An Experience of Reconstruction of Vulva following Malignancy Extirpation in a Tertiary Hospital in Eastern India

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Abstract: _Introduction: Treatment of CA (carcinoma) vulva, although a rare malignancy in the elderly females, involves a multidisciplinary team approach between the Oncologists and the Surgical team (Extirpative and the Reconstructive surgeons). Owning to the complex three dimensional anatomy and the location, reconstruction is a challenging job. There is a wide array of reconstructive options which has evolved from the past, taking into consideration various factors related to the stage of the disease, the nature and extent of the defect and the wishes and compliance of the patients._ _Aims and Objectives:_ _To evaluate the different reconstructive options following CA vulva extirpation curtailed to the wound size, extent and stage of the malignancy._ _Methodology:_ _In this retrospective study patients with Stages II and IIIA CA vulva aged between 50 to 70 years were included in this study, prepared and operated with extirpation of the defects, groin dissection and reconstruction. They were postoperatively monitored for complications and flap viability, discharged and followed up regularly at OPD._ _Results:_ _Over 1 year, we operated on 10 patients of CA vulva, with a mean age of 64.9 years. The post excision defects (modified radical or radical vulvectomy with groin dissection) were reconstructed with different flaps ranging from simple advancement flaps to more complex regional ones like the lotus petal, gracilis and rectus abdominis flaps. The site of tumour was predominantly in labia majora. The mean size of defect created after excision of tumour was 7 x 4.2 cm length and breadth wise. 90% flaps survived completely with partial necrosis of one lotus petal flap._ _Conclusion:_ _Reconstruction of Vulva following extirpation of malignancy requires a holistic multidisciplinary approach and involves a wide array of reconstructive options tailored to each specific case to achieve better wound coverage, escalated wound healing and disease free survival, preserving the form and function._

Keywords: CA vulva, reconstruction of vulva, flaps for perineal defects

1. Introduction

Invasive vulvar carcinoma is an infrequent cancer among females and it accounts for about 4% of all gynaecological cancers. Median age of diagnosis is late sixties or early seventies. 5 year survival is approximately 85% in early stage disease (stage I/II).[1] It is associated with low socio-economic status, poor personal hygiene and Human Papillomavirus (HPV) infections. Approximately 40% vulvar cancer worldwide have been attributed to HPV infection.[2] Other risk factors are cigarette smoking, inflammatory conditions like lichen sclerosis, immunodeficiency etc. More than ninety percent of vulvar cancer is squamous cell carcinoma. Other uncommon histopathologic types are melanoma, adenocarcinoma, basal cell carcinoma, sarcoma etc. [3]

Surgical treatment of CA vulva entails close coordination between the extirpative and reconstructive surgeons, as well as involves the radiation and medical oncology teams in a multidisciplinary approach. There are several factors taken into consideration while reconstructing the defects following extirpation, like the patient's age, sexual function, wishes, compliance, stage of the disease, need for adjuvant chemoradiation etc. An array of reconstructive options are available and are advocated as per the nature and extent of the ablative surgery involving common principles of obliterating the pelvic dead space, separation of intra-abdominal contents from the perineum to ensure escalated and uncomplicated perineal wound healing. Planning of incisions and excisional margins and the extirpative procedures of simple or radical vulvectomies are decided by the extirpative surgeons in presence of the reconstructive team to maximise the reconstructive options while not compromising oncologic clearance. The regional blood supply, condition of the adjoining skin and the donor site, the probable donor area morbidities and plan B are taken into consideration by the reconstructive team. [4-9]

There are several reconstructive options for the ablated site. In the past, smaller defects were left to heal by secondary intention with changes of dressings regularly. Split skin grafts were also used frequently in the past, but their "take" were not satisfactory due to constant shear, discharge and friction; also they did not add to the bulk of the tissue loss. Flaps, which are vascularised composite tissue, are essential tools of reconstruction, adding tissue bulk and being ideal for poorly vascularised tissue beds in cases of neo-adjuvant chemoradiation. Local flaps like rhomboid flaps, transposition flaps, V-Y advancement flaps and the more developed ones like the Lotus petal flaps, Singapore flaps, perforator flaps, posterior thigh advancement flaps are used for the smaller defects encompassing the labia, mons and clitoris with the advantages of lesser dissection, lesser blood

loss, lesser bulk, increased cosmesis and easy learning curve. But in cases of larger and more composite defects, regional and distant flaps like the ALT (anterolateral thigh) flaps, RAM (rectus abdominis myocutaneous) flaps, DIEP (deep inferior Epigastric artery perforator) flaps, SCIP (superficial circumflex iliac artery perforator) flaps, Gracilis myocutaneous flaps, GAP (gluteal artery perforator) flaps are generally considered depending on the expendability of the donor areas and the nature and extent of defects. There are also reported cases of free flap reconstruction with or without prelamination [4-16]

