Abstracts Proceeding

ACBMPS-2013

2nd Annual Conference of Bangladesh Medical Physics Society

15-16 March 2013

National Institute of Cancer Research & Hospital (NICRH)
and
United Hospital Limited (UHL)
Dhaka, Bangladesh

Organized by

Bangladesh Medical Physics Society (BMPS)

In co-operation with

National Institute of Cancer Research & Hospital and United Hospital Limited

VARIAN medical systems

Courtesy by

BANGLA VISION

Media Partner

www.bmps-bd.org/acbmps

International Journal of Cancer Therapy and Oncology
www.ijcto.org

Abstracts Proceeding:

2nd Annual Conference of Bangladesh Medical Physics Society

(March 15-16, 2013)

*****The authors alone are responsible for the content and writing of the abstracts published in this proceeding*****

(Received September 14, 2013; Published Online September 15, 2013)

ISSN 2330-4049

Challenges in brachytherapy dosimetry

Hensley F.W.

Dept. of Radiation Oncology, University of Heidelberg, Im Neuenheimer Feld 400, D 69120 Heidelberg, Germany.

Brachytherapy is one of the most precise treatment techniques in radiotherapy. Small treatment volumes can be covered with excellent conformation and with steep dose gradients to surrounding tissues. The TG43 formalism allows the calculation of planned dose with an accuracy of 3.4%. Despite these facts, experimentally measuring dose from a Brachytherapy source is quite difficult. Due to the steep dose gradients at short distance from a small radioactive source, measurement with typical dosimetry instrumentation may be associated with large uncertainties. E.g., the spatial resolution of a detector with a sensitive volume of several mm diameters (such as an ionization chamber) requires a difficult determination of the effective point of measurement. The precision of positioning both source and detector required to provide an uncertainty of 2% for a measurement at 1 cm distance source-detector is in the region of 5/100 mm. A second important source of uncertainty is caused by the changes in the photon spectrum at different distances from a brachytherapy source. Due to the increase of low-energy photons with distance from the source, the sensitivity of practically all available detectors also changes. This requires the application of position dependent energy correction factors k_Q which so far have scarcely been determined. The spectral variations also affect the selection of phantom materials since water equivalence at low energies requires a different atomic composition than required at high energies. In conclusion, brachytherapy dosimetry yields a number of physical challenges which yet need to be solved.

 ISSN 2330-4049

Essentials of periodic QA in radiation therapy

V. Poopathi, Pankaj Chowdhary, C. Rajesh

North Bengal Oncology Centre, Siliguri, West Bengal – India

According to the International recommendations the average uncertainty in therapeutic dose should not be greater than 5%. The need for high precision in radiation therapy requires quality assurance covering the entire process of Radiation treatment. Most recently the ability to produce very high specific activity of Iridium-192 and Cobalt-60 sources combined with the computer controlled remote after loading technology has led to wide spread use of high dose rate Brachytherapy procedures. The dose rate of HDR is just > 12 Gy/hr. However, because of dangers of using very high activity/dose rate (about 10 Ci/ 300 MU/minute) it is at most important to have QA procedures in place with the required dosimetric and planning equipment and appropriate trained staff.

The objective of the presentation is to discuss and share essentials of QA required executing the 3D-CRT process as performed at North Bengal Oncology Center (NBOC). The QA and periodic checks are performed according to AERB safety code version. We treat cancer patients with superior 3D-CRT process and HDR Brachytherapy. We have ELEKTA PRECISE PLAN for Radiation Therapy treatments in which we can use, MLC, BEV, DVH, Motorized Wedges, DRR, Asymmetric Collimators, Bolus and 2D and 3D views of the plan. We have installed ELEKTA PRECISE LA at our centre for Radiation Therapy treatments in which we can use two photons of energy 6 & 15 MV and electrons from 4 to 15 MeV (6 Beams). Daily QA consists of Energy Check, Functional checks and output consistency. Monthly QA includes O/P measure, Optical/radiation field coincidence, isocenter verification, MLC movement and accuracy, Mechanical movements and RFA procedures. The Annual QA additionally will have radiation safety survey, emergency checks and verification of all safety interlocks. We will make efforts to high-light the essential QA required for the busy centre that practice 3D-CRT and HDR-BT. Procedures necessary for the QA program are explained and results are presented.

Our QA results for last 3 years will be presented. A QA program will be successful if the RT team is formed with trained manpower. We follow the national regulatory body AERB’s protocol for the QA program. We have found our results are found within the tolerance limit. Our IAEA postal TLD dosimetry results show -1% deviation from our measured value. The periodic and systematic QA program ensures proper machine function and correctness of beam parameters to deliver the quality RT. The results are tabulated and discussed in details.

