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GLOSSOPHARYNGEAL NEURALGIA
A CASE BASED DISCUSSION

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WHAT IS GLOSSOPHARYNGEAL NEURALGIA?

Glossopharyngeal neuralgia (GPN) is a rare condition involving the 9th cranial nerve, causing distressing symptoms of severe paroxysmal pain (electrical shooting type), triggered by stimulation of the pharynx, typically during swallowing.
The term GPN was initially described by W Harris in 19211to describe paroxysms of severe pain over the back of the tongue and throat. It accounts for 0.2-1.3% of all cranial neuralgias, with an incidence rate of 0.7 per 100,000 population2.

WHAT ARE THE TYPES OF GPN?

According to the International Headache Society, GPN is subdivided into classical, secondary and idiopathic GPN3. In classical GPN, neurovascular compression on the glossopharyngeal nerve is identified on magnetic resonance imaging (MRI), without any other apparent cause or symptoms. GPN caused by an underlying disease constitutes secondary GPN, while idiopathic GPN is a condition without any evidence of neurovascular compression or underlying disease.
Although the etiology of GPN remains unclear, it has been attributed to compressive effects at the root entry zone of the brainstem, by a vessel or vessels. Other potential causes include tumors, infections, trauma, dental extractions, post surgical complications (disturbing the glossopharyngeal nerve) or structural abnormalities of the throat.

HOW IS GLOSSOPHARYNGEAL NEURALGIA DIAGNOSED?

GPN is typically a clinical diagnosis and requires thorough understanding of the cranial nerve anatomy as well as possible triggers for GPN and correlating it with imaging. The Glossopharyngeal nerve (GN) exits the brainstem from the medulla and traverses the jugular foramen to exit the skull. It is a mixed nerve that carries sensory, efferent motor and parasympathetic fibers. Clinical examination requires touching a cotton swab to the back of the throat, which elicits severe pain. Magnetic resonance imaging (MRI) Brain or MR angiogram help to rule out vascular compression, while a computed tomography scan (CT) aids in ruling out Eagle's syndrome.

Clinically, GPN is characterized by unilateral brief stabbing/shooting pain, abrupt in onset and termination, experienced in the ear, base of tongue, throat, tonsillar fossa and/or beneath the angle of the jaw. It is frequently triggered by swallowing, talking, yawning or coughing. Each episode may range from a few seconds upto several minutes or longer.
GPN may also involve the sensory tributary of the Vagus nerve (VN), leading to cardiovascular manifestations such as bradycardia or hypotension. Considering the likelihood of vessels compressing both GN and VN compared to compressing GN alone, some authors have also suggested vaso-glossopharyngeal neuralgia (VGPN) as a better terminology[4].

According to the International Headache Society[3], diagnostic criteria of GPN are as follows:

a) Recurring paroxysmal attacks of unilateral pain in the distribution of the glossopharyngeal nerve and fulfilling criterion B:
b) Pain has all of the following characteristics:
    1. Lasting from a few seconds to 2 minutes
    2. Severe intensity
    3. Electric shock-like, shooting, stabbing or sharp in quality
    4. Precipitated by swallowing, coughing, talking or yawning

WHAT ARE THE DIFFERENTIAL DIAGNOSIS OF GPN?

1. Trigeminal neuralgia: Similar to GPN pain, patients report electric shock-like pain in the distribution of the second or third branch of trigeminal nerve. The pain episodes usually terminate quickly. It is one of the most common neuralgias and GPN may be misdiagnosed as trigeminal neuralgia.
2. Superior laryngeal neuralgia: Pain is usually triggered by talking and swallowing but palpation of the superior laryngeal nerve (at the location of entrance into larynx) triggers pain.
3. Eagle's syndrome: An elongated styloid process impinges upon the branches and fibers of the GN, causing similar symptoms. Imaging is required to rule out Eagle's whenever GPN is suspected.
4. Nervus Intermedius neuralgia: The pain although similar to that seen in GPN, differs as the pain is located deep in the ear. This pain may also be associated with taste or salivation disorders.
5. Charlin's syndrome: It is characterized by extremely sharp pain in the nasal and paranasal areas, provoked by palpating the lateral aspect of nostril. This syndrome may be associated with tearing of the eyes and conjunctivitis.
6. Jacobson's neuralgia: It involves the tympanic branch of the GN and has similar presentation as GPN. Imaging helps in confirmation of an anatomical anomaly that could cause compression of Jacobson's nerve.

WHAT ARE THE TREATMENT OPTIONS FOR GLOSSOPHARYNGEAL NEURALGIA?

The various treatment approaches are outlined below:

Pharmacological: Conventionally, a combination of analgesics and anticonvulsants are usually the first line of treatment, aiming for alleviation of neuropathic pain. Carbamazepine has been reported to provide pain relief in 70% of Trigeminal neuralgia (TN) cases and is often tried for GPN5. Other medications recommended by the International Association for the study of pain (IASP) include gabapentin, pregabalin, valproic acid, lamotrigine, with optimal doses individually titrated6. Medications provide pain relief in relapsing and remitting pattern and often lead to a tolerable state which may last several months or years, eventually leading to intolerable pain requiring definitive treatment (Surgery or Radiosurgery). Adjuvant medications include selective serotonin reuptake inhibitors, vitamin B12 and opioids.

Surgery: Microvascular Decompression (MVD), where decompression on the root entry zone (REZ) of the GN and VN by the compression vessel is achieved. Total relief rates have ranged from 50% to 100% and requires expertise, with outcomes depending on equipment and surgeon's experience as well as neurophysiological monitoring4,7. Another surgical option is rhizotomy of the GPN (selectively severing problematic nerve roots), with pain relief reported in upto 97% of patients7. Other alternatives are thermo-rhizotomy at pars nervosa of jugular foramen or tractotomy-nucleotomy at the brainstem but these procedures entail significant risk of deficits.

Radiosurgery: Radiosurgery is a precise, non-invasive means of delivering a single session of high dose radiation to the target, while sparing the normal tissues. Most of the reported literature on radiosurgery for GN suggest considerable pain relief (Table 1).

HOW IS RADIOSURGERY DELIVERED FOR GLOSSOPHARYNGEAL NEURALGIA?

We herein describe a case of GPN treated by radiosurgery:
We evaluated a 37 year old gentleman with complaints of severe pain on left side of neck associated with painful swallowing since 2 years. MRI showed a prominent vascular loop (likely left PICA) in the left cerebello-medullary cistern abutting left lower cranial nerves (9-11). On examination, he had severe pain on swallowing water, painful articulation of vowels, painful gag reflex and lack of taste perception (except bitter taste). He was on a combination of four medications (analgesics, anti-convulsants and muscle relaxant) for pain, with Barrow Neurological Institute (BNI) pain grade of V. Each pain episode lasted several minutes (ranging from few minutes to over an hour), severely affecting his sleep and quality of life.
After a diagnosis of GN was established, he was given the option of MVD versus SRS and pros and cons of each modality were explained. He opted for SRS and was planned for Radiosurgery (SRS) to the 9th nerve.

Cyberknife treatment planning

Patient was immobilized in supine position and a uniframe cast was made, with hands by the side. Two radiation planning computerized tomography (CT) scans of the brain (with and without contrast) were taken at 1mm slice thickness and fused with thin 1 mm sequential axial magnetic resonance imaging (MRI) brain slices for delineation purpose.
The target volume consisted of the distal end of the nerve at the level of glossopharyngeal meatus of the jugular foramen (Fig 1). The corresponding bony landmark on a CT scan is the pars nervosa (anteromedial part of jugular foramen). He received Cyberknife-based SRS (80Gy single fraction) to the 9th nerve. The target volume was 0.03cm3. Treatment plan was generated using fixed collimator in with Robotic Radiosurgery (Precision® treatment planning system, Accuray Incorporated®, Sunnyvale, CA, USA). The imaging center was chosen at mid-brain, so that the skull of the patient could be matched with reference to digitally reconstructed radiograph (DRR) image and positional corrections were applied. Dose optimization was performed with sequential optimization algorithm with 5 mm diameter fixed collimator. The maximum monitor units (MU) for each beam and each node were 300 and 450 respectively. Eight conformity shells were created around the target to reduce the dose spillage and the conformity structures diameters from the target was 3mm to 30mm with step of 3mm and 5mm.
The target dose objective for minimum dose and maximum dose were 80Gy and 89Gy respectively. The maximum dose constraints for the Vagus, brainstem and left cochlea were 70Gy, 9Gy and 8Gy. Once the optimization was completed, the final dose calculation was performed using ray-tracing calculation algorithm with the grid size of 0.98mm x 0.6mm x 0.98mm. The total treatment robot positions (node) and beams were 81 and 134 respectively. The total MU for the treatment plan was 33769 with the minimum MU of 11.3 (for beam). The achieved dosimetric parameters were: D100% to the target - 77.9Gy, maximum dose to the Vagus, brainstem and Left cochlea were 65.7Gy 9.2Gy and 8.7Gy respectively. The dose received by 10 cm3 volume of brain was 5.6 Gy. Once the plan was evaluated and approved, the patient specific quality assurance (PSQA) was performed using stereotactic dose verification phantom (SDVP) and A1SL (Standard Imaging, Madison WI, USA) chamber for the verification of delivery accuracy.

Results:

Less than twenty-four hours post SRS, the patient reported rapid relief in symptoms and was able to swallow water and eat food without any pain. At 8 months post SRS, he remains pain free and has resumed work, leading a good quality of life.

Discussion:

Radiosurgery for GPN is technically challenging due to its close proximity to the Vagus nerve (few millimeter posterior to the target). In 1996, a large multi-institutional study of fifty GN patients treated at five centres received SRS doses ranging from 60 to 90 Gy. The median reported time to pain relief was 1 month8. A case of severe, poorly controlled pain due to GN in a patient who refused surgery was treated by Gamma knife and reported in 2005 by Stieber et al9. He received 80 Gy to the cisternal segment of glossopharyngeal nerve and reported complete pain relief 3 months post SRS. A French study of 7 patients with intractable GN received 60-80 Gy SRS targeting the cisternal segment (n=2) or glossopharyngeal meatus (n=5) reported that patients who received a dose greater than 75 Gy were cured at long-term follow up10.
Age does not appear to be a detriment to SRS as it is a non- invasive procedure. The oldest reported patient with GN treated by SRS was a 99 year old lady who received 80Gy to the glossopharyngeal meatus with pain relief at 1 month post SRS11.
Post SRS, no changes in vocal cord function on swallowing disorders have been reported by Shankar et al in a report of 7 patients treated by frameless radiosurgery12.

Reports of re-SRS for recurrent GN have shown sustained pain relief and may be a viable alternative to surgical approach13.

The possibility of cardiac arrhythmia and instability is a complication seen in a few patients with GPN. Severe irritation and hyper-stimulation of the 9th nerve feedback onto tractus solitarius nucleus of midbrain via collaterals reaching the motor nucleus of the 10th nerve, may lead to adversely heightened vagal responses such as cardiac arrhythmia, bradycardia, and hypotension, with cerebral hypoxia, slowing of EEG activity, syncope, and convulsions14.
With SRS, the possibility of averting GPN-related complications such as cardiac arrhythmia is an added advantage.

Recently, Onabotulinumtoxin A has been reported to be an effective treatment in a patient with refractory GN, who underwent microvascular decompression twice15.

