

Abstract BR-01: A Dosimetric Comparison of Whole Breast Irradiation with Conventional and Conformal Radiation Techniques

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Introduction-Modern radiotherapy treatment planning and delivery systems allow forward planned 3D dose distributions to be calculated and delivered to the breast using multi-leaf collimators. Studies have reported improvement in the dose homogeneity within the irradiated breast with added sparing of the heart and lung when intensity modulation was used. This study aimed to demonstrate an advantage of increased dose homogeneity in the target tissue while decreasing the dose to the organs at risk for conformal techniques.

Materials and Methods-At the Department of Radiotherapy, MCH, histologically proven cases of Carcinoma Breast were screened for this study. The patients, after breast conserving surgery, underwent post-operative radiotherapy. Simulation was done on a breast board using the Phillips 16 slice CT simulator and conventional and conformal (3DCRT & IMRT) plans were generated on ECLIPSE and MONACO TPS respectively. Dosimetric parameters were compared using IBM SPSS.

Results-PTV V95 for conventional RT, 3DCRT and IMRT were 92.60+/-2.80%, 97.83+/-0.59% and 98.44+/-0.51%. Statistically significant advantage of 3DCRT over Conventional RT and IMRT over 3DCRT were found for ipsilateral lung V20 (29.08+/-2.34%, 15.89+/-1.47% and 14.71+/-1.50% for conventional RT, 3DCRT and IMRT respectively with $p < .001$) and Mean Lung Dose and mean heart dose (10.78+/-1.05Gy, 7.92+/-1.20Gy and 6.55+/-0.81Gy respectively) in left breast irradiation. However, the contralateral lung mean dose was more for IMRT v/s 3DCRT (1.065+/-0.25Gy v/s 0.8+/-0.06Gy, $p < .001$).

Conclusion-3DCRT remains the standard for whole breast irradiation. IMRT shows dosimetric promise but there is lack of compelling data to make it the standard of care.

Abstract BR-02: Evaluation of Radiation Dosimetric Parameters and its Association with Acute Skin Toxicity in Whole Breast Radiation

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Introduction-Skin toxicity is the predominant acute side effect of radiotherapy to the breast, occurring during or after EBRT in more than 90% of the patients. 10 % of these patients develop RTOG G3 that may limit the patient's quality of life and compliance. If minimal toxicities and good cosmetic results are achieved, breast preservation has clear advantage over mastectomy, by its strong positive impact on patient's quality of life.

Material and Methods- A prospective observational study. Study done from July 2017 to June 2018 for 26 patients. After completion of Breast conservation surgery all patients underwent CT (Somatom Spirit-Siemens), with proper immobilization devices. CT images were used for simulation and planning according to standard protocol. Contouring done according to RTOG guidelines. Contouring of skin for the involved breast was done with 5 mm thickness from the surface of the body. Dose prescription used was 50 Gy/25 # with 3DCRT/IMRT/RAPID ARC technique. Tumour bed boost 12 Gy/6# with Rapid arc was given. Dose volume parameters were obtained from the Dose volume Histograms of treatment planning system using Analytical Anisotropic Algorithm. Dose constraints used for skin dosimetric measure was-Volume received by 40 Gy V40=88%; Volume received 45 Gy V45 = 83%; Volume received by 50 Gy V58=58 %

All patients in this study were followed up weekly by clinical examination during RT and post RT every monthly till 3 months. During follow up worst grade of skin toxicity was recorded.

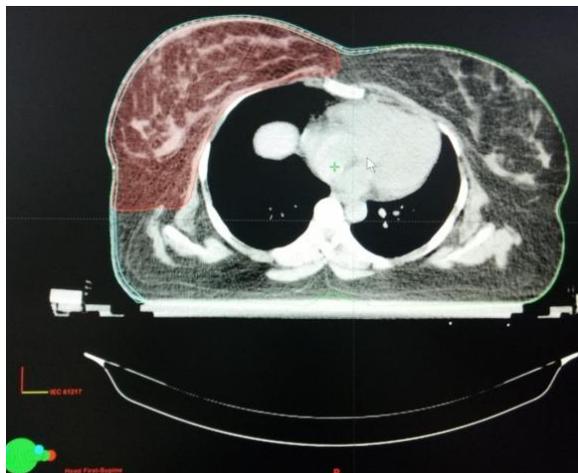
Results- A descriptive study was done. Ordinal logistic regression was used for the analysis. Mean dose of skin was 41.45 Gy with standard deviation of 4.2. Minimum skin dose was 33.23Gy and the largest was 47.72 Gy. Mean volume of V40 was 62.03% with standard deviation of 9.65. Minimum was 44.36% and maximum was 80.8 %. Mean volume of V45 was 56% with standard deviation of

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12.2. Minimum was 23 % and the maximum was 73 %. Mean volume of V50 was 43.9% with standard deviation of 14.2. Minimum was 7.02 and maximum was 66.7. Above variables were normally distributed. The median in grading of skin toxicity was 1.

For grading of toxicity following observations were made:

Skin mean dose (Gy)	Grade 1	Grade 2	Grade 3	Grade 4	TOTAL
<35	1(100%)	-	-	-	1(0.04%)
35-40	7(87.5%)	1(14.3%)	-	-	8(30.8%)
40-45	6(54.5%)	5(45.45%)	-	-	11(42%)
45-47	3(60%)		2(40%)	-	5(19%)
>47	-	-	1(100%)	-	1(0.04%)
					26(100%)



Thus if mean dose is increased by 1 unit, then V40 increases by 2 units keeping all other factors constant ($p=0.000$). If mean dose is increased by 1 unit, then V45 increases by 2.5 units keeping all other factors constant. ($p=0.000$). If mean dose is increased by 1 unit, then V50 increases by 2.49 units keeping all other factors constant. ($p=0.000$). There is a statistical relation between the skin dose and the toxicity.

Conclusion-There is a dosimetric correlation between skin dose and toxicity. The status of

pathological skin clearance should be clinically sorted out prior to the start of RT to the whole breast for better cosmetic outcome and in reducing skin toxicity profile. Thus it can result in lowered skin toxicity and better cosmetic outcome.

Images of skin contour. Sky blue-skin; Red-PTV; Green-Body

Abstract BR-03: An Interim Analysis Of Prospective study to compare heart doses for Left sided Breast or Chest wall Radiotherapy using conventional and Deep Inspiratory Breath Hold technique in Breast Carcinoma (DIBH STUDY)

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Objectives-Radiation associated cardiovascular disease in long term survivors of breast cancer has been a concern for decades. The objective of our study is to compare dose to heart and Left Anterior Descending (LAD) artery using conventional and DIBH techniques in left sided breast carcinoma.

Materials and Methods-31 consecutive left breast cancer patients and 30 observations (on 15 initial patients) have been analysed. Pre-radiotherapy planning CT-scans were done in free breathing and in deep inspiratory breath hold using active breathing coordinator system. Patients received 40Gy/15#3weeks for whole breast/chest wall and tumour bed boost dose of 12.5 Gy/5#1week for BCS.3DCRT plans were generated for both scans followed by comparison of anatomical and dosimetric variables using paired t test with IBM SPSS software version 22.

Results-DIBH plans increased lung volume (2325.7vs3410.7 cc, $p < 0.0001$), chest depth (19.5vs20.2 cm, $p<0.0001$), lung orthogonal distance (2.5vs2.9 cm, $p<0.05$) and decreased maximum heart depth (2.1 vs 1.3 cm, $p<0.01$) and heart chest wall length (6.7 vs 6.0, $p<0.001$). DIBH plans decreased mean heart dose (4.8 vs 2.4 Gy, $p<0.001$),V30 of heart (4.9 vs 0.3, $p<0.001$),V5 of heart (16.2 vs 7.8%, $p< 0.002$),V10 of heart (11.6

vs 3.3 %, $p < 0.001$), max dose to left anterior descending artery (LAD) (35.9 vs 25.6 Gy, $p < 0.0001$), lung V20 (11.1 vs 9.2%, $p < 0.06$), lung V12 (13.4 vs 12.0%, $p < 0.19$) and ipsilateral lung V20 (23.0 vs 19.3%, $p < 0.08$).

Conclusion-Interim analysis showed considerable reduction in heart and LAD doses using DIBH technique compared to non DIBH technique in left sided breast carcinoma.

Abstract BR-04: Contouring and Sparing of Cardia and Coronaries in Left sided Breast Cancer patients: A Dosimetric Comparative Study With and Without the Use of Active Breathing Coordinator (ABC)

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Introduction-Cardiac toxicity is a major concern for left breast cancer irradiation. According to Sarah et al Radiation leads to 7% increase in late cardiotoxicity/each Gy delivered to heart (Ref 1). Moderate deep inspiration breath hold (mDIBH) during radiation treatment delivery helps in reducing the cardiac dose. Recent study shows that Dose to left anterior descending artery (LAD) was also important in reducing the cardiac events (Ref 2). This study compares dosimetric parameters of heart and LAD with and without active breath coordinator (ABC) mDIBH during tangential field breast cancer radiation

Aim-To contour and compare the dosimetric parameters for cardia and LAD with and without ABC technique.

Materials and Methods-CT study sets of twenty five consecutive patients with left sided breast cancer who underwent breast conserving surgery and adjuvant tangential field radiotherapy with ABC mDIBH in our centre were taken for this study. Patients with a comfortable breath hold duration of 20 – 25secs were considered eligible to undergo treatment with ABC. Two sets of CT images (with and without ABC) were acquired for each patient. Cardiac and coronary vessels

contoured according to the cardiac contouring atlas. Tangent field treatment plans with a dose prescription of 40 Gy/15 Fr were generated for each patient, in both scans. Dose to the heart and LAD and target coverage were documented.

Results-Patients median age was 45yrs. Mean breath hold duration for ABC was 24.6 seconds and mean threshold for breathing was 1.35 litres. The mean heart dose was 174.6cGy with ABC and 272.88cGy with FB and it showed a 36% reduction in mean heart dose. The mean dose to the LAD was 640.88cGy with ABC and 1115.2cGy with FB. The mean dose to the LAD was reduced by 42%. A longer follow up may predict the long term effects of radiation.

Conclusion-ABC technique has a great impact on critical organ dose – volume parameters (heart and LAD). The mean heart dose and mean LAD dose were reduced by 36% and 42% respectively. These reductions achieved are likely to predict reduced long term cardiac morbidity and mortality.

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2) Caitlin A. Schonewolf, MD, MS, Jennifer Vogel, MD, Michael LaRiviere, Neil K. Taunk, MD, MS, Fifth Author, James Kolker, MD, Suneel N. Nagda, MD, Bonnie Ky, MD, MSCE, and Gary M. Freedman, MD; University of Pennsylvania : High Volume of Low Dose Radiation Delivered to the Left Anterior Descending (LAD) Artery May Increase Risk for Coronary Artery Stenosis in Left-Sided Breast Cancer . ASTRO 2018

Abstract BR-05: A Prospective Comparative Study of Health Related Quality of Life (QoL) and Fatigue Component in Hypofractionated (HFRT) and Conventional Fractionated Radiotherapy (CFRT) in Adjuvant Setting of Breast Carcinoma

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Introduction-Fatigue is one of the major side effects of radiation therapy. Due to physical effects of radiation along with social, emotional & financial factors lead to great psycho social distress causing a fall in the QoL. This study and compares the health related quality of life, fatigue and pain in patients undergoing CFRT & HFRT. Arm A-CFRT: 50 Gy in 25#, 5 days per week, with 2Gy/#

Arm B-HFRT: 40 Gy in 15#, 5 days per week, 2.66Gy/#

Tools & Methodology-We had 30 patients in each arm. Questionnaires used both before and after radiation.

- *Functional Assessment of Chronic Illness Therapy (FACIT) Measurement System (24) FACIT-Fatigue (FACIT-F)*
- *The Functional Assessment of Cancer Therapy (FACT)-Breast FACT-B version 4*

Results-No statistically significant change when compared with the change in pain scores of both the arms (P=0.88). On comparing the mean scores HFRT developed more pain than CFRT (1.8 vs 1.6). Significant decrease in QoL scores in both the arms. On comparing the change in both the arms wrt to QoL we find that there was no statistically significant change (p value =0.15). Comparing both arms change in fatigue scores there was no statistically significant difference, (P =0.40) & both forms of Radiation induces significant fatigue.

Conclusion-Both HFRT & CFRT can be used interchangeably as far as QoL, Fatigue & Pain is concerned as neither is inferior to the other. There is a significant fall in the QoL & significant increase in pain & fatigue irrespective of the regimes used.

Abstract BR-06: A Retrospective Epidemiological Study on the Pattern of Distribution of ER/PR/HER 2-neu/Ki-67 Status among Patients of Carcinoma of Breast, in a Tertiary Care Level Hospital of West Bengal, India

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Background-Carcinoma of breast is one of the predominant causes of cancer related mortality in women. Though commoner in urban parts of India, especially among the affluent society adopting westernized lifestyle, breast cancer is also becoming increasingly prevalent among rural women and women belonging to the underprivileged sections of the society. Epidemiologic data regarding different phenotypic subgroups in Indian women is scarce and more so for rural scenario.

