

Definitive radiotherapy for locally advanced squamous cell carcinoma of the vulva and technical issues: a case report

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Abstract. This case report describes a complex radical 3D-Conformal Radiotherapy treatment planning, dosimetric issues and outcome of definitive treatment of un-resectable carcinoma of the vulvar in a 42-year old lady. The patient presented with large fungating mass of the vulva which was biopsy confirmed as Keratinizing Squamous Cell Carcinoma. Further staging investigation revealed locally advanced disease (T4), with bilateral inguinal lymph nodes involvement. There is no systemic metastasis or intra-pelvic nodes. The patient was seen by Gynae-Oncology team and the disease was deemed un-resectable without significant morbidity. She was treated to a total dose of 64.8Gy in 36 fractions over 7 weeks with concurrent weekly Cisplatin in 2 phases. 3D-Conformal radiotherapy technique using the modified segmental boost technique (MSBT, large PA and small AP photon fields with inguinal electron matching) was used. TLD chips were used for in-vivo dose verification in phase 1 and 2 of the treatment. At completion of planned radiotherapy, patient had a complete clinical response, grade 2-3 skin toxicity, grade 2 rectal toxicity, and grade 2 dysuria Vulval Squamous Cell Carcinomas are very radiosensitive tumours and the skills of the treating Radiation Oncologist, Dosimetrists, Physicist, Radiation Therapist and also nurses is of foremost importance is ensuring good clinical outcomes.

1. Introduction

Squamous Cell Carcinoma (SCC) of the vulva is an uncommon cancer mostly associated with HPV viral infection. Two common histologies are described – the HPV 16, 18 and 33 associated basaloid or condylomatous SCC and non-HPV associated keratinizing SCC's. In nearly 60% of vulval cancers, HPV infection is likely the causative factor.

This case report will discuss the successful treatment of a Moderately Differentiated Keratinizing SCC of the vulva with definitive chemo-radiotherapy using the modified segmental boost technique (MSBT), large PA and small AP photon fields with inguinal electron matching. This technique is published in the literature for lower pelvic malignancies and Moran M *et al* in his paper described the use of single prescription point in MSBT. In Advanced Medical & Dental Institute (AMDI), we further modified this technique using dual prescription points in the phase I followed by further tumour and inguinal boost in phase II.

A 42-year old lady with locally advanced SCC of the vulva was referred to AMDI Oncology Centre for radiotherapy opinion. She was earlier seen by Gynae-Oncological surgeon and her tumour was



deemed not resectable without significant morbidity. The patient written consent was obtained for publication of her case in this paper.

A month earlier patient presented with 2 weeks' history of labial swelling and a punch biopsy of the lesion revealed Moderately Differentiated SCC (see Figure 1). CT of the thorax/abdomen/pelvis then showed a heterogeneously enhancing lesion measuring 6.4 cm × 3.4 cm × 4.9 cm arising from left labia with suspicion of bladder, rectum and vaginal invasion. There were multiple inguinal nodes, largest measuring 2.7 cm. Otherwise no distant metastasis elsewhere (see Figure 2).