Conclusion

Radiosurgery is a compelling treatment option for patients with glossopharyngeal neuralgia who have pain refractory to medications. It leads to an exceptionally prompt response and must be considered a frontline treatment option for patients with disabling pain.

Conflict of interest:
None

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Fig 1: Upper left: Proximity of the target volume (glossopharyngeal meatus) depicted in red and the avoidance structure (vagus nerve shown in yellow) showing relationship with brainstem (dark blue). Upper right, Dose Volume histogram showing target volume coverage. Lower left and right: Sagittal and coronal CT images of target volume

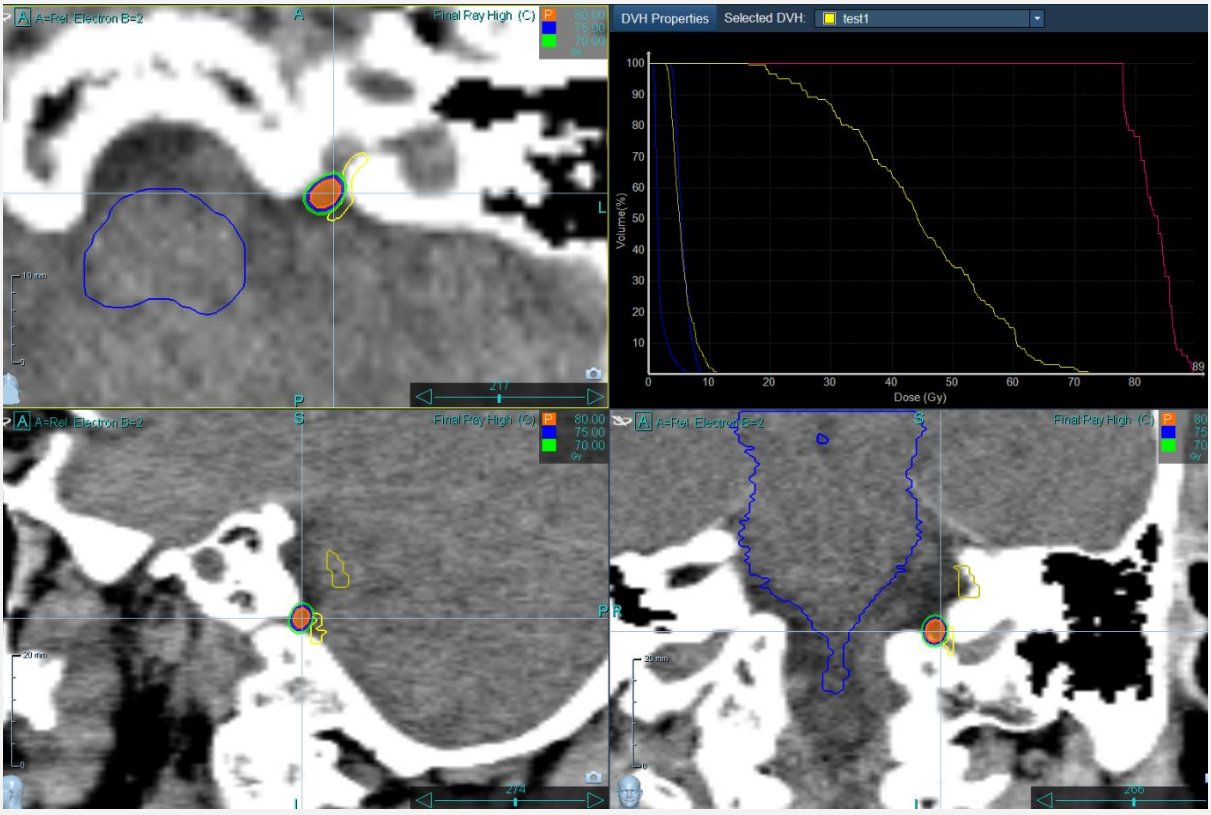

Table 1: Recent publications on radiosurgery for glossopharyngeal neuralgia

Author; Year of publication	No of patients, Age/Sex	Symptoms with duration	MRI findings	Previous management	SRS dose	Response
Evan Chua et al (2020)	N=1 54 years (Female)	Piercing right facial pain x 4 years	-	Microvascular decompression 3 pain medications	80 Gy	Significant pain relief within 2 weeks Pain-free at 2 years without medications
V Shankar et al (2020)	N=7 Median age 60 years (3 male, 4 female)	Long history of pain (28-70 months)	Neurovascular conflict in 4 cases	Microvascular decompression (n=2) Balloon compression (n=1)	80 Gy (Range, 80-85Gy)	Symptom relief at 7 weeks At 3 months, 5 were pain free
Kano et al (2016)	N=22 Median age 60 years (8 male, 14 female)	Pain (1-240 months)	-	Microvascular decompression (n=3) Balloon compression (n=1)	80 Gy	Complete pain relief in 13 patients (59%) at median 12 days (range 1-60 days)
Marc Leveque et al (2011)	N=7 Mean age 62 years (5 male, 2 female)	Intractable pain (8-72 months)	Neurovascular conflict in 4 cases	-	60-80 Gy	No pain in 5 patients at 3 months
Hsieh et al (2019)	N=1 45 years, Male	Left throat intractable pain (6 months)	-	-	86 Gy	Pain completely disappeared at 2 weeks
John K. O'Connor (2013)	N=1 99 years, Female	Electric-shock like pain, 18 months	No evidence of extrinsic compression of brainstem or cranial nerves	Two sphenopalatine blocks 4 pain medications and anti-convulsants	80Gy	Pain relief at 1 month Pain-free at 16 months

REFERENCES:

1. Harris W. Persistent pain in lesions of the peripheral and central nervous system. Br Med J. 1921 Nov 26;2(3178):896-900.
2. Andrew Han, Carver Montgomery, Alexandra Zamora, Emilie Winder et al. Glossopharyngeal neuralgia: Epidemiology, risk factors, pathophysiology, differential diagnosis, and treatment options. Psychology research. 2022;10(5).
3. Headache Classification Committee of the International Headache Society (IHS) The International Classification of Headache Disorders, 3rdedition.Cephalagia. 2018 Jan;38(1):1-211.
4. Chen J, Sindou M: Vago-glossopharyngeal neuralgia: a literature review of neurosurgical experience. ActaNeurochir (Wien). 2015 Feb;157(2):311-21.
5. Philip J Wiffen, Sheena Derry, R Andrew Moore, Eija A Kalso: Carbamazepine for chronic neuropathic pain and fibromyalgia in adults. Cochrane Database Syst Rev (1):CD005451.
6. Joachim Scholz, Nanna B Finnerup, Nadine Attal, Qasim Aziz et al. The IASP classification of chronic pain for ICD-11: chronic neuropathic pain. Pain2019 Jan;160(1):53-59.
7. Jae Sung Park, young Hwan Ahn. Glossopharyngeal neuralgia. J Korean NeurosurgSoc 66(1):12-23, 2023.D. Kondziolka, L D Lunsford, J C Flickinger, et al.
8. Stereotactic radiosurgery for trigeminal neuralgia: a multiinstitutional study using the gamma unit. J Neurosurg. 1996 Jun;84(6):940-5.
9. Volker W Stieber, J Daniel Bourland, Thomas L Ellis. Glossopharyngeal neuralgia treated with gamma knife surgery: treatment outcome and failure analysis. Case report. J Neurosurg. 2005 Jan; 102 Suppl:155-7
10. Marc Leveque, Michael C. Park, AdylMelhaoui, et al. Gamma knife radiosurgery for glossopharyngeal neuralgia: Marseille experience. J Radiosurg SBRT. 2011;1(1):41-46.
11. John K. O'Connor and ShaadBidiwala. Effectiveness and safety of gamma knife radiosurgery for glossopharyngeal neuralgia. Proc (BaylUniv Med Cent) 2013;26(3):262-264
12. V. Shankar, V. Sai Shreya, H. Vyas, et al. Frameless radiosurgery for intractable idiopathic glossopharyngeal neuralgia. Int J Radiation OncolBiolPhys, Vol. 108, No. 3, E231-E232, 2020. DOI: 10.1016/j.ijrobp.2020.07.1506
13. Kaye J, Daggubati L.C, Zeller S, Mclnerney J. Repeat gamma knife radiosurgery for recurrent glossopharyngeal neuralgia: A systematic review and our initial experience. StereotactFunctNeurosurg 2020;98:324-330
14. Dr P. M. Singh. An uncommonly common: Glossopharyngeal neuralgia. Ann Indian AcadNeurol 2013;16:1-8 DOI: 10.4103/0972-2327.107662
15. Katherine T Hamilton, Rachel Seligman, Rachel Blue, John Y K Lee. Refractory glossopharyngeal neuralgia successfully treated with Onabotulinumtoxin A: A case report. Headache. 2022 Nov;62(10):1424-1428.

CARDIAC SBRT

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We will discuss about cardiac arrhythmia
And role of SBRT in refractory arrhythmia.

Infarction and sarcoidosis cause arrhythmia
Ischemic SCAR is the media.

SA/AV node are main sites of conduction.
Scars cause re-entrant phenomenon.

Treatment include medication, ICD and radio ablation
When all of these fail, SBRT is the option.

RFA is good for superficial lesion
For deeper lesion, SBRT is the solution.

There is evidence from animal study
Prof. Loo reported the first case study.

Teamwork of electrophysiologist & radiation oncologist
We also need cardiologists including radiologist.

MRI, ECG guided CT and SPECT
Needed to define the substrate.

Motion management is the problem
Breath hold with ITV will solve this problem.

Lead tracking and active breath control
Are solutions for motion management to handle.

MIMICS and MUSIC are needed for image fusion
These are the hardware and software as our solution.

Twenty-five Gray is the single dose schedule
Coplanar arcs are needed for substrate dose poll.

Do a dry run one day prior to treatment
Electrophysiologists also need to be present.

See the ICD functioning before and after
Do CBCT with every arc treatment before.

Four-hour fasting, if adjacent to stomach
It will its prevent dose spread by any arc.

Side effects include fatigue and hypotension,
Pericarditis, pneumonitis, and gastric fistulation.

Control rates are encouraging
Follow up needs ICD data and echoing.

Costs are almost less than ICD cost
Needs iterative training before you start.

A Glimpse into the Future of Radiation Oncology

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Disclaimer: This article is based on facts and ideas collected from literature, but with a personal touch.

Healthcare has advanced, which has translated into improved longevity. According to World Bank records, life expectancy of population in India has increased from 62 to 70 years between 2000 and 2020. Population is ageing and as we know cancer incidence increases with advancing age. Also for environmental impurities or reasons unclear, cancer is now appearing at a younger age than before. So cancer will remain an important health concern.

One most beautiful glimpse into the future is we will surely find the absolute cure for cancer and we will win in this battle against the crab. Surgery, systemic therapy and radiation therapy are the three pillars of treatment and they are all advancing rapidly.

When reviewing the literature in the field of radiotherapy, one can observe a constant evolution of improvements in treatment delivery, with waves and hypes that come and go, some of which stay and become mainstream approach. Without being exclusive, one can observe a continuous improvement from kV-radiation, to Cs-137/60Co-beams, MV-linacs, the introduction of CT and 3D dose calculation, improved dose calculation algorithms, conformal RT, MLC, IMRT, VMAT, IGRT, SBRT, SRS etc., with MR-linacs and proton therapy being the new kids on the block.