Vulvar cancers, being a rare cancer, few case series have reported the surgical treatment including reconstruction, specially from limited resourced settings like India. The objective of this study is to report such cases and to evaluate the different reconstructive options following tumour extirpation curtailed to the wound size, extent and stage of the malignancy.

2. Methodology

This is a retrospective, descriptive, purposive, institutional study with no randomization of the study subjects using convenience sampling. Over 1 year (August, 2017 to July 2018) we operated on CA vulva involving labia majora, minora, clitoris, mons and fourchette in 10 patients at the Departments of Surgical Oncology and Plastic Surgery, Medical College, Kolkata, India. Photographs of the surgical steps were routinely taken and archived after complete anonymization. For advance postoperative chemoradiation some patients were treated in conjunction with the Radiotherapy department of Tata Medical Center, Kolkata, as per the wishes of the patients. Retrospectively the data was analysed and the cases being followed up on long term basis at OPD.

Pre-operative assessment and planning
Patients with Stages II and IIIA malignancy, aged between 50 to 70 years, without any co-morbidity of peripheral vascular disease, connective tissue disorders, atherosclerosis, uncontrolled diabetes and hypertension and psychiatric disorder, were included in this study. They were counselled, informed consents taken, pre anaesthetic check up done. Before the scheduled operation, the admitted patients were clinically assessed and planned again by the Oncosurgery and Plastic surgery teams together with detailed discussions in terms of nature and extent of tumour ablation, need for groin dissection as per the imaging (MRI or CT scan of the local part) and preoperative incisional biopsy reports. Local adjoining and regional areas were carefully inspected, known vascular axis and perforating vessels identified and marked with hand held Doppler as per the primary reconstruction planned. Every patient was discussed at multi-disciplinary tumour board and a management plan was documented.

Operative steps
General anaesthesia with endotracheal intubation or epidural anaesthesia was advocated with the patients in lithotomy position. Foley's catheterisation was done per urethra in every case. The inguinal dissection (if needed) was done in the beginning as per stage of the malignancy and

involvement of inguinal lymph nodes; thereafter the wide local excision (mostly with a butterfly shaped incision for bilateral lesions or with 3 separate incisions) done with a margin of 1cm (as per literature in some studies it was advised to have a marginal clearance of 1.5cm). [5] Then a template of the defect was made with sterile lint piece to ascertain and confirm the dimensions and reach of the flap marked preoperatively so that adequacy of the tissue and over lining skin as lining were maintained.