Figure 1. Tumour at presentation

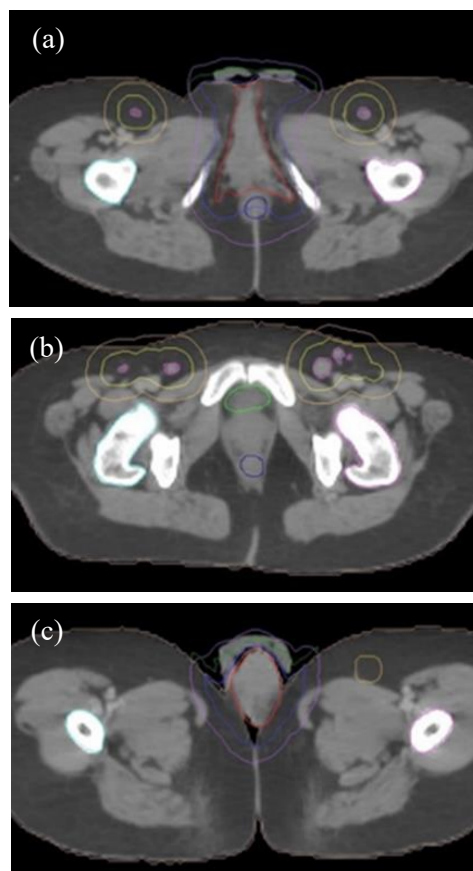


Figure 2. Primary marked red and lymph nodes purple in the CT images, (a) CT slice showing the primary tumour, (b) CT slice showing the lymph nodes and (c) CT slice showing the primary tumour on another slice

The disease extend and treatment expectation was discussed in length with the patient. Mutual decision to treat her condition with concurrent chemo-radiotherapy with definitive intent was made. The plan at that time was to treat in 3 phases: phase I (36 Gy in 20 fraction) treating the whole pelvis, phase II (9 Gy in 5 fraction) to the true pelvis and phase III (18 Gy in 10 fraction) boost to the GTV concurrent with IV Cisplatin 40mg/m² weekly (See Figure 3). Patient is to be re-assessed after the phase I for consideration of bilateral inguinal lymph node dissection.



Figure 3. Clinical photograph after the planned phase I of 36 Gy in 20 fraction (a) before treatment, (b) 1 week and (c) 2 weeks after the full course of treatment.

CT simulation of the patient was repeated after the 18th fraction for the phase II planning since the tumour has shrunk significantly. The option of bilateral inguinal dissection was also discussed with the patient at that point. However, given the fact that inguinal nodes' PTV/CTV was extending into the phase II pelvic field and also the delays in the phase II of definitive radiotherapy that maybe caused by subjecting patient to inguinal dissection, it was decided to proceed with definitive chemo-radiotherapy albeit accepting the significantly higher risk of bilateral lymphoedema in future. As mentioned earlier, since the inguinal nodes' PTV/CTV was extending into the true pelvic photon fields coupled with the fact that good bilateral femoral sparing was achieved with the MSBT technique it was decided to continue with the same phase I field arrangements to 46.8 Gy in 26 fractions. After completing phase I concurrent chemo-radiotherapy of 46.8 Gy the PTV-GTV is further boosted to 64.8Gy in 36 fractions.

2. Radiotherapy technique

2.1 CT-Simulation

Patient was CT-simulated with full bladder, in supine position, both legs flexed and abducted (frog-leg position) to open up the inguinal folds and immobilised with vac bag. Primary tumour was exhaustively bolused with extra care to ensure there is no air gap especially the posterior part of the tumour abutting the anus. Thickness of the bolus is approximated to around 1 cm. 3 mm CT-images obtained with IV contrast from umbilicus to mid-thigh. The same process was repeated for the phase II planning (PTV-GTV boost)

2.2 Planning

In phase I, patient was treated with large AP field covering the bilateral inguinal region anterior superior iliac spine (ASIS laterally), L5/S1 superiorly and 2 cm below the tumour inferiorly while shielding the lateral part of bilateral thighs (see Figure 4a). Posteriorly (PA), a smaller true pelvic field was used with both superior and inferior borders corresponding to the AP field however lateral borders were kept at 1.5 cm outside the pelvic brim (see figure 4b).

For the AP field, the ICRU prescription point was placed at the left inguinal region at 3 cm depth and 46.8 Gy was prescribed to that point. Dose was topped from the PA field to ensure uniform pelvic phase I dose coverage. This is achieved by iteratively changing the PA beam prescription point and also prescribing a dose that compensates the AP beam. The PA beam was also attenuated superiorly (treating full field before partially shielding the superior portion as to attenuate the dose from the

superior portion of the PA beam). This optimisation process uses iterative trial of different beam energy, prescription points, shielding and etc. Finally, an optimal T-shaped plan was achieved, sparing the femoral heads as shown in Figure 5 and Figure 6.