Some of the key areas, radiation oncology is seeing a rapid evolution are as follows-

Imaging technology

We are already streets ahead from where we began and surely still progressing. MR Linac is already ready for use and in future its availability and affordability will improve.

Some argue it is already time or soon will be time to give up on our interpretations of CBCTs, which sometimes involves having to apply a bone match in an otherwise deformable and mobile soft tissue organ tumour. MR based imaging is giving and will continue to give a momentum to Image Guided Radiation Therapy. There are three main evident advantages of on board MR-Linac compared to cone beam computed tomography (CBCT) IGRT: better soft tissue imaging for (1) daily positioning of the patient; (2) monitoring during treatment delivery; and (3) online adapting the treatment plan to the daily anatomy. MR-Linac will play an innovative role in the always more contemporary frame of a fully personalized care, adapting daily radiotherapy treatments to the individual patient needs and successfully moving to a tailored treatment approach.

A counter argument here would be current developments in Machine Learning (ML) and Deep Learning (DL) open the door to real-time image registration, automated segmentation and treatment planning, and biological conformal radiation therapy without the need to generate this information at the time of treatment. Low dose kV-CBCT with the aid of ML/DL provide an image quality that might even challenge MR-imaging for most IGRT-purposes.

Nevertheless, it's a technology that is here to stay. Also, integration of MR spectroscopy and diffusion weighted imaging is now already facilitating biology guided boost and that personalization will definitely be the standard of care in future.

The enthusiasm and interest in MRgRT have also helped expand membership in the MR-Linac Consortium, which includes a diverse group of large and small clinics, both university-affiliated and non-affiliated – all driven by a vision to cure cancer and minimize side effects. Elekta Unity alone has now over 75 installations in the world and we already have one functional unit in India.
Apart from MRI, CT guided imaging is also continuously improving. Transponder based imaging and surface guided RT are other innovations that are partly deemed useful, partly not. They probably lack the flavour and crunch that MR Linac provides us.
Another major change expected is dismissal of CT planning. ASTRO 2021 expo floor introduced software that can now convert MRI datasets into synthetic CT image datasets for use in the treatment planning process. This eliminates the need for a separate CT scan just to create the treatment plan, speeding care and reducing costs. MRI offers much better soft tissue detail than CT and is preferred for diagnosis, and to gain a better understanding of the extent of the disease.

Artificial Intelligence (AI)

While we continue to battle whether AI is a friend or foe of humans; without even realizing, AI is already an integral part of our lives. While we listen to our favourite songs on a mobile app, AI automatically presents to us suggestions based on our liking and we absolutely love it, don't we? Then why resist AI at our work? While AI makes time consuming tasks automated, we will have time to invest our time in more creative and productive ways.
AI will gradually take care of contouring and planning as we devote more time into the clinics, healing more hearts and more time in the labs doing innovation. Daily online Adaptive radiotherapy is one of the recent advancements and we all had some inhibitions in trusting a robot to automatically contour, plan and even do a QA check and deliver treatment, all done while the patient is still on the couch. While some of us continue to have such distrust, it will be the standard in very near future. However, it will always require validation from a human brain although human brain will gradually accept that it does a fantastic job.
There is already literature supporting daily adaptive RT. DARTBOARD showed that daily adaptive RT using Varian Ethos (which could lower the PTV margin to 1mm) was associated with improved dosimetric parameters. More and more such trials will be presented in our conferences to come and it is wise to lead than follow in this evolution.

Radiomics

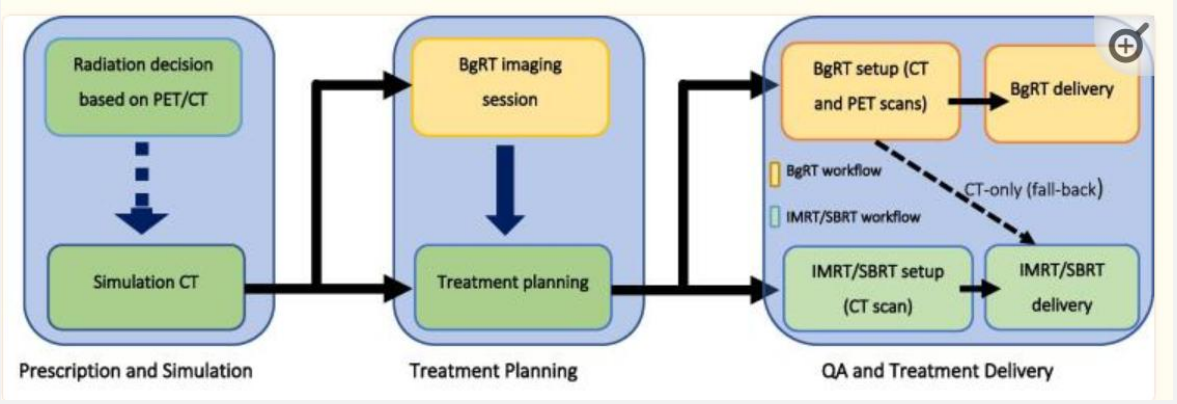
Radiomics is a method that extracts a large number of features from medical images (CT/ MRI/ PET) using data-characterization algorithms. These features, termed radiomic features, have the potential to uncover tumoral patterns and characteristics that fail to be appreciated by the naked eye. If used appropriately, the insights obtained could be a bridge to the era of personalized radiotherapy. Radiomics will also potentially challenge the current clinical trial endpoints which require long follow ups. In contrast, in future, changes in radiomics extracted features may serve as meaningful endpoints describing the changes happening in the heterogeneous tumour cell population.

The workflow begins with the acquisition of images/data (including QA and curation if necessary), the identification of regions of interest (automatically or manually), the pre-processing, extraction of features (handcrafted or deep), and post-processing of features, and machine learning (training of application) is then performed, culminating in a link to clinically actionable insight (diagnosis, prognosis, theragnosis, or follow-up).

Currently, no study has demonstrated clinical level 1evidence (prospective study) for any radiomics signature. Until this hurdle is crossed, the implication for the field is that it is still in the experimental retrospective research stage of development. Also the biggest challenge with this lack of actual clinical benefit till date is its expense to incorporate in all set ups.
However, as clinical data matures, it is surely expected to find a way into our clinics and give us better trial endpoints that will predict persistent response versus a likelihood of recurrence.

PET guided RT

PET scan already plays a very integral part in diagnosis and follow up of cancer treatments. The rationale for the integration of PET into radiotherapy planning is its ability to visualize molecular-biological pathways, which can subsequently be targeted by irradiation. The imaging of tumor hypoxia, proliferation, angiogenesis, apoptosis etc. enables to recognize the enormous heterogenesis of malignant tissue, and accordingly to define subvolumes in the tumor, the so-called biological target volume, which needs to be targeted using different irradiation doses or fractionations. For example, visualization of hypoxic subvolumes and quantification of tumor hypoxia under chemoradiotherapy lead to the concept of individual hypoxia-PET-based dose escalation in patients with advanced H&N cancer treated with primary definitive chemoradiotherapy. Also absence of hypoxia using PET traces have led to significant reduction in dose. Moreover, the visualization of tumor receptors (for example stem cells receptors in malignant gliomas), gene expression, proteins, immunological response, etc., will allow a personalized irradiation treatment based on the molecular characteristics of tumor and normal tissue.



Proposed workflow of Biology guided RT

BIOGUIDE-X: A First-in-Human Study of the Performance of Positron Emission Tomography-Guided Radiation Therapy is published in the April 2024 issue of Red Journal. They concluded that PET-guided therapy is a novel radiation therapy modality in which a radiolabeled tumor can act as its own fiducial for radiation therapy targeting. Emulated therapy dose distributions calculated from continuously acquired real-time PET data were accurate and machine-deliverable in tumors that were 2 to 5 cm in size with adequate FDG signal characteristics.

Biology research

The biology remains the same but our understanding is widening and that will open roads to more personalized care. One of the major breakthroughs in this regard is our deeper understanding of immune biology, and thus rationally designed biologically combined modalities (RT + immunotherapy) will be the future. Understanding the basic mechanisms of specific cell death and the subsequent steps of immune presentation will allow for a specific interference with immune signaling and will ultimately boost the efficiency of radiation treatments. Multiple lines of evidence prove that radiation exerts a complex pattern of cell death events each being associated with multiple and diverging immune reactions. Already, a number of trials have presented their results of combining radiation therapy (commonly hypo-fractionated schedules) with immunotherapy with good results.

Closely interwoven with immune pathways, other pathways like hypoxia associated mechanisms can be taken into interplay in establishing effective combination strategies with radiation. Hypoxia sensitizers have been used in the past without present mainstream use but improved understanding of related biology will open up new horizons in laying the foundations of effective combination therapies with radiation.

FLASH-irradiation, although an evolution from the Physics group, has a complex biological basis. It has been shown to more effectively target tumor cell when compared to non-malignant counterparts. The underlying background is currently poorly understood—in case of lung irradiation the upregulation of fibrosis related genes and senescence induction is reduced. The effect of FLASH-irradiation seems to be critically related to the oxygen level being present. In this regard a pure physical phenomenon directly translates into biological effects. Varian and the Cincinnati Children's/UC Health Proton Therapy Center announced during ASTRO 2021 they completed enrollment in FAST-01 (FeAsibility Study of Flash Radiotherapy for the Treatment of Symptomatic Bone Metastases), the first human clinical trial of flash therapy.

Finally, deciphering the molecular pathways leading to radiation induced toxicity will ultimately open new doors for molecular approaches heading for an increased therapeutic gain. Biology research also drives the search for molecular signatures that enable the definition of prognostic substrata and an individual assignment to these is a substantial part of computational personalized medicine approaches. Large number of molecular prognostic signatures have been published in recent years, however, only a few made it into clinical practice, such as Oncotype DX or Mammaprint in breast cancer.

Possible reasons for the low success rate here are small, non-representative discovery cohorts, flawed study designs and inappropriate choices of bioinformatics approaches. Such signatures in future will also drive radiation delivery decisions like it does for chemotherapy today.
Another game changer integrating biology (hypoxia) research and radiotracer use (PET), researchers from MSKCC have shown that radiation levels for non-hypoxic tumours can be reduced by more than half and FMISO PET reliably identified people with non-hypoxic tumour.

Proton therapy

We all are aware about the fantastic Bragg peak that we obtain with proton beam therapy. Over the last two decades there has been an explosive growth in proton centers around the world, so much so that, as of 2022, there were over 100 proton centers in operation around the world and about 60 more under construction or planned (http://www.ptcog.ch). Even so, less than 1% of the radiotherapy patients world-wide are treated with protons and heavier ions. Let us attempt to understand why. Initially, based on the physical characteristics of proton dose distributions, there was great excitement about the potential of proton therapy to improve the therapeutic ratio considerably. With closer examination of the clinical results of proton therapy over time and the comparison of these results with conventional photon therapy, it seems that the initial high expectations might have been inflated. That's because of the greater vulnerability of protons to uncertainties, especially those introduced by inter- and intra-fractional variations in anatomy. In addition to anatomic variations, other sources of uncertainty in the treatments delivered include the approximations and assumptions of models used for computing dose distributions and the current practice of proton therapy of assuming the RBE to have a constant value of 1.1 which may not be true.
The first step to progress is identifying the vulnerabilities and that's the step already taken. Future research is likely to help us mitigate these uncertainties and traverse through them successfully. While already it has some promising indications like paediatric tumours, skull base tumours, the indications are sure to widen and with time, the cost and hence affordability will also improve.

