	0 (0)	3 (16)	
Nodular	0 (0)	2 (10)	
Metastatic melanoma of unknown primary	1 (7)	4 (21)	
Apocrine carcinoma	1 (7)	0 (0)	
Squamous cell carcinoma	2 (13)	0 (0)	
Merkel cell carcinoma	1 (7)	0 (0)	
Reason for surgery			0.1
Palpable nodal disease	9 (60)	16 (84)	
Positive result of sentinel node biopsy	6 (40)	3 (16)	
Type of dissection			0.007
Superficial inguinal alone	8 (53)	2 (10)	
Superficial and deep inguinal	7 (47)	17 (90)	
No. of nodes excised, mean ± SD	14.1 ± 8.4	14.4 ± 7.4	0.9

ASA = American Society of Anesthesiologists; SD = standard deviation.

\*Except where noted otherwise.

†Included, among other things, the inguinal-crease-preserving skin bridge incision, running subcuticular skin closure and negative-pressure wound therapy.

**Table 2. Postoperative adverse events and use of health care resources**

Variable	Group; no. (%) of cases*		<i>p</i> value
	Lazy S incision	Perioperative bundle	
Creation of sartorius flap	6 (40)	13 (68)	0.1
Incision			< 0.001
Lazy S	15 (100)	0 (0)	
Skin bridge	0 (0)	17 (90)	
Single groin incision	0 (0)	2 (10)	
Surgical site infection	11 (73)	6 (32)	0.02
Postoperative adverse event			
Intravenous antibiotic therapy	6 (40)	2 (10)	0.04
Incision and drainage	0 (0)	1 (5)	0.4
Percutaneous drainage via interventional radiology	1 (7)	1 (5)	0.9
Dehiscence	5 (33)	0 (0)	0.006
Hematoma	1 (7)	0 (0)	0.2
Seroma	3 (20)	4 (21)	0.9
Health care resource			
Wound care consultation	7 (47)	0 (0)	0.001
Return to hospital within 30 d	7 (47)	8 (42)	0.8
Readmitted to hospital within 30 d	5 (33)	3 (16)	0.2

LS incision group, compared to 17 cases (89%) in the perioperative bundle group ( $p = 0.07$ ).

### *Surgical site infection and other wound-related complications*

There were 17 documented SSIs, 11 (73%) in the LS incision group and 6 (32%) in the perioperative bundle group ( $p = 0.02$ ) (Table 2). Six patients and 2 patients, respectively, required treatment with intravenous antibiotic therapy. There were 5 documented episodes of dehiscence, all in the LS incision group (33%) ( $p = 0.006$ ). Seven patients (47%) in the LS incision group requested wound care consultation, compared to no patient in the perioperative bundle group ( $p = 0.001$ ). The average number of lymph nodes retrieved per ILND was comparable between the 2 groups (14.1 [SD 8.4] in the LS incision group v. 14.4 [SD 7.4] in the perioperative bundle group,  $p = 0.9$ ).

In the univariate analysis, use of the perioperative bundle compared to an LS incision alone was associated with decreased odds of SSI development (OR 0.17, 95% CI 0.03–0.70) (Table 3). Comorbidities that increased the risk of SSI were also examined: smoking (OR 1.63, 95% CI 0.41–6.70) and diabetes (OR 1.44, 95% CI 0.27–8.49) resulted in point estimates that trended toward increased risk of SSI, although not statistically significantly so. In the multivariable analysis, after adjustment for smoking and diabetes, the perioperative bundle was still associated with a statistically significant decrease in the SSI rate (OR 0.17, 95% CI 0.03–0.74). However, undergoing both a superficial and a deep

**Table 3. Univariable and multivariable analysis of factors associated with development of surgical site infection after inguinal lymph node dissection**

Variable	OR (95% CI)	
	Univariable logistic regression	Multivariable logistic regression
Male sex	2.62 (0.67–11.05)	—
Diabetes mellitus	1.44 (0.27–8.49)	1.58 (0.25–11.05)
Smoking history	1.63 (0.41–6.70)	1.14 (0.23–5.33)
Sartorius flap	0.49 (0.12–1.89)	—
Retroperitoneal lymph node dissection*	1.00 (0.22–4.49)	—
Perioperative bundle	0.17 (0.03–0.70)	0.17 (0.03–0.74)

CI = confidence interval; OR = confidence interval.  
\*Patient received both superficial and deep lymph node dissection, as opposed to superficial lymph node dissection alone.

inguinal dissection was not associated with a statistically significant decrease in SSI (OR 1.00, 95% CI 0.22–4.49) on univariate analysis and thus was not included in the multivariable analysis.

## DISCUSSION

This single-centre retrospective review showed that, compared to the traditional LS incision with conventional dressings, the use of a skin bridge incision above and below the inguinal fold, combined with application of iNPWT for 7 days, was associated with 5.9-fold reduction in the SSI rate, without compromising lymph node harvest. It was also associated with a significant reduction in dehiscence, use of intravenous antibiotic therapy and consultation with a wound care advanced practice nurse.

Our multivariable model adjusted for smoking history and diabetes, 2 known risk factors for SSI.<sup>28–30</sup> After adjustment for these 2 comorbidities, our model was still suggestive of a statistically significant protective effect from developing SSI with the use of a perioperative bundle. Although the use of videoscopic inguinal lymphadenectomy has been suggested to decrease SSI rates,<sup>31</sup> we feel that our results will still be interesting for surgeons using an open technique for groin dissection.