 ISSN 2330-4049

Interventional radiotherapy or brachytherapy: new challenges for a successful technique

Lindel K.

Dept. of Radiation Oncology, University of Heidelberg, Im Neuenheimer Feld 400, D 69120 Heidelberg, Germany.

Brachytherapy is the oldest radiation technique in history of radiation oncology, but is still one of the most effective method to effectively treat tumors and spare normal tissue. Brachytherapy plays a central role in treatment of gynecological tumors like cervical cancer, but is also very effective in treatment of e. g. head and neck, lung, skin or esophageal cancer. As so called interventional radiotherapy new fields are opening up using modern planning systems. The presentation will give an overview of therapeutic concepts of the Department of Radiation Oncology, University Heidelberg integrating brachytherapy in modern treatment planning and will emphasize the importance of close collaboration between physician and physicist to provide the step from traditional brachytherapy to modern interventional radiotherapy.

 ISSN 2330-4049

External beam radiotherapy and high dose rate (HDR) brachytherapy treatment for carcinoma cervix practice in BPKMCH, Bharatpur, Nepal

Chaurasia P. P., Jha A. K.

Dept. Radiation Oncology, B.P.K.C.H., Bharatpur, Nepal

In 2011, we treated 1333 patients with external beam radiotherapy in which 476 patients were of cervical cancer of different stages and it is 35% of total cases. A total of 835 brachytherapy intracavitary and cylinder applications were performed. In most of head and neck region tele-Cobalt beam of 1.25 Mev is used while 6 MV photons of both linear accelerators are used for other anatomy with separation up to 22 cm. 20 MV is highly penetrating and mostly used in very thick patients with separation more than 24 cm.

Mega voltage external beam pelvic radiation therapy combined with Intracavitary Radiotherapy (ICR) is the standard radio therapeutic management for the patients with carcinoma cervix. Low Dose Rate (LDR) brachytherapy has been used since early 1900's but HDR has become an acceptable treatment modality since last 30 years with remote after loading fully computer controlled systems .The use of HDR brchytherapy treatment times are shorter (in order of minutes than days), patients treatment on outpatient basis, less patient discomfort, reduced risk of applicator dis-placement during therapy. Patients have advantage of 6 MV and 20 MV photons from linear accelerators compared with tele cobalt beam treatment in BPKMCH. Brachy therapy service started in BPKMCH in 2002 with a remote after loader Vari source machine with single Iridium -192 source wire of 5 mm length, 0.38 mm diameter which emits gamma photons of 380 Kev and half life 74 days requires source change in every 4 months. The dose fall off vary rapidly according to inverse square law thus surrounding normal tissues rectum and bladder receive lower dose than tumor.

Dose fractionation schedules for HDR brachytherapy vary from countries and institutions. BPKMCH has its own protocol to prescribe total dose, time and fractionations will be discussed with its biologically effective dose (BED). A dose of 46 Gray/23 Fractions five days in a week and three applications of 8 Gray HDR ICR treatment per week for carcinoma cervix .The physical aspect of the machine, its Brachyvision planning system application in ICR, Orthogonal simulation, The Manchester system and ICRU -38 are followed for reference point's dosimetry. The source strength calibration, quality as-surance tests, source position verifications and radiation protection of staff and patients management along with physics specific concerns and our experiences since last 10 years treating more than thousand patients will be presented. HDR is a vital clinical tool in treatment of gynecological cancers with individualized planning for every patient. It is important for radiation oncologist to pass all information's about tumor volume to physicist so that he can optimize the plan accordingly. Sometimes we have to compromise in dosimetry. It is best that the planning physicist and radiation oncologist be present during treatment. Newer innovations in brachytherapy are required.

 ISSN 2330-4049

Transition from 2D to 3D-CRT (NICRH experience)

Kazi Manzur Kader

Dept. Of Radiation Oncology, National Institute of Cancer Research & Hospital, Dhaka, Bangladesh

Basic treatment capabilities with minimal imaging support have been labeled as 2D RT. With more advanced imaging (CT Scan) and dose calculation capabilities for treatment planning system (TPS) and sophisticated treatment delivery procedures (LINAC), 3D conformal radiotherapy (3D CRT) can be provided. Further sophistication in treatment planning and treatment delivery capabilities allow for intensity-modulated radiotherapy (IMRT).

There are significant differences between conventional 2D RT treatment planning and delivery and 3D CRT. To establish 3D CRT in an institution a number of steps should be taken. This includes the definition of the scope of the programme, developing staffing needs, training of all personnel to be involved, acceptance testing and commissioning of the new equipment and the development and implementation of a comprehensive QA programme.