Changing clinical scenarios

That is last but not at all the least. While many mainstream studies are questioning the role of Radiation Therapy (Prospect in rectal cancers, omission of radiation in certain low risk breast cancers, decreasing role in lymphomas), there is also a parallel rise in its indications.
After the first description of oligometastatic disease (OMD) as a distinct cancer stage between locally confined and systemically metastasized disease by Hellman and Weichselbaum in 1995, this concept is today supported by a growing number of high-quality trials that have reported an improvement in progression-free survival or overall survival. The contribution of radiation therapy in cancer management is likely to shift towards the oligometastatic/oligo progressive realm. Now with effective research in both systemic therapies and advancements in radiotherapy technologies, more and more stage IV patients are already seeing increased longevity that will definitely further improve further in the years to come. Until we find that magical cure of cancer, which being an optimist and believer in Science and Spirituality both, I am sure we will, until then such combination therapies will help alleviate the taboo of life expectancy of only a few months in even stage IV patients.

The only downside is, we will come across late morbidities of treatment more frequently given the increased survival with cancer.
What is lacking today and what will be a reality in future will be availability of biomarkers and liquid biopsy parameters that will enter the definition of oligometastatic disease and help select patients for aggressive management of oligometastases.

Immune checkpoint inhibitors (ICPB) have already revolutionized the treatment of several cancers in metastatic disease and in locally advanced NSCLC. Experimental data suggest that a tumor primarily resistant to ICPB can be reverted back into a sensitive tumor by adding concurrent radiotherapy. It is assumed that the immunogenic tumor cell death after radiotherapy is the mechanism behind these observations. The optimal radiation dose and fraction size to achieve this effect is still controversial in view of conflicting data. Many experts believe that fractions sizes of 4–8 Gy could be optimal. Recently, it has been shown that functionally intact regional lymph nodes are important to establish this radiation induced immune priming and that in takes approximately 7–14 days after radiotherapy until the maximal immune effect has been established. Nevertheless, currently recruiting clinical trials on the combination of radiotherapy and ICPB in locally advanced disease largely do not take these findings into consideration. But this knowledge will definitely be factored in, in future clinical trials.

Another end of the spectrum will be diagnosis of cancers in very early stages owing to improved screening and awareness. In such situations, SABR and brachytherapy will increasingly compete with invasive treatment options similar to the current understanding in early lung cancers. It may come to the mainstream even in operable situations.

Conclusion

With so much evolution on the cards, and AI doing a lot of our work; the question of work of radiation oncologist in future comes up often, so we will be involved in primary care of the patient offering personalized radiation therapy with aid of the models, validating the fantastic work done by the technology and driving the research for future innovations. And don't you worry, we are here to stay and so is radiotherapy.

References

Stefanie Corradini, Maximilian Niyazi, Dirk Verellen et al. X-change symposium: status and future of modern radiation oncology—from technology to biology. Radiat Oncol 16, 27 (2021). https://doi.org/10.1186/s13014-021-01758-w

Feature. Radiation therapy. March 21, 2022. By Dave Fornell. 7 Trends in Radiation Therapy at ASTRO 2021

Michael Baumann, Nadja Ebert, Ina Kurth et al. What will radiation oncology look like in 2050? A look at a changing professional landscape in Europe and beyond. Molecular Oncology 14 (2020) 1577–1585

Obituary

Prof. (Dr.) Chandan Dasgupta

Prof. Chandan Dasgupta left for his heavenly abode on the 10th of January, 2024 at his residence in Kolkata after battling Glioblastoma Multiforme for over an year. He is survived by his wife and daughter. He was Head of the Department of Radiotherapy at Burdwan Medical College, Purba Bardhaman and later became the Joint Director of Medical Education, Department of Health and Family welfare, Government of West Bengal – a post he held till his passing. Dr. Dasgupta was known as an accomplished teacher, an excellent speaker and had keen interest in organizing departmental academics for the PG students. He taught numerous students throughout his career who will remember him for his guidance in shaping their future.

Dr. Upasna Saxena

Dr. Upasna Saxena, a senior consultant at HCG Cancer Centre in Mumbai, India, passed away in January 2024 after a brief illness of unknown cause. At 41, her untimely demise has left her family, friends, and colleagues in profound sorrow. Born in Bhopal, Madhya Pradesh, Dr. Saxena's career journey took her through various regions of India due to her father's service in the Indian Army Medical Services. She completed her MBBS from Gandhi Medical College, Bhopal, and her MD in Radiotherapy from Netaji Subhash Chandra Bose Medical College, Jabalpur, in 2010. Dr. Saxena worked extensively at Rajiv Gandhi Cancer Institute, New Delhi, before joining HCG Cancer Centre, Mumbai, in 2016, where she served as a senior consultant and DNB guide until her passing. Known for her dedication, excellence, and compassion, Dr. Saxena was deeply committed to her patients and meticulous in her teaching and departmental responsibilities.She played a pivotal role in establishing the department, initiating a DNB program in radiation oncology, and founding the HCG-Elekta training school in radiosurgery. Her contributions to academic literature and participation in national and international events were highly regarded. Dr. Saxena's colleagues remember her not only as a professional mentor but also as a supportive friend and a multifaceted individual, excelling in various extracurricular activities. Her loss is deeply felt, leaving a void not only in the medical community but also among the patients and caregivers whose lives she touched. May her soul rest in peace, and may her legacy of service to humanity endure.

Obituary

Dr. C Raghunath Rao

After completing MBBS from Osmania University, Hyderabad, Dr. C. Raghunath Rao obtained his master's degree in MD (Radiotherapy) from Osmania University in 1982. Since then, he started his life journey as a reputed Medical Officer in the field of Radiation. First and foremost, he worked as Medical Officer in P.H.C, Peddagopathy, Khammam in 1982 and while progressing he has made several important contributions in his life's journey as follows: Asst. Prof. at Siddartha Medical College,Vijayawada in November 1983, Asst. Prof. at Osmania Medical College & MNJ IO & RCC, Hyderabad in Feb 1989 to April 1999, Associate Prof at Rangaraya Medical College , Kakinada from April 1999 to November 2000. And finally, from November 2000 till the last phase of his life, he worked as a Professor in Radiotherapy, Osmania Medical College and MNJ IO and RCC, Hyderabad. In the field of Medical, Research & Education Dr. Raghunath Rao 's contribution at the global level has been of high quality and commendable. He has published various research papers mainly on breast cancer and generic studies. During his illustrious career, Dr. Rao won many laurels as joint organizing secretary of AROI conferences. He was actively involved in organizing various workshops and clinical trials. Also worked as Secretary General of AP Chapter of AROI. He retired from Govt. Service in 2010 and joined Indur Cancer Centre Nizamabad as consultant Radiation Oncologist for about 5 years. After that he was confined to his house because of ill health.

Rajasthan AROICON 2024

Rajasthan AROICON was conducted by SMS Medical College this year. The conference kick started with a pre-conference workshop on 23rd of February in RHL Renova Cancer Center. The pre conference workshop included training on contouring for head and neck cancers followed by hands on workshop. The experience was intriguing for the post graduate students. Another workshop organized by the department of palliative medicine, SMS Medical College was just an icing on the cake needed to warm up the students for the upcoming main conference.

The two day conference conducted in the grand auditorium of Rajasthan international centre, Jaipur was attended by faculty and delegates across the length and breadth of the country. Various lectures, debates, quizzes and panel discussions were organized addressing cancers of various regions forcing the students to don their thinking hats on.

The inauguration ceremony was organized in the evening of 24th February which was graced by the presence of the chief guest and principal, controller of SMS Medical College, Dr. Rajeev Bagaratta Sir; the guest of honor, professor and head Department of Radiation Oncology, Dr. J P Agarwal Sir and; the special invitee, Chief of AROI, Dr. Rajesh Vashishth sir. The event also marked the felicitation of senior faculties for their unparalleled contribution in the field of oncology. Various radiation oncologists were also accolade with academic excellence award for various fellowship and super specialty courses.

Day 2 also saw various mind boggling lectures and discussion followed by oral paper and poster presentation. After completion of one year term of Dr OP Sharma as President, Dr. Sandeep Jain Senior Professor Radiation oncology SMS medical college Jaipur who was President elect took charge as President Raj chapter of AROI.

This magnificent state conference organised in the pink city definitely left it's imprints on every faculty and delegate who came.

Glimpses of AROICON, Rajasthan 2024

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10th YROC - AIIMS, Jodhpur

The 10th Young Radiation Oncologist Conference (YROC) was organized by the Department of Radiation Oncology at the All India Institute of Medical Sciences, Jodhpur. It was held between 19th-21st January 2024 with the theme of "Brachytherapy and SABR – Common goals, unique skills" under the leadership of organizing chairman Dr. Puneet Pareek and organizing secretary Dr. Bharti Devnani with the support of Dr. Rajesh Vashishth (AROI Chair), Prof. Manoj Gupta (President AROI), Dr V. Srinivasan (AROI Secretary) and more than 100 distinguished faculties across the country. The conference spanned three days, with the first day involving a live brachytherapy workshop with breast and sarcoma brachytherapy followed by a hands-on workshop focusing on stereotactic radiotherapy for brain metastases and SBRT for lung metastases. The main conference was a culmination of scholarly exchange in collaborative learning, featuring esteemed speakers and panel discussions, scientific sessions, and debates focusing on the evolving techniques of SBRT and established brachytherapy techniques.

The conference had a record-breaking more than 350 registrations, multiple mentorship sessions which were well-appreciated by residents, fellows, and faculties, presentation of oral, poster, video abstracts, and an open house quiz. The conference received an overwhelming response regarding the abstracts, with more than 300 abstracts received from across the country. Video abstract category was added for the first time and first 50 abstrct submitters got the complementary accommodation as an encouragement.

The mentorship sessions were also the first of their kind to be held at the radiation oncology national conference, with the sessions focusing on fellowship opportunities in careers and radiation oncology, writing a scientific paper and interpreting clinical trials, leadership, and oncology, establishing networks and oncology, publishing in a viable Journal and finally meeting examiner's expectations in radiation oncology exams.The students and young consultants met all the sessions with overwhelming responses. The event was attended by international faculties who shared their experience with us.

The valedictory function concluded with awarding prizes to the winners of poster and oral presentations. Dr. Maneesh Singh (TMH, Mumbai) and Dr. J Sahu (HCG, Mumbai) won the first and second prizes in the oral abstract presentation. The award for the best video for oral presentation was awarded to Dr. Tapan Kapoor (Medanta, Gurugram), Faculty best paper was awarded to Dr. Divya Khosla (PGIMER, Chandigarh). The quiz winners were Dr. Abiramasundari V and Dr. Pradeep Naik from NCI and IRCH, AIIMS, New Delhi. The conference ended with a vote of thanks to all the participants and the organizing committee by Dr. Bharti Devnani, organizing secretary of YROC 2024.

