

The Gulf Journal of Oncology



Indexed By PubMed and Medline Database

Issue 42, May 2023
ISSN No. 2078-2101



*8th Gulf Week for
Cancer Awareness,
1-7 February 2023*

The Official Journal of the Gulf Federation For Cancer Control

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Does the Nightmare of Distressing Complications of Groin Dissection Over with “River Flow” Incision? – Experience of 240 Dissections from Tertiary Referral Oncology Centre, India

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Abstract

Objective: Groin dissection has been a nightmare for many surgeons due to its higher morbidity especially flap necrosis. Various modifications in incisions have been described in the literature to reduce the complications but with variable outcomes. By our novel “River Flow” incision technique, we have significantly reduced the procedure related complications without compromising onco surgical principles.

Methods: A prospective longitudinal clinical observational study was designed after Institutional Ethical Committee clearance, aiming to minimize the rate of complications, especially flap necrosis. All patients who underwent unilateral/bilateral ilio–inguinal block dissection (IIBD) from January 2014 to December 2021 were included in the study. The “River Flow” incision was made and standard ilio–inguinal block dissection was performed. Flap viability, seroma formation, lymphedema, infection, etc. were observed and noted during hospitalization and on follow–up. Clavien– Dindo classification was used to grade the postoperative complications. We have taken our historical data of 235 groin dissections as a control and compared them with the results of the present study. It is one of the largest studies on groin dissection so far.

Results: A total of 138 patients underwent 240 groin dissections. The most common diagnosis was carcinoma penis (44.9%) followed by carcinoma vulva (22.4%). Overall, the outcome of all groin dissections showed no postoperative mortality. None of the patients had complete flap necrosis. But in our historical data, the flap necrosis rate was 38%. The most common complication observed was seroma formation in 13.7% of cases followed by surgical site infection (6.52%). All the complications were managed conservatively. The postoperative stay of the patients was also significantly less. The median hospital stay was 3 days.

Conclusion: “River Flow” incision technique is a simple but effective novel surgical technique for therapeutic ILND for any surgical setup without the learning curve. It can avoid flap necrosis, and decrease morbidity significantly without compromising the onco surgical principle of standard groin dissection.

Key words: Groin dissection, skin necrosis, river flow incision

Introduction

Groin dissection is a part of treatment to address regional lymph nodes for malignant conditions of genitourinary, gynaecological, lower extremities, skin and anal canal, and soft tissue cancers in the perineum^[1, 2]. In 1912, Antoine Basset first described the importance of groin dissection^[4]. Historically, groin dissections were considered a very high morbid procedure. Various techniques and modifications are explained in the literature with ineffective outcomes^[1–4]. A few reported complications in four major studies of groin dissections are skin edge necrosis (8–62%), lymphedema

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(23–50%), infection (10–17%), and seroma (6–16%)^[5]. Surgeons usually face the difficulty in balancing survival and perioperative morbidity outcomes that are associated with high complication rates^[1,5]. If both pelvic dissection and inguinal dissection are done in the same setting, groin dissection morbidity increases further. In 1972, Fraley et al.^[6] described a skin bridge technique that failed to gain popularity for groin dissection to reduce postoperative morbidity. We did modifications to the skin bridge technique for groin dissection as described by Fraley et al. and published our new series^[2,3]. This study aims to show our surgical experience of 240 groin dissections done for malignancies of genitalia, the skin below the umbilicus to perineum, lower extremities and anal canal. Our objective herein also to describe our technique which decreases post-operative complications significantly, especially postoperative flap necrosis. This new innovative technique decreases postoperative morbidity of groin dissection with no compromise in early oncological outcomes^[3]. Young surgeons can easily learn this technique and even can be practiced at centres with limited infrastructure and resources.