IMRT techniques are significantly more complex than 3D CRT and require the close collaboration and expertise of an appropriately-trained multidisciplinary team, including radiation oncologists, medical physicists, and radiation technologists.

A complete understanding of all steps is necessary before one can successfully begin a new programme in 3D CRT. It is important to allow sufficient time for physics staff training prior to the arrival of the equipment so that trained staffs are in place to carry out acceptance testing and commissioning. Only radiation oncology departments that have sufficient experience with 3D CRT are in a position to transition to IMRT. Adequate training in IMRT technology for all members of the team is essential prior to the initiation of such a programme. Ideally, the team members are best trained on equipment that they plan to use for IMRT in their own department. A total number of 250 patients were treated by 3D-CRT planning in radiation oncology department of NICRH, since 2008 up to 2012.

 ISSN 2330-4049

Conformal HDR brachytherapy for prostate cancer: comparison between boost and monotherapy

Azhari H. A.[1], Hensley F. W.[2], Xiaoyun D.[3], Zakaria G.A.[1,4]

[1]*Dept. of Medical Physics and Biomedical Engineering, Gono University, Dhaka, Bangladesh,*
[2]*Department of Radiation Oncology, University of Heidelberg, Germany*
[3]*Dept. of Medical Physics, Zhejiang Tumor Hospital, Hangzhou, China.*
[4]*Dept. of Medical Radiation Physics, Gummersbach Hospital, Academic Teaching Hospital of the University of Cologne, Gummersbach, Germany.*

Prostate cancer is the most common malignancy in men. The present treatment options include radical prostatectomy, external beam radiation therapy (EBRT), temporary and permanent brachytherapy, hormonal therapy, and watchful waiting. Of this High dose rate (HDR) brachytherapy is an established and rapidly advancing technique used to deliver highly conformal doses of radiation in the treatment of prostate cancer. The achievement of highly conformal 3D dose distributions enables the delivery of Highly Effective Doses to the target volume(s) and thus improving patient outcome. The achievement of highly conformal 3D dose distribution presupposes: very accurate anatomy, localisation: target(s), OARs. Remote afterloading devices using high activity Iridium-192 (^{192}Ir) sources are commonly used in a variety of centers throughout the world. In this paper different protocols in prostate Brachytherapy such as used in Monotherapy and Boost therapy are compared with Offenbach protocol. Since 2001 different number of implants with different fractionation dose in Monotherapy (HDR 4 × 9.5 Gy , HDR 3 ×11.5 Gy) and since 1996 Boost therapy (transrectal HDR 4 × 5-7 Gy + EBRT 39.6 – 45 Gy, transperineal HDR 3 × 7.0 Gy + EBRT 45 Gy, HDR 2 × 10.5 Gy + EBRT 45 Gy) have been practiced in Offenbach and improvement of patient outcome is continuously observed. It is shown that increasing the number of implants in Monotherapy improves the clinical outcome .The whole procedures for Brachytherapy for both Monotheray and Boost is similar. These procedures consisting of preplan which include set up of patient, stabilization of prostate gland, image acquisition, catheter placement, dose planning and evaluation and live plan have also been described in this paper.

Optimal therapy for organ confined prostate cancer remains an ongoing dilemma. There is abundant evidence showing the benefit of higher radiation doses in treatment outcomes in men with intermediate and high risk features. While favorable risk patients have excellent outcomes with monotherapy, combined external beam and brachytherapy is an excellent treatment option for men with intermediate to high risk prostate cancer.

Combining EBRT with brachytherapy boost is a safe and effective way of delivering high radiation doses to the prostate and can achieve results similar to favorable risk patients. Brachytherapy and combined EBRT has been shown to be both safe and effective, however, we await the results of recently completed and future prospective randomized trials to verify these findings. While the addition of hormonal therapy to external beam irradiation has proven beneficial, the use of hormonal therapy with brachytherapy remains less clear. Future prospective clinical trials will help better define the role of combined external beam radiotherapy and brachytherapy and the additional use of hormonal therapy.

 ISSN 2330-4049

Importance and procedures of quality control of diagnostic CT and CT simulator using for modern radiation therapy

Islam A. M., Islam A., Chowdhury Q.

Oncology & Radiotherapy Center, SQUARE Hospitals Ltd, Dhaka, Bangladesh.

The purpose of the work is to provide the some procedures and importance of quality control (QA) of diagnostic CT and CT simulator. The modern radiotherapy treatments are depending on the precise target volume, accurate patient setup and accurate dose delivery to the target volume of interest. CT simulation is the base of modern radiotherapy treatment. Appropriate contrast, spatial resolution, accurate slice thickness improve the quality of treatment. We performed the QA program for LightSpeed™ RT^{16} CT simulator of SQUARE Hospitals Ltd. The QA procedures were done accordance with the AAPM TG-66 protocol. The contrast scale was tested. Difference of CT number for water and Plexiglas was found to be 119.99 (Tolerance limit = 120 ± 12). The high contrast spatial resolution was tested and the value of standard deviation was found to be 37.87 (Tolerance limit = 37 ± 4) using standard algorithm for ROI in 1.6 mm bar pattern. The low contrast detectability, noise and uniformity were justified and the measured values of these were within the tolerance limit. The slice thickness was measured and no variation was found.