The 10th Young Radiation Oncologist Conference was a testament to our community's unwavering dedication and passion for advancing the radiation oncology field. We extend our heartfelt gratitude to all participants, speakers, sponsors, and organizers for their invaluable contributions to this memorable event. As we reflect on the insights gained and the connections forged, we must continue striving for excellence in patient care and innovation in cancer treatment

Glimpses YROC AIIMS, Jodhpur

AROI West Bengal Chapter
Annual Conference 2024

The Annual State Conference of the AROI West Bengal Chapter for the year 2024, was held on the 2nd and 3rd of March, 2024 at ITC Sonar, Kolkata.

The conference was graced by the presence of more than 275 Delegates includingmore than 100Faculties from all across West Bengal, different parts of India as well as abroad. The scientific programme consisted of six broad academic sessions and one target volume delineation workshop.

The conference was blessed with the presence and participation of the Honourable AROI President Elect, Dr. Surendra Nath Senapati, who was the Guest of Honour at the Inaugural Ceremony of the Conference. Other outstation Faculty included Dr.KaustavTalapatra and Dr.CessalKainickal.

Along with Dr. Senapati, the Conference Inauguration was graced with the presence of the internationally acclaimed celebrated danseuse, dance therapist and social activist MsAlokananda Roy who was the Chief Guest. After the ceremonial lamp-lighting ritual by the guests, office holders and senior members of AROI WB Chapter, the President AROI WB Chapter, Dr.Litan Naha Biswas and the Secretary of AROI WB Chapter, Dr. Abhishek Basufeliciatated both Dr. Senapati and Ms. Roy.

The first day's academic sessions were preceded by a Medical Ethics Session followed by different sessions on Women's Oncology, Immunotherapy in Oncology, Genitourinary cancers, Technologies etc. The sessions consisted of intriguing panel discussions and lectures chaired, moderated and discussed by prolific physicians from genres of Radiation, Medical & Surgical Oncology and Medical Physicists. There was a heated yet enriching debate on the topic of Radical radiotherapy in Oligometastatic Prostate Cancers under the Genitourinary Cancers session.

The lunch of the first day was preceded by the much awaited AROI West Bengal Chapter Oration, delivered by Ex Vice President AROI and Ex President AREOI WB Chapter, Prof. Dr.Santanu Pal. He delivered his oration on cancer being "A New Way of Life". He was felicitated for the oration by Prof. Dr.Litan Naha Biswas and Dr. Abhishek Basu.

With the ongoing academic sessions, e-poster session in Best Paper Category (for residents) and Proffered Paper Category (for delegates) was organised in a simultaneous manner. The Organising Committee received

a whopping 69 abstracts in total in both categories for e-poster session, out of which 10 papers were selected for Best Paper (on-stage) Presentation Session to be held on the second day.

The Annual General Body Meeting 2024 was held in The Pala Auditorium of ITC Sonar at approx. 1700 hrs of 2nd March, which was attended by 100+ members of AROI WB Chapter. The central issue of discussion was the upcoming AROICON 2025, the successful bid to organise which has been won by Narayana Superspeciality Hospital, Howrah under the aegis of AROI West Bengal Chapter and an outline of tentative organising committee was declared and ratified by the General Body.

The high points of the day were two Keynote lectures (virtual) delivered by the invited International faculties. E were extremely privileged to listen to Dr. Anna Kirby, Current President ESTRO, Clinical Oncologist, Institute of Cancer Research, London on "Cardiac sparing Radiotherapy in Breast Cancer". The conference was also graced by the virtual presence of Dr. Kevin Harrington, Joint Head of the Department of Radiotherapy and Imaging, Royal Marsden Hospital, London, UK. He delivered a riveting talk on "Navigating the molecular genetic landscape of recurrent metastatic HNSCC in search of therapeutic agents".

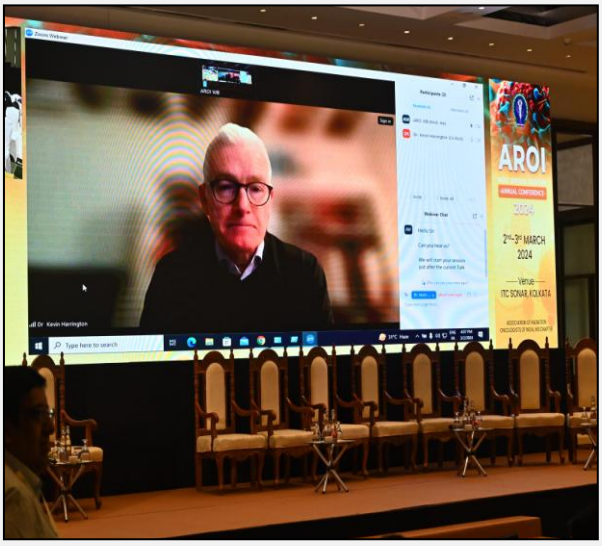
The second day began with a Target Volume Delineation Workshop on Lung Cancers, catering mainly towards residents. This was followed by a session on Head and Neck.

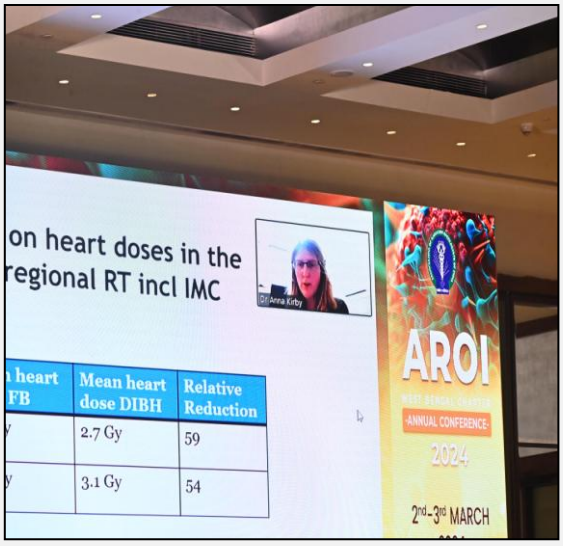
Post lunch, there was a session dedicated to Young Rad Oncs - "Young Oncologist's Session: Think out of the box!!" This year, the session was dedicated to the memory of Senior Member and Ex Vice President, AROI WB chapter, Dr. Chandan Dasgupta, whom we lost on 10th January, 2024. It consisted of two panel discussions on molecular level advances in treatment of glioma and endometrial cancers, participated by relatively younger and diverse group of radiation oncologists, medical oncologists, neurosurgeons, gynaecologists, onco-pathologists and radiologists.

The last two agenda were the very popular and adrenaline fuelled Quiz for Residents session, followed by the on-stage Best Paper oral presentation session. The Winners of AROI WB Fight Cancer Fellowship 2024 - Dr. Addway Chakraborty (3rd year) and Dr. Shridhar K.R. (2nd year) - both from Medical College, Kolkata and AROI WB Young Oncologist Fellowship 2024 - Dr. Bitan Pramanik and Dr. Debanjan Kundu both from CNCI, Kolkata. The Winner of the Best Paper Oral rounds was Dr. Souvik Sankar Das from CNCI, Kolkata.

Glimpses of AROI West Bengal

Glimpses of AROI West Bengal





Bid for
Best of ASTRO 2024
Invited

Dr. V. Srinivasan

Secretary General (AROI)

M 98410 22366

E secretaryaroi@gmail.com

Old Memories

Sitting on Chair (L to R):- Maj. Gen. Ananthanarayan, Dr. N. Pradhan, Dr. S. C. Klevenhagen, Sir. Brian Windeyer Dr. M. Mitter , Dr. K. N. Udupa, Dr. G. C. Pant, Dr. R. P. Singh, Dr. T. K. Dutta, Dr. B. D. Gupta.

Standing Ist Row (L to R) :- Dr. A. D. Singh, Dr. M. S. Agrawal, Dr, S, K. Shrivastava, Dr. T. B. L. Jalawal,
Dr. Faith Rangad, Dr. Tara Dangol, Dr. V. Mathuria, Kulbir Handa, Dr. S. P. Jain, Dr. L. S. Sundara Rao, Dr. Prem Narayan, Dr. A. K. Nagpal.

2nd Row (L to R):-Dr. B. Sanyal, Dr. L.M. Barlar, Dr. B. Deka, M.L. Gupta, Dr.U. Madhvanath, Dr. P.Q. Sood, Dr. P.S. Iyer, Dr. H.C. Pant, Dr. P. Subrahmanyam, Dr. M.K. Mahajan, Dr R. L. Bhalavat, Dr. S. J. Supe.

3rd Row (L to R):-Dr. T. K. Gaur, Dr. S. Sanyal, Dr. K. Rao, Dr. A. K. Asthana, Dr. Anand Kumar, Dr. Manoj Sharma, Dr. Harbans Lal, Dr. Ganapathi, Dr. J. R. Yarnold, Dr. M. Ahmad, Dr. B. Rajan.

4th Row (L to R):- Dr. Sudarashan, Dr. V. Dilip Kumar, Dr. A. C. Deke, Dr. Ajay Khanna, Dr. R. P. Gupta,
Dr. B. S. Sudhakar, Dr. S. Ayyagari, Mr. B. N. Vithal, Dr. D. Krishnan.

Congratulations!

AROI Rajasthan

Dr Sandeep Jain
State Chapter President

Head, Department of Radiation Oncology
SMS Medical College, Jaipur
PIN-302004

AROI Rajasthan

Dr Nidhi Patni
State Chapter Secretary

Director, Department of Radiation Oncology
Narayana Hospital, Jaipur
PIN-302033

7th AROI ESTRO Teaching Course on Gynecological Cancers (14th -17th March 2024), Varanasi.

Organizing Institute: Department of Radiation Oncology, Mahamana Pandit Madan Mohan Malaviya Cancer Centre (MPMMCC) and Homi Bhabha Cancer Hospital (HBCH), Varanasi.

Local Organising Chairperson: Prof Satyajit Pradhan, Director.

Local Organising Secretary: Prof Ashutosh Mukherji, Prof and Head, Dept of Radiation Oncology.

AROI Course Director: Prof Supriya Chopra, Prof, Dept of Radiation Oncology, TMH, Mumbai.

ESTRO Course Directors: Dr. Kari Tanderup, Medical Physicist, University Hospital, Aarhus (DK) and Dr. Remi Nout, Professor of Radiation Oncology, Erasmus University Medical Centre,Rotterdam (NL).

Course Title: 3D Radiotherapy with a Special Emphasis on Implementationof MRI/CT Based Brachytherapy in Cervical Cancer.

The 7th AROI ESTRO Gynecological Cancer Management course was held during 14th to 17th March 2024 at the Inter University Centre for Teacher Education (IUCTE)Auditorium, Sundarpur Road, Varanasi. The course aimed at teams of Radiation Oncologists and Medical Physicists from institutions with concrete plans to implement 3D radiotherapy for cervical cancer. Institutions which had participated in previous editions of this Gynecology AROI ESTRO teaching course were encouraged to register and were selected on priority for the course. The workshop involved both the advanced track and freshers who would then help in implementation of 3D technique.