Depending on the true defect size, extent and the structures to be reconstructed, the planning in reverse was done and the definite reconstructive option finalised. In case of bilateral bipedicled flap advancement following bilateral groin dissection and tumour excision, the intervening skin between the wound of the primary excision medially and that of groin dissection laterally was carefully undermined below the level of fascia bilaterally keeping the superior and inferior skin intact. Medially the skin from both the sides was advanced and sutured with interrupted 2-0 Polyglycolate to the cut end of the vaginal and urethral mucosa followed by lateral closure of the wound. [Fig.1] In case of Lotus petal flaps, the skin in the triangle made by the points of anal verge, urethral meatus and ischium was utilised. 2 flaps, primary and secondary resembling the petals of lotus were marked with the primary flap superiorly and obliquely for the defect and the secondary flap transversely oriented in the gluteal fold inferiorly to resurface the primary flap donor site with direct closure of the secondary flap donor area. Flap dissection was done in subfascial plane preserving the perforators and the subfascial and subcutaneous plexus of blood supply. [Fig.2] The flap is based on the dense network of perforating vessels that originate from the internal pudendal vessels, near the midline of the perineum. These perforators are generally preserved during vulvectomy, whereas external pudendal vessels are usually divided. [9,11,17] The muscle sparing rectus abdominis myocutaneous flap was planned for a huge bilateral defect 8 x 5 cm sized, encompassing the whole of vulva along with portion of the mons superiorly and the perineum posteriorly. The perforators of the DIE (deep inferior Epigastric vessels) were marked preoperatively with hand held Doppler and localized on the right paraumbilical region 7 cm from the umbilicus in the right lower quadrant of the abdomen. After planning in reverse with a defect template, the flap incisions were made laterally first to enter the subcutaneous plane and anterior rectus sheath. The right sided rectus belly was lifted and undermined carefully to visualize the DIE perforator after which a small 1 x 1 cm segment of muscle incorporated with the perforator into the proposed flap unit. The committing incisions were made subsequently medially and all around and the muscle split longitudinally along the axis of the DIE vessel visualized directly underneath (this was a modification where the entire rectus muscle was not taken in the flap). Dissection was continued till the origin of the DIE vessels from the external iliac vessels and the flap carefully harvested completely, and passed onto the defect by incising the inguinal intervening skin. The donor area was repaired in layers with an underlay prolene mesh to prevent ventral hernia over a suction drain. The flap skin inset was made with the remnant of the defect margins. The neo-introitus was recreated by the margins of the skin adjacent to the umbilicus to give a button-hole (fenestration) appearance.

[Fig.3] A corrugated drain was placed underneath the flap which was removed after 72 hours postoperatively. [4,6,7,9,15,16,18,19] For smaller defects mainly involving partial labia majora and the fourchette, we advocated the Gracilis myocutaneous flap. After tumour extirpation, the true defect size was confirmed, planning in reverse done and the gracilis flap skin paddle marked on the line joining the pubic tubercle and the upper medial part of the patella with the hip in abduction and external rotation, clinically ascertaining the gracilis muscle postero-medial to the belly of the adductor longus. The gracilis flap is supplied by the medial circumflex femoral artery, originating from the profunda femoris, and entering the gracilis 8 to 10 cm from its origin. The flap was designed over the medial aspect of the thigh (in the upper and middle third of thigh), centered over an axis between the pubic tubercle and semitendinosus tendon. An elliptical skin island (curtailed to the defect template) was outlined over the proximal aspect of the muscle and the flap elevated with care to preserve cutaneous perforators and to identify the pedicle, which entered the proximal third of the gracilis muscle between the adductor longus and adductor magnus muscles (the branch of the obturator nerve supplying the muscle was divided to prevent animation). The gracilis was divided distally and the myocutaneous flap tunneled into the vaginal defect. Donor sites were closed primarily over suction drains. [Fig.4] The flap inset was given in a standard way. [6,7] Average flap dimensions were 6.5 x 4 cm length and breadthwise considering all the cases.

Post-operative care
The flaps were monitored clinically (with the parameters of colour, temperature, turgor and capillary refill) postoperatively every 6 hourly for the first 24 hours and twice daily for the next 3 days. The average time of hospital stay postoperatively was 5 days. Enteral feeding was started on the second post-operative day. Foley's catheter was retained for the first 1 week and the patients were encouraged to mobilize and ambulate gradually after 3 days onwards with daily changes of dressings. The skin sutures were removed on an average after 2 weeks postoperatively. The patients were subsequently followed up at OPD at 2 weekly intervals, referred to Radiation and Medical oncology for the first 2 months and at monthly interval thereafter.

