VOLUME X | 2026

Association of Oncologists North East India

AONEI NEWSLETTER

DARPAN

A reflection of **AONEI** activities

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Message

At the outset I would like to extend my gratitude to all the members of AONEI and wish you all a very Happy Bihu and a Happy New Year.

It gives me immense happiness to write this message and with utmost humility, I would like to offer my best wishes to everyone who has taken up different responsibilities in planning and organising this annual conference. I would like to specially appreciate Team Mizoram, the local organisers, who have been working tirelessly for making this event successful. I hope and wish that the conference achieves success in every aspects.

AONEI is a unique organisation that brings together various specialities of oncology under one umbrella. The annual conference gives us an opportunity to learn from each other and to give the best of care in terms of treatment and creating awareness in the entire north eastern states of India. As President of AONEI, I would like to request all the esteemed members to put forward their valuable suggestions so that we can do better in patient care and awareness initiatives, and grow in the field of research across all specialities of oncology. Let us take up the challenges together, start collaborating with each other and work towards best possible cancer care and research in the North East of India.

As we approach our own Annual Conference happening in the beautiful state of Mizoram in February 2026, I look forward to seeing you all and wish the conference a great success.

Long Live Mizoram Oncology
Long Live AONEI

Dr. Jina Bhattacharyya
President, AONEI

Editorial

DARPAN (Mirror) reflects purpose and persistence, progress and provocation and truths that trouble before they teach. Oncology in the North Eastern Region (NER) has traversed the difficult distance, from scarcity, scattering, and silent exits to structure, subspecialty strength and scholarly strides! In a measured metaphor for the metamorphosis, like the Brahmaputra—wide, patient, and persistent, oncology in the NER has gathered strength from many tributaries. What began as isolated efforts has grown into a flowing force of subspecialty depth, developing infrastructure, and academic confidence firmly rooted in the region.

AONEI has been the confluence through conferences and conversations! It has fostered dialogue, deliberation and direction. Darpan captures this current. It carries the voices, visions, and vigour of the association. The young speak with urgency, seniors with seasoned sagacity, and institutions narrate stories of growth against gradients. It is a space for reflection and risk, narrative and novelty!

As Editor, I am privileged to present the third consecutive issue under my stewardship—an edition that reflects evolution without erasure of essence. I have invited wider participation, varied perspectives, and versatile formats—from clinical contemplations to personal passages—while remaining anchored to rigour, reason, and respect for evidence.

May this issue of Darpan prompt introspection, intention, and initiative. A mirror matters most when it moves us – from seeing, to seeking, to shaping what comes next!

Dr. Gaurav Das, MS, MCh.
Editor, Darpan

Contents

AONEI
SECRETARY'S REPORT

Warm greetings to all esteemed members of the ***Association of Oncologists of North East India*** (AONEI).

It is my privilege to present the Secretary's Report for the current period. The past months have been marked by sustained academic engagement and effective organizational functioning, reflecting the commitment of AONEI towards advancing oncology through education, collaboration, and professional excellence.

ACADEMIC ACTIVITIES
AONEI has successfully conducted multiple academic programs, including continuing medical education (CME) activities, workshops, and scientific meetings. These initiatives were designed to promote evidence-based clinical practice, encourage skill development, and facilitate knowledge exchange among faculty, practitioners, and postgraduate trainees. The enthusiastic participation of members has contributed significantly to the academic rigor and success of these programs. In the last year, AONEI has organised around 12 site specific CMEs, in addition to various awareness and academic programmes on World No Tobacco Day and AONEI Mid-term CME in Guwahati.

ORGANIZATIONAL AFFAIRS
Regular meetings of the executive committee were held to review ongoing activities and to ensure transparent, efficient governance. Coordination between the central body and regional chapters has been strengthened to facilitate uniform academic standards and streamlined communication.

MEMBERSHIP AND PROFESSIONAL DEVELOPMENT
The association continues to witness steady growth in membership, including increased involvement of early-career oncologists and trainees. There has been 50 new members in the last year. The current number of total Life members is 225 and counting. Efforts have been made to encourage active participation of young members in academic forums, research activities, and organizational initiatives.

COLLABORATIONS AND OUTREACH
AONEI has been engaged in various outreach and public awareness activities aimed at improving Oncology health education have also been undertaken, reinforcing the association's commitment to community service.