Aim-Our aim was to find out the epidemiological distribution of different phenotypic subgroups in the patients suffering from carcinoma of breast, who attended the Outpatient Department of Radiation Oncology, Burdwan Medical College and Hospital, which predominantly caters to the rural population of the Southern districts of West Bengal. We also aim to find out any difference of disease biology and its epidemiologic distribution in our rural population, with that of the international data.

Methods-This is a retrospective, observational, descriptive, single-institutional epidemiological study from pre-recorded hospital data. Cases of Carcinoma of breast attending the Radiation Oncology outpatient department of Burdwan Medical College and Hospital, during the last five years (June 2013 – May 2018) were selected for this study. Hospital recorded data was taken and analyzed regarding the age of presentation, menopausal status, stage at presentation, histopathological subtypes, tumour grade, hormone receptor (ER/PR) expression status, HER 2-neu expression status, Ki-67 status, and their phenotypic subgroup classification.

Results-Among the 416 patients enrolled for this study 35.8% were premenopausal while 64.2% were postmenopausal with 93.9% of them being of the infiltrating ductal carcinoma variety. Histopathological grade wise, majority of the patients were of Grade III (53.61%) variety and 69.9% of the total number of patients had a high

Ki-67 score. Majority of the patients enrolled had presented in the locally advanced stage (59.6%). The phenotypic subgroup classification of the enrolled patients were as follows: Luminal A – 29.1%; Luminal B – 31.7%; TNBC – 26.9%; HER 2-neu overexpressing – 12.3%.

In subgroup analysis, we found that in premenopausal subgroup, incidence of Luminal B were higher at 42.9%, followed by TNBC at 29.5%, and that of Luminal A disease was low at 22.2%; 77.9% of this subgroup had high Ki-67 score. In the postmenopausal subgroup, Luminal A was the most predominant subtype (32.9%), and 53.9% of the patients were ER positive.

Conclusion-It is concluded from the current study that the Luminal A was the most prevalent subtype in postmenopausal patients of carcinoma of breast while Luminal B was the commonest variety, followed by triple negative carcinoma of breast, in younger premenopausal women and highly aggressive tumours with high Ki-67 score were also commoner in this group. The prevalence of triple negative carcinoma of breast in Indian women is comparable with their western counterparts. Further multi-centric studies involving greater number of patients are required to confirm the results.

Abstract BR-07: Pathological Complete Response after Neoadjuvant Chemotherapy and Survival Outcome among Breast Cancer patients: A Single Institute Experience

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Introduction-Pathological complete response (pCR) after neoadjuvant chemotherapy is important prognostic marker for disease free survival and overall survival, but the association between them is not yet well described.

Materials and Methods-This study included 24 patients of breast cancer who received neoadjuvant chemotherapy and the survival outcome were compared between patients who received pCR and those with residual disease

Result-Out of 24 patients, 5 patients achieved pathological complete response (pCR) after neoadjuvant chemotherapy (NACT). Disease recurrence was seen in only one (20%) patient with pathological complete response v/s 7 (36.8%) patients without pathological complete response. The mean disease free survival was higher in patients with pathological complete response (34 months) as compared to those without pathological complete response (22.4 months). Death occurred in one (20%) patient with pathological complete response v/s 5 (26.3%) patients without pathological complete response. The median overall survival was more in those with pathological complete response (36 months) as compared to those without pathological complete response (34 months).

Conclusion-Pathological complete response after neoadjuvant chemotherapy is associated with improved disease free survival and overall survival. However the results were not significant as the study was small and needs more number of patients for further confirmation.

Abstract BR-08: A Study on Risk Factors of Triple Negative Breast Cancer among Patients attending a Tertiary Hospital from July 2016 to July 2018

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Introduction-To study the risk factors in patients of triple negative breast cancer based on major patients and tumor related variables (Age of presentation, Stage of presentation, First degree relative, Body mass index, Age of menarche, Grade of tumor) and to analyze relative risk of significant variables.

Materials and Methods-A single tertiary centre retrospective study with data from 265 subjects suffering from biopsy proven breast cancer who presented in radiotherapy department at IPGME&R from July'2016 to July'2018 was used to investigate influence of statistically significant variables in patients of TNBC compared to non-TNBC. Data was then analyzed in IBM SPSS 26.0 with help of descriptive analysis, co-relation study, binary logistic regression.

Results-Out of 265 breast cancer patients, 96 patients were found to have TNBC ($z=5.74$).

Among the 6 variables only BMI & Age of presentation found to be significant variables posing as risk factor for TNBC

1. Younger age group increases risk of TNBC (RR = 1.07, P < 0.001).
2. Increase in BMI possess higher risk of TNBC (RR = 1.11, P = 0.003)
3. All other variables have no significant risk with TNBC.

Conclusion-Study shows that age of presentation & BMI are the most significant risk factors for TNBC. This is a single hospital based study.

Abstract BR-10: Dosimetric and Field Optimization parameters between Standard monoisocentric 3 field techniques and posterior Boost/ High energy Photon with regards to supraclavicular dose coverage in Post mastectomy adjuvant radiation treated with 3D-CRT

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Introduction-We compared the monoisocentric 3 field technique (2 tangential and one AP field) vs the use of Extra posterior/Higher energy MV with respect to homogeneity and conformality index of the Supraclavicular dose, and occurrence of Hot spots, and OAR doses.

Materials and Methods-9 Postmastectomy patients were treated using 3D-CRT techniques. For each patient, 3 plans, 1 standard 3 Field monoisocentric with AP SCLF, and 2 tangentials (**Plan A**). PLAN A supplemented with higher energy 10 MV / weighted PA fields/ (**PLAN B**). Field in field techniques were used in both Plan A and B. **Plan C** was a conventionally simulated plan (using the same CT data set). Plan A and Plan B was estimated according to target coverage, Hotspots, and OAR DVH. Plan C was just compared with A & B to estimate the mean dose in SCF according to ICRU limits

Results-Plan A was most optimised regarding all parameters in 7/9 patients The 2 patients treated with Plan B had depths of axilla and

supraclavicular >6cm & >7 cm respectively (higher than rest cohort), and also increased A-P length than rest cohort Use of higher MV and PA field increased dose coverage in SCLF at the cost of hot spots..Use of FIF technique was more efficient in reducing hot spot size and better homogeneity index in the chest wall than the junctional Field area.. 21 % of the patient in PLAN C received mean dose within ICRU limits whereas 88% received it with Plan A & B

Conclusions-Monoisocentric 3 field is a good choice for most of the PMRT patients. Posterior fields and higher MV with use of FIF gives a acceptable SCLF dose distribution in selective patients.

Abstract BR-11: Axillary Lymph Node Coverage with 3-D Tangential Field Whole Breast Irradiation in Post Breast Conservation surgery patients- An Institutional Study

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Purpose-The American College of Surgeons Oncology Group (Z0011) trial indicated no benefit from axillary lymph node (LN) dissection after a positive sentinel LN biopsy in patients receiving whole breast irradiation, suggesting that level I-II LNs were covered in tangential fields

Aims and Objectives-To evaluate the axillary lymph node coverage in post breast conservation surgery patients who received whole breast radiotherapy by 3-dimensional tangential field irradiation.

Materials and Methods-Sixteen computed tomography-based tangential whole breast radiotherapy plans were evaluated which were planned for a total prescribed dose of 40 Gy in 15 fractions. Level I, II and III axillary LNs were contoured using Radiation Therapy Oncology Group guidelines. The mean and median dose coverage of the three different levels of axillary lymph nodes was calculated.

Results-Mean and median dose coverage of Level -I axillary lymph nodes were 36.74 Gy and 37.14

Gy, which were 91.84% and 92.84% respectively of the prescribed dose of 40 Gy. Similarly, mean and median dose coverage of Level –II axillary lymph nodes were 30.59 Gy and 31.21 Gy, which were 76.48% and 78.01% respectively of the prescribed dose. Further, Mean and median dose coverage of Level –III axillary lymph node were 10.51 Gy and 5.72 Gy, which were 26.27% and 14.3 % respectively of the prescribed dose.

Conclusion-In this review of conformal CT-based 3-dimensional tangential whole breast irradiation plans, level-I LNs were covered by approximately 92% of the prescribed dose which is inadequate. In only 31% of cases, Level-I lymph nodes were covered by 95% of the prescribed dose. Doses to level-II LNs were around 76.5 % of the prescribed dose which was sub-therapeutic. Doses to Level-III axillary LNs were minimal with only 26% of the prescribed dose.

In this group of patients, a standard tangential radiation field did not provide significant therapeutic coverage of level-I and Level-II LNs and provided negligible coverage of level-III LNs.

Key Words-Axillary lymph node, 3D tangential whole breast irradiation, dose coverage, prescribed dose.

Abstract BS-01: Role of Extra Corporeal Radiotherapy in Management of Primary Bone Tumors

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Material and Methods-From year 2014 to 2017 patients of primary bone tumor were enrolled. 6 of Ewing's sarcoma and 5 were of osteosarcoma. After neoadjuvant chemotherapy, surgery was performed which consists of en bloc removal of tumor and involved bone.

Bone segment was irradiated on 6 MV linear accelerator with parallel opposed field at a dose of 50 gray. After which bone was re-implanted with fixation device.

Result-During median follow up period of 18 months none of the patient develop local recurrence. One patient developed lung and subsequently Brain Mets without local failure.

Conclusion-ECI is the safe and effective way for local control of primary bone tumor. However

more studies and longer follow up period will needed to validate results.

Abstract BS-02: Diagnosis, Prognosis and Optimal Management of a Case Series of Extraosseous Ewing's Sarcoma: Experience in a Tertiary Care Institute in Eastern India, between 2016-2018 and review of literature

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Introduction-The Ewing sarcoma family of tumors (ESFT), characterized histologically by primitive small round cells of neuroectodermal origin, includes Classic Osseous Ewing sarcoma, PNET, Askin tumor (Ewing sarcoma of the chest wall) and Extraosseous (soft-tissue) Ewing sarcoma. Extraskelatal Ewing sarcoma represents a small subset of the ESFT, though the exact incidence has not yet been ascertained.

Materials and Methods-5 cases of extraosseous Ewing's sarcoma i.e. one in kidney, one in suprarenal gland and 3 cases in lungs diagnosed histopathologically attended in Radiation Oncology OPD in IPGMER between 2016-2018 were accrued. Their clinical, radiological, operative and histopathological findings, course of treatment and response are reviewed and analysed.

Result-Mean age of the study population is 24.4 yr. Male : female is 3:2. None of them had addiction history or significant family and past history. Three patients received NACT showing partial response followed by surgery and two of them were given Adj RT. One patient presented after surgery with bone mets received palliative CT. One patient had metastasis at presentation received Palliative CT and lost to follow up after 4 cycles. 3 patients on follow-up are doing well and 1 patient is undergoing treatment. EWS-FLI gene study was done in two patients- both found positive.

Conclusion-Non metastatic disease at presentation carries better prognosis. A trimodality approach with NACT followed by surgery and Adj CT & Adj RT, if indicated should be followed. While the diagnosis relies on the HPE and IHC, finding

awareness of this clinical entity can help radiologist and physician to make an early diagnosis. Regular follow up is necessary as it has high rate of local recurrence and distant metastasis. EWS-FLI gene study should be done in all cases and in future gene therapy or targeted therapy might improve the outcome of metastatic disease.

Abstract BT-01: A Dosimetric Study of Cobalt 60 Source Based High Dose Rate Intravaginal Brachytherapy: A Case Series of 20 Patients

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Introduction-To analyse the dosimetric parameters of Co-60 source based HDR intravaginal brachytherapy in patients of cancer cervix and endometrium.

Materials and Methods-A study was conducted on 20 patients of cancer cervix and endometrium who were fit for boost to local vaginal cuff by intravaginal brachytherapy post pelvic radiation by EBRT. Computed tomography images were obtained after cylinder application. Patient was planned for 2 weekly fractions (#) 5 Gray (Gy) each.

Results-The mean dose to clinical target volume (CTV) at 90% volume (D_{90}) was found to be 145 % (standard deviation SD: 17). The mean D_{2cc} (dose to 2 cubic centimeter volume) of the bladder, rectum, sigmoid colon and bilateral femur heads was found to be 7.04Gy (SD:0.77), 7.43Gy (SD:1.09), 2.28Gy (SD:0.95) and 0.27 Gy (SD:0.28) respectively.

Conclusion-The target coverage to target volume and organs at risk was achieved as per American Brachtherapy Society guidelines. Hence it is concluded that the Co-60 based cylinder cuff brachytherapy is a good choice in patients after pelvic irradiation in terms of optimizing the doses to organs at risk which is a primary concern in pelvic irradiation.