Methods

This is a prospective clinical observational study planned and maintained computerized cancer database. This includes the clinical profile of all the patients who underwent groin dissections including inguinal lymph node dissection (ILND) or ilioinguinal block dissection (IIBD) that are included in the surgical treatment from January 2014 to December 2021. This computerized database is based on Microsoft access version 2007. Institutional ethical committee clearance was obtained for quality assurance. The study was performed according to “Declaration of Helsinki for Biomedical Research 1964” and its further modifications. All the patients who had undergone ILND or IIBD for different cancers aged above 18 years were included in the present analysis. Surgery is done after obtaining informed consent from all the patients. Skin cancer (squamous cell carcinoma, malignant melanoma, and Marjolin’s ulcer and a few cases of sarcoma) below the umbilicus, lower extremity and up to perineum, carcinoma scrotum, carcinoma penis, carcinoma anal canal (post-chemoradiation), carcinoma vulva, carcinoma of unknown primary (CUP) and selected soft tissue sarcoma of lower extremity involving lymph nodes were included in the present series. If the complete information of the patients is lacking, they were excluded from the analysis. Our current data is compared with the historical data just to validate our study. We cannot compare other procedures with the current study patients as we know it is unethical to do older techniques that are already known for their high morbidity. So, we analysed and compared our experience from the

same centre with the current novel technique.

Standard protocol-based treatment was followed during the whole study period. History of presenting illness, treatment history, and comorbid conditions was noted for all patients. All the patients were clinically examined and the extent of the primary lesion and the status of inguinal and pelvic node involvement were identified. Radiological imaging is done whenever required to look for the extent of the disease. Staging is done for various cancers based on the eighth edition of the American Joint Committee on Cancer (AJCC)/Union for International Cancer Control (UICC) staging manual in the present study.

Interdepartmental audits were regularly performed every 3 months for quality assurance to check that data generated, recorded, analysis is done accurately, and reported according to protocol, standard operating procedure (SOP), and good clinical practices (GCP). For further internal/institutional quality assurance, an annual report was submitted to Dean’s research as per the Institutional protocol.

All the patients were undergone groin dissection by the lead surgeon or under his direct supervision to maintain the same standard. Standard protocols were used to manage all primary sites of cancers. Upfront inguinal dissection was performed for genitourinary cancers, gynaecological cancers, and skin cancers like malignant melanoma and squamous cell carcinoma of lower extremities and perineum, anal cancers with palpable inguinal nodes. If inguinal lymph nodes are positive for malignancy and also if the image shows iliac lymph nodes, then pelvic nodal dissection was performed. We cleared one station ahead as per oncological principle. Groin dissection was performed in patients if they had a good response to neoadjuvant chemotherapy (NACT) with upfront inoperability. After definitive chemoradiation in carcinoma anal canal, salvage groin dissection was done in patients with proven metastatic inguinal nodes. Groin dissection was also done in patients with enlarged inguinal lymph nodes in case of high-risk soft tissue sarcomas of lower extremities.

Carcinoma of unknown primary (CUP) was defined in those patients who presented with neoplastic inguinal lymphadenopathy where clinical examination, radiological, and multiple investigations such as positron emission tomography scan, cystoscopy, lower GI endoscopy, and colposcopy failed to diagnose the primary tumour. Those patients also had undergone therapeutic groin dissection.

In penile carcinoma and vulval carcinoma, prophylactic groin dissections were done in all patients except those with pT1 tumours without lymphovascular invasion. Prophylactic dissection was also undertaken in all melanoma patients with a depth of tumour >1 mm.



Figure 1. Position of the patient



Figure 2. Inguinal and Iliac incisions



Figure 3. skin flap superficial to Scarpa's fascia.



Figure 4. intraoperative photograph

All the operative procedures were either directly performed or performed under the direct supervision of the lead Surgeon to avoid any protocol violations. For inguinal dissection, a single curvilinear incision was used. When pelvic dissection was added to the inguinal dissection, a previously published novel technique was used.

The position of the patient is the hip and thigh are on external rotation and abduction. The knee is in flexion position as shown in Figure:1.

In this “river flow” incision technique, incisions used are two parallel and curvilinear incisions. Approximately 4cm below and parallel to the inguinal ligament, about 5–7cm inguinal incision is made and a similar incision, an iliac incision is made above the inguinal ligament which is approximately 4cm above and about 5–7cm (Figures: 2 and 5). Flaps are raised just below the membranous layer of the thigh as shown in Figure: 3. Inguinal incision margins were freshened routinely. Primary closure was undertaken in most of the cases. Few cases, where primary closure were not possible—skin grafts, VRAM (vertical rectus abdominis myocutaneous) flap, Tensor Fascia Lata (TFL) flap were used.

