Brachytherapy for GI malignancies

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BRACHYTHERAPY IN GASTROINTESTINAL MALIGNANCIES

HEPATOBILIARY

- Klatskin tumor
- HCC Liver
- Malignant strictures

LOWER GIT

- Anal canal
- Rectum

Brachytherapy for biliary tract Anatomical considerations



Brachytherapy for biliary tract

- To relieve obstruction
- Brachytherapy catheter is placed in the bile duct via transcutaneous route.
- Radiation is delivered using high dose rate brachytherapy using 192Iridium source

Presenting symptom Jaundice

- Intrahepatic
 - Cholangiocarcinoma
- Extrahepatic
 - Cancer Gall bladder
 - Cancer head of Pancreas
 - Periampullary Cancers
 - Lymph nodes
- ~ 90% unresectable at presentation
- > 50% present with obstructive jaundice



Work up

- For obstructive jaundice
 - Liver function tests , X ray chest etc.
 - Ultrasound / CECT scan / MRI
 - Cholangiography Percutaneous transhepatic cholangiography / ERCP / MR cholangiogram
 - FNAC during Ultrasound / CECT/ ERCP
 - Brush / Exfoliative cytology during cholangiogram
 - Staging and Classification
- Establish biliary drainage
 - Transhepatic route
 - Endoscopically through transduodenal route

Bile duct brachytherapy

Indications

- Patient usually unresectable
- Lesion preferably less than 3 cm
- Fit enough to undergo the procedure
- Malignant strictures of the duct which can be cannulated through either
 - Trans-duodenal endoscopic technique
 - Trans-hepatic technique

Target volume

- Identified through cholangiograms/ CECT/ MRCP
- Based on orthogonal films / CECT based
- > 1 or 2 cm margins taken both proximally and distally



Cardiac sheath



PTC Cholangiogram



Complete block at Hilum



CT based planning













Dose – RT Various schedules

14Gy/ 4# HDR 10Gy/ 1# HDR LDR – 25-30Gy

COMBINED MODALITY TREATMENT IN UNRESECTABLE EXTRAHEPATIC BILIARY CARCINOMA

Alessio G. Morganti, M.D.,* Lucio Trodella, M.D.,* Vincenzo Valentini, M.D.,*

- Evaluate the effect of CTRT plus intraluminal brachytherapy in unresectable or residual extrahepatic biliary ca
- 20 patients unresectable 16 or residual 4
- Mean age 61 years
- Median follow-up 71 months
- Nonmetastatic extrahepatic tumors (CBD8; GB1;Klatskin 11)
- External beam radiation(39.6–50.4 Gy); in 19 patients,
 5-fluorouracil (96-h continuous infusion, days 1–4
- 12 patients received a boost by intraluminal brachytherapy using 192Ir wires of 30–50 Gy
- MOS-212 mths TTP 33 1mths

Tumori. 1998 Jul-Aug;84(4):467-71. Interventional radiology and radiotherapy for inoperable cholangiocarcinoma of the extrahepatic bile ducts.

Milella M, Salvetti M, Cerrotta A, Cozzi G, Uslenghi E, Tavola A, Gardani G, Severini A.

Division of Radiology C, Istituto Nazionale per lo Studio e la Cura dei Tumori, Milan, Italy.

•	111 patients		MOS (days)
•	Group 1 - palliative PTBD	n= 89 (80%)	108
•	Group 2 - ERT	n = 10 (9%)	345
•	ERT plus EBRT	n =12 (11%)	428

HEPATIC BRACHYTHERAPY

LIMITATIONS: CURRENT THERAPEUTIC APPROACHES

- SURGICAL
 - Liver Transplant : Long delay, Complications
 - Partial Resection: Only for small lesions, 15-25% eligible

MINIMALLY INVASIVE

- TAE : Effective only for <3cm lesions
- TACE: Significant liver dysfunction
- RFTA: ~ 50% ablation if size <3cm; 13% complications

NON-INVASIVE

- External Beam Radiation Therapy : Poor Tolerance

DEMAND FOR ALTERNATIVE APPROACHES

Liver brachy

11%

- RADIATION TOLERANCE OF WHOLE LIVER *
- <u>DOSE (cGy)</u>
 <u>HEPATITIS</u>

INCIDENCE OF

- •
- **3000 3500**
- 3500 4000
- 4000

22.2% 38.8%

75%

REDUCE VOLUME FOR BETTER TOLERANCE

Results

Ricke J et.al (Germany)

- 20 Pts (19 mets unfavorable for thermal ablation
 CT Guided Interstitial HDR- BRT
- Mean Tumor diameter : <u>7.7cm</u> (Grp A), <u>3.6cm</u> (Grp-B)
 Treated with Ir-192, Median dose : 17 Gy

- Toxicity: 2/20 (10%) Obstr. jaundice from Tx edema Liver enzyme elevation: 70%

Bilirubin elevation: 50%

- Tumor Control: LC 6m (74%), 12m (40%) Grp. A (100%), 12m (71%) Grp. B
- <u>Golfieri R2 (J. Chemo., 2004)</u> •
 - 11 Pts, Bilateral percutaneous drainage + BRT+
 - -ERT - Mean Śurvival : 10.5mssss





