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ORIGINAL SCIENTIFIC REPORT

Minimizing Post-operative Complications of Groin Dissection Using Modified Skin Bridge Technique: A Single-Centre Descriptive Study Showing Post-operative and Early Oncological Outcomes

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Abstract

Introduction Historically, groin dissections are associated with high morbidity. Various modifications have been described in the literature with inconsistent outcomes. The aim of this paper is to highlight modified skin bridge technique to minimize all post-operative complications of groin dissection without compromising early oncological outcomes.

Methods A retrospective descriptive study of the computerized cancer database was performed to retrieve details of all the cancer patients who had undergone groin dissections during January 2012 to September 2016. Data pertaining to clinical profile including demographics, clinical and histopathological details, treatment profile, procedure-related morbidity and relapse patterns were extracted and analysed.

Results A total of 75 patients underwent 105 groin dissections during this period. Out of 105 groin dissections, 43 were inguinal lymph node dissection (ILND) and 62 were combined ilio-inguinal lymph node dissection (IILND). The most common diagnosis was carcinoma penis (25%) followed by malignant melanoma (14.6%) and squamous cell carcinoma (13.33%) of lower extremities. Overall, the most common complications were seroma (14.28%) and skin edge necrosis (7.61%) followed by surgical site infection (4.76%). After a median follow-up of 17.64 months (IQR 5–61.53), a total of 18 patients (24%) developed recurrence.

Conclusion Groin dissection still remains an important diagnostic as well as therapeutic procedure justifying its potential of morbidity. Modified skin bridge technique is a very effective method to minimize all post-operative complications with optimal early oncological outcomes.

Introduction

Groin dissection continues to be the treatment of choice to address regional lymph node basins for malignant conditions of genitals, anal canal and skin in the lower extremities and perineum [1, 2]. The importance of groin dissection was first realized by Antoine Basset who described it in 1912 [3]. Historically, groin dissections are associated with high morbidity. Various modifications have been described in the literature with inconsistent outcomes [1–3]. Reported complications in four major series of groin dissections include skin edge necrosis (8–62%), infection (10–17%), seroma (6–16%) and lymphedema (23–50%) [4]. Surgeons always face the dilemma of balancing survival vis-a-vis perioperative morbidity outcomes associated with high complication rates [1, 4]. The morbidity of groin dissection further increases if the pelvic dissection is added to the inguinal dissection. Though Fraley et al. [5]

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described a skin bridge technique for groin dissection in 1972 to reduce post-operative morbidity, it failed to gain popularity. We modified the skin bridge technique for groin dissection as described by Fraley et al. and published our initial experience [2]. The aim of this paper is to report our surgical experience of 105 groin dissections undertaken for malignant conditions of genitalia, anal canal and skin of perineum and lower extremities. We herein also present our modified skin bridge technique to decrease post-operative complications, specifically post-operative flap necrosis. This new innovative technique is effective in minimizing post-operative morbidity of groin dissection without compromising early oncological outcomes. This simple technique can be easily learned by young surgeons and practised even at centres with limited infrastructure.

Methods

A retrospective descriptive study of the prospectively maintained computerized cancer database was performed to retrieve details of all the cancer patients who had undergone groin dissections including inguinal lymph node dissection (ILND) or ilio-inguinal lymph node dissection (IILND) as part of surgical treatment during January 2012 to September 2016. This computerized database is based on Microsoft access version 2007. Institutional ethical committee clearance was sought for quality assurance. The study was performed according to "Declaration of Helsinki for Biomedical Research 1964" and its further modifications. All the patients aged more than 18 years who underwent ILND or IILND for different cancers were included in the present analysis. The consent before surgery was obtained from all the participants. Skin cancer (malignant melanoma, squamous cell carcinoma and marjolins ulcer) of lower extremity or perineal region, carcinoma penis, carcinoma vulva, carcinoma scrotum, carcinoma anal canal (post-chemoradiation), carcinoma of unknown primary (CUP) and selected soft tissue sarcoma of lower extremity were included in the present study. Those patients who did not have complete information regarding clinical details were excluded from the present study.

A consistent protocol-based treatment strategy was followed during the study period. Detailed history including clinical presentation, previous treatment and the presence of comorbid conditions was recorded for all patients. A detailed clinical examination was done to know the anatomical extent of index lesion and the status of inguinal and pelvic nodes. Clinical findings were supplemented with appropriate radiological imaging whenever required for the assessment of extent of the disease. The seventh edition of the American Joint Committee on Cancer (AJCC)/Union for International Cancer Control (UICC) staging manual (published in 2010) was followed for the staging of various cancers in the present study.

For quality assurance regular 3-monthly interdepartmental audits were performed to look that data were generated, recorded, analysed and accurately reported according to protocol, standard operating procedure (SOP) and good clinical practices (GCP). Every 6-monthly report was submitted to institutional ethical committee for further internal/institutional quality assurance.