Abstract BT-02: A Prospective Evaluation of Interfraction Change in Dosimetric Parameters in Patients of Locally Advanced Carcinoma Cervix undergoing Intracavitary Brachytherapy

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Background-Recent advances in technology have allowed the use of volumetric imaging in gynecological brachytherapy planning. Evaluation of interfraction organ deformation and its association with dose distribution are essential to analyze the risk of acute and late adverse events on Organs at risk. Data from some of the recent series have highlighted the problem of interfraction dose variation in HDR brachytherapy using volumetric imaging modalities.

Purpose-Keeping these previous works in the background, the aim of this study is evaluation of interfraction change in dosimetric parameters by CT guided imaging of Target volumes and organs at risk along with its comparative analysis during the course of Intracavitary brachytherapy.

Methods-Following the completion of External beam radiotherapy, image (CT) guided High Dose Rate Intracavitary brachytherapy was with a strict bladder protocol. To analyse the interfraction change in detail, every applicator insertion was imaged to obtain dose volume histogram parameters. The GTV, IRCTV, HRCTV & OARs were contoured on the CT images based on the prebrachytherapy MR image and clinical findings as well as the present CT findings. Treatment of all the patients was provided by the GammaMedplus HDR afterloader machine using Iridium¹⁹². All the contours were compared with the initial reference CT images.

Results-For a sample size of 32 patients, the systematic dosimetric variations for all organs at risk, i.e. mean variations of D_{2cm^3} , were found to be minor (<5%), while random variations, i.e. standard deviations were found to be high due to large variations in individual cases. The D_{2cm^3} variations (mean \pm 1SD) were

0.7 ± 17.6% and 3.4 ± 23.1% for the bladder and rectum. For HR CTV, the variations of D90 were found to be -1.3 ± 14.2% for the whole sample. No statistically significant differences between the two groups were detected in dosimetric variations for the HR CTV.

Conclusion- Substantial variations occur in fractionated cervix cancer ICBT but the treatment approach has to balance uncertainties for individual cases by maintaining Institution based protocol against the use of repetitive imaging, adaptive planning and dose delivery.

Abstract BT-03: Calculation of Dose Volume parameters and indices in plan evaluation of HDR interstitial brachytherapy by MUPIT in Carcinoma cervix.

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Introduction- Evaluation of a HDR- interstitial brachytherapy plan is a challenging job. Owing to the complexities and diversity of the normalization and optimization techniques involved, a simple objective assessment of these plans is required. This can improve the radiation dose coverage of the tumour with decreased organ toxicity. To study and document the various dose volume indices and parameters required to evaluate a HDR interstitial brachytherapy plan by Volume normalization and graphical optimization using MUPIT (Martinez Universal Perineal Interstitial Template) in patients of carcinoma cervix. Single arm, retrospective study.

Materials and Methods - 35 patients of carcinoma cervix who received EBRT and HDR brachytherapy using MUPIT, were selected. The dose prescribed was 4 Gray/Fraction in four fractions (16Gy/4) treated twice daily, at least 6 hours apart. CTV and OARs were delineated on the axial CT image set. Volume normalization and graphical optimization was done for planning. Coverage Index (CI), Dose homogeneity index (DHI), Overdose index (OI), Dose non-uniformity ratio (DNR), Conformity Index (COIN) and dose

volume parameters i.e. D2cc, D1cc, D0.1cc of rectum and bladder were evaluated.

Results- CI was 0.95 ± 1.84 which means 95% of the target received 100% of the prescribed dose. The mean COIN was 0.841 ± 0.06 and DHI was 0.502 ± 0.11. D2cc rectum and bladder was 3.40 ± 0.56 and 2.95 ± 0.62 respectively which was within the tolerance limit of these organs.

Conclusion- There should be an optimum balance between these indices for improving the quality of the implant and to yield maximum clinical benefit out of it, keeping the dose to the OARs in limit. Dose optimization should be carefully monitored for the acceptability criteria of these plans.

Abstract CN-01: Outcome of patients with vestibular schwannoma treated with Linac based stereotactic radiosurgery-a single center experience

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Introduction- Stereotactic radiosurgery (SRS) is the treatment of choice as primary modality for vestibular schwannomas <3 cm in size and as an adjuvant for residual after surgery. We aimed to analyze the outcome, treatment related toxicities, and its correlation to patient and treatment related factors in patients with vestibular schwannomas who received Linear Accelerator (LINAC) based SRS.

Materials and Methods- Among the 100 patients, there were 101 tumors. The radiation treatment plan parameters such as tumour volume, tumor margin radiation dose, conformity index, and brainstem dose were noted from the records along with the indication for SRS, hearing and facial nerve function at follow up and were correlated with outcome and toxicities.

Result- SRS was primary for 53(52.5%), adjuvant in 35(34.6%), for post surgery recurrence in 13(12.9%). Progression free survival (PFS) was 96% and overall survival was 99% with a median follow up period of 5 years (0.5 to 10). At presentation, 13(12.9%) had House-Brackmann (H&B) grade 3-4 facial paresis and 5(4.9%) had

grade 5-6 facial palsy. On follow up, in 2(1.9%), paresis resolved completely and new onset facial paresis was seen in 4(3.9%). Surgical resection was a co-variate that was significant for facial nerve paresis. Five (4.9%) of them noticed worsening of hearing within median duration of 5 years (2-7).

Conclusion: SRS is an effective treatment modality for Vestibular Schwannoma with minimal toxicity. Radiation treatment plan parameters did not affect the outcome of tumor control and complications. Prior surgery was a significant factor that affected facial nerve function deterioration.

Abstract GI-01: Clinicoradiological response of Rectal Cancer post Neo-adjuvant Chemoradiation and its correlation with outcomes and decision making.

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Introduction: The standard treatment of locally advanced rectal adenocarcinoma is neo-adjuvant chemoradiation followed by total mesorectal excision with or without adjuvant chemotherapy. Radiation dose of 50 Gy at 1.8-2 Gy per fraction with 5-FU based chemotherapy is known to achieve complete clinical response in about 15-27% cases. Observation post complete clinical response has emerged as a viable treatment alternative, however 15-20% of these patients experience local tumor progression. Escalating dose till 60 Gy to primary rectal tumor using local boost with intracavitary HDR brachytherapy or external beam radiotherapy has shown to improve complete clinical response. Reassessment using palpation, endoscopy and MRI is necessary to decide on the need for further treatment with surgery or postpone surgery with the intention of organ preservation.

Materials and Methods: Non metastatic cT2-4 cN0-2 adenocarcinoma rectum cases who received NACTRT to a dose of 45-55.8 Gy with concurrent capecitabine followed by endorectal brachytherapy to a dose of 8 Gy over 2 fractions from October 2017 to August 2018 were retrospectively assessed at pre-treatment, conclusion, 6 weeks and 12 weeks. Clinical extent of disease using digital rectal examination and maximum thickness using T2W

MRI imaging were recorded and clinical outcome correlated.

Result: 66 patients received NACTRT of whom 21 received brachytherapy boost. 16 out of 21 patients showed either complete response or near complete response, 6 patients underwent surgery, 1 had distant metastasis and 9 had organ preservation with no progression at a median follow up of 6 months. Among 5 patients who had incomplete response, 2 refused surgery. No grade 2 toxicity or late toxicities recorded. Among the patients with organ preservation mean clinical response at conclusion, 6 weeks and 12 weeks were 47%, 74% and 82% (SD of 13, 24 and 18) and MR response at the same time points being 46%, 64% and 75% (SD of 22, 5 and 18).

Conclusion- Assessing clinicoradiological response at conclusion of NACTRT for cases of adenocarcinoma rectum may help us to decide on dose escalation and organ preservation.

Abstract GU-01: The Role of EBRT in Organ Preservation for Penile Cancer: A Tertiary Care Institutional Experience.

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Introduction- Penile carcinoma is one of the most common genitourinary cancers encountered in developing countries like India where aim of treatment is to completely remove the primary tumour. Partial or total penectomy is the gold standard of therapy. However, the disfigurement that follows penile amputations has directed more efforts towards organ-sparing techniques such as partial excision, Mohs microsurgery, and non-surgical techniques with radiotherapy, lasers, or cryotherapy.

Aims and Objective- To study the role of EBRT in the treatment of Tis, T1-T2, N0, M0 carcinoma of the penis and assess the quality of sexual life post radiotherapy in early, node negative carcinoma penis.

Materials and Methods- Biopsy proven cases of carcinoma penis attending RTD OPD of Medical College Kolkata from January, 2017 to May, 2018, Tis, T1-2, N0, M0 at presentation received 60 Gy in 30 fractions over 6 weeks with parallel opposed lateral (Co60) fields to encompass the entire length of the penis with the patient in supine position. The physical set-up consisted of a rectangular wax block placed around the shaft of the penis to achieve a uniform dose distribution according to the Toronto technique. After completion of EBRT, all patients were followed up at 3 weeks, 6 weeks, thereafter 3 monthly till last visit. During each follow up visit, clinical examination and QOL assessment for sexual function was done before EBRT and 3 months and 6 months after completion of EBRT.

Results- Of the five patients included in this study, four of them were CR post radiotherapy with normal sexual function while one of them had to undergo partial amputation due to post RT persistent and progressive lesion.

Conclusion- Organ preservation is a much sought-after paradigm in oncology and is exemplified in the management of penile cancer. The decision about whether organ conservation is appropriate, and which modality to use, is best made in a multidisciplinary meeting, with discussion between the radiation oncologist and urologist.

Abstract GU-02: Evaluation of Chronic toxicities in the patients of Cancer Prostate treated with IMRT with daily CBCT.

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Introduction- Prostate cancer has always been one of the most common malignancies in men. Patients having localized prostate cancer have many treatment options that include prostatectomy, brachytherapy, and EBRT. EBRT can be given by various techniques such as 3DCRT, IMRT and IGRT. By using IMRT technique higher dose of radiation can be given to the prostate and toxicity reduced to the surrounding organs. For implementation of this technique we follow the patient for over the period of two and more years

for genitourinary, gastrointestinal and other toxicities.

Material and Methods- In this study 42 patients from 2010 to 2016 that were treated with IMRT with daily CBCT for adenocarcinoma of prostate were taken. Most patients received treatment to the prostate to a median dose of 76 Gy. Late toxicities were noted and defined as per RTOG late radiation morbidity scheme as greater than 2 years after radiation therapy completion.

Results- With a median follow-up of 60 months, the 2-year freedom from maximal Grade 2+ late toxicity was approximately 90% and 80% for GU and GI systems, respectively.

Conclusion- IMRT with daily CBCT is associated with low rates of severe GU or GI toxicity after treatment for prostate cancer.

Abstract GU-03: Outcome of organ sparing trimodality treatment in muscle invasive bladder cancer

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Background- Radical cystectomy is the standard of treatment for muscle invasive bladder cancer but Bladder preservation with trimodality treatment using maximal TURBT and chemo-radiation therapy has shown good results. In this study we have evaluated treatment response, overall survival and recurrence free survival in patients with muscle invasive bladder cancer.

Material and Methods- Total forty-seven patients with biopsy proven muscle invasive bladder cancer, unfit and unwilling for RC were treated with chemo-radiation therapy after TURBT between Jan 2012 to Jan 2018. Three patients didn't continue radiotherapy and two patients didn't completed chemotherapy. Total forty-two patients followed the protocol; radiation therapy consists of 2 Gy per day up to 60-66Gy over a period of 6-7 weeks. Chemotherapy consists of induction chemo

followed by concurrent weekly cisplatin(40 mg/m²) alongwith radiotherapy.

Results- Median age of the patients was 55 years. Median follow-up of 40 months. Overall survival and recurrence free survival was 59% & 50% respectively at 5-years using the Kaplan-Meier method. Overall response rate was satisfactory (Complete 62.22% and partial 33.88%). Acute Grade 3 toxicities of concurrent chemoradiation were nausea, vomiting, diarrhoea and cystitis in 10.6%, 12.7% and 12.7% cases respectively but it was acceptable and manageable and a salvage cystectomy rate of 19% (8) for patients with local recurrence following TMT.

Conclusion- Trimodality bladder preservation treatment is an effective alternative to radical cystectomy for patients who wish to preserve the bladder.

Keywords: Muscle Invasive Bladder Cancer (MIBC), Trimodality Treatment (TMT), Transurethral Resection of Bladder Tumor (TURBT), Radical Cystectomy (RC).

Abstract GY-01: Comparison of Outcomes and Toxicity in Locally Advanced Carcinoma Cervix Treated with Hypofractionated Radiotherapy and Concurrent Cisplatin versus Conventional Radiotherapy And Concurrent Cisplatin

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Introduction- Conventionally fractionated radiotherapy with concurrent cisplatin followed by intracavitary brachytherapy is the standard practice for locally advanced carcinoma cervix. Local tumour control decreases by 0.5% per day when the overall treatment time exceeds 49 days. Hypofractionation involves giving larger dose per fraction, reducing the total number of fractions and the overall treatment time, leading to better patient compliance. It can reduce the long waiting time for

initiating treatment by reducing the load on machine.

