Proton Beam Therapy for Large Hepatocellular Carcinoma

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Table 1. Patient and tumor characteristics

Total number of patients	22
Sex	
Male	18
Female	4
Age (years)	
Median (Range)	64 (45～90)
Performance Status (no.)	
0 or 1	21
2	1
Child-Pugh classification (no.)	
Class A	11
Class B	11
Surgical treatment	
operable	1
inoperable	21
advanced tumor	11
advanced liver cirrhosis	1
small liver volume after operation	2
intercurrent disease	4
age > 80 with Class B liver Cirrhosis	3
Combined other treatment (no.)	
absence	9
presence	13
TACE	7
HAI	3
PEI	2
Oral chemotherapy	1
Hepatitis virus type	
HBV	4
HCV	9
None	9
Serum tumor marker level	
AFP (>20ng/ml)	18
Median AFP level (ng/ml) (range)	368 (33-32597)
PIVKA-II (>40mAU/ml)	15
Median PIVKA-II level (mAU/ml) (range)	3821 (54-335000)
Tumor size in maximum diameter (cm)	
Median (range)	11(10-14)
Number of tumors	
Solitary	18
Multiple	4
Tumor type	
Nodular	18
Diffuse	4
Portal vein thrombosis	
presence	11
absence	11
AJCC stage	
T1N0M0, Stage I	7
T3N0M0, Stage III	15

TACE: transarterial chemo-embolization
HAI: hepatic arterial infusion
PEI: percutaneus ethanol injection

Table 2. A summary of dose-volume analysis

Variables	Range	(median)
CTV (cm^3)	335-1398	(567)
NLV (cm^3)	451–1292	(998)
V_0 (%)	31 - 80	(53)
(cm^3)	126-922	(556)
V_{10} (%)	17 - 58	(40)
(cm^3)	196-530	(399)
V_{20} (%)	15 - 55	(33)
(cm^3)	92-505	(203)
V_{30} (%)	11 - 50	(34)
(cm^3)	9 - 62	(17)
V_{40} (%)	2 - 47	(23)
(cm^3)	1 - 32	(12)
V_{50} (%)	0 - 43	(22)
(cm^3)	0 - 18	(11)
D_{33} (GyE)	1.2-62.8	(30.2)
D_{66} (GyE)	0-1.6	(0.8)
D_{100} (GyE)	0	

CTV = clinical target volume; NLV = nomal liver volume

V_0 =Percengate of normal liver volume that received no dose in the total liver volume

$V_{10,}$ $V_{20,}$ $V_{30,}$ $V_{40,}$ V_{50} =Percentage of normal liver volume that received ≧10Gy, ≧20Gy,≧30Gy,≧40Gy,≧50Gy in the total liver volum

D_{33}, D_{66}, D_{100} = Delivered dose to non-cancerous liver of 33%, 66%, and whole liver