3. Results

Among the 10 study female patients with CA vulva extirpation and reconstruction, mean age was 64.9 years (ranging from 59 to 70 years). Comorbidities of systemic hypertension and diabetes were present in 50% and 30% of the cases respectively. The sites of the tumour resection were predominantly labia majora in most cases with bilateral involvement seen commonly in 70% of our cases. 6 cases (60%) belonged to Stage II malignancy while the other 4 cases (40%) belonged to Stage IIIA. Modified radical vulvectomy was done in Stage II diseases (60%), Radical vulvectomy in Stage IIIA ones (40%) and inguinal lymph node dissection in 80% cases. The mean size of defect created after excision of tumour was 7 x 4.2 cm length and breadthwise. Average flap dimensions were 6.5 x 4 cm length and breadthwise. Mean operative time was 3.5 hours for wide local excision, groin dissection (if applicable) and reconstruction. Median blood loss was 100ml. Final histopathology report was Squamous cell CA (well to moderately well differentiated) in all cases with resection margins greater than 1 cm beyond the tumour all around. Mean post-operative hospital stay was 5 days. Among the complications partial flap necrosis (for a unilateral lotus petal flap) was reported in 1 patient (10%) due to arterial insufficiency on 2nd post-operative day and wound dehiscence was present in 2 patients (20%). The wound complications were managed with regular dressings and healed by secondary intention. There was no incidence of fistula with bowel or bladder. Adjuvant radiation was given in 80% cases post-operatively and well tolerated without any flap complications at a mean follow up of 3 months. There was no recurrence noted in any case at 3 monthly follow up. The age and comorbidities of the patients, the sites of the lesions, the types of flaps chosen for reconstruction and the complications are described in Table 1.

Table 1: Showing the patient details, sites of lesions, stages of malignancy, defects created, flaps advocated and the complications

S. NO.	Age (Yrs)	Co-Morbidities	Site of Tumor	Clinical Stage of Malignancy	Defect Size (In cm)	Type of Excision	Flap Used For Reconstruction	Complications
1	67	Diabetes, hypertension.	Bilateral Labia majora, minora and clitoris	T2N1M0 (Stage IIIA)	8 x 4	Radical vulvectomy.	Bilateral bipedicled advancement flap.	Suture line dehiscence on the left side.
2	65	Coronary artery disease, hypertension.	Clitoris, bilateral labia minora	T2N0M0 (Stage II)	7 x 3	Modified radical vulvectomy.	Bilateral bipedicled advancement flap.	Nil.
3	62	Nil.	Bilateral labia majora and clitoris	T2N1M0 (Stage IIIA)	9 x 7	Radical vulvectomy.	Bilateral lotus petal flap.	Nil.
4	68	Hypertension.	Fourchette and bilateral labia majora	T2N0M0 (Stage II)	5 x 3	Modified radical vulvectomy.	Left sided gracilis myocutaneous flap.	Nil.
5	59	Bronchial asthma.	Bilateral labia minora and clitoris	T2N0M0 (Stage II)	6 x 4	Modified radical vulvectomy.	Bilateral lotus petal flap.	Nil.
6	68	Diabetes.	Mons, clitoris, bilateral labia majora and minora	T2N1M0 (Stage IIIA)	8 x 5	Radical vulvectomy.	Right sided pedicled muscle sparing rectus abdominis myocutaneous flap.	Nil.
7	66	Nil.	Fourchette	T2N0M0	7 x 4	Modified radical	Left sided gracilis	Suture line