The course was conducted in the form of didactic lectures and tutorials, practical workshops, video presentations and hands on contouring, planning and evaluation sessions. The tutorials included discussions of basics, evidence-based treatments, contouring guidelines, various processes involved in advanced EBRT and brachytherapy techniques and quality assurance. The practical hands-on demonstration covered a direct learning process involved in approach, brachytherapy techniques, contouring exercises, evaluation and discussions on 3D radiotherapy. A total of 80 delegates registered onsite and 50 delegates registered online for the course from centers all across the country such as from Jaipur, Agra, Aligarh, Guwahati, Patna, Kolkata, Trivandrum, Pondicherry, Shillong, Chandigarh, Bangalore, Varanasi, Delhi, Lucknow, Cuttack, Hyderabad, Chennai, Mumbai as well as from countries such as Nepal, Bangladesh, Myanmar, Malaysia, Indonesia and Philippines. This particular course also had a significant component of international participants who joined online due to travel logistic restrictions.

Faculty included prominent speakers such as Dr. Manoj Gupta (AIIMS, Rishikesh), Dr. Umesh Mahantshetty (HBCH, Vishakhapatnam), Dr. Supriya Chopra (ACTREC, Navi Mumbai), Dr. Bhavana Rai (PGIMER, Chandigarh), Mr. Yogesh Ghadi(Tata Memorial Hospital, Mumbai),

Dr. Abhishek Basu (Burdwan Medical College), Dr. Ajeet Gandhi (Dr RMLIMS, Lucknow), Dr. Arun Oinam(PGIMER, Chandigarh).Guest faculty included Dr. Harjot Kaur Bajwa (Hyderabad), Dr. Prachi Mittal (Mumbai) and Ms Jeevanshu Jain (Mumbai).

The program was inaugurated on 14th March morning by Chief Guest, Dr. Shelley Hukku in presence of Dr. Rajesh Vashisht (Chair, AROI), Dr. Manoj Gupta (President AROI), Dr. SN Senapati (President Elect, AROI), Dr. V Srinivasan (Secretary AROI),Dr. Satyajit Pradhan (Organising Chairperson), Dr. Ashutosh Mukherji (Organising Secretary) Dr. Supriya Chopra (AROI Course Director), Dr. Kari Tanderup (ESTRO Course Director), and Dr. Remi Nout, (ESTRO Course Director). At the end of the course, the feedback from the participants on the course model, material, benefits and teaching ranged from very good to excellent. The ESTRO Course Directors were also very happy with the way the course was cconducted, the audio-visual and interactive logistic components and the new idea of hybrid method for participants not able to attend physically. Dr. Kari presented travelling fellowships to 3 physicists (Mr. Kamalnath J, Ms. Anjana AK both from ACTREC, Mumbai and Satinder Pal Kaur from PGIMER, Chandigarh) who had performed very well in the hands-on planning sessions.

Dear Honourable members of Executive Committee,

We had a discussion in our AROI WORKING COMMITTEE on the conduct of Annual Conferences of the Chapters and Zones (14 Chapters and 2 Zones) that happens every year.

We are extremely proud and happy that the academic conferences are being conducted by you all in a meticulous way, but at times we get to know such an event has happened by some posts in Facebook or Instagram and that is really hurtful.

We also get to see WhatsApp Messages regarding your Conferences but there is no official communication to the Central Body neither to secretaryaroi@gmail.com nor to presidentaroi.manoj@gmail.com.

We want to reiterate that the state chapters and zones of AROI are part and parcel of national AROI and not an individual body and by projecting your Conferences in our National Website-www.aroi.org, gives us more pride to tell the world that we are in the forefront in disseminating knowledge and the best performing Oncology Association in INDIA.

It is an important duty of the Organising Chapter/ Zone to invite the Chair/ President/ President Elect and the Secretary General of AROI to participate in your Conferences and atleast an email communication and invitation to the President and Secretary General of AROI.

We will be more than happy to be a part of your Conferences and also if your budget is limited, we don't mind travelling and staying by spending money from our pocket and let that not be an inhibiting factor for you to invite us.

We look forward to working as a Team and with Camaraderie, as the basic Aim of AROI is coming together to share our Knowledge and Experience in Academics.

Regards,

Dr. V. Srinivasan
Secretary General - AROI

Prof Manoj Gupta
President - AROI

AROI Academic Calender 2024 for forthcoming Conferences

AROI-ESTRO				
Head & Neck Teaching Course				
MIOT INT. Hospital, Chennai	6-8 June, 2024	Dr. V. Srinivasan	9841022366	secretaryaroi@gmail.com
Advanced Technology Teaching Course				
AIIMS, Patna	5-8, Dec, 2024	Dr. Pritanjali Singh	9334931395	drpritanjalis@gmail.com

AROI-ICRO Sun PG Teaching Courses				
JNCH & RC, Bhopal (Recent Advances in Clinical Oncology)	20-21 April, 2024	Dr. Gautam K Sharan	9326323109	dr.gautamsharan@gmail.com
NRS Medical College, Kolkata (Clinical Trials and Cancer Statistics)	24-25 August, 2024	Dr. Srikrishna Mandal	9830648931	mondal_srikrishna@rediffmail.com
Max Super Speciality Hospital, Bathinda (Management of Radiation Toxicities)	October, 2024	Dr. Rajesh Vashistha	9316911970	drvashistha@gmail.com
Pre Conference Workshop (AROICON)	28 Nov, 2024	Tumor Board Review- Discussion of interesting/difficult cases.		

AROI-ICRO Sun PRODVANCE Courses				
SZ-RCC, Trivandrum	27-28 July, 2024	Dr. Francis V James	9847189270	fvjames9@gmail.com
NZ-PGIMER, Chandigarh	21-22 Sep, 2024	Dr. Rakesh Kapoor	7087009396	drkapoor.r@gmail.com

AROI-ICRO INTAS Radiobiology Courses			
AIIMS, Rishikesh	Dr. Manoj Gupta	9816137344	presidentaroi.manoj@gmail.com
Rest Courses- Yet to be decided			

AROICON-2024				
KMC, Mangalore	28 Nov-1 Dec, 2024	Dr. M. S. Athiyamaan	8892118848	athiyamaan.ms@gmail.com

ESTRO	3-7 May, 2024	Glasgow
ASCO	31 May-4 June, 2024	Chicago
ASTRO	29 Sep- 2 Oct, 2024	Washington

Best of ASTRO-2024
Details to be announced later.

Indian College of Radiation Oncology (ICRO)

Academic Wing of

Association of Radiation Oncologists of India (AROI)

46TH ICRO PG Teaching Program

20th & 21st April 2024

On

Management of Radiation Toxicities

Organised by,

Jawaharlal Nehru Cancer Hospital and Research Centre ,
Bhopal, Madhya Pradesh

REGISTRATION FORM

I would like to participate in the 46th ICRO PG teaching Program

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INSTITUTE _____

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For Indian students

- 2nd and 3rd year MD / DNB (Radiation Oncology) Post Graduate students to be nominated by the Head of the Departments / Institutes
- AROI Membership is mandatory to apply for the Course.
- Registration will be based upon first-cum-first-served basis.
- Last date for submission of application with CV : 14th April, 2024.
- Candidates will have to pay Registration fee of Rs. 1,500/- upto 31st of March (Post 31st of March Rs. 2000) through online payment mode only. Account details for the same mentioned below.

  Bank: State Bank of India
  Account Name: AROI - ICRO
  Account No: 39535445525
  Address: Millerganj, Ludhiana
  IFSC CODE: SBIN0000731

For FARO members & SAARC countries:

- Registration fee is 30USD
- After making the payment, please mail the payment receipt to **secretaryicro@gmail.com,** & **drvashistha@gmail.com**
- For any correspondence please contact Secretary, ICRO at **Secretaryicro@gmail.com** or The decision of ICRO body will be final and binding

MANGALURU

AROI

KASTURBA MEDICAL COLLEGE
MANGALORE
(A constituent unit of MAHE, Manipal)

AROI
Karnataka Chapter

44th Annual Conference of Association of Radiation Oncologists of India

AROICON 2024

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ABSTRACT SUBMISSION

Scientific Committee of AROICON 2024 invites submission of abstracts showcasing research contributions as both oral and poster presentations. Faculties, Researchers & Postgraduates are encouraged to submit their work on the sub-themes specified on the website. Presentations will be awarded in all site-specific categories of oral and poster presentations. Abstracts of all presentations will be published in Journal of Cancer Research & Therapeutics. Abstract submission is open and details of the same is available on the website. The last date for abstract submission is **31st August 2024**.

Guidelines for Abstract Submission

General Guidelines

- It is mandatory for Oral Presenters and Poster Presenters to be registered for the conference.
- All abstracts must be prepared according to the guidelines provided.
- All fields on the online abstract submission form must be completed.
- Abstracts must be submitted by the presenting author, who should complete all fields on the online submission form.
- Submission of your abstract(s) implies that you have read, understood, and complied with the terms and conditions as outlined in the abstract portal.
- All abstracts should be submitted online by **31st August 2024.**
- The subcategory of presentation should be chosen at the time of abstract submission and cannot be changed later.
- The abstract or manuscript must not disclose the identity of the presenter or the institution.
- A panel of judges in the Oral Paper Presentation Category will scrutinize the abstract and select it for podium presentation during the conference.
- A paper if not selected for Oral Presentation Category will automatically fall into the Poster Presentation category

Submission Guidelines

- Click on the “Submit Abstract” menu in the home page or Scientific page.
- Enter the Conference registration number.
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- Select appropriate category (Oral Paper/Poster or Only Poster).
- Update following details on the website.
- A person can submit maximum 2 Abstracts (one 'oral paper/poster' & one 'only poster' allowed per delegate).
- Title of your Abstract should be less than 25 words.
- The Abstract should be less than 350 words excluding the title.
- The abstract should contain Introduction, Materials and Methods, Results & Discussion/Conclusion.

REGISTRATION

AROICON 2024

28th November- 1st December 2024
Dr. TMA Pai International Convention Centre, Mangaluru, Karnataka

CATEGORY	DISCOUNTED	EARLY BIRD	REGULAR	LATE	SPOT
	6th to 31st December 2023 (₹)	1st January to 31st March 2024 (₹)	1st April to 31st July 2024 (₹)	1st August to 31st October 2024 (₹)	1st November 2024 onwards (₹)
AROI Member	Rs. 5300 /-	Rs. 6500 /-	Rs. 8900 /-	Rs. 10000 /-	Rs. 12,400 /-
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- All registrations are to be done online through the website.
- There will be no offline registrations.
- Details of registration & refund policy is available on the website

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Conference Secretariat:

AROICON 2024

Department of Radiation Oncology
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ESTRO meets ASIA 2024

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ESTRO meets Asia 2024

23-25 August 2024

Kuala Lumpur, Malaysia

ESTRO

WWW.ESTRO.ORG

FRIDAY 23 AUGUST 2024

09:00-09:40	**TEACHING LECTURE** Oral cavity cancers	**TEACHING LECTURE** Accumulated dose in clinical practice	**TEACHING LECTURE** Pushing boundaries in radiotherapy: advancements, challenges, and future directions
09:45-11:00	**SYMPOSIUM** Management of nasopharyngeal carcinoma in 2024 and beyond	**PANEL DISCUSSION** Lessons learned in online adaptive worksflows: A physics perspective	**SYMPOSIUM** Motion management
11:00-11:30	COFFEE BREAK		
11:30-12:30	**PROFFERED PAPERS**	**PROFFERED PAPERS**	**PROFFERED PAPERS**
12:30-14:00	LUNCH & INDUSTRY SYMPOSIA		
14:00-14:40	**TEACHING LECTURE** Management of oesophageal cancer	**TEACHING LECTURE** All the way from the clinic to scientific publications: Hints and tips for medical physicists	**PANEL DISCUSSION** Emerging trends in publishing
14:45-16:00	**SYMPOSIUM** Combined immunotherapy and radiotherapy: What don't we know yet?	**SYMPOSIUM** Brachytherapy	**SYMPOSIUM** Role development in RTT advanced practice
16:00-16:30	COFFEE BREAK		
16:30-17:30	**MINI-ORALS**	**MINI-ORALS**	**MINI-ORALS**