 ISSN 2330-4049

Medical physics and biomedical engineering education in Gono University

Paul K. C.[1], Akhtaruzzaman M.[1] , Azhari H. A.[1], Zakaria G. A.[1, 2]

[1]*Dept. of Medical Physics and Biomedical Engineering, Gono University, Dhaka, Bangladesh*
[2]*Dept. of Medical Radiation Physics, Gummersbach Hospital, Academic Teaching Hospital University of Cologne, Gummersbach, Germany*

Medical Physicists put a major contribution in safe and effective radiation treatment of cancer patient. A high standard education is required for this purpose, which is difficult to achieve in developing country due to lack of resources. The medical physicists in radiation oncology are not adequate to the current requirement and expecting more radiotherapy centers with the increase the number of cancer patients in Bangladesh. The purpose of the study is to provide the information regarding the scope of Medical Physics and Biomedical Engineering (MPBME) education in Gono University. This paper represents an overview regarding current status of education; collaboration and future programme of education in Gono University. The syllabus is based on IAEA, DGMP and AAPM documents considering the requirement of Bangladesh. A good number of students obtained Master of Science (M. Sc) in Medical Physics from this department. Academic collaborations exist with national and international institutions such as National Institute of Cancer Research and Hospital (NICRH), Mohakhali, Dhaka Medical College Hospital (DMCH), Dhaka and the University of Heidelberg in co-operation with German Cancer Research Centre (DKFZ), Heidelberg, Germany, North Bengal Oncology Center, Siliguri, India. Recently this department has established collaboration with Mannheim Medical Center of the Ruprech- Karkls University, Germany. A standard education program has been conducting successfully at Gono University from 2001. Other universities especially public universities should come forward to meet the requirement of medical physicists in the country by offering medical physics & biomedical engineering education.

 ISSN 2330-4049

Plan verification in tomotherapy using 3D semiconductor detector

Zakaria G. A.[1], Garbe S.[2]

[1]*Dept. of Medical Radiation Physics, Gummersbach Hospital, Academic Teaching Hospital of the University of Cologne, Gummersbach, Germany*
[2]*Radiological University Hospital, Radiation Therapy, Bonn, Germany*

Highly conformal rotational IMRT requires high spatial resolution in dose verification of less than 3mm for modulated steep dose gradients in three dimensional dose distributions. By introducing a novel semiconductor based 3D semiconductor detector, one can investigate an improvement in the detection of those steep dose gradients in three different clinical entities.

For this study in rotational IMRT, both a TomoTherapy Hi-Art II system (TomoTherapy Inc, Madison, WI) and a RapidArc™ (Varian Medical Systems Inc, Palo Alto, CA) have been used. For the detection of the dose gradients we have utilized a novel 3D semiconductor detector ArcCHECK (Sun Nuclear Corp., Melbourne, FL). This detector is a cylindrical PMMA-phantom containing 1386 Si diodes in a helical grid arrangement with a detector space of 1.0 cm in length and an array diameter of 21.0 cm.

Dose verification of patient treatment plans (PQA) of re-irradiated cases of head and neck cancer, retreatment of the spinal cord, high risk prostate cancer cases are created and exported as DICOM RT dose plan from the TomoTherapy machine to MapCHECK software (Version 5.0). In the prostate case the PQA plan has not only been verified, but also a QA-test for interruption of the irradiation has been performed. The resulting measured files were saved separately and combined as one to evaluate the overlapping feature in the interrupted measured file. Furthermore, we tilted the phantom central axis up to 6^0 on both right and left sides to evaluate whether significant deviations and uncertainties occur in the quality of PQA. Quality control tests for the Tomotherapy like couch y-translation and gantry synchrony, synchrony of leaf opening and gantry angle were also observed. In addition, a comparison was performed to RapidArc™ PQA results for high dose gradients in the prostate case.