|				(Stage II)		vulvectomy.	myocutaneous flap.	dehiscence on the inferior part of flap.
8	70	Diabetes, hypertension.	Lower right labia majora	T1bN1M0 (Stage IIIA)	6 X 4	Radical vulvectomy.	Unilateral (right) lotus petal flap.	Nil.
9	64	Bronchial asthma.	Left labia majora	T2N0M0 (Stage II)	6 x 3	Modified radical vulvectomy.	Left sided gracilis myocutaneous flap.	Nil.
10	60	Coronary artery disease, hypertension.	Right labia majora and minora	T2N0M0 (Stage II)	8 x 5	Modified radical vulvectomy.	Unilateral (right) lotus petal flap.	Partial flap necrosis.
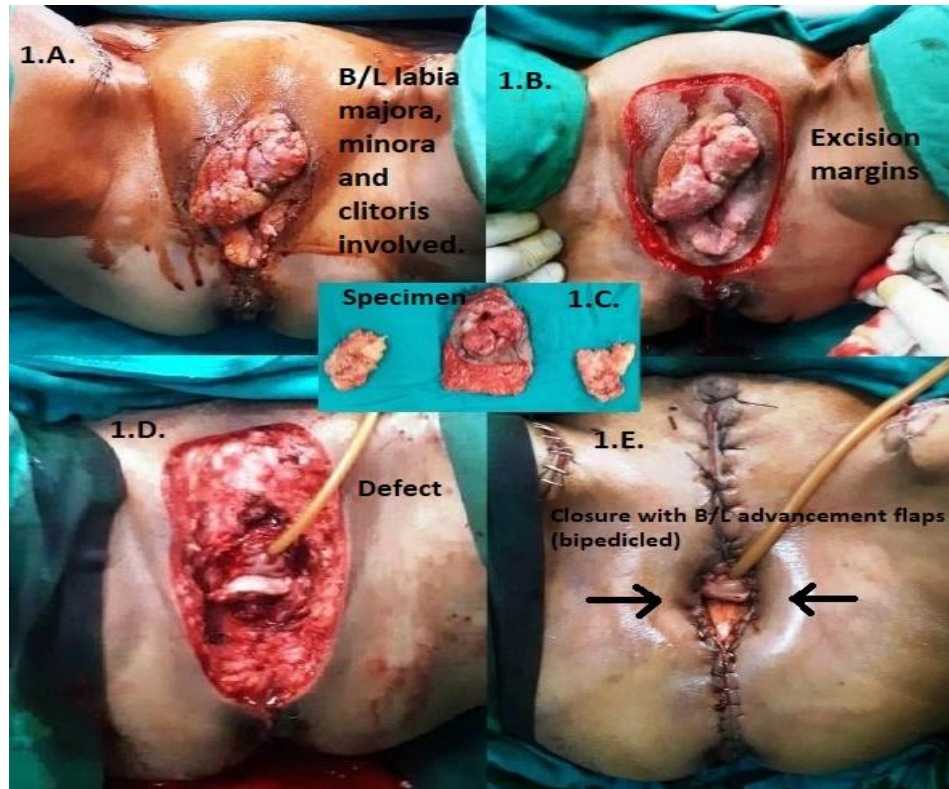
Figure 1: 67 year old female with Stage IIIA malignancy involving bilateral Labia majora, minora and clitoris. A. Showing preoperative picture. B. Showing the margins of excision. C. showing the resected specimen with bilateral groin dissection lymph nodes. D. Showing the true defect. E. Showing reconstructed vulva with bilateral bipedicled advancement flaps.
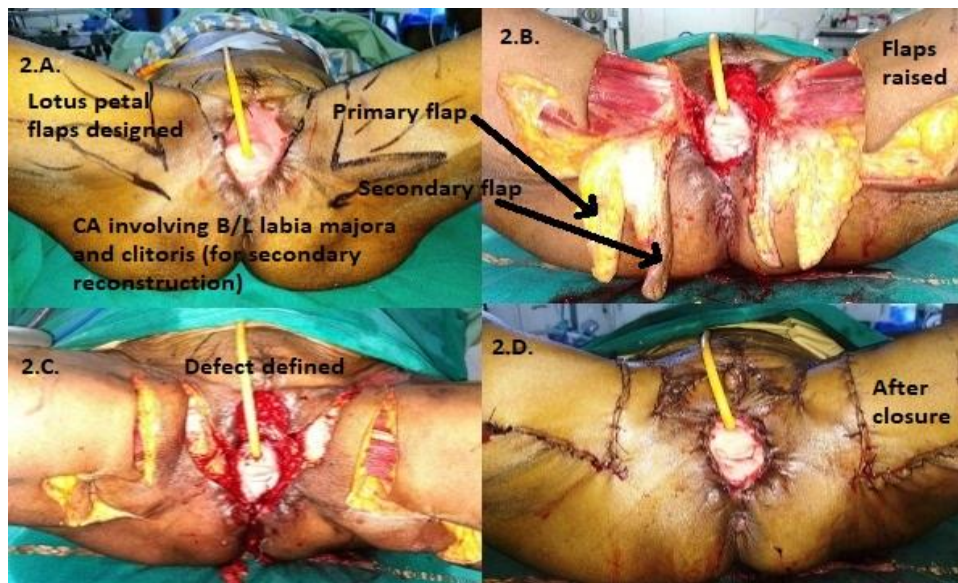
Figure 2: 62 year old female with Stage IIIA malignancy involving Bilateral labia majora and clitoris (A. Preoperative picture). B. showing the true defect after excision and raising of bilateral lotus petal flaps. C. flaps oriented in original position. D. Flaps after inset- primary flap for defect and secondary flap for donor defect of the primary one, the secondary flap donor defect being closed directly
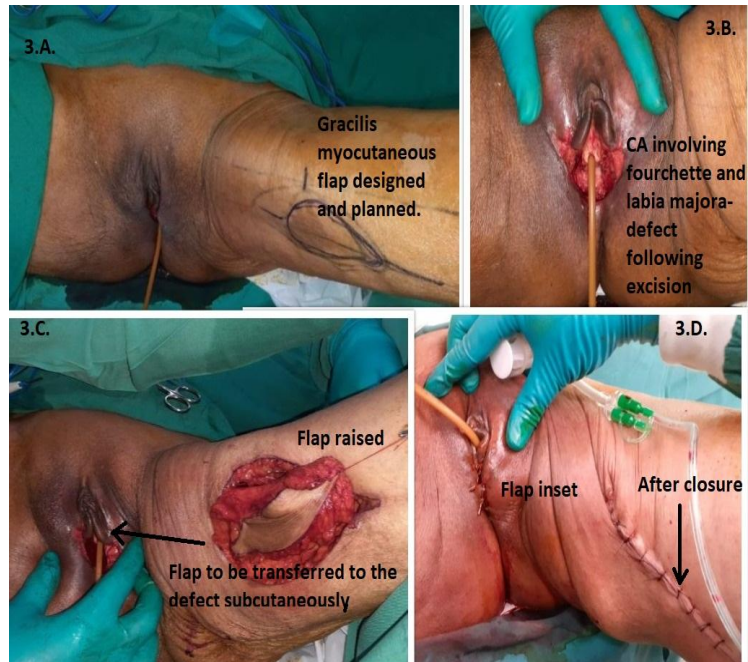
Figure 3: 68 year old female with Stage II malignancy involving Fourchette and parts of bilateral labia majora (A. Preoperative picture). B. showing the true defect after excision. C. showing the harvested Gracilis myocutaneous flap (left sided) to tunnel into the defect area subcutaneously D. Flap inset and primary closure of the donor site

