

Clinical Practice Patterns for Proton Therapy in Gynecological Cancers: Report from a Prospective Multi-Institutional Registry

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PURPOSE/OBJECTIVE(S)

- Recent studies have demonstrated benefit of using advanced radiation modalities like intensity modulated radiotherapy (IMRT) in reducing treatment related toxicity for patients receiving adjuvant therapy for cervical or endometrial cancer.
- Similar data supports use of IMRT for vulvar cancers.
- Role for proton therapy (PT) in the management of gynecological malignancies is unclear.
- Dosimetric comparison studies of proton therapy in gynecologic malignancies demonstrate significant decrease in dose to the small and large bowel, kidneys, bladder, bowel, rectum and bone marrow despite maintaining excellent dose-distribution to the target volume (1-3).
- A clinical study reported results for eleven women who had undergone hysterectomy for gynecologic cancers and who were treated with pencil beam scanning proton therapy (PBS) (4).
- To review the clinical indications for the use of PT in gynecological cancers, we analyzed practice patterns within a prospective, multi-institutional Proton Collaborative Group (PCG) registry of US community and academic institutions treating patients with PT.

MATERIAL & METHODS

- We reviewed clinical data on 83 patients with gynecological cancers who were enrolled in the registry between July 2012 to March 2019 from eight institutions.
- Patients receiving PT alone or with a component of brachytherapy/photon treatments were analyzed.
- Descriptive analyses are reported

RESULTS

Table 1: Patient Characteristic

Median age at diagnosis	69 years (range 33-88 years)	
Ethnicity		
White	61	73.5
Black	15	18.1
Asian	4	4.8
Other	3	3.6
ECOG at time of PT		
0	42	50.6
1	28	33.7
2	2	2.4
Not known	11	13.3
Disease site category		
Uterine cancer	57	68.7
Vulvar cancer	8	9.6
Ovarian cancer	7	8.4
Vaginal cancer	6	7.2
Cervical cancer	5	6
Histology		
Adenocarcinoma	40	48.2
Squamous carcinoma	10	12.1
Sarcoma	18	21.7
Papillary/Serous carcinoma	9	10.8
Carcinoid	2	2.4
Other/not available	4	4.8
Prior treatment history		
Prior Surgery	67	80.7
Prior Chemotherapy	47	56.7
Prior Radiation (re-irradiation)	21	25.3

Table 2: Proton therapy Details

Proton therapy target volume		
Primary tumor site/nodes	37	44.6
Locally recurrent disease	26	31.3
Metastatic site	20	24.1
Proton therapy body site		
Pelvis alone	58	69.9
Abdomen alone	14	16.9
Abdomen and Pelvis	3	3.6
Other sites	8	9.6
Proton Dose-Fractionation		
Median Proton Therapy Dose	50.4 Gy RBE (range, 16-72.17)	
Median Fraction Dose	1.8 Gy RBE (range, 1.1-7)	
Re-irradiation		
Median Re-irradiation Dose	48.8 Gy RBE (range, 16-65.6 Gy RBE)	
Median Cumulative Dose	100.8 Gy (range, 34-156 Gy)	
Brachytherapy Boost	21	25.3
Concurrent chemotherapy	19	22.9

Table 3: Treatment Tolerance

Acute Toxicity (Grade 3-4)	
Dermatitis	3
Pain	3
Rectal hemorrhage	1
Treatment interruptions	
Toxicity	2
Unrelated Medical issue	7
Machine downtime	6
Social	5
Early treatment completion	
Side effects	5
Progression	2
Proton dose at treatment completion	47.5 Gy RBE

SUMMARY/CONCLUSION(S)

- In this largest reported prospective multi-institutional cohort of gynecological cancer patients, PT is being primarily employed for uterine malignancies.
- Uterine sarcoma, high-risk uterine histologies and others form nearly 40% of the patients.
- Proton therapy is being used to treat recurrent or metastatic sites in little over half patients.
- Indication for proton therapy was re-irradiation in one-fourth of the patients with patients treated to a cumulative dose of 100 Gy.
- Overall toxicity profile is favorable with Grade 3-4 toxicities noted in 8.4% patients, with more than 90% patients completing planned treatments.
- This data supports further investigation into use of proton therapy for gynecological malignancies.

REFERENCES/ACKNOWLEDGEMENTS

- Milby et al. Int J Radiat Oncol Biol Phys. 2012 Mar 1;82(3):e477-84. PMID: 22177626
- Dinges et al. Radiother Oncol. 2015 Jun;115(3):373-8. PMID: 25981130
- van de Schoot et al. Acta Oncol. 2016 Jul;55(7):892-9. PMID: 26934821
- Lin et al. Int J Radiat Oncol Biol Phys. 2016 May 1;95(1):181-189. PMID: 26372435.