Liver Protocol 2009-0556
Planning Guide

Last Updated Dec2019

Introduction
Original protocol

Passive scattering hypo-fractionated treatment in **15** fraction to different total doses

- Rx was 67.5 Gy (450cGy/Fx) for peripheral tumor and 58 Gy (387cGy/Fx) for central tumor

Normal Tissue Constraints, which must be met:

- **Mean normal liver dose (Liver-GTV): < 24 Gy (most difficult one) + >700cc < 20 Gy**
- Spinal cord max dose: 30 Gy (RBE)
- Stomach max dose: 42 Gy (RBE)
- Bowel (including duodenum, small bowel, large bowel) max dose: 45 Gy (RBE)
- Kidney V14 (volume receiving 14 Gy (RBE) < 30%)

Protocol states:

"Under dosing of the PTV will be permitted to maintain normal tissue constraints as described below. However 90% of the PTV should receive the prescription dose."

Other constraints:

Heart Max dose: 45 Gy (RBE), V40<10%

Chest Wall: no more than 2ccs may receive >60 Gy (RBE)

Introduction
Alternate protocols using SIB techniques

While dose level may vary, here are 2 more examples:

A) 75 and 67.5 Gy in 15 Fx (constraints are the same as on previous slide)

B) 100 Gy, 75 Gy, 45 Gy in 25 Fx (normal tissue constraint differ due to different radiobiology):

Normal Tissue Constraints, which all **must be met**:

Liver-GTV: < 28 Gy (most difficult one) + more than 700 cc receives 20 Gy or less

Spinal cord max dose: << 45 Gy

Colon max dose 65 Gy

Stomach and Duodenum max dose: 60 Gy

Bowel (including duodenum, small bowel, large bowel) max dose: 55 Gy

Kidney V20 < 30%)

Main Bile duct max dose < 80 Gy

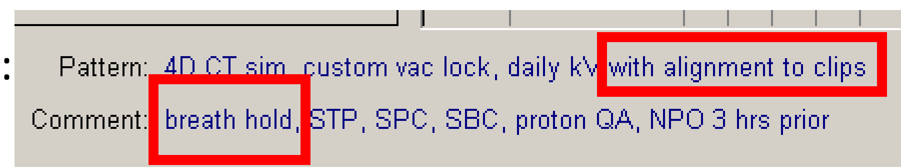
Often the 45 Gy volume is normally an expansion of the 75 Gy, therefore the 45 Gy volume may not have defined an aperture and just 75 volume is used for planning

BH yes/no, Contrast yes/no

- Even if simulation note suggest Breath hold (BH) treatment, dosimetrist need to make sure that correct dataset is being planned. The BH-CT must contain some kind of radio-opaque marker inside liver. If there are no marker, plan must be done on 4D-avg CT without contrast.
- Planning can only be done on None-contrast CT
- If contours were drawn on contrast CT or on BH-scan w/o fiducials, contours need to be copied on appropriate CT using Velocity and structure deformation techniques.

Checklist for BH:

- fiducials present?
- Does Rx contain BH? And Setup Note states: “align to fiducials”



- normally there are multiple BH-CT taken during sim, please import all w/o contrast and the one were contours are drawn
- Put fiducials on Setup DRRs, sometimes primary tumor is useful, if fiducial are far away from it
- Put in pt note “Planned on BH” etc.

3 Types of Liver Cancer

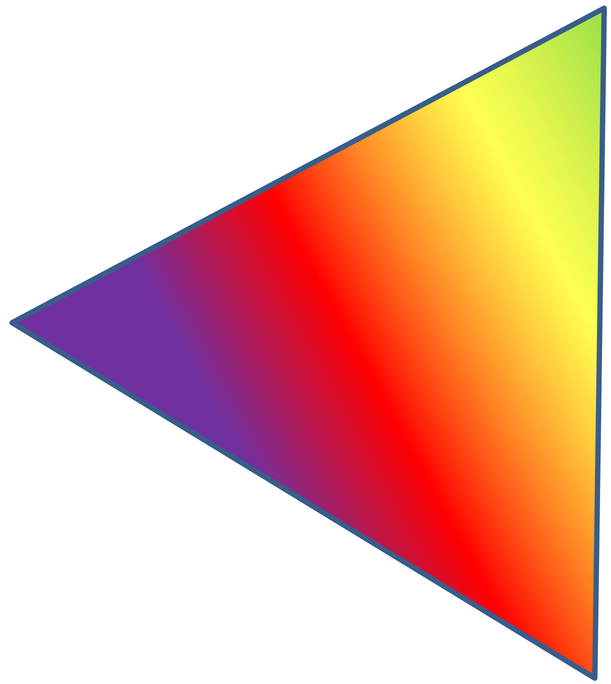
Type	hepatocellular carcinoma (HCC)	Cholangio-carcinoma (CC)	Liver Metastasis
Visible in CT?	Very Bad	good	Very good
Liver size	Can be very big >3000 cc (cirrhosis)	Normal (~2200cc)	Normal (~2200cc)
Allowed Liver-GTV mean dose (2Gy/Fx)?	28 Gy	28-30Gy	32 Gy
Allow on protocol?	Yes	Yes	No, could be treated off-protocol

Now there are more than one target structure: GTV, CTV, PTV, PTV45, PTV75, PT100 etc.
Thus, find out which contour represents best the visual agreement with CT data (liver tumor shows less HU compared to healthy liver). This structure should be plotted on DVH when printing out.

4 General Cases

Peripheral tumors
next to chest wall

Very large tumor with
multi-dose volumes



Central tumors next
to bowel

Very large tumor

4 General Cases

Case	Peripheral tumor	Central tumor	Very large tumor	Very Large tumor with multi-dose volumes
Main Issue	Chestwall+Skin dose	Bowel constraint	Liver-GTV constraint	Liver-GTV constraint & combining vols& # of beams limitations
Difficult level?	Easy	Difficult	Very Difficult	Very Very Difficult
Number of fields? ♣	3-4 primary or (3+2 boost)	3-4 primary or (3+(1or2) boost)	3 primary or (2+2boost)	2-3 primary + 2-3 boost
Target coverage?	Full	Compromised by bowel max dose	Very tight dose lines, little to no margins	Very tight dose lines, little to no margins, compromised coverage

♣If no SIB, boost fields can be omitted