The technique of iliac LN dissection: External oblique muscle divided along its direction. The internal oblique and transverse abdominis muscles are split along the muscle fibres and then entered into retroperitoneal space. Pelvic lymph node dissection in the iliac territories was performed with the standard technique. All the lymph nodes of the femoral triangle along with Cloquet's node were all removed in inguinal dissection, whereas in pelvic dissection, pelvic nodes including external iliac, internal iliac and obturator were removed up to common iliac artery bifurcation along with fibrofatty tissue.

Closed suction drains are used in the inguinal region but in the iliac region, no drains were placed. Elastic compression stockings and early ambulation were allowed from the second day of surgery. Antithrombotic prophylactic doses were not prescribed routinely. All patients were given 3 doses of antibiotic only but ointment was used for 5 days, and in case of infection or other complications, oral antibiotics were prescribed for 5 days. Patients are reviewed in outpatient clinics to monitor wound healing and physiotherapy. Drain output is measured daily by the patient and is removed if the output is less than 40 ml around 10–12 days. Surgical site infection (SSI) is diagnosed by a treating surgeon which includes pain, erythema, or pus discharge seen within 30 days of surgery and managed on an outpatient basis^[7].

Regular follow-up of patients with every 3-monthly interval for 2 years, every 6-monthly interval till 5 years, and yearly thereafter. Data regarding the clinical profile of

patients including demographics, clinical, radiological, and histopathological details, treatment is taken, procedure related morbidity, recurrence, and relapse patterns were analysed from the database.

Results

This prospective observational study was conducted in the Department of Surgical Oncology of our hospital from January 2014 to December 2021. A total of 138 patients underwent groin dissection. The mean age was 48 years with 83% of males and 33% of females. Nodal dissection was done in the same sitting with primary cancer management in 75% (104 patients), while 25% (34 patients) had undergone staged procedures. Overall, 240 groin dissections were performed and were included for morbidity analysis. Bilateral groin dissection was performed in 73.9% (102 patients) and unilateral groin dissection was done in 26.1% (36 patients). Out of 240 groin dissections, 95 were inguinal lymph node dissection (ILND) and 145 were combined ilioinguinal lymph node dissection (IIBD). Prophylactic groin dissection was done in 12.1% (29 patients), while therapeutic elective groin dissection was done in 87.9% (211 patients). The most common diagnosis was carcinoma penis (44.9%) followed by carcinoma vulva (22.4%) and malignant melanoma (10.14%) of lower limbs. Disease-wise distribution of patients are summarized in Table 1.

The overall outcome of all groin dissections showed no postoperative mortality. None of the patients had complete flap necrosis. The most common complication observed was seroma formation in 13.7% (19 cases), surgical wound infection in 6.52% (9 cases), and skin edge necrosis in 5.07% (7 cases). During the routine follow-up, 4.34% (6 patients) had persistent seroma. Grade II lymphedema was seen in 2.17% (3 patients) and 1.44% (2 patients) who developed DVT. Overall, 5.07% (7 patients) had recurrence at the local site while systemic recurrence was observed in 4.34% (6 patients). Complete flap necrosis was not seen in any patient. Other complications are comparable except for grade II lymphedema which are more in the control group. No intraoperative complication occurred. Vacuum-assisted closure (VAC) or re-exploration of the wound was not needed in any patients during the post-operative period and no patients needed readmission. Details of post-operative complications of both groups are summarized in Table 2. In our historical data, we found the most common incision was the Lazy S incision and flap necrosis was 38% (89 patients) and skin edge necrosis, it was 44% (103 patients). Other complications are compared in Table 2. Our control arm needed TFL reconstruction in TFL reconstruction in 25% (22 out of 89 patients) and VRAM flap

in 5.6% (5 out of 89 patients) and other 69.7% (62 out of 89 patients) managed by long antiseptic dressings, antibiotics, and secondary suturing.

All patients were managed on an outpatient basis. The median lymph nodes harvested were 10 on both the sites (interquartile range (IQR)7–15). The median operative time was 80 min (IQR 60–90) and blood loss was minimal 25ml (IQR 20–35ml). None of the patients had femoral artery blow-out even after receiving radiotherapy. The median hospital stay of these patients was 3 days with a range of 2–7 days.