SATURDAY 24 AUGUST 2024

09:00-09:40	**TEACHING LECTURE** How to treat rectal cancer in 2024	**TEACHING LECTURE** MLC modelling and configuration in TPSs: Current challenges and new methodologies	**TEACHING LECTURE** Image-guided adaptive radiation therapy
09:45-11:00	**SYMPOSIUM** Experience with advanced radiotherapy in Asia	**SYMPOSIUM** Advanced monitoring and management of treatment delivery uncertainties	**SYMPOSIUM** Cultural perspectives on PROMs implementation: A global dialogue in radiation oncology
11:00-11:30	COFFEE BREAK		
11:30-12:30	**PROFFERED PAPERS**	**PROFFERED PAPERS**	**PROFFERED PAPERS**
12:30-14:00	LUNCH & INDUSTRY SYMPOSIA		
14:00-14:40	**TEACHING LECTURE** Current standard of care treatment in non-metastatic cervix cancer	**TEACHING LECTURE** New radiobiological insights and how we can apply them in the clinic	**TEACHING LECTURE** Burnout, balance and retention in radiation therapy
14:45-16:00	**SYMPOSIUM** Dose, fractionation & target volume in non-metastatic prostate cancer	**PITCH SESSION** Education in radiation oncology: World perspectives in support of global progress in mzsical physics education	**SYMPOSIUM** Leadership and management
16:00-16:30	COFFEE BREAK		
16:30-17:30	**MINI-ORALS**	**MINI-ORALS**	**MINI-ORALS**

SUNDAY 25 AUGUST 2024

09:00-09:40	**TEACHING LECTURE** Radiotherapy for breast cancer in 2024: A review of hot topics	**TEACHING LECTURE** Statistics for for outcome modelling/radiomics	**PITCH** What is the best immobilisation device?
09:45-11:00	**SYMPOSIUM** Management of non-squamous cell lung cancer	**PITCH SESSION** Surveying approaches to, and developments in, dosimetry audits in radiotherapy	**SYMPOSIUM** Imaging protocols: Cutting-edge advancements in radiation therapy imaging
11:00-11:30	COFFEE BREAK		
11:30-12:30	**CLOSING SYMPOSIUM** Artificial Intelligence in daily routine management of malignant tumours		

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MEDICAL PHYSICS & RADIOBIOLOGY

15th – 16th June 2024

How to reach: 10.8 kms from Indore Airport; 11.2 kms from Indore Railway Station; 45 kms from Ujjain Railway Station

For Contact: 0731 423 1728/1807, 9893115337, 9452363314 |

Email : mahee813@gmail.com/virencancer@yahoo.co.in

Course Co-ordinator : *Dr. Virendra Bhandari,*
Professor and HOD,
Department of Radiation Oncology
Sri Aurobindo Institute of Medical Sciences,
Indore

Registration fees :750Rs

For Contact: 0731 423 1498/1807, 9893115337, 9452363314 |

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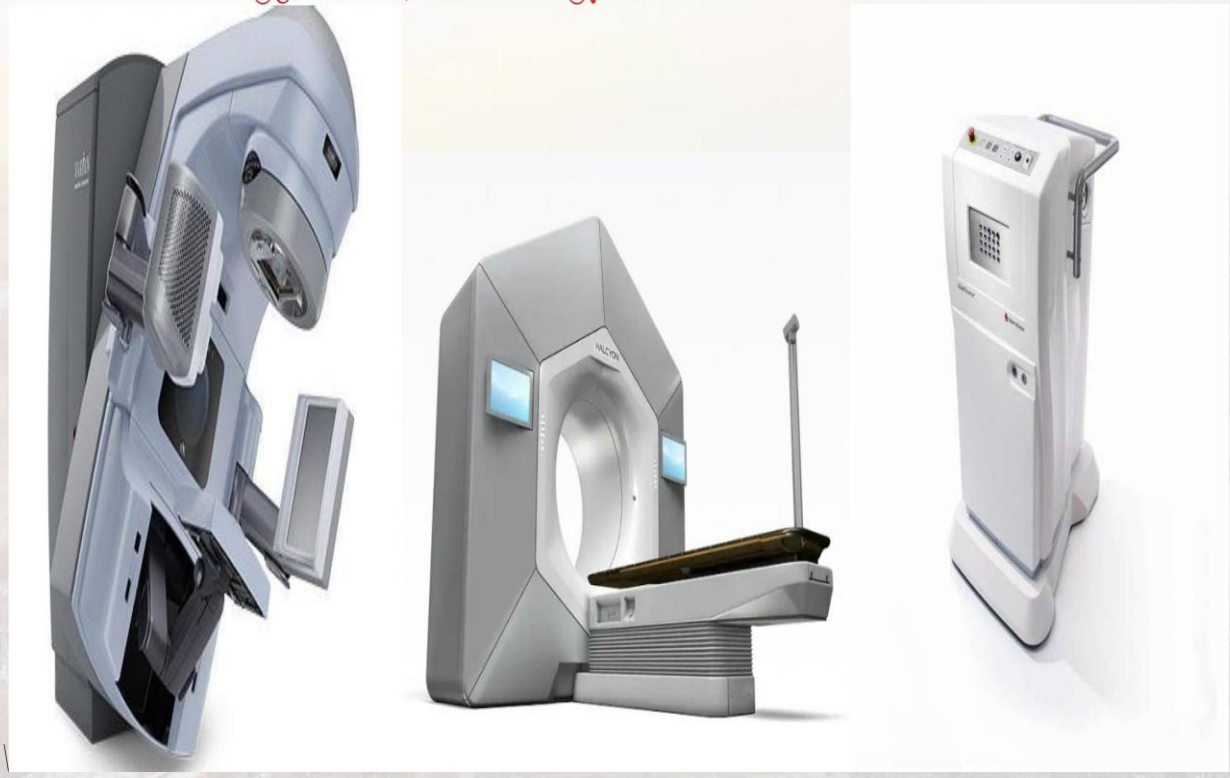

SEVENTH TEACHING COURSE

MEDICAL PHYSICS & RADIOBIOLOGY

15 - 16 June 2024

Sri Aurobindo Medical College & P.G Institute, Indore

11th AROI - ESTRO

Teaching course on

Advanced Technologies in Radiation Oncology

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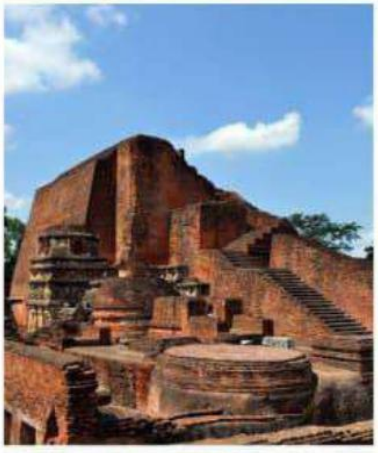

All India institute of medical sciences, Patna, Bihar

11 th AROI-ESTRO

LECTURE ON:

1. Imaging in target delineation .
2. Errors and margins.
3. Correction strategies.
4. Respiratory motion management.
5. SBRT.
6. Particle therapy.
7. TCP ,NTCP.
8. Surface guided radiotherpay.
9. Adaptive radiation using CT and MR LINAC.
10. Automation and AI in treatment planning.
11. Health technology assessment.

PRACTICAL INTERACTIVE SESSIONS:

1. IMRT plan evaluation.
2. Generating department specific margins and protocol.
3. Breast DIBH.
4. Prostrate SBRT.
5. Lung SBRT.
6. Cranial SRS.

Parallel sessions for medical physicists and radiographers.

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MIOT International

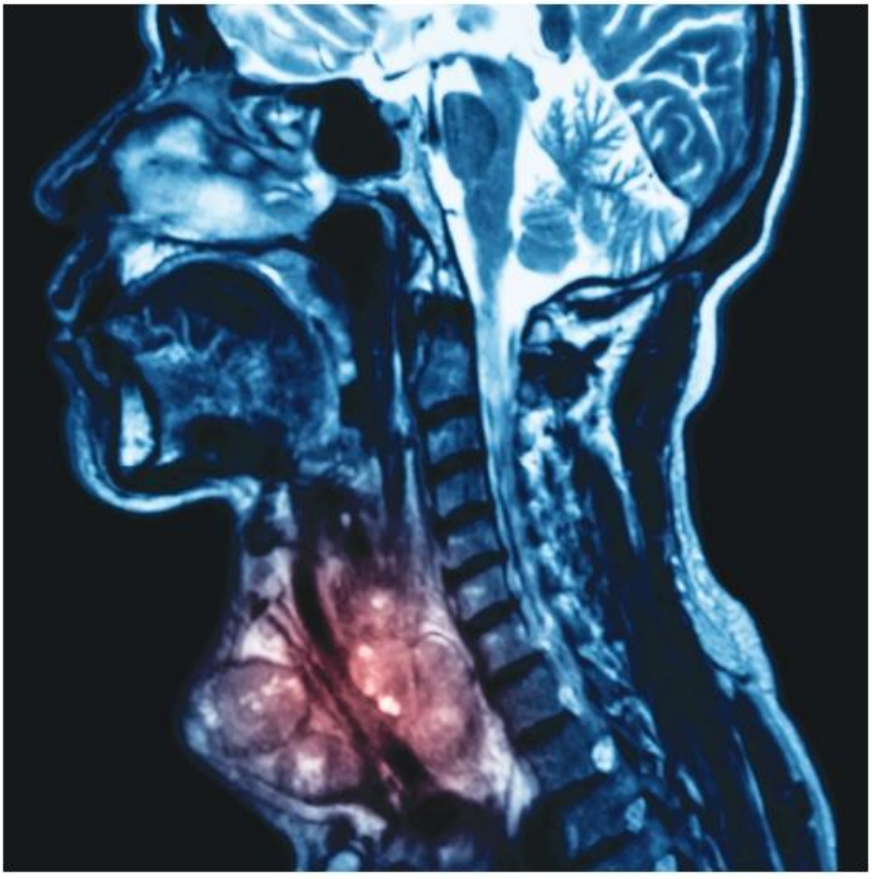
2nd AROI-ESTRO

HEAD & NECK TEACHING COURSE

Theme: Oropharynx & Nasopharynx

Dates: 6th to 8th June 2024

Venue: Retreat Auditorium, MIOT International, Chennai, India.



