

Risk Factors for Pericardial Effusion in patients with Esophageal Cancer Treated with Definitive Chemoradiation Therapy without Surgery

Xiong Wei, M.D.,* H. Helen Liu, Ph.D.,* Zhongxing Liao, M.D., † Susan L. Tucker, Ph. D.,‡ Shulian Wang, M.D., § Radhe Mohan, Ph.D.,* James D. Cox, M.D., † and Ritsuko Komaki, M.D. †

*Departments of Radiation Physics, †Radiation Oncology, ‡Biostatistics and Applied Mathematics, The University of Texas M. D. Anderson Cancer Center, Houston, TX, USA; § Cancer Hospital, Peking Union Medical College and Chinese Academy of Medical Sciences, Beijing, China

Purpose:

To determine clinical and dosimetric factors influencing the risk of pericardial effusion (PCE) in esophageal cancer patients treated with definitive concurrent chemotherapy and radiotherapy (CCRT).

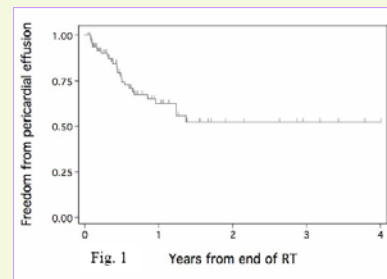
Methods and Materials:

We retrospective analyzed 101 esophageal cancer patients treated with definitive CCRT without surgery from 2000-2003. There were 87% stage III-IV tumors located at mid-lower esophagus. 3D-CRT was used for radiation therapy with a median dose to the primary tumor of 50.4 Gy in 28 fx, 1.8Gy/fx, once daily, 5 days/wk. PCE was assessed from follow up chest CT scans obtained with or without intravenous and oral contrast. Patients were followed every 3 months for the first 3 years post-therapy and every 6 months thereafter. The median follow-up time was 8.4 months (range, 0.4 - 48 months). The Cox proportional hazards model was used to

identify clinical and dosimetric factors influencing freedom from PCE. Dosimetric factors were calculated from the dose-volume histogram (DVH) for whole heart and pericardium. The “pericardium volume” was defined as a “rind” extension 0.5 cm from the contoured heart.

Results:

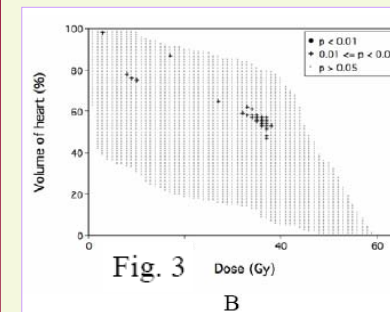
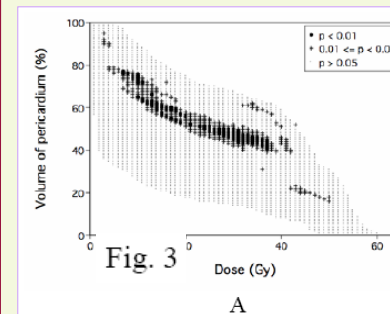
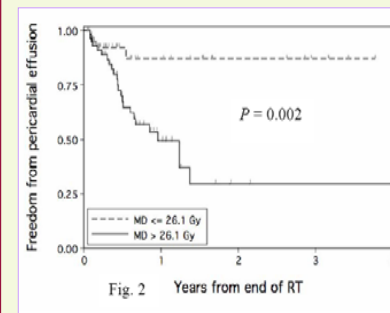
The crude rate of PCE was 27.7% (28/101). The actuarial incidence at 18 months was 48% (95% CI 34% - 63%) (Fig.1). The median observed time of onset of PCE was 5.3 months (range, 1.0-16.7 months) post-CCRT. The rate of PCE tend to stable after 18 months of CCRT (Fig.1)



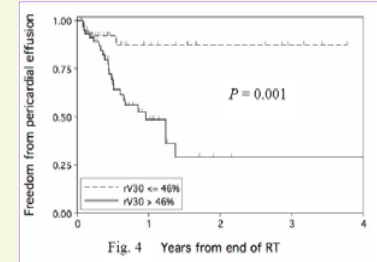
None of the clinical factors investigated was significantly associated with the risk of PCE (Table). Patients who received

Characteristic	No. of patients (%)	P value
Age		
≤ 67 years	51 (50.5)	0.910
> 67 years	50 (49.5)	
Sex		
Male	76 (75.2)	0.068
Female	25 (24.8)	
Karnofsky performance status		
< 90	51 (50.5)	0.520
≥ 90	49 (48.5)	
Unknown	1 (1.0)	
Tumor location		
Cervical-upper thoracic-and-thoracic	37 (36.6)	0.680
Lower thoracic-GE junction	61 (60.4)	
Unknown	3 (3.0)	
Clinical stage		
I - II	22 (21.8)	0.102
III - IV	74 (72.9)	
Unknown	6 (5.9)	
Histology		
Adenocarcinoma	62 (61.4)	0.777
Squamous carcinoma	39 (38.6)	
Smoking history		
Current smokers and former smokers	74 (73.3)	0.264
Never smoked	27 (26.7)	
Hypertension		
Yes	59 (58.4)	0.478
No	42 (41.6)	
Atrial fibrillation		
Yes	6 (5.9)	0.092
No	95 (94.1)	
Coronary artery disease		
Yes	22 (21.8)	0.297
No	79 (78.2)	
Diabetes		
Yes	18 (17.8)	0.782
No	83 (82.2)	
Induction chemotherapy		
Yes	8 (32.0)	0.276
No	20 (26.3)	
Radiation dose		
< 50.4 Gy	18 (17.8)	0.786
50.4 Gy	68 (67.3)	
> 50.4 Gy	14 (13.9)	
Unknown	1 (1.0)	

induction chemotherapy did not have a significantly higher risk of PCE. The risk of PCE was found to be significantly associated with the DVH for pericardium, including the mean pericardial dose ($p = 0.002$) (Fig.2) and relative volumes of the pericardium receiving doses greater than 5 to 45 Gy ($p < 0.05$) (Fig. 3A & 4). The whole heart DVH were less able to discriminate between patient groups with different incidence rates of PCE (Fig.3A & 3B).



The best of which was for rV30, $p = 0.001$ (log-rank test) (Fig.4).



Conclusions:

PCE rate was 27.7% in this group. The risk of PCE was significantly associated with the DVH of pericardium; much less association was seen between PCE risk and factors from the whole heart DVH.

References:

1. Tripp P, Malhotra HK, Javle M, et al. Cardiac function after chemoradiation for esophageal cancer: comparison of heart dose-volume histogram parameters to multiple gated acquisition scan changes. *Dis Esophagus* 2005;18:400-405.
2. Martel MK, Sahijdak WM, Ten Haken RK, et al. Fraction size and dose parameters related to the incidence of pericardial effusions. *Int J Radiat Oncol Biol Phys* 1998;40:155-161.
3. Adams MJ, Lipshultz SE, Schwartz C, et al. Radiation-associated cardiovascular disease: manifestations and management. *Semin Radiat Oncol* 2003;13:346-356.
4. Lee PJ, Mallik R. Cardiovascular effects of radiation therapy: practical approach to radiation therapy-induced heart disease. *Cardiol Rev* 2005;13:80-86.