In TomoTherapy prostate plans we have obtained above 98% pass rate (repetition of 10 times, sigma 1% relative comparison) using gamma criteria of 3% and 3mm.The uncertainty found between combined and full plan is less than 1%. A tilt of the phantom for less than a degree does not cause any significant changes to the quality of the patient treatment plans, however we could observe that more than 1^0 causes 2-3% difference in the passing rate. Couch y- translation and gantry synchrony are checked over the course of several rotations by opening the leaves for segments of the 3rd, 8th, 13th of the fifteen consecutive rotations while driving the couch 1 cm per rotation. The spacing of the irradiated segments is checked to ensure that it is 5 cm (± 1 mm). For the leaf opening and gantry angles synchrony opening, the two middle MLC leaves for 5^0 projections are centered at the gantry angle of 0^0, 120^0, 240^0, and the gantry is rotated 40 times at a speed of 20 s per rotation. In prostate treatment plans using RapidArc™ the ArcCHECK pass rate was above 98% (relative comparison) using the gamma criteria of 3% and 3mm.

In dynamic and helical IMRT using TomoTherapy and RapidArc™ the ArcCHECK shows excellent reproducible results in dose verification. ArcCHECK does not only show better detection of steep dose gradients in PQA dose verification, but also in the Tomotherapy machine QA. To achieve a better resolution in dose verification with the 3mm space in 1cm detector spacing, the patient QA plan should be calculated for less than 4mm space (grid) in planning station and then with the MapCHECK software, the planned dose file should be overlaid with the measured file.

 ISSN 2330-4049

Comparison of the miniaturized Co-60 and Ir-192 sources in HDR brachytherpy applications

Muralidharan A. N.

Eckert & Ziegler BEBIG -Chennai India

The purpose of this presentation is to investigate the advantages or disadvantages of both radionuclides for HDR brachytherapy due to their physical differences. The motivation is to provide useful information to support decision- making procedures in the selection of equipment for brachytherapy treatment rooms. The results of this work show that no advantages or disadvantages exist for Co-60 sources compared to Ir-192 sources with regard to clinical aspects rather Co-60 has an edge due to its long half life usage.

Though the smaller size of Ir192 sources made it the preferred radionuclide for temporary brachytherapy treatments, the introduction of miniaturised Co-60 sources have been made available with identical geometrical dimensions to make it useful for all brachytherpy applications which was not possible with older co60 sources based afterloaders.

The physical data has been entered in the clinically useful HDRplus planning system and comparison of the isotopes Co-60 and Ir-192 distribution as radiation sources for high-dose-rate (HDR) afterloading brachytherapy is done.

Comparison of the characteristics of both nuclides in different applications of brachytherapy based on various physical characteristics and from scientific literature is presented.

The Dosimetry aspects were compared and presented with Co-60 over Ir-192 with no clinical differences. Nevertheless, there are potential logistical advantages of ^{60}Co sources due to its longer half-life (5.3 years vs. 74 days), making it an interesting alternative especially in developing countries. As a result it would prove to be advantage to plan for a Co-60
HDR room plan at the start of the planning process to make the use of the available Co-60 HDR which would be cost effective and viable. The advantage will provide the motivation and useful information to support decision-making procedures in the selection of equipment for brachytherapy treatment rooms.

International Journal of Cancer Therapy and Oncology
www.ijcto.org

A Supine based cranio-spinal irradiation technique using moving field junctions radiotherapy

Hossain M. F., Bhuiyan A., Frederick V.

United Hospital Limited, Dhaka, Bangladesh.

Patients were immobilized with a thermoplastic mask and scanned in the supine position. Target volumes and critical organs were delineated and the intention is to deliver 36Gy in 18 fractions (1.8Gy /fraction) to the entire cranio-spinal region. Two plans designed to be treated simultaneously were created with different, yet constant isocenters. The isocenter of the first plan was identified along the C2 vertebra and the other usually falls at the lower thoracic/upper lumbar region. In the first plan, three beams two laterals opposed and one posterior were placed using asymmetric jaws to cover the entire skull and the cervico-thoracic spinal regions. In the second plan, a single posterior beam was used to cover thoraco-lumbosacral region, with its cranial junction overlapped with the caudal edge of the posterior thoracic field of the first plan at the level of the vertebral spine. The dose coverage was optimized by using enhanced dynamic wedge and / or field in field methods. Both the plans were duplicated twice with the original isocenter intact, but with a cranial shift in order to feather the junction. To effectuate this, two more junctions were created between the thoracic and lumbar fields in the duplicated plans. All the three junctions were separated with a planned gap of 3cms, using asymmetric jaws .all the plans were scheduled in the RT electronic scheduling chart such that the three junctions alternate with a three fraction cycling time ;albeit with only two fixed isocenters. A sagital dose verification film was taken to verify this 'moving-junction' technique.

