THE DOSIMETRIC IMPACT OF GASTRIC FILLING ON RADIATION THERAPY OF PATIENTS WITH UPPER GASTROINTESTINAL TRACT AND PANCREATIC CARCINOMA

Amr Abd El Aziz El Sayed , Mohamed Yousry Soliman Goda, Neamat Elsayed Elsayed Hegazy, Mohamed A.M. Meheissen ,Zena Kassim Moh'd

Department of Clinical Oncology and Nuclear Medicinem , Alexandria University, Egypt.

Introduction

: Upper GIT carcinomas are the most common malignancies in both sexes. In 2018, stomach cancer was the most commonly diagnosed upper GIT cancer then closely followed by liver cancer, esophageal cancer, pancreatic cancer and gallbladder cancer in terms of incidence and mortality. Radiation therapy is among the main modality of cure, control and palliation of upper GIT malignancies. However, the advantage of radiation therapy combined with other modalities in upper GIT cancers has been established, challenges remain in providing accurate and safe radiation delivery. These challenges include proximity of organs at risk within the abdomen, nature of organs motion and gastrointestinal filling.

Aim of the work

The aim of this study is to evaluate the dosimetric effect of gastric filling on the motion of targets and organs at risk in patients with upper gastrointestinal and pancreatic cancers receiving radiotherapy.

Patients and methods

A prospective study included 30 patients with upper GIT malignancies. All patients were treated with radiation therapy and were instructed to take nothing by mouth at least 8 hours before the simulation of the treatment. CT simulator (SIEMENS, somatom go. Up) two sets of images were taken, the first image was taken after on fasting state, then the second scan was taken after the patient drank 1.5L of water within 30 minutes. The region of interest for each of the 30 patients on both CT scans images were delineated. ES images sets were planned by Elekta TPS (Monaco 03, version: 5.11.02). Then FS image sets were automatically fused and all structures of interest copied to the planned image. The dosimetric impact was analysed by DVH and DSC was calculated between ES and FS.

Results

The majority (70%) were males. The mean age at diagnosis was 57.1 years range 28-78). The most common histological diagnosis was HCC – 3%. The majority of patients had stage III disease. Among the 30 patients, 2 patients underwent surgery. The radiotherapy dose ranged from 20Gy to 5Gy. The amount of water taken ranged from 50 ml to 1000 ml. There were remarkable significant differences in stomach volume ($p< 0.001$) on an empty stomach (ES) versus Full stomach (FS). There were no significant differences in the planned Dmax and Dmean of target volumes (GTV, CTV and PTV) on an empty and full stomach. The only showed significant differences in the Dmax of the esophagus, right kidney and heart ($p=0.021$, $p=0.01$, and $p=0.041$) respectively. The mean dose to the esophagus and right kidney was higher in the FS while to the heart was higher on ES. There were significant differences in the Dmean of the right kidney, bowel right lung and stomach ($p=0.034$, $p=0.01$, $p=0.009$, and $p=0.007$) respectively. The mean dose to the bowel, stomach and right lung was higher in the ES while to the right kidney was higher in the FS. The Dice similarity coefficient (DSC) was showed that the most