The final plan was reviewed and we tried to conform to the ICRU 50 recommendations. The minimum PTV coverage of 95% for the volume of interest was aimed and at points where this is not achievable, the CTV coverage is ensured at least at 95% of prescribed dose. Though at a couple of points the maximum dose crossed the 107%, these spots were either in the bolus or inside the tumour itself.

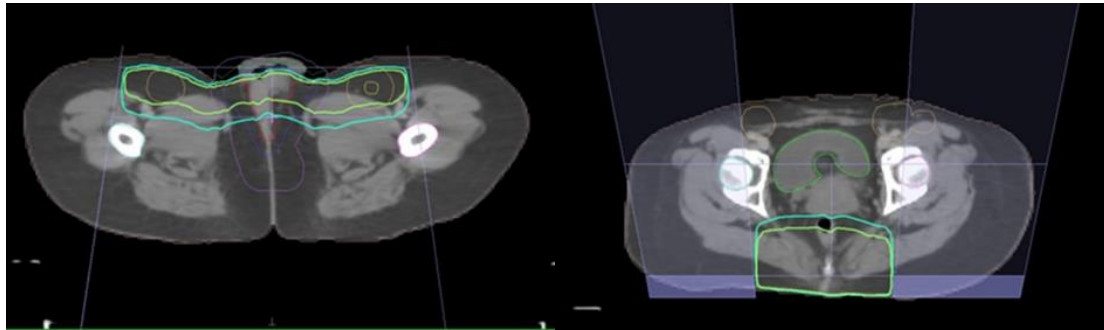


Figure 4. (a) large AP field with prescription point, (b) smaller PA field with prescription point

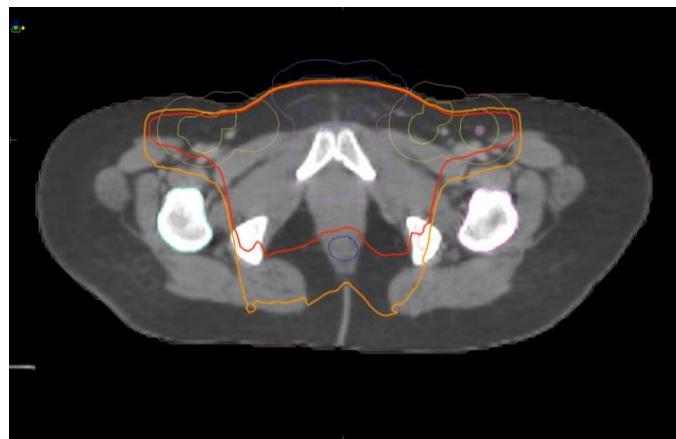


Figure 5. Phase I coverage – pelvic and inguinal coverage with sparing of the bilateral femorals (isodose lines: 95% in red, 90% in orange).



Figure 6. Electron-photon beam matching in phase II (isodose lines: 95% in red, 90% in orange).

In phase II, the primary tumour and the bilateral inguinal nodes were further boosted to 64.8 Gy in 38 fractions (a further 18 Gy in 10 fractions). The primary tumour was boosted with single direct anterior 10 MV photon beam matched bilaterally with electrons for the inguinal lymph nodes. The electron-photon beam was matched at the skin where the was overlap.

3. Treatment and verification

On the first day of the phase I treatment, extreme care was taken on bolusing the primary tumour to ensure there is no air gap and also correct bolus thickness. Cone beam CT was used to verify the positioning and also presence of any air gap.

Four TLDs were places at different corners of the primary tumour as to verify the tumour dose coverage. In phase II, TLDs were also placed on the skin surface where the electron beams covers the inguinal region. The TLD readings was compared to MONACO 5 planning system dose distribution as in Figure 7. Mostly there is an overdose rather than underdose to the tumour as recorded by the TLD readings. Cone beam CT was performed once a week to ensure patient positioning is the same as per simulation.