MCQs Physics

1. Which is the less sensitive gas filled detector among following?

A) GM counter B) Proportional counter

C) Ionization chamber D) None of above

2. Why GM counter is not used in measurement of ionization radiation?

A) Response Time B) Delay Time

C) Recovery Time D) Dead Time

3. GM counter can detect.....?

A) Beta particle B) Gamma Rays

C) Alpha particles D) All of above

4. Which detector is used to measure neutron contamination...?

A) Ionization chamber B) REM counter

C) GM counter D) Proportional counter

5. In TLD disk number two (D2) represents the radiation exposure of.....?

A) Gamma rays B) Alpha(α) rays

C) Gamma & α-rays D) Beta(β) rays

6. The quality of high energy X-ray beam is expressed in.....?

A) MV B) HVT & TVT

C) MeV D) KeV & KV

7. What mAs is X-ray beam denotes...?

A) Energy B) Quality

C) Quantity D) All of above

8. Which type of target is used in high energy linear accelerator...?

A) flattening filter B) Reflection target

C) Scattering foil D) Transmission target

9. One Rontgen is equals to....?

A) $2.58X10^{-4}$ C/Kg B) $3.58X10^{-3}$C/Kg

C) $3.58X10^{-4}$C/Kg D) $2.58X10^{-3}$C/Kg

10. MeV cm^2gm^{-1} is unit of.....

A) Energy B) LET

C) Stopping power D) All of above

11. Radiation weighting factor is minimum for.....?

A) Proton B) Alpha particle

C) X-ray D) Beta particle

12. The dose range of LD 50/60...?

A) 1-2 Gy B) 2-3 Gy

C) 3-5 Gy D) 4-6 Gy

13. What material is used as central electrode in farmer chamber...?

A) Graphite B) Copper

C) Lead D) Aluminium

14. What kind of source movement mechanism used in Telecobalt machine...?

A) Rotating wheel B) Sliding drawer

C) Mercury shutter D) All of above

15. According to TRS-398 What material is commonly used for water proofing sleeve in ionization chamber..?

A) Graphite B) Polystyrene

C) PMMA D) Aluminium

16. Penumbra increases with.....?

A) Source diameter B) SSD

C) Depth D) All of above

17. Tongue & Groove effect in MLC reduce...?

A) Intra leaf transmission B) Inter leaf transmission

C) Leaf end transmission D) Over all transmission

18. Unit of specific activity....?

A) Bq/gm B) Bq/litre

C) Bq/cm^3 D) Bq/cm^2

19. DICOM states for.....

A) Digital Imaging and Communication in Medicine

B) Digital Integration and Computation in Medical

C) Digital Information and Communications in Medicine

D) Digital Imaging Communication on Medicine

20. One curie is equals to.....?

A) $3.7X10^{-11}Bq$ B) $3.7X10^{-10}Bq$

C) $3.7X10^{10}Bq$ D) $3.7X10^{11}Bq$

21. One tenth value thickness (TVT) is equals to how much half value thickness (HVT)...?

A) 3.30HVT B) 3.32HVT

C) 3.31HVT D) 3.33HVT

22. What combination of electron beam bending used in slalom system bending magnet...?

A) 50°,50°,113° B) 45°,45°,112.3°

C) 45°,45°,112° D) $45°,45°,112.5^{0}$

23. Which of the following isotope is used in SPECT image....?

A) O_{15} B) Cu_{64}

C) F_{18} D) Tc-99m

24. Which type of target is used by low voltage X-ray tube....?

A) Reflection Target B) Transmission type target

C) Flattening filter D) Scattering foil

25. Which is the directly ionizing radiation..?

A) X-ray B) Proton

C) Neutron D) Gamma ray

26. According to this equation $H^{3}{}_{1}$ 12.3 year $\longrightarrow$ $He^{3}{}_{2} + e_{-1}{}^{0} + \mu^{0}{}_{0}$ what decays...?

A) Alpha decay B) Internal Conversion

C) Beta decay D) Electron capture

27. From which type of ionizing radiation interaction 0.511 MeV electron-positron are emitted annihilated.....?

A) Bremsstrahlung B) Characteristics

C) Pair production D) Rayleigh scattering

28. Which kind of interaction requires threshold energy to produce interaction....?

A) Photoelectric B) Pair production

C) Compton D) Rayleigh scattering

29. The probability of which charge particle interaction increases with energy.....?

A) Photoelectric B) Pair production

C) Compton D) Rayleigh scattering

30. Which kind of ionizing radiation will not be detected by TLD....?

A) X-rays B) Neutron

C) Gamma rays D) Alpha

31. According to TRS-398 what kind of chamber is used to measure surface dose above 10 MV energy....?

A) Parallel plate chamber B) Well type chamber

C) Cylindrical chamber D) None of above

32. An ionization chamber cavity is filled with.....?

A) Liquid B) Gas

C) Solid D) Gel

33. Which chamber is preferably used for calibration of brachytherapy source....?

A) Farmer chamber B) Re-entrant chamber

C) Parallel plate chamber D) Extrapolation chamber

34. Which chamber is used to measure in dosimetry of low energy X-ray and Beta rays....?

A) Re-entrant chamber B) Thimble chamber

C) Extrapolation chamber D) Semiconductor detector

35. Which type of atoms comes under isomers....?

A) Atoms with same Z(Atomic Number), different number of neutrons

B) Atoms with same number of neutrons, different Z(Atomic Number)

C) Atoms with same A(Mass Number)& different Z(Atomic Number)

D) Atoms with same A(Mass Number)& Z(Atomic Number), but different Nuclear energy state

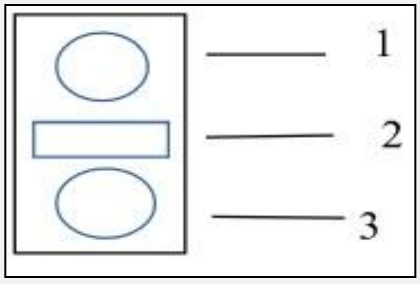
36. Which combination of series of filter used in TLD badge as shown

A) Open, Plastic, Cu+Al 1

B) Plastic, Open, Cu+Al 2

C) Cu+Al, Plastic, Open 3

D) LiF: Mg, Tl, Plastic, Open



37. The average life of a radioactive atom is given by....?

A) 1.42 T½ B) 1.43 T½

C) 1.44 T½ D) 1.45 T½

38. Activity of 1g Radium is.....?

A) 0.975 Ci B) 1.125 Ci

C) 1 Ci D) 0.985 Ci

39. If the half life of radioactive atom is 60 days, what will be the average life of that atom...?

A) 86.2 days B) 88.2 days

C) 85.4 days D) 86.4 days

40. The process of shaping the radiation beam to match the shape of the tumor is called.....?

A) Dosimetry B) Beam collimation

C) Beam modulation D) Treatment planning

41. The process of adjusting the radiation dose based on change in tumor size and location during treatment is called.....?

A) Adaptive Radiotherapy B) Conformal Radiotherapy

C) Stereotactic Radiosurgery D) Inverse Planning

42. Which of the following is the correct composition of cerrobend / Lipowitz material....?

A) 50% Bismuth, 26.7% Lead, 13.3% Tin, 10% Cd

B) 50% Lead, 13.3% Bismuth, 26.7% Cd, 10% Tin

C) 50% Tin, 26.7% Lead, 13.3% Bismuth, 10% Cd

D) 50% Bismuth, 26.7% Cd, 13.3% Tin, 10% Lead

43. According to AERB dose limit for radiation worker is....?

A) 10 mSv/yr B) 20 mSv/yr

C) 2 mSv/yr D) 20 mSV/yr X 5 consecutive years

44. Half life of Co-60, Ir-192, I-131....?

A) 5.26 years, 74 days, 8 days B) 5.2 years, 73.8 days, 8 days

C) 5.26 years, 73..8 days, 8 days D) 5.26 years, 73.8 days, 7.8 days

45. The space between X-ray tube housing & envelope is filled with...?

A) Transformer oil B) Liquid gallium alloy

C) Water D) All of above

46. Commonly used target material in mammography....?

A) Lead B) Tungsten

C) Rhenium D) Molybdenum

47. Tungsten is most widely used anode material because of.....

A)High melting point & high atomic number

B) A tungsten anode can handle substantial heat deposition without cracking or pitting of its surface

C) The high atomic number of tungsten provides better bremsstrahlung production efficiency

D) All of above

48. The limit of stray radiation in the beam off condition for a telegamma unit at 5 cm & 1 m from the source are respectively.....?

A) 0.2 mGy/hr & 0.02mGy/hr

B) 0.1 mGy/hr & 0.01 mGy/hr

C) 0.2 mGy/hr & 0.01 mGy/hr

D) 0.1 mGy/hr & 0.02 mGy/hr

49. In soft tissue a beam of 9 MeV electrons loses most of its energy by....?

A) Bremsstrahlung radiation

B) Ionization

C) Compton interactions

D) Collision with nuclei

50. Arrange the given tissues in increasing order based on their absorbed dose of 6 MV radiation....?

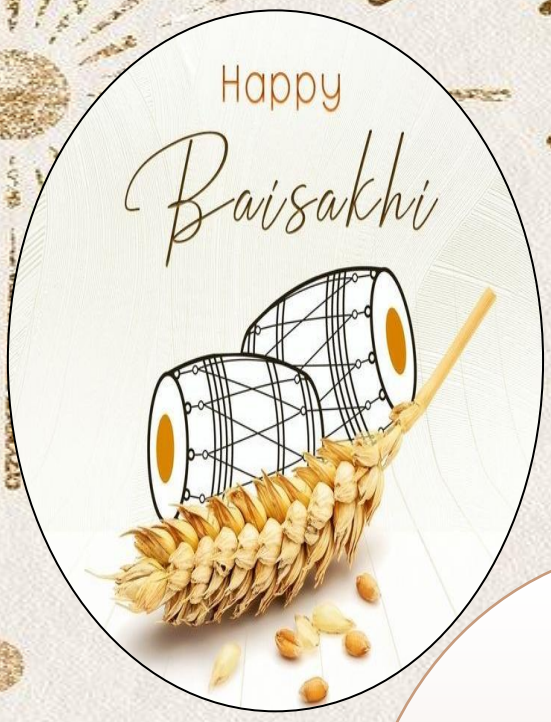
A) Fat, Muscle, Bone

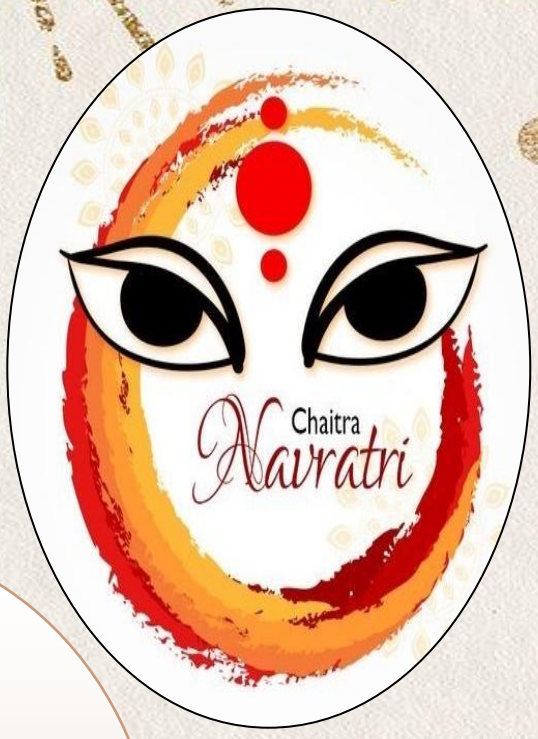
B) Muscle, Fat, Bone

C) Bone, Fat, Muscle

D) Bone, Muscle, Fat

Answer Key will be provided in the next Newsletter





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