Courtesy Dr D N Sharma

Interstitial Brachytherapy Liver



Courtesy Dr D N Sharma

ATTMS PET/CT P.K.BARMAN 57/M PET/7715/08 May 05, 2008

IBT Liver : Pre-brachytherapy CT and PET-CT



I ATTMS PET/CT I P.K. BURMAN 61/M I PET/9391/08 Nov 07, 2008



I P.K. BURMAN 61/M | PET/9391/08 | Nov 07, 2008



Courtesy Dr D N Sharma

Results - Ir 192

Thomas D, Dritschilo A (USA) Phase I-II

33 Pts (19 mets – unfavorable for thermal ablation

- Intraoperative catheters \rightarrow HDR- BRT
- Mean Tumor diameter 5 cm : <u>Average Vol: 174 cc</u>
- Treated with Ir-192, Median dose: 15-30 Gy
- Well tolerated
- 7/20 Alive , Stable disease at 4,5,5,6, 36m

ANAL CANAL CANCERS

- At TMH: 50-60 new cases every year
- Standard of Care: Concomitant chemoradiation
- Radiation:
 - Radical : External alone / Brachytherapy alone
 - Boost : 1. Posterior Oblique

2. Brachytherapy: LDR or HDR

TMH Cancer Registry 1999

Patient Selection Criteria Indications

- Brachytherapy alone:
 - Effective in controlling very small lesions
 - Painful reactions in 50%, late necrosis in 10-15%
 - Usually not used as sole treatment modality
- Boost following concomitant Chemoradiotherapy, usually after 40-45 Gy of Ext. RT
- Located within 8 cm of anal verge
- Tumor size preferably not more than 6 cm
- Thickness preferably less than 3 cm
- Less than half of the lumen infiltration

Contraindications

- Insufficient tumor response to prior

chemoradiotherapy at 40-45 Gy

More than 1/2 involvement of circumference

- Sphincter involvement
- Medically Inoperable (relative)
- Proximal ends of tumor cannot be palpated, extends far beyond into rectum
- Extensive T4 (except those with limited penetration to anovaginal septum)





- Select of needle size (length)
- Insert needles according to your calculation
- Fixing of needles in template
- Then fix the template to skin at 4 corners
- Put a flatus tube for drainage fecal matter if any afterwards

Other Templates











Interstitial brachytherapy Martinez Universal Perineal Implant Template (MUPIT)



Anal canal Brachytherapy ----Planning Details

- Orthogonal X-rays or Axial Planning CT scans (3-5 mm)
- Catheter tracking
- Appropriate Loading lengths
- Doses:
 - Prescription Isodose: 90 -100%
 - Optimization as needed (graphical)
 - Dose
 - 1. Radical 50-55 Gy equivalent @ 3.4 -4 Gy/#,2#/d

2.Boost -15 -20 Gy equivalent @3.4 - 4 Gy/#,2#/d

CARCINOMA ANAL CANAL

RESULTS n = 83 (1985 - 1997)



Implant dose (Gy)	Recc (%) Total (n=83)	Ano- Rectal Complications (%)	Bladder Complications (%)
15-20	12/49 (25)	13 (25)	1 (2)
21-30	11/32 (34)	6 (15)	1 (5)
> 40 (Radical)	2/2 (100)	1 (50)	
Total	25/83 (30)	20/83 (24)	2 (2)

Rectal cancer

- Second most GI malignancy in India
- 14.9% of all GI malignancies seen in T.M.H TMH Cancer Registry 1999
- APR & Anterior Resections are the standard of care
- Radiotherapy remains the standard of care after the surgery tumors more than T₂-N₀
- Brachytherapy is the newer modality of care

Radiotherapy for rectal cancer

• XRT

- Conventional
- Conformal
- Brachytherapy
 - Endocavitary
 - Interstitial
 - Endoluminal approach
 - Transperineal approach

Palliative Brachytherapy for Bleeding, Discharge per rectum

Rectal Brachytherapy ----Planning Details

- Orthogonal X-rays or Axial Planning CT scans (3-5 mm)
- Catheter tracking
- Appropriate Loading lengths
- Doses:
 - Prescription Isodose: 90 -100%
 - Optimization as needed (graphical)
 - Dose
 - 1. Radical 50-55 Gy equivalent @ 3.4 -4 Gy/#,2#/d

2.Boost -15 -20 Gy equivalent @3.4 - 4 Gy/#,2#/d

Flexible multi-channel rectal probe



Preoperative high dose rate endorectal brachytherapy as an alternative preoperative modality for patients with resectable rectal cancer

Flexible multi-channel rectal probe



Disposable Re-usable parts part

Endoscopic clips



Delineation on CT scan with applicator in situ



Conformity with brachytherapy



Asymmetrical catheter loading

Conformity with brachytherapy



- Asymmetrical catheter loading
- Stand-off balloon
- Inverse optimization, graphical optimization

Conformity with brachytherapy



Results after 6 weeks



N=285 T2-6%, T3 91%, T4-3%, N0-52%, N+ 38%

No anaesthetics needed