Figure 5. Immediate postoperative photograph



Figure 6. Good post-operative wound healing.

S No	Malignancy	Percentage with number of patients
1	Ca penis	44.9% (62)
2	Ca vulva	22.4% (31)
3	Melanoma lower limb	10.14% (14)
4	Inguinal metastasis of unknown origin	6.52% (9)
5	Ca anorectum (post CRT)	5.07% (7)
6	Ca cervix	3.62% (5)
7	SCC lower limb	2.89% (4)
8	STS lower limb	2.17% (3)
9	Periurethral carcinoma	2.17% (3)
Total number of patients		138

Table 1. Disease-wise distribution of patients

Complication	Percentage of total groin dissection (Number of patients) study arm (n=240)	Percentage of total groin dissection (Number of patients) Control arm (n=235)
Seroma	13.7% (19)	15.3% (36)
Surgical wound infection	6.52% (09)	13.6% (32)
Skin edge necrosis	5.07% (07)	5.9% (14)
Persistent seroma	4.34% (06)	8.5% (20)
Local recurrence	2.89% (04)	3.0% (07)
Grade II lymphedema	2.17% (03)	11.0% (26)
Systemic recurrence	2.17% (03)	3.4% (08)
DVT	1.44% (02)	1.3% (03)
Complete flap necrosis	0	38% (89)
Post-operative mortality	0	0

Table 2. Complications of groin dissection

Out of 138 patients, unilateral dissection was done in 45(32.6%) patients and bilateral dissection was done in 93(67.39%) patients. Pathological positive lymph nodes were seen in 34(75.5%) patients in unilateral dissection and 67(72%) patients in bilateral dissection. Total lymph node positivity was seen in 73.18% patients. Lymph node positivity was most commonly seen in ca penis (77.4%) followed by ca vulva (61.2%). Table 3.

After a median follow-up of 24 months, a total of 15.21% (21 patients) developed recurrence. The most common site of recurrence was local recurrence in 5.07% (7 patients). Table 4 shows the recurrence pattern observed after surgery. Distant metastasis was most commonly seen in lungs 66.6% (4 patients) followed by metastasis in the liver in one patient. Diffuse metastasis to lung, liver, and bone was seen in one patient with extremity melanoma. A total of 82.6% (114 patients) were alive and free from the disease, 10.14% (14 patients) were alive with the disease, while 7.24% (10 patients) had died.

Discussion

The important goal of groin dissection is to accurately reveal the stage of the disease, predict outcome, and to help in planning adjuvant treatment. Also, it has a therapeutic value for selected malignancies, although the procedure is not well established^[8-10].

In Asian countries, most of the data of gross dissection from carcinoma penis, while Western countries reported mainly from lower extremity skin tumours. There are differences in the incidence of disease and so outcomes after surgery and its morbidity cannot be compared.

S No	Malignancy	LN+ (%)
1	Ca penis	48 (77.4%)
2	Ca vulva	19 (61.2%)
3	Melanoma lower limb	10 (71.4%)
4	Inguinal metastasis of unknown origin	09(6.52%)
5	Ca anorectum (post CTRT)	04 (57.1%)
6	Ca cervix	05 (100%)
7	SCC lower limb	03 (75%)
8	STS lower limb	01 (33.3%)
9	Periurethral carcinoma	02 (66.6%)
Total number of patients		138

Table 3. Pathological lymph node positive patients

S No	Site of recurrence	Number (n =21)	Percent (%)
1	Primary tumour site	3	2.17%
2	Local recurrence	7	5.07%
3	Systemic recurrence	6	4.34%
4	Locoregional and systemic	5	3.62%

Table 4. Recurrence details

Techniques also differ which leads to different outcomes. Various modifications described in the literature did not show proven outcomes^[9, 11, 12]. Therefore, in this study, we have presented our novel technique of groin dissection with a "River Flow" incision designed by Prof.M D Ray.