The moving junction technique intuitively seems to have lesser dosimetric variability compared to the other matching junction's technique. The verification film ensures the technique is safer and reproducible .We observed in the parker et.al. Matching junction technique that mere 2mm mismatch in the longitudinal direction resulted in considerable dosimetric variability that ranged from a 45% hot spot (in case of an overlap) to a 30% cold- spot (in case of a gap) between the junctions. Care should be taken to ensure that the nomenclature of the plans and fields is clear and unambiguous: and that the sequencing and scheduling of the plans is entered accurately in the RT scheduling chart. Moreover, if necessary, anesthesia can be delivered easily in this technique rather than in the prone position.

This approach of supine craniospinal irradiation is simple and easy to implement; and saves time required for planning and treatment while improving patient comfort and reproducibility.

ISSN 2330-4049

Statistical variation and significance in the responses of thyroid follicular cells of two areas of Bangladesh due to radiotherapy into head and neck region

Chakraborty S. R.[1], Deb A. K.[1], Uddin M.[2], Rahman M.[3]

[1]*Department of Physics, University of Chittagong, Chittagong-4331, Bangladesh.*
[2]*Department of of Radiotherapy, Chittagong Medical College Hospital, Chittagong.*
[3]*Department of of Radiotherapy, Sylhet MAG Osmani Medical College Hospital, Sylhet.*

Thyroid gland is sensitive to gamma radiation. During radiotherapy (Co-60 teletherapy) in the head-neck region, patients' thyroid gland is exposed to high level gamma irradiation. The exact dose on thyroid depends upon the tumor site, stage and overall total dose. In this research, an attempt has been made to find the extent of the response of thyroid follicular cells due to fractionated gamma irradiation as the thyroid follicular cells produce the hormones T3 (triiodothyronine) and T4 (tetraiodothyronine or thyroxine) and to find the statistical significance and variation of those responses.

A total of 180 head-neck cancerous patients having mean age 54.57 years who had no thyroid problem and who had to be treated with radiotherapy (^{60}Co) of Chittagong Medical College Hospital (106 from CMCH) and Sylhet MAG Osmani Medical College Hospital (74 from SMAGOMCH) have been selected in the present research. The patients' hormones T3, T4 and TSH (Thyroid Stimulating Hormone or thyrotropin) had been measured six times for each patient. The measurement times of which have been before the beginning of the patients' individual radiotherapy course, immediately after the radiotherapy, six weeks after the radiotherapy, twelve weeks after the radiotherapy, six months after the radiotherapy and finally twelve months after the radiotherapy for individual patients.

Thyroid's follicular cells' response have been estimated by the percent of decrease in secretion of hormones T3 and T4 in spite of increased secretion of TSH by the pituitary gland. Statistical significance of the responses of thyroid follicular cells due to radiotherapy has been justified by the values of paired t –test, correlation coefficient, and the coefficient of variance. Graphs have been plotted to show the variation in the values of the mentioned statistical parameters for the patients of CMCH, SMAGOMCH, and overall patients for different dose levels and for different time.

No significant variation has been observed unto the completion of twelve weeks of radiotherapy. At six weeks following completion of individual radiotherapy course, moderate variation has been observed. However, at one year following completion of radiotherapy, highly significant variation has been noticed with lower t –test values and higher multiple regression and coefficient of variance values. However, no significant variation in the responses of the patients of two areas has been found.

Fractionated acute radiation exposure to thyroid gland causes irreparable damage to the thyroid follicular cells. With the increase of time after completion of radiotherapy, the responses seem to depend not only upon radiotherapy but also on other factor(s). The patients of CMCH and SMAGOMCH are of similar genetics/ethnicity and no significant variation between them has been noticed, the individual average values are very close to their total average values.

 ISSN 2330-4049

Determining proper patient's set-up parameters like IFD, gantry angles, and field width in Ca. breast to achieve precise treatment, in a center where TPS & simulators are not available

Islam N.

Dept. of Radiotherapy and Oncology, Shaheed Ziaur Rahman Medical College Hospital, Bogra, Bangladesh

Ca Breast is becoming the most common cancer in our country women than Ca Cervix. To achieve good survival and quality of life, radiation therapy plays an important role. The treatment portals should be placed such that Lung and Heart should get less doses, so calculation of the exact gantry angles (parallel opposed) plays important role. Conventional radiotherapy to Ca Breast is by tangential fields. For a center where TPS & Simulator are not available taking images/contour is the only way to find treatment set up parameters, which is time consuming. Using the method described here one can calculate the patient set up parameters instantaneously.

