Limited Toxicity After Proton Beam Therapy for Esophageal Cancer: Outcomes from the Proton Collaborative Group

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Research. Innovation. Results.

Introduction

- Minimizing radiation dose to normal organs in esophageal cancer patients is challenging because of the central thoracic location of the esophagus.
- Dose received by normal organs, especially the heart and lungs, can lead to serious complications and may affect overall survival.
- The lack of exit dose from proton beam therapy (PBT) results in reduced normal organ dose compared to PT, the clinical significance of which has been suggested primarily by retrospective studies.
- However, prospective data are needed to better guide PBT recommendations for esophageal cancer patients.

Methods

- The PCG REG001-09 trial (NCT01255748) prospectively collects data for patients who received PBT for a variety of tumors including esophageal cancer.
- All esophageal cancer patient and treatment data enrolled to the PCG REG001-09 trial between 2010 and 2015 were analyzed with a focus on evaluating patterns of care and treatment-related toxicities.
- Patients were staged according to the AJCC 7th edition staging manual.
- Acute toxicity was considered to have occurred during or within 3 months of PBT completion.

Results

- A total of 77 esophageal cancer patients were enrolled.
- Annual patient enrollment increased significantly starting in 2012 as the number of contributing institutions began to increase. Thirty-three enrollments (42.9%) were from a single institution with smaller contributions from the other institutions.
- Median follow-up was 5.0 months (range 0-47.6).
- Most patients did not have surgery at any time and received concurrent PBT and chemotherapy.
- Radiation dose escalation above ~50 Gy was not commonly used.
- Pencil beam scanning use was reported starting in 2015 for 8 patients. The proton delivery technique used for other patients was uniform scanning or otherwise was not recorded.
- Acute grade 3 toxicities were reported in 12 patients (15.6%); there were no grade 4 or 5 toxicities.

Conclusions

- These data suggest PBT utilization for esophageal cancer is increasing.
- Acute toxicity was limited despite some patients receiving re-irradiation and/or dose escalation. Longer follow up is needed to better assess late toxicities.
- These encouraging data lend support to an ongoing randomized PBT vs. PT trial for esophageal cancer.

Figure 1. PCG REG001-09 enrollment by year

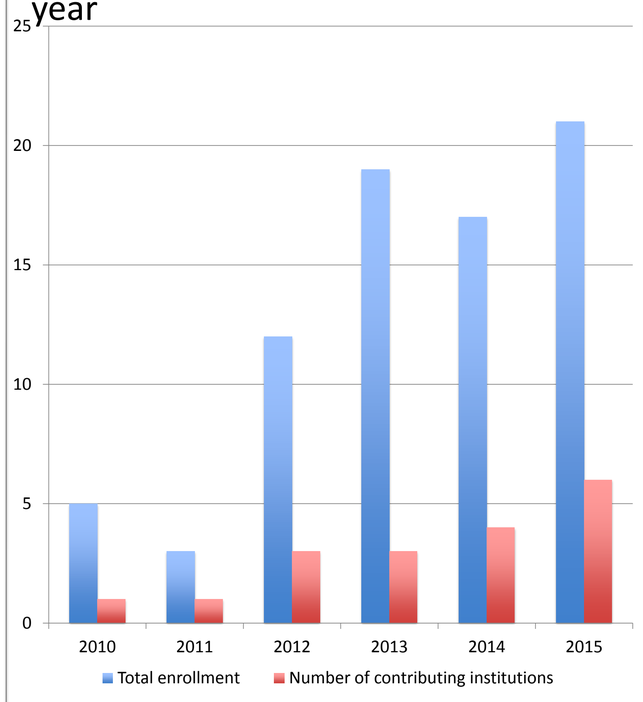

Table 1. Patient and tumor characteristics

	N (%)
Histology	
Squamous cell carcinoma	16 (20.8)
Adenocarcinoma	61 (79.2)
Primary tumor location	
Upper	4 (5.2)
Mid	2 (2.6)
Lower/GE junction	29 (37.7)
Unknown	42 (54.5)
Grade	
1	4 (5.2)
2	29 (37.7)
3	20 (26)
Unknown	24 (31.2)
Clinical T stage	
1	5 (6.5)
2	9 (11.7)
3	45 (58.4)
Unknown	18 (23.4)
Clinical N stage	
0	23 (30)
1	28 (36.4)
2	14 (18.2)
Unknown	12 (15.6)
Clinical M stage	
0	49 (63.6)
1	11 (14.3)
Unknown	17 (22.1)

Table 2. Treatment characteristics

	N (%)
Surgery prior to PBT	
Yes	12 (15.6)
No	64 (83.1)
Unknown	1 (1.3)
Surgery after PBT	
Yes	5 (6.5)
No	65 (84.4)
Chemotherapy	
Concurrent with PBT	57 (74)
Sequential with PBT	10 (13)
None	10 (13)
RT modality	
IMRT + PBT boost	5 (6.5)
PBT only	72 (93.5)
Prescribed dose	
Median, Gy(RBE)	50.5
Range	36.1-75.7
<45 Gy(RBE)	7 (9.1)
45-50.5 Gy(RBE)	49 (63.6)
>50.5 Gy(RBE)	21 (27.3)
Prescribed PBT fractions	
Median number	28
Range	10-42
>2 Gy(RBE) per fraction	9 (11.7)
≤2 Gy(RBE) per fraction	68 (88.3)
PBT re-irradiation	
Yes	14 (18.2)
No	63 (81.8)
Prescribed re-irradiation dose	
Median, Gy(RBE)	45.1
Range	30.1-50.5
Prior RT dose	
Median, Gy	50.4
Range	37.5-59.4
Interval from prior RT	
Median, months	37.1
Range	17.6-336.6

Table 3. Acute Grade 3 toxicity	N (%)
Anorexia	4 (5.2)
Nausea	1 (1.3)
Dermatitis	2 (2.6)
Esophagitis	5 (6.5)
Dysphagia	1 (1.3)
Dyspnea/Cough	2 (2.6)