Materials and Methods- A single institution longitudinal study was done comprising of 62 patients of locally advanced carcinoma cervix, who first attended the Radiotherapy Department between 2015-2016. 33 patients received conventionally fractionated pelvic EBRT with concurrent cisplatin. 29 patients received hypofractionated EBRT with concurrent cisplatin. Following EBRT, all patients received 3 fractions of intracavitary HDR brachytherapy, 7 Gy per fraction. The patient characteristics, response to treatment and side effects were noted and analyzed.

Results- Commonest presentation in the 5th decade, in stage IIIB. 6 wks post-treatment, 83.3% and 76.7% patients in the hypofractionated and conventionally fractionated arm respectively showed CR (p=0.556). The mean DFS for the hypofractionated and conventionally fractionated arm were 19.6 months and 18.2 months respectively (p=0.433).

The hypofractionated arm had higher rates of both acute and late toxicities (p> 0.05). On univariate analysis, age and haemoglobin levels were found to have significant relationship with response at 1 year. On multivariate analysis, haemoglobin level retained significance.

Conclusion: Patients in both the arms showed comparable response in terms of loco-regional control and toxicity. However, further studies are required to derive more conclusive evidence regarding this matter.

Abstract GY-02: Retrospective Study of Sexual Dysfunction after Radiotherapy for Cervical Cancer

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Background- Sexual dysfunction in gynaecologic cancer patients is a field of increasing interest. This reflects a greater acknowledgment of sexual

problems after cancer diagnosis and treatment. Furthermore, the demand for dialogue between health care professionals and patients on all aspects of adverse effects after treatment is increasing. Patients treated for cervical cancer by external beam & intracavitary RT (EBRT & ICRT) are likely to experience radiation-induced damage to the vaginal mucosa, causing stenosis and fibrosis that may lead to sexual dysfunction. This retrospective study aims to describe the self-reported sexual function in females treated for cervical cancer by RT.

Materials & Methods- A total of 50 patients of cervical cancer referred for RT were included. The patients were assessed for sexual function, using a validated self-assessment questionnaire- European Organization for Research and Treatment of Cancer Quality-of-Life Questionnaire (EORTC QLQ-CX24), at the termination of RT and 1, 3 & 6 months later. The results were compared with pre-diagnosis sexual function of the patients using Wilcoxon's signed rank test and a p-value of <0.05 was considered significant.

Results- Persistent sexual dysfunction was reported throughout the 6 months after RT. Approximately 80% had low or no sexual interest, 30% had moderate to severe lack of lubrication, 50% had mild to severe dyspareunia, and 25% were dissatisfied with their sexual life. Despite sexual dysfunction, 60% of those sexually active before having cancer remained sexually active after treatment, although with a considerably decreased frequency.

Conclusion- Patients who are clinically disease free after RT for cervical cancer are at a high risk of experiencing persistent sexual problems and there is a need to counsel the patients about the importance of regular intercourse after RT & the likelihood of adverse effects to decrease their anxiety.

Abstract GY-03: Comparison of Neoadjuvant Chemotherapy Followed by Concomitant Chemo-radiation with Concomitant Chemo-radiation Alone in Patients with Locally Advanced Cervical Cancer

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Introduction- The role of neoadjuvant chemotherapy (NACT) has been investigated in order to improve prognosis of patients with locally advanced cervical cancer. NACT before radiotherapy could potentially eradicate subclinical distant metastasis, reduce the tumour size and correct pelvic anatomy distortion, ultimately allowing better delivery of radiation.

Materials and Methods- Between June 2015 and November 2018, 100 patients were randomly assigned, 50 patients in the neoadjuvant chemotherapy plus concomitant chemoradiation group (GROUP A) and 50 patients in the concomitant chemoradiation only group (GROUP B), with a median follow-up time of 28.5 months. Patients in group A received three cycles of Taxane based neoadjuvant chemotherapy followed by concurrent EBRT then ICRT. Patients in group B received concurrent CTRT followed by ICRT. Both the groups were assessed for response evaluation and toxicity grading every month for three years.

Results- 74.5% in group NACT v/s 66.7% in group CTRT (p=0.01) had complete response to treatment. 25.5% (NACT) v/s 33.3% (CTRT) patients had residual pelvic disease. The delayed toxicities at 24 months or later after treatment completion in the neoadjuvant chemotherapy plus concomitant chemoradiation group versus the concomitant chemoradiation only group were rectal (2.2% v 3.5%, respectively), bladder (1.6% v 3.5%, respectively), and vaginal (12.0% v 15.7%, respectively).

Conclusion- Neoadjuvant chemotherapy resulted in better clinical response and less residual disease with similar toxicity profile, thereby suggesting NACT with concurrent chemoradiation to be a viable option for patients with locally advanced cervical cancer.

Key words- Taxane, Neoadjuvant chemotherapy

Abstract GY-04: Association of Bone Marrow Dosimetric Parameters and Acute Hematologic Toxicity in Patients of Locally Advanced Cervical Cancer Treated With

Conformal Radiotherapy and Concurrent Weekly Chemotherapy - Comparison of 3DCRT and IMRT

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Introduction- Acute haematological toxicity is common in patients receiving concurrent chemoradiation in carcinoma cervix. The objective of this study was to compare the dose received by the bone marrow by IMRT and 3DCRT techniques and to correlate the severity of acute hematological toxicity.

Material and Methods- A prospective randomized study was done by taking 56 patients of locally advanced carcinoma cervix in each arm 3DCRT and IMRT with weekly concurrent cisplatin were evaluated. Pelvic bone marrow (BM) was contoured for each patient and divided into four sub region: Ilium (IL), Lower pelvis (LP), Lumbo-sacrum (LS), and Pelvic Bone marrow (BM). The volume of each BM region receiving 10,20,30,40 Gy was calculated (V10, V20, V30 and V40). Weekly blood counts were recorded and graded as per common toxicity criteria version 4.0 for all the patients

Results- IL-V10, V20, V30, V40Gy, LS-V10, V20, V30, V40; LP-V20, V30, V40 Gy were significantly reduced in the IMRT planning group compared to the 3DCRT planning group. Grade 2 or greater acute anemia, leukopenia, neutropenia, thrombocytopenia was observed as 40%, 36.4%, 29.1%, 1.8% in IMRT group and 54.5%, 43.6%, 30.9% and 1.8%. Logistic regression analysis of potential predictors showed that none of the dosimetric parameters were significant for predicting acute HT.

Conclusion- IMRT planning significantly reduced irradiated bone marrow as compared to 3DCRT planning. Even though this reduction of dose did not correlate with the clinical occurrence of acute hematological toxicity, incidence of haematological toxicity was less in IMRT arm. The concurrent cisplatin based chemotherapy is the probable cause for the acute haematological toxicities in our set of patients.

Abstract GY-05: Assessment of Impact of Bone Marrow Sparing for Haematological Toxicities in Cervical Cancer with External Beam Radiation Therapy

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Introduction- Cervical cancer is a leading cause of cancer death in women worldwide. CT guided bone marrow-sparing intensity modulated radiation therapy has shown potential to reduce acute toxicity of chemoradiotherapy.

Materials & Methods- We enrolled patients with stage IB to IVA cervical carcinoma in two arms with 25 patients each receiving either 3DCRT and IMRT from Jun 2017 to Oct 2018. All patients received weekly cisplatin concurrently with once-daily external radiation by 3DCRT or IMRT, followed by intracavitary brachytherapy. The primary endpoint was the occurrence of either acute grade ≥ 3 neutropenia or anaemia or clinically significant diarrheaduring the course of chemoradiation therapy. Dosimetric analysis was also done for volumes of bone marrow and bowel bag irradiated.

Results- The median age was 50 years. The median follow-up duration was 6 months. The incidence of grade ≥ 3 neutropenia and clinically significant GI toxicity was 19% and 10 % in 3DCRT and IMRT, respectively. V5, V10, V20, V30, V40, V50 were lower in IMRT arm than 3D CRT arm. V30 and V45 for bowel bag was also significantly lower in IMRT arm.

Conclusion- IMRT reduces acute hematologic and GI toxicity compared with standard treatment, with promising therapeutic outcomes

Abstract GY-06: An Institutional Prospective Study on Interfractional Setup Error in Carcinoma Cervix Patients Undergoing Radiotherapy

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Introduction- Interfraction setup variation is important uncertainty in patients treated with External Beam Radiotherapy for cervical cancer. We studied to assess whether the ITV (Internal target volume)–PTV (Planning target volume) margin is adequate in the patients treated at our institution

Materials and Methods- 20 patients were treated on linear accelerator with 50Gy in 25fractions,5 fractions per week. Patients were immobilized in supine position with knee and ankle rest. Patients emptied bladder and drank 500ml water 40minutes before simulation and before treatment. CBCT was done twice a week and these images were registered with planning CT scan images and translational errors were recorded, bladder and rectal volume were contoured. The margins of planning target volume were calculated from setup variations using Van Herck's formula.

Results- The setup variation was 3.6mm in mediolateral, 4mm in superoinferior and 3.6mm in antero-posterior direction. Mean bladder volume at simulation was 217cc and during treatment from week 1-5 are 283.7cc, 225.7cc, 209.4cc, 159.8cc, 153.9cc. Mean rectal volume at simulation was 50.6cc and during treatment from week 1-5 are 58.6cc, 54.5cc, 52.4cc, 55.9cc, 52cc respectively. Soft tissues were measured.

Conclusion- In our set of patients 5mm ITV-PTV margin is adequate and in centres with high workload daily imaging is not necessary if margin is adequate. CBCT may be appropriate in week 4,5 when bladder volume appears to be smaller.

Abstract HN-01: Radiation Induced Changes in CT Number and Volume of Gross Tumour Volume and Parotid Glands during the Course of IMRT for Head and Neck Cancers

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Introduction-CT number (CTN) for the tumour and organs at risk can change with radiation therapy which could be an early indicator for radiation response. This study investigates the correlation of radiation induced changes in volume

and CTN in gross tumour volume (GTV) and parotid glands (PG) during the course of intensity modulated radiation therapy (IMRT) in head and neck cancers (HNC).

Material and Methods-Re-CT scans were acquired at 4 weeks for 71 patients with stage II-IVb HNC treated with chemoradiation. The changes in volumes and CTN of the GTV primary, GTV node and PG at 4 weeks of radiation were analysed. Pearsons's correlation were used to assess any correlation between CTN change and volume reduction of the GTVs and PGs.

Results-The volumes of the GTVs and the ipsilateral PG and contralateral PG were reduced during the course of the radiation therapy after 4 weeks with mean volume shrinkage of 26.30 ± 7.66 ($p<0.0001$), 32.09 ± 37.2 ($p<0.04$), 8.38 ± 1.61 ($p<0.0001$) and $9.10\pm 1.81\text{cm}^3$ ($p<0.0001$) respectively and the mean CTN reduced by 2.50 ± 5.4 , 1.79 ± 4.12 , 1.90 ± 3.57 and 1.99 ± 3.54 HU's respectively. For GTVs, the CTN and GTV volume decreases were found to be positively correlated though the relationship is weak. However, no noticeable correlation were observed between the CTN change and the volume change in both PGs.

Conclusion-The CTN changes in GTVs and PGs during delivery of radiation for HNC is measurable and are patient specific. The CTN can be reduced in GTVs and PGs with a reasonable correlation between the mean CTN and volume reductions in GTVs, but no correlation with PGs.

Abstract HN-02: Assessment of Toxicity and Survival Outcome of Neoadjuvant Chemotherapy followed by Reduced Dose Radiotherapy in HPV Positive Oropharyngeal Cancer

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Objective-Assessment of toxicity and survival outcome of NACT followed by reduced dose radiotherapy in HPV positive oropharyngeal cancer

Methods-It is single-arm, phase 2 trial. Newly diagnosed biopsy-proven LASC oropharynx,

positive for HPV by p16 testing, PS 0 or 1 were included. Patients received 3 cycles of NACT with TIP regime given 21 days apart, followed by IMRT plus 30 mg/m² cisplatin per week concomitantly. Complete or partial responders to NACT received 54 Gy in 27 fractions, and those with less than partial or no responses received 60 Gy in 30 fractions. The primary endpoint was progression-free survival at 1 year.

Results-Between 2017 to 2018, 14 patients were enrolled with a median age of 52 years for analysis. 65% patients with CR or PR to NACT received 54 Gy, and 35% with less than partial responses received 60Gy. Median follow-up 10 months. 10% had locoregional recurrence and one had distant metastasis; 1-year progression-free survival was 95%. 50% patients had grade 3 adverse events, but no grade 4 events were reported. The most common grade 3 events during NACT were leucopenia (60%), and during chemoradiotherapy was mucositis (20%). No patient was dependent on a gastrostomy tube at 3 months and none was dependent 6 months after treatment.