FUTURE DIRECTIONS
Several academic and professional programs are planned in the coming months, including conferences, CMEs, and hands-on workshops. Members are encouraged to actively participate and contribute to these initiatives to further strengthen the academic mission of AONEI.

ACKNOWLEDGEMENTS
I express my sincere gratitude to the President, office bearers, executive committee members, faculty, and all members of AONEI for their continued support, cooperation, and dedication.

CONCLUSION
With collective effort and shared vision, AONEI will continue to uphold the highest standards of academic excellence, ethical practice, and professional unity in oncology.

With regards,

Dr. Kaberi Kakati
Secretary, AONEI

A FEW OF THE CME ACTIVITIES UNDER AONEI IN THE YEAR 2025 ARE AS FOLLOWS :

- AONEI annual conference at Itanagar (Arunachal Pradesh) in February
- Thyroid CME at Guwahati in April
- CME on Vaccines at Guwahati in May
- CME on Skull Base Tumours at Guwahati in May
- World No Tobacco Day CME at multiple cities and towns in North-East India in May
- CME on Hepatocellular carcinoma at Guwahati in June
- CME on NHL at Guwahati in July
- Mid Term AONEI CME at Guwahati in August
- GO Skill workshop and CME on Gynecological Cancers at Guwahati in September
- CME on Colorectal Cancer and NHL at Imphal in October

AONEI No Tobacco Day CME at Hotel Gateway Grandeur 31st May 2025

AONEI CME on 28 June 2025 at Novotel Hotel, Guwahati

AONEI Annual Conference at Itanagar in February 2025

Mid Term AONEI CME at ARHI Guwahati in August 2025

GO-Skill workshop and CME on Gynecological Cancers at Guwahati in September 2025

Surgical Training in a Tertiary Care Centre in Northeast India

Surgical Training: Excellence Through Reflection and Reform

Dr. Mohit Malhotra
MCh. Resident, Department of Surgical Oncology, Dr. B. Borooah Cancer Institute, Guwahati

Dr B. Borooah Cancer Institute, Guwahati

Surgical training is a dynamic academic process that must continually evolve in response to changing disease patterns, technological advances, and societal expectations. At Dr B. Borooah Cancer Institute (BBCI), Guwahati, surgical education is structured around high clinical volume, rigorous academic activity, and supervised operative experience, with the explicit aim of producing safe, ethical, and academically oriented surgical oncologists. At the same time, the department recognises that excellence in training is not a static achievement but an ongoing pursuit, one that requires honest appraisal of strengths, identification of limitations, and a willingness to adapt.

Clinical Volume and Operative Training

As a tertiary cancer referral centre, BBCI provides trainees with exposure to a broad and complex oncological case mix. At a departmental level, approximately 1,200 – 1,500 major oncological procedures are performed annually, translating to 250–350 operative cases per resident per year, depending on the stage of training. Residents are actively involved in the entire continuum of care from outpatient evaluation and operative planning to surgical execution and postoperative management allowing development of comprehensive clinical judgment alongside technical skill. Operative training follows a graded responsibility model, wherein autonomy is progressively granted based on demonstrated competence rather than seniority alone. This approach ensures patient safety while facilitating steady professional growth. Nevertheless, the department recognises that high surgical volume does not automatically ensure uniformly balanced exposure. Variability in case complexity and subspecialty distribution (Disease Management Group) necessitates ongoing review of rotations, operative logs, and competency benchmarks to optimise individual training experiences. We have 5 Surgical Oncology Residents per year, and they get rotated among Head and Neck Surgery, Gynecologic Oncology Surgery and Breast Oncosurgery department during their 3-year tenure of training. Additional 1 year of bond after completion of MCh exams, residents are entitled to take decisions on patient management and treatment executions.

Mentorship and Supervision

Mentorship and supervision constitute the central pillars of surgical training at BBCI. The training model is structured around close faculty–resident interaction, ensuring patient safety while facilitating progressive development of technical skill, clinical judgment, and professional maturity. Residents are assigned clinical responsibilities under the direct supervision of the faculty, particularly during the early phases of training. Operative exposure is deliberately structured, with trainees initially assisting and subsequently

performing components of procedures before advancing to supervised independent operating. This graduated approach allows competence to be assessed longitudinally and ensures that autonomy is earned through demonstrated proficiency rather than duration of training alone. Beyond operative guidance, mentorship at the institute extends to perioperative decision-making, complication management, and ethical considerations. Case-based discussions, intraoperative teaching, and postoperative debriefings are routinely employed to reinforce learning objectives and promote reflective practice. Informal mentorship relationships also contribute significantly to professional development, providing residents with guidance on career planning, subspecialty interests, and academic progression.