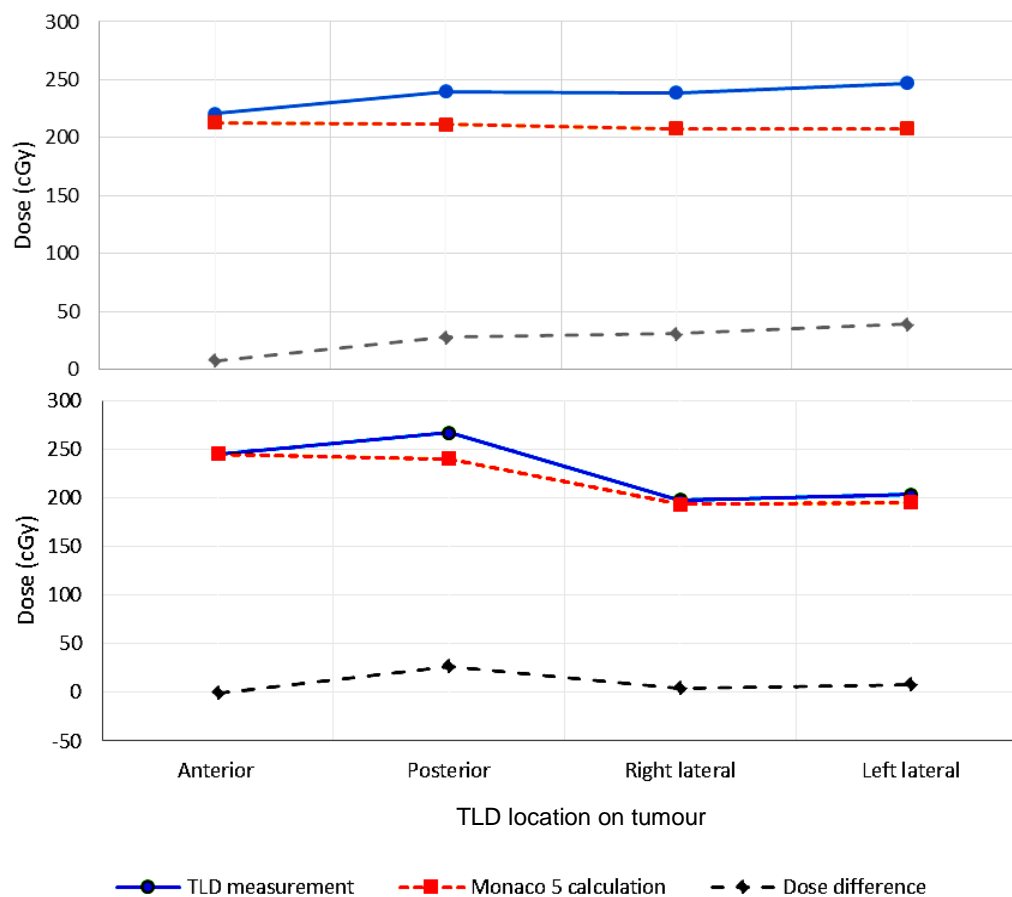


Figure 7. TLD readings at the start of phase I (a) and phase II (b)

4. Conclusions

Though HPV associated basaloid or condylomatous SCC is considered the more radiosensitive, keratinizing SCC of vulva also do respond well to radiotherapy as seen in this patient (complete clinical response, CR). The skills and training of the treating radiation oncologist, dosimetrists, physicist,

radiation therapist and also nurses is of foremost importance is ensuring good clinical outcomes. This whole process had been very exhaustive, time consuming and resource intensive.

Though there were discrepancies in the actual TLD reading compared to MONACO planning system, our team had been happy that it is more of overdosing the tumour rather than underdose. This discrepancy can also be attributed to the fact that the precise point of posterior and lateral TLD placement could not be ascertained with high accuracy unlike the anterior TLD placement point which was easily visible and identifiable.

Though it is tempting to use IMRT in these type of difficult cases, there are many issues with IMRT such as confidence with not bolusing the tumour, or if bolused then ensuring the daily uniform thickness of the bolus, daily bladder variation, significant changes in the tumour dimensions during treatment and etc. As such, the use of 3D-CRT is the safest method in definitive radiotherapy of vulval carcinoma until a validated standard protocol on the use IMRT in vulval carcinomas is available.

5. References

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