Evolution of groin dissection: In the past, multiple incision techniques were attempted to reduce flap necrosis, but most of the techniques did not give satisfactory results. One group of surgeons used the method of TFL flap insertion routinely. Catalonia limited the boundary up to the lateral border of the femoral artery to limit flap necrosis. Costa reduced the extent still further up to the medial surface of the femoral vein. In 10%, sentinel nodes are seen in a lateral superior zone which is not addressed in both modifications resulting in a rationale for recurrences. Another group of surgeons had done laparoscopic groin dissection followed by a robotic technique to reduce flap loss. It carried the minimal risk of skin complications but high risk of lymphocele formation and is expensive. But none of them gave satisfactory results. All these issues are solved by our simple technique that does not require any additional training. It could be easily learned by all surgeons and can be used even in centres with minimum facilities.

The three main advantages of our inguinal incision technique are i)Two lower curvatures define the standard medial and lateral boundaries ii)medial curvature spares the saphenofemoral junction area i.e. fossa ovalis, from and around which superficial circumflex iliac, superficial external pudendal and superficial epigastric vessels emerge and supply the flap iii)because of two-sided curvature we

could retract the lower flap easily to reach apex of the femoral triangle without compromising supply at the edge of the lower flap.

The advantages of iliac dissection: because of the upper curvilinear incision the whole groin flap looks like the origin of a river and its meeting zone with the sea. It depicts the high flow of circulation throughout the whole flap thereby no question of flap necrosis.

Boundaries of standard iliac dissection (Figure: 7)

- Above: Up to common iliac bifurcation
- Below: Deep circumflex vein.
- Laterally: Genital branch of genitofemoral nerve
- Medially: Medial border of Internal iliac artery
- Posteriorly: Obturator nerve

Boundaries of inguinal dissection (Figure: 8)

- Upper limit: 3cm above the inguinal ligament i.e., external oblique aponeurosis and spermatic cord/round ligament.
- Lateral limit: Medial border of the sartorius.
- Medial limit: Lateral border of adductor longus.
- Lower limit: Apex of the femoral triangle.

The incidence of skin flap necrosis mentioned in the literature ranges from 8 to 62 percent[5, 8, 9, 11, 12]. Skin edge necrosis was 11% in our study and no flap necrosis. Ornellas et al.^[11] found 45% skin edge necrosis in their analysis of 200 groin dissections. On analysis of the subgroup, it was found that bi-iliac incision had 82% skin flap necrosis, S-shaped incision had 72%, and only 5% with Gibson incision. Ravi reported in a study of 405 groin dissections which is one of the largest studies, various incisions were attempted and found skin flap necrosis incidence rate of 40–74% in ILND and 69–100% in IIBD; however, 30 patients with myocutaneous flap reconstruction, edge necrosis was not observed[12]. After 15 years, modification of technique was done using lazy S incision and conducted 202 groin dissections and the result showed only 19.8% rate of skin edge necrosis[9]. In our study, skin edge necrosis incidence rate is still low which is only 11 percent. Skin flap necrosis was not found in our novel technique because the blood supply to the skin flap is preserved, proper anatomical dissection done and skin edges are routinely freshened^[2]. Patients who developed skin edge necrosis were treated easily on an outpatient basis and delayed secondary suturing done under local anaesthesia. Hospital admission was not required for any patients. Debridement and secondary suturing were done in only one patient who had partial flap loss.

Catalona (1988) first described the technique of saphenous vein preservation, a flap superficial to Scarpa's

fascia and a shorter length of the incision. Advantages of our technique are i) Both ends of incision demarcate both side boundaries, ii) Medial curve spares Saphenofemoral junction (fossa ovalis) through and from which all vessels emerge, iii) Standard groin dissection is followed because its curvature gives access to the tip of the femoral triangle and groin dissection could be carried out smoothly.

According to the literature, the seroma formation incidence rate ranges from 6 to 16 percent^[5, 8, 11–13]. The incidence of seroma formation was 13.7% in our present analysis. In that, 8 patients had seroma formation in the ILND group and 11 patients had seroma in IIBD group. This is because therapeutic dissections were done are high in IIBD group. Patients who developed seroma formation were identified in the follow-up and aspiration done. Patients are advised to wear elastic compression stockings which prevents seroma formation to some extent and none of the patients required any re-intervention or drain insertion.