Figure 4: 68 year old female with Stage IIIA malignancy involving Mons, clitoris, bilateral labia majora and minora (A. Preoperative picture) B. true defect after excision with planning and marking of pedicled rectus abdominis myocutaneous (muscle sparing type) flap on the right lower abdomen. C. showing the flap harvesting. D. Showing the flap pedicle. E. Showing the flap inset after tunnelling it subcutaneously to reach the defect area and closure of the flap donor site in layers using a prolene mesh. F. Postoperative picture after 5 days.

4. Discussion

Vulvar reconstruction is a very challenging job. The complex three dimensional shape is difficult to recreate. Flaps of any type are bulky and skin grafts are prone to graft loss owning to the shearing forces, contamination and bowstringing. Vulva, being situated just adjacent to groin creases, is subjected to constant movement and shear during movements and ambulation. The proximity to urine and faeces contaminates the wound and causes wound infection. Previous surgeries and radiotherapies lead to scarring and compromised vascularity of the adjoining area. It is also a dependent area that is prone to swelling and is difficult to dress. Presence of comorbidities and elderly age with immunocompromised status add to the difficulties. [5,7,9]

The main objective of the reconstruction is to create an adequate sized sensitive skin fold that resembles the appearance of labia majora, tension free skin closure, with good quality tissues, maintenance of vaginal and urethral introitus without shrinkage and deviation from their central position, restoration of the anovaginal partition, and simultaneous closure of associated defects, such as mons pubis or inguinal defects if necessary while in half-vulvar reconstructions, it is important to obtain symmetry with the contralateral side. Secondary goals include sensate reconstruction, sexual function, cosmetic restoration of external shape, and minimal flap donor site morbidity. It is important to guarantee the presence of a wide orifice for the vagina, if preserved, to avoid alteration for micturition and to allow the restoration of sexual activities. [5,6,7,9,11,12]