Use of prophylactic iNPWT has been looked at extensively in groin surgery in the vascular surgery population. Although a recent prospective RCT of patients undergoing infrainguinal revascularization showed no difference in rates of SSI between iNPWT and standard gauze,<sup>22</sup> several meta-analyses have shown a 2.8- to 5.2-fold reduction in SSI rates with the use of iNPWT.<sup>16,23,24</sup> Overall, given the data from these studies, we believe there is strong evidence supporting iNPWT to reduce SSI development in groin incisions. In addition, qualitative studies have suggested that iNPWT is manageable for patients in the home setting, which could potentially avert admission to hospital.<sup>32</sup> To our knowledge, this effect has not been studied extensively

in patients with cancer who undergo ILND, for control of malignant disease via lymph node dissection rather than for revascularization.

Compared to the LS incision group, the perioperative bundle group was found to have a statistically significantly higher rate of deep inguinal node dissections in addition to superficial node dissections, and a trend toward a higher proportion of patients with creation of a sartorius flap. Although there is evidence from small studies suggesting no major differences in complication rates between superficial and deep groin dissections,<sup>33,34</sup> deep inguinal node dissections and sartorius flaps do increase the operative time (compared to superficial groin dissections without a sartorius flap), which may increase the risk of SSI. Thus, the true effect of SSI reduction with the perioperative bundle may have been underestimated.

Our findings suggest that use of a perioperative bundle may decrease the incidence of SSI after ILND. What remains unclear is the driving mechanism behind this potential effect. Is the possible reduction in SSI occurrence due to the use of a skin bridge incision or the use of iNPWT? Although evidence exists in the literature to support the latter,<sup>16,19–24</sup> studies comparing the association among skin incision, postoperative SSI and lymph node harvest are limited to retrospective, single-centre reviews with small samples. One retrospective cohort study comparing 2 incisions that cross the inguinal fold (LS v. vertical) gave results in favour of the straight incision (wound infection rate 11.8% with straight incision v. 50.0% with S-shaped incision,  $p = 0.06$ ).<sup>15</sup> In another retrospective cohort study comparing an LS incision to a single oblique incision above the inguinal fold for inguinofemoral lymph node dissection for vulvar cancer, the oblique incision was associated with a lower rate of major adverse events (14% v. 57%,  $p < 0.02$ ) but fewer lymph nodes collected (mean 7 v. 11,  $p < 0.001$ ).<sup>35</sup> Given the limited data currently available, incision choice is based on surgeon preference.

This study was not designed to assess the skin bridge incision or iNPWT independently. Although we believe both interventions played a part in reducing SSI development in our study, we suspect that the type of incision may have played a larger role, as a smaller incision that avoids the groin crease may improve wound healing by avoiding moisture and mechanical stretch over the healing incision. However, given the paucity of data on types of incisions and outcomes for groin lymphadenectomy, the true mechanism of reduction in SSI development remains unclear. As a next step, our research team plans to investigate the trends in incisions used for ILND by surgical oncologists to determine whether a clinical trial may be performed to compare the 2 incisions and if equipoise between these 2 incision types still exists. Other potential research includes performing a dedicated RCT comparing the skin bridge incision with and without iNPWT to further investigate this association.

One quality metric that has been looked at for ILND is lymph node yield. Although there are inadequate data to set the standard for minimum lymph node yield in ILND, some authors have suggested that surgeons should aim for a minimum yield of 5–11 lymph nodes.<sup>36,37</sup> The mean number of lymph nodes retrieved in the present study was greater than these recommendations in both groups.

### Limitations

Although our study results are consistent with the findings of meta-analyses,<sup>16,23,24</sup> our study could not assess the effect of iNPWT alone; instead, it was assessed as part of a perioperative bundle. In addition, our study involved a smaller sample from a single institution, resulting in larger CIs. Despite this, the 95% CI in our multivariable model is still suggestive of a reduction in the SSI rate of at least 13.2% with the use of a perioperative bundle.

As 1 surgical oncologist performed ILND in our institution's catchment area, all referral and follow-up care was centralized and easily accessible through the institution's electronic medical record. However, the fact that this was a single-institution cohort study of a small group of patients who underwent surgery performed by 1 surgeon, the findings may have limited generalizability. Although our results are suggestive of a statistically significant reduction in SSI rate with the perioperative bundle, our study did not show any statistically significant difference with factors known to increase the risk of postoperative SSI, such as smoking and diabetes; this is likely due to our small sample.

Given that the LS incision was used earlier in the surgeon's career and the perioperative bundle was implemented several years later, improvement in technical skill is an important confounder to consider. However, it would have been difficult to adjust for this factor, as increased technical skill likely would have shown a collinear relation with implementation of the perioperative bundle.

### CONCLUSION

Our findings suggest a decrease in the rate of SSI with use of a perioperative bundle consisting of a skin bridge incision and iNPWT compared to the traditional LS incision and conventional dressing. Randomized controlled trials are required to better understand the associations among the skin bridge incision, iNPWT and SSIs.

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**Competing interests:** None declared.

**Contributors:** Y. Zhang and C. Nessim designed the study. G. Frenda acquired the data, which G. Frenda and L. Baker analyzed. G. Frenda wrote the manuscript, which L. Baker, Y. Zhang and C. Nessim critically revised. All authors gave final approval of the article to be published.

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