Despite the strength of this apprenticeship-based model, the department acknowledges inherent challenges. High clinical volumes and service demands in a tertiary cancer centre can at times constrain the availability of faculty for structured, individualised mentoring. Teaching often occurs opportunistically within clinical workflows rather than through formally protected educational sessions, which may lead to variability in mentorship experiences among trainees. In recognition of these limitations, the department is actively exploring mechanisms to strengthen mentorship frameworks. Proposed initiatives include the introduction of designated faculty mentors for each resident, scheduled feedback sessions, structured operative assessment tools, and protected teaching time. These measures aim to enhance consistency, transparency, and accountability within the mentorship process while preserving the strengths of experiential learning. Ultimately, mentorship at Dr B Borooah Cancer Institute is viewed not merely as a teaching responsibility but as an academic obligation. By fostering a culture of supervision that balances patient safety, trainee autonomy, and reflective learning, the institute seeks to ensure that residents emerge as surgeons who are confident, ethical, and capable of independent practice while remaining receptive to lifelong mentorship and self-improvement.

Academic Framework and Research Engagement

Academic rigor is integral to surgical training at BBCI. The department conducts multidisciplinary tumor boards twice weekly, monthly morbidity and mortality meetings, and regular journal clubs on every Tuesday and academic seminars every Saturday on Zoom meetings in hybrid mode and every Friday case presentation by the exam going batch ensuring continuous engagement with evidence-based practice. Residents actively participate in clinical audits, dissertation-based research, and protocol-driven studies, with outputs including conference presentations at regional, national and international levels and peer-reviewed publications. These activities cultivate critical appraisal skills and reinforce the integration of research into clinical practice. However, balancing academic pursuits with demanding clinical responsibilities remains a recognised challenge. At times, research engagement risks becoming compliance-driven rather than inquiry-focused. Strengthening research mentorship, improving access to methodological support, and creating protected academic time are identified priorities to enhance the depth and quality of scholarly output.

Training at BBCI also emphasises professional development and systems-based practice. Residents function within multidisciplinary oncology teams, gaining insight into coordinated cancer care involving medical oncology, radiation oncology, pathology, radiology, anaesthesia, and palliative services. Ethical practice, patient-centered decision-making, informed consent, and end-of-life care are integral components of training. While these competencies are often acquired experientially, the department recognises the need for more structured teaching in communication, leadership, and emotional resilience.

Looking ahead, the department remains committed to continuous self-evaluation and reform. As surgical oncology evolves with advancements in minimally invasive techniques, precision medicine, and technology-driven care, training frameworks are adapting accordingly. Periodic review of training outcomes, incorporation of trainee feedback, and alignment with national and international standards are central to this vision.

In conclusion, surgical training at Dr B Borooah Cancer Institute is defined by high clinical exposure, structured supervision, and academic engagement tempered by an honest recognition of existing limitations and a commitment to improvement. It is this balance between achievement and introspection that underpins the institute's academic maturity and its ongoing mission to train surgeons equipped not only for present-day practice, but for leadership, teaching, and lifelong contribution to cancer care. ■

Baby steps to a full stride- Journey of a Head and Neck Surgeon.

Dr.Amlan Debbarma
Consultant Head and Neck Onco Department, ABV-RCC, Agartala.

Khulumkha jotono ! (Greetings)

Among the many intellectual,awe inspiring sharpest of papers published in this souveniere here lies the humble account of a medicore story teller reflecting the love for the subject, the difficulties I faced and the blessings I counted on my way.