All the patients were treated with protocol-based multimodality treatment. All primary site cancers were managed according to standard protocols. For carcinoma penis, vulva and skin cancers (squamous cell carcinoma and malignant melanoma) of lower extremities and perineum with palpable inguinal nodes, upfront inguinal dissection was performed. Pelvic lymph node dissection was also performed in cases of image-detected pelvic nodes and proven metastatic or grossly enlarged inguinal nodes. Neoadjuvant chemotherapy (NACT) was prescribed in patients with upfront inoperable inguinal lymphadenopathy. Groin dissection was performed in this group if they had responded to NACT. For carcinoma anal canal, groin dissection was performed in salvage cases after definitive chemoradiation in patients with proven metastatic inguinal nodes. Groin dissection was also performed in patients with high-risk soft tissue sarcomas of lower extremities associated with enlarged inguinal lymph nodes.

Patients who presented with neoplastic inguinal lymphadenopathy and, in whom, both clinical examination and extensive investigations including positron emission tomography scan and lower GI endoscopy, cystoscopy and colposcopy failed to identify the primary tumour site, were labelled as carcinoma of unknown primary (CUP). These patients also underwent therapeutic groin dissection.

Prophylactic groin dissection was undertaken in patients with carcinoma penis and vulva with high-grade lesions (G3/G4), pT1 tumours with lymphovascular invasion (pT1b) or pT2 to pT4 tumours. In melanoma cases, prophylactic dissection was performed in patients with tumour depth more than 1 mm.

All the operative procedures were either directly performed or performed under direct supervision of first author (MDR) to avoid any protocol violations. A single curvilinear incision was used for inguinal dissection. We used our previously published modified skin bridge technique when pelvic dissection was also added to the inguinal dissection. In this technique, two curvilinear incisions were used: an inguinal incision of 5–7 cm, approximately 4 cm below and parallel to inguinal ligament and an iliac incision of 5–7 cm, 4 cm above and parallel to inguinal ligament (Fig. 1). Margins of inguinal incisions were routinely freshened. Primary closure was undertaken whenever it

Fig. 1 Two parallel curvilinear incisions for groin dissection approximately 4 cm above and below the inguinal ligament

was feasible without undue tension. In other cases, where primary closure was not possible—skin grafts, tensor fascia lata (TFL) flap, VRAM (vertical rectus abdominis myocutaneous) flap were used for closure by primary surgical team only.

In inguinal dissection, all the lymph nodes of femoral triangle were removed along with Cloquet's nodes, whereas in pelvic dissection along with these tissue nodes along pelvic side wall and external iliac vessels were removed up to iliac vessel bifurcation.

One closed suction drain was placed in inguinal region, and no drain was placed in iliac region. Elastic compression stockings were applied immediately after surgery, and patients were allowed ambulation from 24 h after surgery. Antithrombotic prophylaxis was not routinely prescribed. All patients received perioperative antibiotics for 5 days, and duration or drug was changed in case of infection or other complications. All patients were followed in outpatient clinics for wound care and physiotherapy. Drains were removed once output reached less than 40 ml. Diagnosis of surgical site infection (SSI) was made by treating surgeon and defined as localized pain, tenderness, erythema or purulent drainage with or without laboratory confirmation from surgical site within 30 days of surgery [6].

After the completion of the treatment patients were followed at 3-monthly intervals for 2 years, at 6-monthly intervals till 5 years and annually thereafter. Data pertaining to clinical profile including demographics, clinical and histopathological details, treatment profile, procedure-related morbidity and relapse patterns were extracted and analysed from the database.

Results

A total of 80 patients underwent groin dissection; however, complete medical records were available for 75 patients who were included for the present study. Mean age was 49.62 (SD 13.72) years with male/female ratio of 53:22. Nodal dissection was done simultaneously with primary cancer management in 56 (75%) patients, while 19 (25%) underwent staged procedures. Unilateral dissections were performed in 45 (60%) patients, and bilateral dissections were done in 30 (40%) patients. Overall, 105 groin dissections were performed and were included for morbidity analysis. Out of 105 groin dissections, 43 were inguinal lymph node dissection (ILND) and 62 were combined ilio-inguinal lymph node dissection (IILND). Prophylactic groin dissection was performed in 19 (25%) patients, while therapeutic elective groin dissection was performed in 56 (75%) patients. Mean blood loss was 29.86 (SD 10.16) cc. Mean duration of surgery was 101 (SD 31.70) minutes. Mean duration of hospital stay after surgery was 5.72 (SD 2.96) days. Primary closure could be achieved in 71 patients, and only 4 patient required flap cover due to skin loss. Tensor fascia lata (TFL) flap was used in three patients, while one patient required vertical rectus myocutaneous flap (VRAM) for wound closure.