Conclusions-NACT followed by reduced dose (15%-25%) radiotherapy in HPV positive oropharyngeal cancer was associated with same progression-free survival and an improved toxicity profile compared with historical regimens using standard doses.

Abstract HN-03: Quality of Life of Patients with Head and Neck Squamous Cell Carcinoma (H&NSCC) receiving 3D-CRT vs IMRT Technique with Concomitant Chemotherapy with Cisplatin

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Introduction-Oncological outcomes are mainly centered around quantity rather than quality-of-life (QoL) which may sometimes be more relevant for the individual. Hence a balance has to be maintained between the two. This study prospectively evaluates and compares QoL outcomes in patients with H&NSCC randomized to either 3D-CRT or IMRT and assess serial longitudinal change in QoL over time.

Materials and Methods-QoL of all patients was assessed using the EORTC-QoL questionnaire head-and-neck-35-module (QLQ-H&N35) at baseline, end of treatment and 3 months post-treatment. Mean scores of individual domains of 3D-CRT and IMRT were compared using 't-test' at each time point; while longitudinal change in mean scores of both groups was evaluated by ANOVA-test.

Results-Thirty randomized patients who filled the H&N-QoL-questionnaire at all three time points were included in the analysis. QoL domains such as taste (P=0.04), speech (p=0.03) and eating (p=0.03) were better preserved with IMRT compared to 3D-CRT three months post-EBRT. There was deterioration in QoL scores immediately post-treatment in both arms which improved after three months for most domains.

Conclusion-IMRT results in clinically and statistically significant QoL scores for some domains compared to 3D-CRT after 3 months of treatment, that could advocate its widespread adoption in routine clinical practice.

Abstract HN-04: A Prospective Comparative Study of Quality of Life (QoL) Outcomes in Patients with Head and Neck Squamous Cell Carcinoma (HNSCC) treated with Intensity Modulated Radiotherapy (IMRT) versus 3-Dimensional Conformal Radiotherapy (3DCRT)

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Aims/Objectives-The purpose of the study is to assess and compare the health-related quality of life (HRQOL) of patients with head and neck squamous cell carcinoma (HNSCC) undergoing radical radiotherapy with intensity modulated radiation therapy (IMRT) technique with three-dimensional conformal radiation therapy (3D-CRT) technique.

Materials and Methods-From January 2018 to May 2018, 40 patients of biopsy proven squamous cell carcinoma of oropharynx, larynx and hypopharynx (cT1-3N0-3M0 except cT1N0 glottic

cancer) undergoing radical radiotherapy either alone or with concurrent chemotherapy were included in this study. Patients were treated with radical doses with conventional fractionation using either IMRT or 3DCRT technique. The European Organization for Research and Treatment for Cancer (EORTC) QLQ-C30 and HN35 were used to study the HRQOL and assessed for each patients at baseline i.e. before the commencement of radiation, at 3rd week during radiation, after completion of treatment, at 1 month and at 3 months of follow up. Radiation induced acute toxicities were assessed by Radiation Therapy Oncology Group (RTOG) toxicity criteria every week during radiotherapy. For comparison, QOL data collected at different point of time were analyzed using unpaired 't' test. Acute radiation induced toxicities were compared between the two arms using chi-square test.

Results-40 patients were included in the study. The mean age of the sample population was 60 years with predominant male population (90%). Larynx was the commonest site (18 patients, 45%). 13 patients (32.5%) had T3 disease and 10 (25%) patients had node positive disease. 15 (35%) patients received cisplatin based concurrent chemotherapy. The number of patients treated with 3DCRT and IMRT were 19 and 21 respectively. HRQOL scores of various components deteriorated during and after treatment in both the arms. HRQOL scores of fatigue (24 vs 17, $p=0.041$), appetite loss (73 vs 44, $p<0.001$) and sense problems (31 vs 15, $p<0.001$) were significantly worse in IMRT group during and after completion of treatment. However, this difference was not evident at 3 months of follow up. Dryness of mouth and sticky saliva were significantly more in 3D-CRT group (HR-QoL score for dryness of mouth 60 vs 0, $p<0.001$ and for sticky saliva 9.52 vs 0, $p=0.24$) during radiation and 3 months after completion of treatment.

Insomnia and ill feeling were found to be significantly more in 3DCRT patients. Other parameters of HRQOL, like global health, physical, emotional and social functions, speech and swallowing, nutritional parameters remained comparable in both arms. There was no grade 4 or above acute toxicities. No significant difference was observed in acute toxicities e.g. mucositis, dysphagia, skin toxicities between IMRT and 3DCRT arm during radiotherapy.

Conclusions-This prospective observational study shows how technique of radiation (3D-CRT and IMRT) affects QoL in HNSCC patients treated with radical intent. Though there was no difference in terms of acute toxicity in between groups but IMRT group did significantly better considering dryness of mouth and sticky saliva, not only during treatment but 3 months after completion of treatment. This can be explained by the fact that IMRT can spare the major and minor salivary glands quite efficiently compared to 3DCRT. More number of patients and long term follow up is required to validate these findings.

Abstract HN-05: Comparison of F¹⁸ FDG PET-CT and CT Based Target Volume Delineation in Head and Neck Cancers

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Introduction-Fusion of FDG PET with CT has been shown to improve diagnostic accuracy and also for target delineation in radiotherapy planning. The aim of this study is to do volumetric comparison of FDG PET/CT and CT for tumor delineation in patients with head and neck squamous cell carcinoma (HNSCC).

Materials and Methods-In this retrospective study total of 15 patients from June 2018 to November 2018, under radical intent of treatment were included. Most of them are hypopharynx (60%). FDG PET and CT scans performed in all these patients and were fused. GTV tumor and GTV nodes were contoured by a single radiation oncologist on both CT and PET CT separately and then compared quantitatively.

Results-On average GTV tumor volume delineated on CT and PET CT was 40.35cc (3.9-189.6) and 37.05cc (1.8-181.8) respectively, GTV nodal volume 14.25cc (1.8-32.9) and 13.02cc (1.4-35.1) respectively. Comparing PET CT to CT, GTV tumor volume decreased in 10 on an average of 31.4% (4.01%-63.46%) and in 9 GTV nodes decreased on an average of 25.99% (7.39%-62.5%) on PET CT. In 5 patients GTV tumor increased on PET CT on an average of 13.79% (4%-26.49%)

and in 4 GTV nodes increased on average of 11.21% (6.69%-14%).

Conclusion-PET GTV volume was significantly lower compared to CT GTV in both tumor and nodes. Differences are not only in volume but also in position. A combined modality approach of PET CT and CT based for proper delineation and defining target volumes should be practiced in order to decrease dosages to OARs and thereby reduce toxicities

Abstract HN-06: Dosimetric Comparison between Intensity Modulated Radiotherapy And Three Dimensional Conformal Radiotherapy in Carcinoma Base of Tongue

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Introduction-Concurrent chemo-radiation is the preferred treatment modality for locally advanced carcinoma oropharynx. The purpose of this study is to present a comparison between dosimetric aspects of target dose distribution and dose to normal tissue in 3DCRT and IMRT in malignancy of base of tongue and to compare both techniques in regard to their efficacy on tumor coverage and doses received by the organs at risk (OAR).

Materials and Methods-Between July 2014 and November 2016, 25 patients with base of tongue squamous cell carcinoma stage II/III were enrolled for study and planned for IMRT for a dose of 66Gy to PTV. The simulation slices used for IMRT were used for imaginary non executed 3D-CRT plan. Best achievable plans were generated and evaluated using dose volume histogram on ELEKTA Oncentra planning system (version 4.3).

Results-The IMRT plans were significantly better than 3D-CRT in regards of the target coverage (V95%), with p value 0.001. target coverage D95% in 3D-CRT was 82.7% while in IMRT it was 95.45% (13% difference). Similarly, IMRT plans were better in sparing the parotid glands and other OAR, than the 3D-CRT plans.

Conclusion-IMRT should be standard method of treatment for Carcinoma oropharynx. As it results in improved dose distribution within PTV compared to 3DRT while reducing the dose to the

organs at risk at the same time allowing us to use Simultaneous Integrated Boost (SIB) for better treatment.

Abstract HN-07: A Dosimetric Study of Electron Beam Therapy V/S HDR Mould Brachytherapy in the Adjuvant Treatment of Non-Melanoma Skin Carcinomas (NMSC) Of Head and Neck Region

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Introduction-The treatment of choice for resectable non-Melanoma skin cancers (NMSC) is surgery followed by adjuvant radiation in certain cases (close or positive margins and/or invasion of nerve, cartilage, or bone). The radiation to such superficial tumours can be given either by brachytherapy or electrons or by photons. Brachytherapy (BT), due to rapid dose fall off and minor set-up errors, should be superior to external beam radiotherapy (EBRT) for treatment of lesions in difficult locations like nose and earlobe. The purpose of this study is to do a dosimetric comparison of computer tomography (CT)-based mould brachytherapy treatment plans with 3D conformal electron beam therapy in the treatment of NMSC.

Materials and Methods-From December 2017 to November 2018, 10 patients with NMSC of head and neck region (forehead, nose, cheek) who underwent adjuvant radiation with HDR-Brachytherapy (BT) with surface mould individual applicator, were enrolled for analysis. We evaluated dose coverage by minimal dose to 90% of planning target volume (PTV) (D90), volumes of PTV receiving 90-150% of prescribed dose (PD) (VPTV90-150), conformal index for 90 and 100% of PD (COIN90, COIN100), dose homogeneity index (DHI), dose non uniformity ratio (DNR), exposure of organs at risk (eyes, lens, underlying bone and skin. Prospectively, we created CT-based treatment plans for Electron beam therapy. We compared conformity (COIN90, COIN100), dose coverage of PTV (D90, VPTV90, VPTV100), volumes of body receiving 10-90% of PD (V10-

V90), doses to OARs ($D_{0.1cc}$ and D_{2cc}) of EBRT and electron plans.

Result-We obtained mean BT-DHI = 0.66, BT-DNR = 0.33, Electron-DHI = 1.15. We observed no significant differences in VPTV90 and D90 between BT and Electron. Mean BT-VPTV100 (95%) was higher than Electron-VPTV100 (90%). Both COIN90 and COIN100 were superior for BT plans. We observed more exposure of normal tissues with electron than with BT except skin, which received higher dose in BT.

Conclusion-CT-based surface mould brachytherapy for superficial lesions on irregular surfaces is a highly conformal method with good homogeneity. Brachytherapy is superior to Electron in those locations in terms of conformity and normal tissue sparing ability in high doses. The only downside of BT is that skin gets a higher dose.

Abstract HN-08: A Prospective Study of Comparison between Conventional Fractionation And Accelerated Fractionation Radiotherapy In Head and Neck Cancers

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Introduction-Head and neck cancers are the most common cause of cancer related mortality and morbidity in India. The prognosis of patients with locally advanced head and neck squamous cell cancer (LAHNSCC) is poor and 5 year survival rate with conventional radiotherapy is 40-50%. Hence the realization that conventional fractionation radiotherapy (CRT) may not be the best fractionation for all situations has led to the concept of altered fractionation radiotherapy.

Material and Methods-68 patients were recruited and divided into two arms, conventional radiotherapy CRT arm(5 fractions per week) and accelerated radiotherapy ART arm (6 fractions per week) . Final analysis was done in 62 patients (32 in arm A and 30 in arm B). Concurrent chemotherapy with weekly cisplatin $40\text{mg}/\text{m}^2$ was given to patients in both the arms who are medically fit for chemotherapy.

Results-On first follow-up, 68% in CRT arm and 96% in ART arm ($P = 0.003$) had complete response. At median follow up of 17 months, LRC was 86% in CRT arm compared to 90% in ART arm. DFS was comparable in both arms. Acute complications like skin reactions and mucositis were slightly more in ART arm.but not statistically significant. Radiation induced late morbidity in the form of xerostomia, subcutaneous fibrosis and dysphagia did not differ significantly in both arms.

Conclusion-ART can be considered as an alternative treatment strategy to CRT which is radiobiologically superior and is beneficial for centers where the patient load is much higher than the facility available.

Abstract HN-09: A Prospective Study to Compare Patient Reported Outcome Measures (PROM) and Physician Reported Acute Toxicities in Patients Treated with Concurrent Chemoradiation for Locally Advanced Head and Neck Squamous Cell Carcinoma

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Aims & Objectives-The purpose of our study was to prospectively assess and compare acute toxicities reported by radiation oncologists and patient reported outcome measures (PROM) during concurrent chemoradiation for locally advanced squamous cell carcinoma of head and neck. The aim was to find discordance between subjective and objective assessments and its characteristics.