The formula is used on patients for whom contour is taken with POP cast to calculate IFD, Gantry angles & field width. The method to determine patient set up parameters is as follows:

1. The gantry cross hair set at mid portion of medial border market by radiation oncologist. SSD is set to 80 cm, the couch is raised till the lateral laser matches the mid axially line marked by radiation oncology.
2. At medial border SSD is noted say "X"=80-SSD
3. Now the couch is moved laterally until Gantry cross hair touches the mid axillary center. The lateral reading is noted as "Y"= from couch lateral scale. The above points 1, 2, 3 forms right-angled triangle.
4. Calculate IFD = square root (X2+Y2)
5. Gantry angle = Cos-1(Y/IFD)

FOR RIGHT BREAST:

Right Medial Tangential = 0 + Gantry angle
Right Lateral Tangential = 180 + Gantry angle

FOR LEFT BREAST:

Left Medial Tangential = 360 - Gantry angle
Left Lateral Tangential = 180 - Gantry angle

To calculate width for tangential fields move gantry as per obtained gantry angle, virtually adjust such that field is parallel to chest wall and 1.5 - 2 cm margin is left in air to account respiration. The above procedure is for SSD technique using breast treatment (Half beam block).

The mathematical formula describe here is done on 40 patients each patients is subjected to both contour with POP and mathematical formula the results are well matching.

The procedure described is done on 40 patients and results are well matching with the contour procedure. This method gives patients set up parameters on table, save time, eliminates the cost involved in making cast. Also if any small shift is made in patient skin marks by Radiation Oncologist, instantaneously one can calculate the set up parameters.

 ISSN 2330-4049

Accidental exposure of cancer patient and its prevention

Kabir S. M. E.

Department of Radiotherapy and Oncology, Shaheed Ziaur Rahman Medical College Hospital.

This publication aims to make awareness about the accidental exposures involving patients undergoing treatment from external beam Brachytherapy as well as staff. In order to prevent accidents in radiotherapy, it is important to learn from accidents that have occurred previously. The document is addressed to a diverse audience of professionals directly involved in radiotherapy procedures, hospital administrators, and health and regulatory authorities. The approach adopted is to describe illustrative severe accidents, discuss the causes of these events and contributory factors, summaries the sometimes devastating consequences of these events, and provide recommendations on the prevention of such events. The measures discussed include institutional arrangements, staff training, quality assurance programmes, adequate supervision, clear definition of responsibilities, and prompt reporting. In many of the accidental exposures described in this report, a single cause cannot be identified. Usually, there was a combination of factors contributing to the accident, e.g., deficient staff training, lack of independent checks, lack of quality control procedures, and absence of overall supervision. Such combinations often point to an overall deficiency in management, allowing patient treatment in the absence of a comprehensive quality assurance program. The use of radiation therapy in the treatment of cancer patients has grown considerably and is likely to continue to increase. Major accidents are rare, but are likely to continue to happen unless awareness is increased. In this publication, explicit recommendations on measures to prevent radiotherapy accidents are given with respect to regulations, education, and quality assurance.

 ISSN 2330-4049

Comparison of physical and enhanced dynamic wedges beam characteristics for 6 MV photon energy using pencil-beam convolution (PBC) algorithm

Sabur M. A.[1], Akhtaruzzaman M.[2], Kabir S.M.E.[3], Zakaria G. A.[4]

[1]*Department of Medical Physics, kyamch Cancer Center, Sirajgonj, Bangladesh*
[2]*Department of Radiation Oncology, Ahsania Mission Cancer & General Hospital, Dhaka, Bangladesh*
[3]*Department of Radiotherapy, Shaheed Ziaur Rahman Medical College & Hospital, Bogra, Bangladesh*
[4]*Department. of Medical Radiation Physics, Gummersbach Hospital, Academic Teaching Hospital of the University of Cologne, Gummersbach, Germany*

Both Enhanced Dynamic Wedge (EDW) and Physical Wedge (PW) of modern linear accelerators are required for treatment planning and dose delivery to patients. In this study, wedge beam characteristic of Physical and Enhanced Dynamic Wedge were calculated and verified by measurement.

All measurements were performed with a linear accelerator (Clinac 2100C, Varian Medical System) at 6 MV X-ray beams. Wedge factors and profiles for PW and EDW were measured by a PTW cylindrical ionization chamber and a Scanditronix-Wellhoefer LDA-99 linear array detector in a water phantom respectively. Measured profiles were compared with calculated profiles from the Eclipse Treatment Planning System (TPS) for PW and EDW. Measured Wedge factors for PW and EDW were also compared.

The comparison of measurement and calculation of PW shows in the middle-field region a deviation of less than 1%. However, on field boundaries, a greater deviation (maximal 4%) is present, which is largely independent on the wedge angle. For EDW, the deviation between measurement and calculation in the middle-field are in general slightly larger than for PW (maximal 2%). Additionally, on field boundaries a higher deviation is present which increases with the wedge angle. By using PW, the maximum variation in normalized wedge factor NWF with field sizes is 4.5% for thick wedge (60°) and decreases with decreasing wedge angle. Whereas for EDW, the maximum variation is from 20 % to 40% from thinner to thicker wedge.