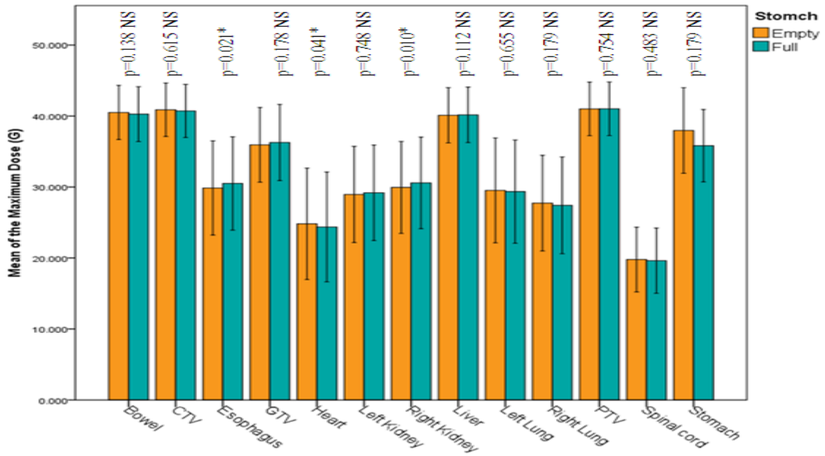

Fig. (1) Comparison of maximum dose between an empty and full stomach

Dice Similiarty Coefficient of organs interest

Bowel	CTV	Esophagus	GTV	Heart	Kidney left	Kidney right	Liver	Lung left	Lung right	PTV	Spinal cord	Stomach
0.861	0.668	0.148		0.829	0.89	0.893	0.866	0.824	0.822	0.79	0.605	
0.825	0.764	0.681		0.835	0.791	0.923	0.859	0.939	0.909	0.831	0.849	
0.853	0.653	0.692		0.895	0.892	0.827	0.863	0.952	0.955	0.74	0.87	0.547
0.807	0.617	0.676		0.903	0.896	0.806	0.862	0.921	0.955	0.746	0.836	0.509
0.817	0.74	0.857		0.951	0.835	0.854	0.94	0.95	0.973	0.81	0.923	0.761
0.647	0.499	0.348		0.555	0.495	0.542	0.769	0.6	0.989	0.622	0.492	0.384
0.881	0.658	0.705		0.887	0.872	0.899	0.887	0.957	0.961	0.76	0.761	
0.788	0.737	0.25		0.897	0.75	0.907	0.815	0.888	0.851	0.836	0.652	
0.776	0.798	0.857		0.903	0.86	0.913	0.935	0.868	0.843	0.844	0.904	0.67
0.732	0.726	0.78		0.965	0.822	0.949	0.95	0.958	0.971	0.78	0.75	0.661
0.756	0.708	0.358		0.966	0.831	0.887	0.9	0.989	0.899	0.775	0.865	0.525
0.682	0.756	0.761	0.695	0.929	0.899	0.862	0.929	0.993	0.993	0.789	0.818	0.699
0.791	0.812	0.75	0.766	0.821	0.928	0.879	0.879	0.923	0.945	0.851	0.88	0.32
0.801	0.828	0.583	0.787	0.84	0.854	0.912	0.903	0.942	0.905	0.864	0.871	0.401
0.819	0.784	0.408	0.73	0.823	0.87	0.879	0.852	0.876	0.906	0.813	0.617	0.365
0.88	0.773	0.923		0.967	0.985	0.988	0.976	1	1	0.833	0.489	0.95
0.546	0.844	0.689	0.784	0.775	0.484	0.72	0.812	0.894	0.906	0.8	0.463	0.468
0.613	0.587	0.704	0.551	0.812	0.52	0.662	0.832	0.889	0.878	0.601	0.676	0.681
0.826	0.788	0.821	0.751	0.811	0.801	0.905	0.865	0.892	0.965	0.819	0.621	0.346
0.745	0.652	0.736	0.577	0.856	0.756	0.953	0.89	0.942	0.956	0.695	0.868	0.329
0.748	0.715	0.722	0.654	0.923	0.896	0.932	0.959	0.972	0.933	0.739	0.805	0.654
0.793	0.8	0.562	0.729	0.79	0.901	0.863	0.886	0.898	0.832	0.834	0.83	0.469
0.458	0.586	0.705	0.4	0.855	0.671	0.882	0.862	0.835	0.912	0.674	0.705	0.362
0.757	0.862	0.909	0.84	0.938	0.878	0.92	0.936	0.966	0.995	0.966	0.859	0.471
0.727	0.629	0.699	0.498	0.882	0.682	0.857	0.893	0.923	0.97	0.677	0.852	0.404
0.745	0.846	0.852	0.835	0.87	0.845	0.936	0.906	0.888	0.906	0.876	0.812	0.383
0.817	0.815	0.492	0.768	0.804	0.875	0.902	0.897	0.902	0.941	0.858	0.831	0.411
0.727	0.629	0.674	0.498	0.882	0.682	0.857	0.893	0.952	0.97	0.677	0.852	0.404
0.489	0.589	0.734	0.526	0.872	0.632	0.893	0.882	0.892	0.952	0.678	0.712	0.341
0.83	0.796	0.909	0.788	0.994		1	1	1	0.998	0.837	1	0.85

1 0.975 0.95 0.925 0.9 0.875 0.85 0.825 0.8 0.775 0.75 0.725 0.7 0.675 0.65 0.625 0.6 0.575 0.55 0.525 0.5 0.475 0.45 0.425 0.4 0.375 0.35 0.325 0.3 0.275 0.25 0.225 0.2 0.175 0.15

Tab. (1) **Heat map of dice similarity coefficient of organs interest**

Conclusion

The variation in the gastric filling (ES and FS) during treatment planning has no impact on dose coverage of the targets, while in some organs at risk can result in clinically unwanted overdose. Therefore we need to make sure that the patients have the same gastric filling during the simulation process and treatment delivery to reduce the maximum dose to OAR and maximize dose to the target volumes.