Total seven patients had controlled diabetes on insulin, and none of the patient was uncontrolled diabetic. Two patients were taking tablet ecosprin for the past cardiac events. Seven patients were taking treatment for hypertension.

Most common diagnosis was carcinoma penis (25%) followed by malignant melanoma (14.6%) and squamous cell carcinoma (13.33%) of lower extremities. Diagnostic details are summarized in Table 1.

A total of 72 patients underwent upfront inguinal dissection, while two patients of anal carcinoma and one of CUPS underwent salvage dissection for nodal relapse after definitive chemoradiation. A total of 25 patients (34.7%) received adjuvant post-operative radiotherapy (PORT). Adjuvant chemotherapy was also prescribed in 4 (5.5%) patients.

Median number of nodal harvest was 14.5 (IQR 2–40), and median number of node positive was 0.5 (IQR 0–18). Median number of positive node among node positive patients was 4.5 (IQR 1–18).

None of the patient had any systemic complications, and 33 patients (31.42%) had surgery-specific complications. The most common complications were seroma (14.28%) and skin edge necrosis (7.61%) followed by surgical site infection (4.76%). Partial skin flap necrosis occurred in one patient, and no full thickness flap loss was observed in any patient. Details of post-operative complications are

Table 1 Histopathological diagnosis of the patients in the present case series

S. no.	Diagnosis	Number (n = 75)
1.	Carcinoma penis	19
2.	Malignant melanoma	11
3.	Marjolins ulcer	9
4.	Squamous cell carcinoma (SCC) extremity	10
5.	Anal carcinoma	2
6.	Lower extremity sarcoma	8
	a. Synovial sarcoma	4
	b. Clear cell sarcoma	1
	c. Alveolar soft part sarcoma	1
	d. Pleomorphic sarcoma	1
	e. MPNST (malignant peripheral nerve sheath tumour)	1
7.	Carcinoma vulva	9
8.	CUPS (carcinoma of unknown primary)	5
	Squamous cell carcinoma	2
	Adenocarcinoma	2
	Transitional cell carcinoma	1
9.	SCC scrotum	2

summarized in Table 2. No intraoperative complication occurred. No perioperative mortality was observed, and no episode of deep vein thrombosis (DVT) or pulmonary embolism (PE) occurred in any of the patients. None of the patient had persistent lymphocutaneous fistula. None of the patients required re-exploration or vacuum-assisted closure (VAC) for wound management in the post-operative period. None of the patients required readmission.

After a median follow-up of 17.64 months (IQR 5–61.53), a total of 18 patients (24%) developed recurrence. Most common site of recurrence was systemic in 14 (18.66%) patients, and isolated regional recurrence was observed in only 3 (4%) patients. Recurrence patterns are summarized in Table 3. Among systemic recurrences, the most common site was lung in 12 (85%) patients followed by liver in one patient. One patient of extremity melanoma had diffuse metastasis to lung, liver and bone after surgery. A total of 55 (73.3%) patients were alive and disease free. Eleven (14.6%) patients were alive with disease, while 9 (12%) patients had died.

Table 3 Recurrence details

S. no.	Site of recurrence	Number (n = 18)	Percentage (%)
1	Primary tumour site	1	1.33
2	Regional (inguinal or pelvic)	3	4
3	Systemic	9	12
4	Locoregional and systemic	5	6.67

Discussion

The main aim of groin dissection is to provide accurate pathological staging, to clarify prognosis and to guide adjuvant treatment decisions. Though it is not well established, it may have a therapeutic value for selected malignancies [7–9].

There is a wide variation in reported outcomes and surgery-related morbidity of groin dissections as most of the series from Asian countries report data on carcinoma penis, while main data from Western countries discuss about various lower extremity skin tumours. Different techniques reported in the literature have shown inconsistent outcomes, and superiority of any single technique is not established [8, 10, 11]. So in this paper we have presented our institutional experience of groin dissection with modified skin bridge technique.

The reported incidence of skin edge necrosis varies from 8 to 62% in the literature [4, 7, 8, 10, 11]. Overall, skin edge necrosis was 7.6% in our series. In an analysis of 200 groin dissections, Ornellas et al. [10] found 45% skin edge