In this study, it was found that the deviation between measurement and calculation for both PW and EDW has no relevant effect in the clinical practice. However, one should note that the irradiation of patients with fields using EDW could lead to errors due to non-constant movement of the collimators. Therefore, it must be examined at frequent intervals.

 ISSN 2330-4049

Procedure to set up a radiotherapy unit & low cost unit analysis

Rana K. M. M.[1], Azhari H. A.[1], Zakaria G. A.[1,2]

[1]*Department of Medical Physics & Biomedical Engineering, Gono University, Dhaka, Bangladesh*
[2]*Dept. of Med. Radiation Physics, Gummersbach Hospital, Academic Teaching Hospital of the University of Cologne, Germany*

Radiotherapy is a multidisciplinary specialty which uses complex equipment and radiation sources for the delivery of cancer treatment. If this radiation not delivered in a controlled process, this may lead to unnecessary radiation exposure to patient & staff, and deterministic effects as well. According to WHO, 2 teletherapy machines are required for one million people. In our country 320 teletherapy machines would be required to meet the needs of a population of 160 million. To ensure the safety setting up and running a radiotherapy unit and also delivering treatment, protocols according to Atomic Energy Commission of each respective country must be followed. This study is aimed to provide a procedure (document) for establishing new Radiotherapy facilities as par Regulatory procedure of Bangladesh Atomic Energy Commission. In addition, the capital costs for construction and maintenance of a radiotherapy unit comprises huge expenses including building costs, equipment costs, manpower costs and maintenance costs. For developing countries like Bangladesh, there is strong need to set up radiotherapy units at the minimum costs as possible consistent with the necessary quality. In this work a cost effectiveness analysis has been done for several aspects. This document is intended to act as a guide to set up a radiotherapy unit in a proper regulatory process in Bangladesh Atomic Energy Commission. Further, is revealed in this study advanced modern techniques in radiotherapy, increases the capital costs due to relevant factors. The Co-60 modality needs low costs in comparison to advanced modern techniques (e.g. Dual Energy Linacs, Linac with IMRT). On the other side a Linac may be superior to a Co-60 machine due to better dose distributions, spare of costs for source replacement, shorter treatment times and safety considerations. In any case, professional personnel are needed for all steps during the set up procedure. This may shorten the time in obtaining the approval license to run a radiotherapy unit.

International Journal of Cancer Therapy and Oncology
www.ijcto.org

Patient setup verification and quality control (QC) of electronic portal imaging device (EPID)

Hossain M.T.[1], Islam M. A.[1,2], Aunapam H. A.[1], Zakaria G. A.[1,3]

[1]*Dept. of Medical Physics and Biomedical Engineer-ing, Gono Bishwabidyalay,Bangladesh.*
[2]*Dept. of Radiation Oncology, Square Hospitals Ltd, Bangladesh.*
[3] *Dept. of Med. Radiation Physics, Gummersbach Hospital, Academic Teaching Hospital of the University of Cologne, Germany*

The increased intricacy of the treatment planning and delivery techniques has made the verification of the dose delivery before and during the actual patient treatment extremely significant. The purpose of this study is to evaluate Electronic Portal Imaging Device (EPID) as a mean way to verify patient's setup position in treatment conditions and to perform QC tests of EPID to ensure the quality of it.

In this study 40 patients suffering from different carcinoma (cervix 6, prostate 4, lung 10, head and neck 10, breast 10) have been randomly selected from the Offline Review of treatment planning system (TPS). All the images have been acquired with a Portal Vision™ aS1000 EPID based on Amorphous Silicon (a-Si) technology of VARIAN Medical System. The individual acquired image has been matched with the CT Digitally Reconstructed Radiograph (DRR) with reference to the anatomical landmarks in the computer workstation (ARIA) and the patient treatment position has been shifted along the longitudinal, lateral and vertical axes. Afterwards the displacement between acquired and treatment position have been calculated for three days among the entire course of treatment for every individual patient. The collision interlocks, positional accuracy of detector, mechanical checks and image quality have been performed according to AAPM TG-58 protocol.

The mean setup deviations in mm along the longitudinal, lateral and vertical axes were 0.3, 0.4, 0.05(cervix), 0.4, 0.2, 0.2 (prostate), 0.3, 0.2, 0.3 (lung), 0.2, 0.2, 0.2 (head & neck) and 0.3, 0.2, 0.2 (breast) respectively. QC tests showed resemblance with acceptance values. This work demonstrates the efficiency of EPID in most accurate patient setup for more successful patient outcomes and encourages the effective use of it in every radiotherapy treatment as a clinically significant device.

ISSN 2330-4049