Wound infection rate ranges from 10 to 17% in the literature^[5, 8, 11–13]. The incidence of wound infection was 6.52% in our study. Superficial erythema was noted in the follow-up and were treated with antibiotics and a drainage procedure was not required in any patients. The infection rate was low in our study. The contributory factors might be because of gentle tissue handling, routine use of perioperative antibiotics, and less occurrence of skin edge necrosis.



Figure: 7. Boundaries of iliac dissection



Figure: 8. Boundaries of iliac dissection

Lymphedema occurrence ranges from 23 to 50% in multiple studies^[5, 8, 11–13]. In the present study, lymphedema was present in only 2.17% and debilitating or severe oedema was not seen in any patients. Lower limb elevation, early ambulation, good surgical technique, and regular use of early compression stockings might be associated with low incidence.

Deep vein thrombosis (DVT) was seen in 2 patients (1.44%) and none of the patients had haemorrhage, sepsis, pulmonary embolism (PE), or death. Arbeit et al.^[14] showed in the study, that after groin dissection, the incidence of DVT was 13.6% and there was no benefit of heparin prophylaxis. DVT is less common in Indian patients which are shown in various studies.^[15, 16] Median post-operative hospital stays ranged from 8.3 to 23 days after ILND and 12–25.2 days after IIBD^[11–13]. The median post-operative hospital stay was only 3 days in our series which might be the contributory factor for the overall less occurrence of various different complications. Clavien–Dindo classification was used to grade the post-operative complications. One of the strongest prognostic factors is lymph node/nodes involvement. However, minimum number of lymph nodes to be removed during groin dissection has not been well understood to date^[17]. In our series, the median nodal harvest was 10 (IQR 7–15). An optimum number of nodes to be removed in nodal dissection was not obtained from the present study as it includes various types of cancers.

The importance of groin dissection, therapeutic benefit, and its survival advantages have been explained in various studies^[8–10, 12]. Median follow-up of 24 months is analysed, patients who are alive and disease free are 82.6%, patients living with the disease are 10.14%, and 7.24% of patients had died in the present series. Survival analysis was not performed due to short follow up and a different spectrum of malignancies. In our institution before 2014, the groin dissection was a nightmare both for the consultants and as well as the senior residents. On the very first post-op day, everybody used to take the name of GOD before the dressing as the flap necrosis was as high as 38% and when including skin edge necrosis, it was 44%. After the implication of ‘River Flow Incision’, the flap necrosis rate came down to nil. Former HOD of the Department of Surgical Oncology, Professor N K Shukla with his first experience put his comment “The procedure described by Dr. M D Ray is a significant contribution in surgery of Ilioinguinal block dissection. Complication of flap necrosis is avoided, thereby early recovery of patients and decrease the period of hospitalization, thus decreasing cost to the patients as well as the hospital.”

Dynamic sentinel node biopsy and laparoscopic/robotic groin dissection techniques are newer techniques that showed comparable oncological outcomes with less

morbidity compared to open techniques^[8, 18, 19]. These emerging techniques are still in the investigational phase, costly and limited to experienced centres while our technique is a simple technique that has a minimal post-operative morbidity. This technique can be easily done even in smaller centres with limited infrastructure by following the basic principles as explained.

In the future, survival analysis can be planned with large sample size and long follow up

Conclusion

Groin dissection is an important oncosurgical procedure with a diagnostic and therapeutic value which keeps patients free from disease and helps in deciding adjuvant treatment, justifying its potential for morbidity. In the present series, we have shown the results of our technique which is an effective method to minimize post-operative complications, especially flap necrosis with optimal oncological outcomes. Thereby, the nightmare of Surgeons is over now even at a smaller set up. “River Flow” incision technique is a simple and effective surgical technique for therapeutic ILND and IIBD for any surgical setup without the learning curve. It can avoid flap necrosis, and decrease morbidity significantly without compromising the oncosurgical principle of standard groin dissection along with the removal of the Surgeon’s nightmare forever.

Acknowledgement

Prof N K Shukla ,Former HOD, Department of Surgical Oncology, AIIMS, New Delhi

Ethical approval

This is to undertake that our original research was conducted under the approval of the institutional ethical committee and after taking the consent from each patient in both English and Hindi (national language).

Funding and Conflict of Interest

The authors declare that they have no conflict of interest. Funding received—None.

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