Table 2 Overall post-operative morbidity and management

S. no.	Morbidity	Total (n = 105)	Inguinal dissection (n = 43)	Ilio-inguinal dissection (n = 62)	Management
1	None	72 (68.71%)	36 (83.7%)	36 (58.06%)	
2	Skin edge necrosis	8 (7.61%)	3 (7%)	5 (8%)	Secondary suturing
3	Seroma	15 (14.28%)	3 (7%)	12 (19.35%)	Aspiration and compression
4	Superficial surgical site infection	5 (4.76%)	1 (2.3%)	4 (6.45%)	Conservative
5	Lymphedema	5 (4.76%)	0	5 (8%)	Conservative

necrosis. Further on subset analysis, the rate of skin edge necrosis was 82% with bi-iliac incision, 72% with S-shaped incision and only 5% with Gibson incision. In one of the largest study of 405 groin dissections, Ravi reported an incidence of skin edge necrosis with different incisions of 40–74% in ILND and 69–100% in IILND; however, no edge necrosis was observed in 30 patients who underwent myocutaneous flap reconstruction [11]. After 15 years with modifications in surgical technique by using lazy S incision, another paper from the same institute reported results of 202 groin dissections and showed only 19.8% rate of skin edge necrosis [8]. Incidence of skin edge necrosis was 7% in ILND and 8% in IILND group in our study. This low rate of skin flap necrosis was achieved with our modified technique with the preservation of blood supply of skin flaps, proper anatomical dissection and routine freshening of skin flaps [2]. This edge necrosis was easily managed in outpatient clinic with secondary suturing under local anaesthesia. Only one patient had partial skin flap loss which required debridement and secondary suturing.

Incidence of seroma formation varies from 6 to 16% in the literature [4, 7, 10–12]. Incidence of seroma formation was 14.2% overall in the present series. However, only 7% had seroma formation in ILND group, while 19.35% had seroma in IILND group. This high incidence can be probably explained by more therapeutic dissections in IILND group. All patients were managed by simple aspiration and compression, and none required drain insertion or operative intervention.

Incidence of wound infection varies from 10 to 17% in the literature [4, 7, 10–12]. Incidence of wound infection was only 4.76% in the present series. All patients had superficial erythema which was managed by antibiotics; none of the patients required drainage. Routine use of perioperative antibiotics, gentle tissue handling and low rate of edge necrosis may be the contributory factors for low incidence of infection in our series.

Incidence of lymphedema varies from 23 to 50% in various series [4, 7, 10–12]. In the present series, the overall incidence of lymphedema was only 4.76% and none of the patient had debilitating or severe oedema. None of the patients in ILND group had lymphedema, while incidence was 8% in IILND group. This low incidence is likely to be related to early ambulation, better surgical technique and routine use of compression stockings.

None of the patient in the present series had deep vein thrombosis (DVT), pulmonary embolism (PE), sepsis, haemorrhage or death. Arbeit et al. [13] have shown overall 13.6% incidence of DVT after groin dissection with no benefit of pharmacological heparin prophylaxis. Various studies have shown low incidence of DVT in Indian patients [14, 15]. Apart from ethnicity, early ambulation and routine use of mechanical prophylaxis might have resulted in zero incidence of DVT/PE in the present series.

Mean post-operative hospital stay varies from 8.3 to 23 days after ILND and 12–25.2 days after IILND [10–12]. Mean post-operative hospital stay was 5.72 (SD 2.96) days in the present study which may be the contributory factor for overall low incidence of various complications.

Lymph node involvement is one of the strongest prognostic factors, but adequate number of nodes to be removed during groin dissection has not been defined [16]. Median number of nodal harvest was 14.5 (IQR 2–40), and median number of positive node in node positive patients was 4.5 (IQR 1–18). As nodal dissection was performed in different spectrum of cancers in the present series, it is difficult to reach at optimum number of nodes to be removed.

Therapeutic benefit and survival advantage of groin dissection have been shown in various studies [7–9, 11]. In the present study, after a median follow-up of 17.64 months, 73.3% patients were alive and disease free, 14.6% patients were alive with disease, while 12% had died. In view of different nature of malignancies involved and short follow-up, we have not performed survival analysis; however, recurrence patterns are shown in Table 3.

Emerging newer techniques of dynamic sentinel node biopsy and laparoscopic/robotic groin dissections techniques have shown initial comparable oncological outcomes with less morbidity to open techniques [7, 17, 18]. While these emerging techniques still remain investigational, costly and limited to experienced centres, we have shown a simple technique resulting in minimal post-operative morbidity. These results can be reproduced even at smaller centres by adhering to proper principles described in this technique.

Retrospective nature descriptive study with small and heterogeneous patient population did not allow us to do statistical analysis. With a large sample size and long follow-up, a future analysis can be planned for survival analysis. A comparative study between different techniques of groin dissection with our technique can also be planned to establish its superiority.

Conclusion

Groin dissection is an important oncosurgical procedure with diagnostic as well as therapeutic value which keeps patient disease free and helps in deciding adjuvant treatment, justifying its potential of morbidity. In the present series, we have shown that modified skin bridge technique is a very effective method to minimize all post-operative complications with optimal early oncological outcomes. By

this technique based on excellent knowledge of anatomy and gentle tissue handling, best outcomes can be achieved and results can be reproduced even at smaller centres.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

Ethical approval This article does not contain any studies with animals performed by any of the authors.

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