Materials and Methods-Between January to August 2018, twenty patients diagnosed as locally advanced head and neck squamous cell carcinoma undergoing radical concurrent chemoradiation were included. Non-squamous histology and nasopharyngeal malignancy were excluded. Acute toxicities were assessed at baseline, weekly and at the end of treatment by the radiation oncologists and patients themselves independently. National Cancer Institute's Common Terminology Criteria for Adverse Events (CTCAE version 5.0) for 12 domains was used by the radiation oncologists while PROM for the same were recorded using

PRO-CTCAE. At each point of assessment, the toxicity grades were compared in terms of agreement or disagreement between patients and physicians. The incidence, pattern and degree of disagreement between patients and physicians were analysed statistically. The relation between severity of toxicity, point of assessment and degree of disagreement was studied and plotted.

Results-20 male patients with mean age of 59years with advanced carcinoma oral cavity, oropharynx, hypopharynx and larynx were assessed.6 (30%) and 12 (60%) patients presented with T4 disease and Node positive disease respectively. All patients were treated with cisplatin based chemoradiation. IMRT technique was used in all patients. 30-35% patients developed grade 3 acute toxicity in terms of dysphagia, mucositis or dermatitis as per CTCAE. No grade 4 or above toxicity was noted. Some degree of disagreement existed at baseline for symptoms like pain (10%), dysphagia (20%), anxiety (25%) and depression (20%). The agreement between physician assessments and PROM demonstrated a decreasing trend from 80-100% at baseline to 20-35% at week 6 of treatment for all domains. Maximum disagreement was observed with pain (80%) and Anorexia (20%) at 6th week. The degree of disagreement (by one or two points) was found to be increasing with severity of toxicity grades (mean toxicity grades). The patient reported toxicity grades always remained higher across all domains towards the end of treatment. 3 patients required hospitalisation for toxicity management and treatment was interrupted for 4 patients.

Conclusions-The study found that a significant amount of disagreement exists between physician and patients and the gap increases with the severity of toxicity. The result evokes the thought that there is a possibility of under-assessment by the physician or over-assessment of acute toxicities by the patients which may ultimately affect the final clinical outcome. These two scales can be used as complementary tools to assess acute toxicities more accurately so that an early intervention can be done. This is an ongoing prospective study in our department.

Abstract HN-10: Analyzing the Incidental Dose to Lacrimal Glands in Carcinoma

Nasopharynx by IMRT Technique And Its Clinical Outcome

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Introduction-Radiotherapy (IMRT) with or without chemotherapy is the standard of treatment in Ca Nasopharynx. Lacrimal gland (LG) is situated in the lacrimal fossa which is in close proximity to treatment fields. Dose constraints of LG is Dmax < 40Gy and V30 < 50%. Hence in this study dosimetric analysis of LG was done.

Material & Methods-Analysis of 27 patients with Ca Nasopharynx treated with IMRT technique was done. LG was contoured as OARs on the treatment planning CT. Dosimetric parameters were evaluated: mean dose, maximum dose, minimum dose and V30 and the toxicity was assessed using RTOG grading.

Results-Median volume of Right and Left lacrimal gland was 1.3cc each. The mean dose, maximum dose and minimum dose received by right and left LG was 6.56Gy & 6.70Gy (mean); 15.98Gy & 18.96Gy (mean) and 3.26Gy & 3.25Gy (mean) respectively. V30 was 1.2 % and 2.8 % respectively for right and left LG. Correlation of gland volume and V30 was not statistically significant (paired T-test, p value- 0.45 and 0.09 for right and left LG). Out of 27 patients 6 patients received dose >30Gy to LG, of which 4 patients had grade 1 keratitis sicca and was managed conservatively.

Conclusion-Using IMRT technique, keratitis sicca is found to be minimal. Future studies with high number of patients is required to redefine the dose constraints using conformal techniques and strict clinical evaluation of grading is to be done in lacrimal gland in Ca Nasopharynx.

Abstract HN-11: Correlation of Radiotherapy Toxicity Profile, Response and Outcome with Human Papilloma Virus

(HPV) Infection in Head and Neck Carcinoma

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Introduction-A subset of head and neck cancers is associated with the human papillomavirus (HPV). Viral infection is closely correlated with expression of p16INK4A in these tumors. We evaluated p16INK4A (cell cycle inhibitor gene function as tumor suppressor gene) from Biopsied tissue by using immunohistochemistry (IHC) technique than molecular detection of DNA as a prognostic marker of treatment response in a well-defined and prospectively collected cohort of patients treated solely with concurrent chemoradiotherapy. Patient with HPV related Tumors tend to be younger age group, are often diagnosed with lower T- stage and higher N- stage and have better prognosis as compared to HPV- unrelated tumors. HPV positive HNSCC shows better complete response (CR) rate compared to other subgroup of Head and Neck cancer patients and 2-year overall survival (OS) is better.

Material and Methods-Immunohistochemical (IHC) expression of p16INK4A was analyzed in punch biopsy pretreatment paraffin-embedded formalin fixed tissues by using monoclonal antibody kit (BiogenX) from 216 patients of stage III & IV Inoperable Head and Neck Squamous cell carcinoma patients were enrolled in the Two arms of p16INK4A positive and p16INK4A negative from Jan 2016 to Jan 2017 and treated with conventional Concurrent chemoradiotherapy and assesment of toxicity during and after Radiotherapy and response of treatment were assessed at one monthly foe 3 month followed by 3monthly up to 2 year till January 2019.

Results-p16INK4A positivity was found in 50 patients of mostly oropharyngeal cancer. Tumor-positivity for p16INK4A was significantly correlated with improved response to treatment and locoregional tumor control. In group I most of the patients are responders (CR+PR= 76%) and 24% are Nonresponders (SD+PD). In group II 67% patients are responders and 34% are nonresponders category. Patients in group I are mostly of younger age (74% are in age < 50 year age) and in group II are mostly of older age in comparison to group I

(54% are in age >50 year). Most common site involving in group I is Oropharynx (76%) in oropharynx most common site is tonsil followed by base of tongue because of rich lymph node tissue which harbours HPV. In group I most common histopathology is undifferentiated followed by poorly differentiated (UD+PD=62%), and in group II most common histopathology is well differentiated followed by moderately Differentiated. HPV positive patients shows better outcome in comparison to other subgroup.

Conclusion-Expression of p16INK4A has a major impact on treatment response in patients with head and neck cancer treated with conventional radiotherapy. In this study, there is significant difference in response and treatment outcome in Group I (HP16INK4Apositive) arm with CRT showed better result than Group II (HPV p16INK4A negative) arm.

Abstract HN-12: Recurrence Pattern in Head and Neck Cancer: An Institutional Study

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Aim-To evaluate the likely casual factors including age, stage, previous treatment received with pattern of recurrence in head and neck cancer.

Material and Methods-We retrospectively reviewed data of 80 patients aged > 18 years with non metastatic recurrent squamous cell carcinoma of head and neck region who reported to Radiotherapy OPD at GCRI, Ahmedabad from November 2017 to November 2018. Individual subsite was evaluated for age, site, stage at presentation and time at recurrence.

Results-Majority of patients were between 41-50 years (38%). Most common subsite was buccal mucosa (45%) followed by oral tongue (31%), oropharynx (18%) and larynx (6%). The primary treatment in oral cavity cancer was surgery followed by adjuvant radiotherapy with or without chemotherapy and in oropharynx and larynx definitive radiotherapy with or without chemotherapy. In our study the cumulative incidence of local plus nodal recurrence was 85%.

34 patients (42.5%) had not taken adjuvant treatment at the time of primary disease. High risk factors like lymphovascular permeation, greater depth of invasion, perinodal extension and advanced stage at presentation were associated with early recurrence.

Conclusion-Age, previous treatment received and stage at first diagnosis are significant factors for recurrence in head and neck cancer patients. Since this is a retrospective study, we would like to do a prospective study to validate the results further.

Abstract HN-13: Acute Toxicity in Patients of Oral Cavity Squamous Cell Carcinoma Treated With Surgery Followed By Postoperative Volumetric Modulated Arc Therapy

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Introduction-Data of postoperative radiation for oral squamous cell carcinoma (OSCC) using VMAT technique is rare.

Objective-To evaluate acute toxicity in patients of oral cavity squamous cell carcinoma treated with surgery followed by postoperative radiation or chemoradiation using volumetric modulated arc therapy (VMAT).

Materials and Methods-Medical records of patients of oral cavity squamous cell carcinoma (OSCC) treated with surgery and postoperative radiation using VMAT technique were analysed. Acute toxicities were evaluated during radiation and up to ninety days after radiation. Toxicity was graded according to Common Terminology Criteria for Adverse Events (CTCAE, version 5.0).

Results- Between September 2017 and May 2018, 35 patients with histologically confirmed oral cavity squamous cell carcinoma required postoperative radiation and planned with VMAT technique. Oral cavity subsites included were: buccal mucosa and gingivobuccal complex-22, oral tongue-12, floor of mouth-1. Patients had

pathological tumor stage II – IVA. Thirteen patients (37%) also received concurrent chemotherapy. Median radiation dose received was 60Gy (60-66 Gy). Acute toxicities were assessed during radiation and ninety days thereafter. Median overall treatment time was 45 days (40-56 days). Treatments were well tolerated by most of the patients. Most toxicities were Grade 1 or Grade 2 in nature. 3 patients developed Grade 3 mucositis (8.5%). 2 patients developed grade 3 skin reaction and one patient developed Grade 4 skin reaction (5.7%, 2.8% respectively). 13 patients (37%) developed Gr3 dysphagia requiring assisted feeding via Ryle's tube or jejunostomy. Almost all patients experienced some form of fatigue (32 out of 35, 92%). Nausea and anorexia were experienced by 20 out of 37 patients (57%). None of the patients developed Gr 3 nausea or actual vomiting. Gr1 xerostomia was observed in 43% patients while rest of the patients developed Gr 2 xerostomia. Gr 3 or Gr 4 xerostomia during radiation was not documented in any of the patients. 3 out of 35 patients showed some signs of aspiration requiring conservative treatment only.

Conclusions-Postoperative radiation using VMAT technique was well tolerated in most patients of OSCC. Toxicities were much less compared to historical data.

Abstract MC-01: Double Primary Malignancies-A Retrospective Case Series Study

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Background- Patients who have been diagnosed with a cancer, have a life time risk for developing another de novo malignancy depending on various inherited, environmental and iatrogenic risk factors. Second malignancy detection rate increases in view of advanced diagnostic and treatment modalities.. This article mainly aims to report our observed trend of both synchronous and metachronous second primary malignancy, among the cancer victims, and to review the relevant literature.

Methods-A retrospective analysis of patient profile was done from hospital records during time period spanning from Jan 2014 to June 2018. All patients

who were diagnosed with a histologically proven second malignancy as per Warren and Gates criteria have been included. The malignancies have been categorised as synchronous if the interval between development was less than or equal to 6 months and metachronous if it was more than 6 months. Various details with regard to site of malignancy, age at presentation, sex, synchronous or metachronous primary, treatment received have been recorded.

Results-Among 16 cases of double primary malignancies that were observed, 10 were metachronous (62.5%) and 6 were synchronous (37.5%) primary. 7(43.75%) of the patients were male and 9(56.25%) female. Among the synchronous primary malignancy, breast and stomach were most commonly involved sites. Among the metachronous malignancy cases, carcinoma breast had the most common incidence as first primary malignancy(40%) whereas carcinoma lung was the most commonly encountered second primary malignancy(60%). 1 case was GIST during second malignancy presentation whereas two cases were of hematomphoid variety. It was also observed that in case of metachronous malignancies(10 cases), most of the cases of first malignancies were of earlier stage or good prognostic variant (4 carcinoma breast had stage IIA/B, 1 case of stage IA endometrial carcinoma, 1 case of carcinoma prostate, 1 case of seminoma testis).

Conclusion-The incidence of multiple primary malignancies has not been rare at all. So physicians should have an eye regarding this while encountering unusual symptoms during presentation or on followup visits. Screening procedures are especially useful for the early detection of associated tumors, whereas careful monitoring of patients treated for primary cancer and a good communication between patients and medical care team would ensure an early detection for secondary tumors and subsequently, an appropriate management.

Abstract MC-02: Choosing a Career in Radiation Oncology in India: Survey among Young Radiation Oncologists

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Background-Radiation oncology in India is a much debated cancer speciality as a career option to take up. The junior and middle tier radiation oncologists are faced with dilemmas related to their profession life. This survey among young radiation oncologists (YRO), the first of its kind, attempts to assess the career expectations and concerns that affect most of us.

Materials and Methods-This survey was conducted using the online survey tool of Survey Monkey in the month of October 2018. The AROI members' data base was used to send the survey link over e-mail to recipients.

Results-Out of 1685 invitees, 492(29.19%) recipients took the survey. Most (340, 69.14%) were males who worked as senior residents (140, 28.4%) and junior consultants (137, 27.84%), employed in private hospitals and state level teaching institutes (188, 38.21%). Post specialisation (MD/DNB) experience was mostly less than 3 years (278, 56.52%) followed by 3-6 years (128, 26%). Most of YRO worked in Tier I city (241, 48.9%) having IMRT compatible LINACS (73, 14.81%) and brachytherapy (415, 84.3%).