As per literature, there are algorithmic approaches to the specific method of reconstruction to be chosen. As per one study, most part of the external vulvar defects, without any vaginal involvement, can be easily repaired with Lotus petal flap. In cases of wider resections, including other pelvic organs, the reconstruction can be achieved with pedicled DIEP flap. Hence almost all the vulvar defects can be repaired using 2 pedicled flaps: Lotus petal flap (unilateral or bilateral) and DIEP flap. [11] As per another study, the perineum is divided into six areas by a midline and a horizontal line drawn between the ischial tuberosity at the level of perineal body into right upper and lower, left upper and lower, and central areas; the central area again divided into an anterior half containing urogenital organs and a posterior half containing the anal orifice. For defects in the upper quadrant, the donor for skin flaps can come from the groin and/or mons area; for the lower quadrant, the donor can be from the gluteal fold and/or the gluteal area. The midthigh can also provide a flap for these situations. For the central area of the perineum, the donor can be selected from any of the above. There are three ways of moving the local perforator flaps: rotation (lotus petal flaps), transposition (pudendal, mons pubis flaps), and V-Y advancement flaps. [9] The thin, pliable, hairless Singapore flap or the neurovascular pudendal thigh flap (based on the posterior labial arteries, branches of perineal arteries) has also been used for recreating versatile vulvovaginal defects mainly used in vaginal reconstructions as tubed bilateral flaps. [7] Another study reported an algorithmic approach where it is mentioned that the vulva and perineum can be well repaired by lotus petal flaps and traditional V-Y flaps. When more mobility than a standard V-Y flap is required, as in the case of deep vaginal or urethral resection, a perforator based V-Y flap advanced from the inner thighs, based on perforators arising from medial circumflex femoral artery, or profunda fermoris artery with a free style method, gaining much more mobility, while still allowing an easy donor site closure, is preferred. When a mons pubis defect is added to vulvoperineal resection the area is well covered by abdominal flaps (DIEP- deep inferior Epigastric perforator, VRAM- vertical rectus abdominis myocutaneous) and ALT flap (anterolateral thigh flaps based on the descending branch of the lateral circumflex femoral vessels). Another good option for inguinal, mons pubis and anterior vulvar area is the SCIP flap but when its pedicle is not severed during lymphadenectomy. In presence of abdominoperineal resection, anterior pelvectomy or pelvic exenteration, myocutaneous flaps, including gracilis, VRAM, or ALT with vastus lateral is must be preferred to fill in the defect caused. [6] The rationale of choosing our reconstruction protocol is based on these data.

In our study, the mean age of patients was 64.9 years (ranging from 59 to 70 years) compared to other studies with median age of 69 years, ranging between 25 to 93 years [4] and mean age of 78 years, ranging between 39 to 89 years [12]. We included only patients with defects following extirpation of malignancy of vulva while other studies incorporated malignancy in 78% cases and other pathologies like trauma and infection in other cases [4]. Comorbidities of systemic hypertension and diabetes were present in 50% and 30% of our study cases respectively while 11% and 30% respectively in another study [4]. 60% of our cases belonged to Stage II malignancy and 40% belonged to Stage IIIA as opposed to other studies where Stage I disease comprised of a majority of 70% [4]. In our study, simple vulvectomy was done in 60% cases, Radical vulvectomy in 40% cases and inguinal lymph node dissection in 80% cases compared to other studies where simple vulvectomy was done in 30% cases, partial Radical vulvectomy in 55% cases and Radical vulvectomy in 15% cases [4]. The mean area of defect created after excision of tumour in our study was 29.4 square cm while 30 square cm [4] in another study, almost identical. Mean operative time was 3.5 hours in our study while 3 hours [4] and 3.3 hours [12] as per other studies. Median blood loss for all surgeries in our study was 100ml while 50 ml as per another study [4]. Final histopathology report was Squamous cell CA (well to moderately well differentiated) in 100% cases in our study while 81% in another study [4] while epidermoid carcinoma was predominant in 86% cases as per another study [12]. Mean post-operative hospital stay in our study was 5 days while 3 days as per another study [4]. Among the complications we encountered partial flap necrosis, reported in 1 patient (10%) and wound dehiscence, present in 2 patients (20%) as compared to other studies where the reported flap survival was 100% [4,12] with no flap necrosis but primary wound healing complications were 33% [4] and 15% [12]. There was no recurrence noted in any of our case till 3 monthly follow up, similar to another study [4].

5. Conclusion

Reconstruction of Vulva following extirpation of malignancy requires a holistic multidisciplinary approach and involves a wide array of reconstructive options tailored to each specific case to achieve better wound coverage, escalated wound healing and disease free survival, preserving the form and function.

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