Most of our respondents (309, 62.96%) aspired to work in academic teaching hospital/research institute and the primary concern was academics/research (194, 39.43%) followed by income (116, 23.57%). The responses over change of stream and/ or shifting to medical oncology was nearly equally dispersed over disagreement (227, 46.12%) to agreement (202, 41.05%) on a Likert scale. There was marked dissatisfaction over remuneration (350, 71.1%) and job openings (424, 86.17%). There was also marked job insecurity (350, 71.13%) and poor scope of career improvement (302, 61.38%) as felt by the respondents. 122 (24.8%) YROs felt distressed with the unavailability of IGRT and allied technologies. 278 (56.50 %) respondents believed that they need to move abroad to improve their quality of life. On the brighter side, 377 (76.62%) respondents still felt passionate about their professional choice. Finally, 377 (76.62%)

professionals believed that this survey will correctly reflect the present scenario among YROs.

Conclusion-The survey portrays the mixed picture as expected. Medical graduates must be aware of the pros and cons before taking RO as their profession. Major policy changes are required to improve the infrastructure and job opportunities of this profession.

Abstract MC-03: A Prospective Study Evaluating Patient Satisfaction, Cost-Effectiveness, Ease of Treatment and Impact of Shorter Treatment Course on Patients and Caregivers Treated with Cyberknife in Indian Patient Population

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Introduction-Evaluation of patient perception, satisfaction and cost-effectiveness regarding CyberKnife treatment in Indian patient population.

Materials and Methods-134 consecutive patients treated with CyberKnife were evaluated after informed consent. Patients were evaluated with questionnaire before and after treatment and during follow up evaluation. Institutional ethical & scientific committee approved Questionnaire for patient and caregiver in Malayalam/ English was used as assessment tool. Patient satisfaction scores pre and post-CK were evaluated. Socio demographic, clinical characteristics and hospital related factors affecting patient satisfaction were evaluated. Patient perception about CyberKnife treatment before the procedure, and perception at radiation therapy completion were evaluated.

Result-One thirty-four (n=134) patients were evaluated with questionnaire method before & after CyberKnife treatment. Short course radiation therapy with CyberKnife is more acceptable option in benign & curative indications. Perception about CyberKnife changes completely immediately after the treatment completion. Majority of the patients are satisfied with the ease of treatment with high patient compliance is. Short course treatment is more acceptable by care-givers. Side-effect immediately after treatment is minimal.

Conclusions-Short course radiation therapy with CyberKnife is more acceptable option in benign

and curative indications. CyberKnife in metastatic setting need to be addressed with maturity and need involvement of care givers.

Abstract MC-04: Effects of Integrated Yoga Programme on Patients Receiving Highly Emetogenic Chemotherapeutic Drugs

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Objective-Nausea and vomiting have been one of the most common and distressing side effects that patient face while getting treated for malignancy. For which various anti emetic drugs have been used. Yoga is a spiritual practice that helps and strengthens in union of mind with body. The word yoga is derived from the Sanskrit word "Yuj" which means to bind. The main aim is to demonstrate the effect of Yoga and Pranayam in reducing the side effect of chemotherapy.

Material and Methods-Total 50 patients receiving moderate to highly emetogenic chemotherapy were selected and randomised in 2 groups at ATRCTRI. The study group started yoga and pranayam (under supervision of yoga master) 2 days prior to scheduled chemotherapy and continued it through the cycle and post CT days as well. These patients also received standard anti emetic agents. The control group received chemotherapy cycles along with standard anti emetic agents. Both the groups were followed for 3 days post CT for incidence and grades of nausea and vomiting according to RTOG grading for the same.

Results-In the study arm, insignificant reduction in the incidence of chemotherapy induced nausea (90% vs 78%, p value=0.35) was observed but significant reduction in the incidence of vomiting (42% vs 22%, p value=0.01) was found when compared with the control arm. There was significant reduction in grade 2 and 3 nausea (84% vs 38%, p value<0.01) and vomiting (14% vs 0%, p value<0.01).

Conclusion-The study including Yoga and Pranayam successfully demonstrated that these can be utilised and are very safe and effective in reducing the side effect of chemotherapy.

Keywords-Yoga and pranayam, highly emetogenic chemotherapy, nausea and vomiting

Abstract MC-05: Evaluation of Quality of Life of Caregivers of Cancer Patients in India Using CQOLC Scale

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Introduction-Caregivers of cancer patients face unique challenges which impact their Quality of Life (QoL). Although numerous studies have addressed QoL of cancer patients, very few studies have evaluated QoL of caregivers. This study aimed at evaluating impact of treatment on QoL of caregivers of cancer patients in the Indian setting and its correlation with socio-demographic variables.

Methods-Adult caregivers of cancer patients being treated at the Radiotherapy Department, R.G.Kar Medical College, Kolkata, India who were capable of self answering the culturally adapted, validated Bengali translation of the Caregiver Quality of Life Index – Cancer (CQOLC) scale were included. The sociodemographic variables of the caregivers and their QoL scores were captured. Pearson's correlation was used to assess the impact of sociodemographic variables on caregiver QoL.

Results-Eighty one caregivers were included in this report. Median age was 46 yrs, 56% were men, 46% were the spouse of the patient. The most common cancer was breast (36%). The mean total CQOLC score was 73.16 ± 22.03 . The highest scores were found for the caregiver emotional aspects (21.30 ± 9.66). There was a clear negative correlation of total CQOLC scores with higher family income ($p = 0.03$) and being unmarried ($p = 0.001$) but not caregiver education, type of cancer or ECOG PS of the patient.

Conclusion-Primary caregivers have to share a major burden of the disease while taking care of their loved ones suffering from cancer which negatively impacts their QoL. Higher family income and being unmarried resulted in lower scores.

Abstract MC-06: Barriers and Explanatory Mechanisms in Diagnostic Delay in Four Cancers – A Health Care Disparity?

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Introduction-Most cancer disparities research has traditionally focused on two key outcomes, access to appropriate treatment and survival but they do not encompass important aspects of patient-centred care such as the timeliness of diagnosis and treatment. Prolonged time intervals between symptom onset and treatment initiation increase the risk of poorer clinical outcomes and are associated with worse patient experience of subsequent cancer care. The aim of this study is to assess the delay from symptom onset to the start of definitive treatment, and to identify the possible contributory factors & its impact on response in cancers of Head & Neck, Breast, Cervix & Lung.

Materials & Methods-Retrospective study of patients enrolled between 2015 and 2017. A questionnaire was filled in about socioeconomic aspects, patient history, tumor data, professionals who evaluated the patients, and the respective time delays. Statistical test included Mann-Whitney U , Univariate & Multivariate test, one way ANOVA to evaluate the correlations.

Results-Stage migration was significant with patient delay ($p < 0.01$). In HNSCC & CA Lung, Significant correlation was found between Referral delay & Residence ($p < 0.01$), treatment delay & Reason for referral (HNSCC only) ($p = 0.04$). Referral delay & Treatment delay was correlated to response in breast & cervix respectively ($p < 0.01$).

Conclusion-Social awareness, regularly updating primary care physicians about alarming symptoms of cancer, developing guidelines to identify these symptoms, promoting continuity of care, and enabling access to specialist expertise through prompt referral should all help to prevent delays in cancer diagnosis.

Abstract MC-07: Assessment of Caregivers' Strain during Radiation Therapy of Head and Neck Cancer Patients: An Institutional

Report Using Modified Caregivers' Strain Index Scale

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Introduction-Very little works have been reported on the issues of burden perceived by the caregivers of Head and Neck Cancer (HNC) patients. Job of the caregiver is complex and it limits their social, psychological and economical wellbeing. Our study aims at assessing caregivers' strain during Radiation Therapy (RT) of HNC patients using Modified Caregivers' Strain Index (MCSI) Scale.

Materials and Methods-In this single institutional cross sectional study we interviewed caregivers of HNC patients undergoing curative RT. Along with MCSI, a 13 point questionnaire, which were self administered in local languages we collected baseline data of patients and their caregivers. Scores were evaluated. For each question score varies 0-2. Higher the Median Hazard Score (H Score) more was the level of the strain.

Results-We interviewed twenty four participants. Response rate was 100%. 45.8% patients were in Stage III. Median Age of caregivers was 40years, 58.3% were male, 79.2% were employed and 58.3% were belonging to Upper Lower Class.66.6% were spouse of the patients and 70.8% belongs to joint family.

In MCSI score analysis, H Score was 22 (range 14) with a minimum score of 14 and maximum score of 26. Commonest Score was 20. 65.1% participants responded score 2 in all aspects of strain indices. Travel time had a significant positive association with total H scores (Pearson's $r = 0.663$, $p < 0.05$).

Conclusion-Majority of the caregivers was suffering from severe physical, personal, emotional and social/financial strain. This issue must be addressed in holistic cancer care.

Keywords-Caregiver, Head and Neck Cancer, Strain

Abstract TH-01: Survival and Time to Development of Metastasis in Patients of Non Small Cell Lung Cancer with Brain Metastasis who Received Whole Brain

Irradiation, according to Histological Subtype: A Single Institutional Study

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Introduction-Lung Cancer is one of the most common cancers in India. One of the common sites of metastasis in lung cancer is to the brain. Aim of this study is to ascertain if there is any association between the overall survival and the time from initial diagnosis to development of brain metastasis, according to the histopathological subtype of the lung cancer.

Methods-The records of 57 patients with primary NSCLC who had received whole brain irradiation for brain metastasis from January to December 2016 were accessed. Data was collected regarding the age, gender, histopathology, initial stage, site of metastasis, time to development of metastasis, extracranial metastasis if any, the radiation regimen, and overall survival. Data was analysed using IBM SPSS.

Results-Age at presentation was mostly in sixth decade (50%), with a male preponderance (82%). Most common histopathology was adenocarcinoma of lung (68%). Synchronous brain metastasis was seen in 35% of patients, and observed mostly in patients with squamous cell histology. There was a significant difference ($P < 0.1$) between time to metastasis and the histopathology of lung cancer (Adenocarcinoma vs squamous carcinoma) by t-test. Adenocarcinoma patients had better OS than squamous carcinoma (5.5 v/s 4.5 months)

Conclusion-The histopathological subtype of the primary lung cancer may be an indicator of the time to brain metastasis. However, as this is a single institutional study with a small sample size, more research is needed to validate these results.

Abstract TH-02: A Prospective Study on Association of Dose Volume Histogram Parameters with Oesophagitis, Radiation Pneumonitis & Radiation Induced Lung Fibrosis after receiving Chemoradiation for

Non Small Cell Lung Cancer at Radiation Oncology Department, IPGME&R, Kolkata

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Aim-Assessment of relationship between lung V30, age, gender, smoking history, tumor location & incidence, grade of oesophagitis, radiation pneumonitis (RP) and radiation induced pulmonary fibrosis (RIPF) (within radiotherapy portals) in NSCLC patients treated with chemoradiation.

Materials and Methods-A hospital based prospective study with 64 NSCLC patients treated (between November 2017-2018) with chemoradiation (paclitaxel & carboplatin + total 60 Gy in 30# i.e. 2Gy once daily) was conducted. Relationship between V30, age, gender, smoking history, tumor location & incidence, grades of oesophagitis, RP, RIPF(HRCT confirmed) with a median follow up of 7 months was analysed using Spearman's rank correlation coefficient in SPSS software (multivariate analysis). Kruskal Wallis test was used to test significance. Ethical clearance was obtained from ethics committee.

Results-

Oesophagitis of grade 0,1,2,3,4 was diagnosed in 23,30,8,2&0 patients respectively. Corresponding mean V30 values were 33.8%, 34.5%, 37.2%, 39.6& 41.2%. RP of grade 0, 1, 2, 3, 4 was detected in 18, 19, 24, 2 & 1 patients respectively. Corresponding mean V30 values were 21.3%, 22.4%, 26.8%, 30.0% & 36.2%. RIPF of grade 0, 1, 2, 3, 4 was detected in 32, 26, 8, 0 & 0 patients respectively. Corresponding mean V30 values were 31.2%, 34.4%, 35.9%, 38% & 38.6%. Significant correlation was detected between V30 \geq 30% & incidence & grade 2 oesophagitis (p=0.02, r =0.86), grade 2 radiation pneumonitis (p=0.001, r=0.74), grade 1 RIPF (p=0.01, r=0.88). Increasing age (p=0.03), smoking history (p=0.04), tumor location i.e. upper vs middle/lower lobe (p=0.02) had a significant correlation with incidence & grades of oesophagitis, RP, RIPF.

Conclusion-Hence, the incidence & grades of oesophagitis, RP, RIPF are significantly related to V30, age, smoking history, tumor location

Abstract TH-03: Early Response to Platinum based Chemotherapy Combined with Paclitaxel or Pemetrexed in EGFR Non Mutated Wild Type Advance Adenocarcinoma of Lung: An Interim Analysis

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Aim-To assess how wild type adenocarcinoma of lung behaves with paclitaxel or pemetrexed based chemotherapy- using RECIST criteria.

Materials & Methods-In this study 40 adult patients with stage III/IV EGFR non mutated wild type adenocarcinoma of lung identified who received three or more cycles of first line chemotherapy with (Paclitaxel 175mg/m² & Carboplatin AUC-5) or (Pemetrexed 500mg/m² & Carboplatin AUC-5).Overall response rate, disease progression & disease control rate were assessed.

Results-Baseline profiles in terms of age, sex, smoking status, performance status, primary site, metastatic site, tumour status & nodal status were comparable between two groups.The overall response rate were 20% in paclitaxel with carboplatin group & 35% in pemetrexed with carboplatin group (p=0.111).However more patients receiving paclitaxel with carboplatin showed 50% disease progression compared to 20% in pemetrexed with carboplatin group.Disease control rate of patients receiving pemetrexed was 80% was significantly higher than paclitaxel group which was 50% (p=0.008).

Conclusion-An interim analysis of our study reveals that Pemetrexed based chemotherapy responds better than Paclitaxel based chemotherapy in EGFR non mutated wild type adenocarcinoma of lung which is more common than EGFR mutated lung cancers.

Abstract TH-04: An Observational Study to Evaluate the Response and toxicity with Conventional Fractionation and Hypofractionated Radiotherapy for Locally

Advanced Non Small Cell Lung Carcinoma Following Induction Chemotherapy

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Introduction-Prospective observational study to evaluate the response and toxicity with Conventional fractionation and hypofractionated radiotherapy for locally advanced NSCLC following induction chemotherapy.

Materials and Methods-40 stage III NSCLC patients, ECOG PS ≥ 1 were enrolled. All received induction chemotherapy with Paclitaxel and Carboplatin 3weekly for 3 cycles, then divided into two arms (20 in each). Conventional Radiotherapy Arm- 60Gy/30fractions/6weeks. Hypofractionated Radiotherapy Arm- 55Gy/20fractions/4weeks.

Result- In Conventional arm, CR at the end of treatment, at 3months, 6months and 9months after RT was 25%, 25%, 20%, 10%. In Hypofractionated arm, CR at end of treatment, at 3months, 6months and 9months after RT was 20%, 15%, 10%, 10%. Both groups had similar outcomes in terms of local disease status. Although, the number of PD and PR were more in Hypofractionated arm than Conventional, it was not statistically significant. DFS at 3, 6, 9months was seen in 25%, 25%, 10% in Conventional and 15%, 10%, 5% in Hypofractionated arm. PFS at 3, 6, 9months was seen in 95%, 75%, 50% in Conventional and 90%, 80%, 50% in Hypofractionated arm. Hypofractionated arm had 1patient with grade3 dermatitis at end of RT. At 6 and 9months, no grade2/3 dermatitis was observed. Grade 2 esophagitis was noted in 3(15%) patients at the end of RT, but no further \geq grade2 esophageal toxicities. No grade3/4 pneumonitis was observed.

Conclusion-This study shows that in Stage III NSCLC patients with poor performance status who cannot tolerate concurrent chemoradiation, induction chemotherapy with hypofractionated radiotherapy regimen can be considered with manageable toxicities.

Abstract TH-05: Adjuvant Hemithoracic RT Using IMRT in Malignant Pleural Mesothelioma

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Background-Malignant Pleural Mesothelioma is an uncommon and aggressive disease associated with asbestos exposure. Management of MPM is complex and controversial as there is paucity of good quality evidence. Multi-modality treatment with surgery, systemic therapy and radiation therapy is associated with significant morbidity. We intend to analyze toxicity and outcomes in patients who received tri-modality treatment for non-metastatic MPM at our institution.

Methods and materials-We reviewed the electronic medical records of surgically managed MPM patients at our institution in the last decade. Patient details, disease characteristics and treatment information were retrieved from the institutional electronic medical record and radiation oncology information system. Dosimetric parameters of target volume and organs at risk were documented from planning workstation. SPSS was used for statistical analysis.

Results-Between January 2008 and October 2018, 21 patients (17 male and 4 female) underwent surgery for MPM – all but 2 patients underwent extra-pleural pneumonectomy (EPP). Primary was located in the right and left in 11 and 10 patients respectively. Epithelioid MPM was the commonest histology (12 patients - 57%). Resection was R0 in 18 patients and R2 in 2 patients. Four patients had minor complications and 8 Patients had major surgical complications. All patients received neoadjuvant Pemetrexed/platinum doublet chemotherapy, except for 2. Fourteen patients received adjuvant hemi-thoracic RT; of these, 2 underwent treatment elsewhere and 2 were treated with conventional technique. Ten patients treated with conformal technique at our institute and

ABSTRACTS

dosimetric data was available for analysis. Average time to start RT after surgery was 51 days (range 32-82 days). All patients were treated with conformal technique using IMRT/VMAT to a dose of 45Gy in 25 fractions; one patient received a further boost of 5.4Gy. Dosimetric characteristics are as shown in Table 1. Mean overall RT duration was 38 days (range 31 – 43 days). Acute toxicity was uncommon; Grade I/II Pneumonitis was seen in 4 patients. One patient developed grade III acute lung toxicity; however, it was established to be unrelated to RT. Acute oesophagitis was not seen in any patient. At a median follow up of 15 months, none of the patients developed late toxicities; 8 patients had controlled disease, 1 had local relapse and 1 developed distant metastasis.

PARAMETER	Mean ±SD
CONTRALATERAL LUNG	
Volume(cc)	1197.44
Mean dose(Gy)	5.95 ± 1.74
V _{5Gy} (%)	42.82 ± 23.31
V _{10Gy} (%)	7.49 ± 5.35
V _{20Gy} (%)	0.42 ± 1.03
HEART	
Mean Dose(Gy)	20.55 ± 3.54
V _{10Gy} (%)	70.56 ± 18.23
V _{20Gy} (%)	40.02 ± 11.08
V _{30Gy} (%)	26.25 ± 7.62
LIVER	
Dmean	13.99 ± 6.97
V _{20Gy} (%)	28.29 ± 21.34
v _{30Gy} (%)	16.15 ± 14.59
v _{40Gy} (%)	9.06 ± 8.80
PTV	
Dmean(Gy)	47.21 ± 2.71
Dmin(Gy)	31.59 ± 5.07
Dmax(Gy)	50.49 ± 3.37

D2(Gy)	48.60 ± 2.95
D98(Gy)	44.55 ± 2.42

Conclusion-Despite the extensity of surgery and complexity of hemi-thoracic RT, we demonstrated excellent dosimetric, toxicity profile and favorable outcomes in non-metastatic MPM.

Abstract TH-06: Safety of Concurrent Whole Brain Radiation along with ALK Inhibitors for Brain Metastases in ALK Positive NSCLC

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Introduction-Despite the high incidence of brain metastases (BM) at first diagnosis and during the course of their treatment, patients with ALK mutation positive NSCLC have a better survival. We aim to review the role of radiation therapy given along with ALK inhibitors in the management of BM from ALK positive NSCLC in our practice.

Materials and Methods-We reviewed the electronic medical records of 33 patients diagnosed with BM from ALK positive NSCLC and received cranial radiotherapy at our institution between January 2014 and September 2018. Radiotherapy details were obtained from the in-house Radiation Oncology information system. Statistical analyses was performed using SPSS; overall survival was censored at death or last follow up.

Results-Mean age at presentation of the entire cohort was 47.6 years (range 27 to 71 years). Male: Female ratio was 4:1; ALK mutated patients were more likely to be never smokers (70%). Performance status score was more than KPS 70 in 72% patients and the average GPA score was 1.27. There were 42.4% of patients who presented with BM at first presentation; none of the patients were asymptomatic and incidentally detected to have BM. Overall, 15 patients developed BM as the only site of progression while on TKIs (oligo-progression); of these, 6 patients (18%) changed

over to a different line of TKI and the rest continued the same agent along with WBRT. Cranial RT was concurrently delivered with TKIs in 27 patients (81%). All patients received whole brain RT (WBRT) using conventional technique, except for one patient who had stereotactic radiosurgery. Radiotherapy schedule was 20Gy in 5 fraction (42%) and 30Gy in 10 fractions (55%); 4 patients received a focal boost after WBRT; 1 patient received single fraction SRS 18Gy. Mean biological equivalent dose (BED) delivered was 90.9 Gy and the average EQD_{2Gy} was 59.87 Gy. Six patients (18%) underwent re-WBRT for disease progression and the mean time to re-WBRT was 23.5 months (range 11-46 months). Cumulative BED and EQD_{2Gy} for patients who underwent re-irradiation were 157.5 Gy and 113.85 Gy respectively. No patient developed grade 2/3/4 acute or late toxicities. All patients received oral steroids during WBRT which was tapered at completion except in 8 patients. At a median follow up of 22 months, 9 patients were alive at one year after completion of WBRT.

Conclusion-Concurrent use of WBRT with ALK inhibitors did not result in additional toxicity and is a safe and effective treatment in the management of BM in patients with ALK mutated NSCLC. Continuing same line of TKI along with WBRT is an additional option in patients with neuro-oligoprogression.

Abstract TH-07: Correlation of EGFR Mutation Status in Pleural Fluid with Biopsy Specimen in NSCLC Lung Cancers: A pilot study

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Introduction-Current treatment of non-small-cell lung cancer (NSCLC) is individualized based on mutational profile of EGFR which are suitable for tyrosine kinase inhibitors. Ideal sample for EGFR testing is tumor biopsy, however in advanced stages, biopsy may not be always possible due to patient's poor performance status, associated comorbidities and other logistics generating a need

for alternative sample for EGFR testing. Pleural fluid may serve as potential alternative specimen as pleural tapping procedures are less invasive.

The aim of present pilot study was to explore feasibility and reliability of EGFR testing in malignant pleural effusion (PE) compared to biopsy.

Materials and Methods-121 histologically proven NSCLC patients registered in Department of Radiotherapy between Jan 2016 to June 2017 were included in this prospective study. Paired PE and biopsy samples were used for EGFR testing. PE smears were screened for malignancy and cellularity. Two positive smears were tested for hot-spot mutations in 18-21 exons of EGFR by real-time PCR using FDA approved Therascreen kit.

Results-PE was present in 63 (52%) patients of which malignant PE was confirmed in 30 (24.8%). Twenty patients with malignant PE having adequate cellularity and paired biopsy were tested for EGFR of which 18 (90%) were successfully tested (low cellularity & hemorrhage - 2 cases). EGFR mutation in PE was seen in 55.6% (10 cases) while it was 38.9% in biopsy. EGFR mutation concordance was documented in 15 (83.3%) while discordance in 3 (16.7%) cases.

Conclusion-Malignant pleural effusions are valuable alternative sample for EGFR mutation analysis in advanced stage NSCLC in patients.

Abstract TH-08: Dosimetric Effects of Repeat CT-Scan During Radiotherapy Planning in Carcinoma Oesophagus

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Introduction-Esophageal cancer is advanced at the time of presentation and delivering a tumoricidal dose of radiation to target structure, large volumes of normal tissues get irradiated including lung, heart, and spine. Adaptive radiotherapy increases the accuracy of RT delivery to the tumour and sparing the surrounding normal tissue.

Materials and Methods-Histologically proven 14 patients of inoperable cancer esophagus were

studied. All patients received induction chemotherapy followed by concurrent chemotherapy and radiotherapy. CT simulation with proper immobilization was done and images were transferred to the treatment planning system. Delineation of target volumes and organs at risk (OARs) was done and planned for 60 Gy in 30 fractions with IMRT keeping the doses to OARs within tolerance limits. Replanning was done on repeat CT scan during 4th week of radiotherapy treatment and potential reduction in doses to OARs and target organ volume was assessed.

Results-A total of 14 cases were analyzed for the adaptive plan with the coverage of the 95% prescription isodose for PTV was given. (t-test) Left Lung V_{20} (mean 20.02 Gy vs. 18.23 Gy) and Dmean (mean 16.90 Gy vs. 15.25 Gy), right lung V_{20} (mean 19.23 Gy vs. 17.62 Gy) and Dmean (mean 16.61 Gy vs. 15.0 Gy), heart V_{25} (mean 40.36 Gy vs. 37.91 Gy) and Dmean (mean 30.59 Gy vs. 26.63 Gy) were not significantly smaller, but spine 1% vol (mean 35.95 Gy vs. 32.60 Gy) and Dmax (mean 38.52 Gy vs. 33.60 Gy) , GTV volume (mean 67.37 cm³ vs. 24.58 cm³) were significantly smaller for the adaptive plan.

Conclusion-By doing adaptive radiotherapy in 4th week of treatment using repeat CT-scan, response evaluation can be done as there was a significant reduction in the volume of GTV and replanning of treatment on repeat CT scan also helps us in reducing doses to the OARs resulting in reduced toxicity and better patient convenience .