Before I start rambling, I would like to mention that the state of Assam has a profound effect on my professional career. My post graduate HOD was Dr. Kabita Baruah, one of the most reputed minds in our field, I consider Dr.Ashok Das as my Idol,Guru, mentor all mould into one. Dr. Tashnin Rahman, my HOD, stood before us like a mother—firm, gentle, and endlessly guiding. In her wisdom, I found the truest compass of my journey. Around me were Dr. Rajjyoti Das, Dr. Kishore Das, Dr. Anupam Das, and Dr. Kaberi Kakati—stalwarts who formed my constellation—teaching, shaping, and urging me, time and again, to rise to the furthest reach of my own potential.My Temple of workship was BBCI,Guwahati so naturally as I toil hard in OT under the guidance of my mentors my soul was captivated by the music of our great Jubeen Da. Thus on his untimely heart breaking demise I pay my homage to the great soul, ***In Jubeen's voice lives the echo of a thousand stories — whispered, wept, and wildly celebrated.***

In a society where the use of tobacco, areca nut, and betel is not merely habitual but deeply intertwined with cultural and religious practices, I have witnessed an alarming number of head and neck cancer cases. My state, however, lacked adequate infrastructure and skilled professionals for the proper surgical management of these patients. It took just one meaningful encounter with Dr. Ashok Das to set my feet upon an unfamiliar path, despite the uncertainties that lay ahead. Driven by a deep passion for learning and a desire to make a difference, I joined the Tata Fellowship in Head and Neck Oncology at BBCI, Guwahati. The experience was transformative - it challenged me,forged me &above all prepared me for the demanding yet rewarding journey that lay beyond. As I bid farewell, my mentor's words resonated deeply: ***"I will come and see what you have built in a few years."*** Those words remain both an inspiration and a quiet reminder of the responsibility I carry forward.

Thus, leaving the comfort of the medical college where I was serving as an Assistant Professor, I chose to resign and join my regional cancer hospital. From the supportive environment of a multi specialty institution — surrounded by experienced colleagues and well-established systems - I suddenly found myself standing alone, faced with the challenge of building something from the ground up. It was daunting, yet invigorating, and marked the true beginning of my independent journey in head and neck oncology.

As days passed, I gradually built a dedicated team of five members, mentoring and guiding them to the best of my ability. In return, their commitment and enthusiasm inspired me to dream bigger and envision what we could achieve together.

Looking back at our yester years

Over the years, my journey as a Head and Neck Onco-surgeon has been a mosaic of experiences—some smooth, others demanding, and a few deeply humbling. Each case has taught me the joy of precision, the patience for complexity, and the grace to accept what lies beyond control. Through every success and setback, one principle has remained constant — my commitment to serve my people.

1. Departmental Growth

Since the inception of our surgical wing, the department has grown steadily with strong administrative support—from a modular OT to advanced electric saws. With increasing manpower, our surgical numbers rose consistently, reflecting teamwork and dedication. Today, our unit stands as a testament to steady progress and patient-centered care.

Year	Major OT	Minor OT
2021	56	91
2022	154	309
2023	266	765
2024	274	993
2025	291	1021

2. Reconstruction and Innovation

Being the only dedicated cancer centre in our state providing comprehensive care—surgical oncology, radiotherapy, and chemotherapy—it was only natural for us to evolve into a high-volume centre. Over time, we progressed to undertaking increasingly complex oncological surgeries and reconstructions.

With oral cancers forming the bulk of our case load, our focus extended beyond achieving cancer-free survival to ensuring an acceptable quality of life following surgery and adjuvant therapy. We therefore moved past the limitations of regional and local flaps and successfully embraced free-tissue transfer, in keeping with the demands of modern oncological reconstruction.From radial forearm free flaps to free fibula flaps, the journey has been both challenging and deeply rewarding.

3. Laryngectomy Experience

We have performed 33 laryngectomies—19 salvage and 14 upfront—with a three-year disease-free survival (DFS) of 43%. Thankfully, no laryngopharyngeal leaks occurred. While most patients use TEP prostheses and a few electrolarynx, speech therapy remains an area for growth. Among notable cases was a massive laryngeal chondroma involving the entire framework—a rare entity (<1% of laryngeal tumors). The patient remains disease-free three years post-surgery.

4. Challenging Thyroid Cases

At ABV-RCC, among the routine thyroid cases there were few thyroid cases which tested our limits. One standout case involved a tumor invading the trachea. We performed total thyroidectomy with tracheal resection and anastomosis. The patient recovered well and continues follow-up post-radio iodine therapy with good function. We encountered 2 cases with retrosternal extension, and with support from our CTVS surgeons from medical college we were successful in doing complete resection.

5. Cultivating Work Force

We are only as strong as the people who stand beside us. Starting an institutional fellowship program was not an easy decision—it came with pain, doubt, and many quiet struggles—but the need to give back what I had learned, to shape the next generation of surgeons, made the journey inevitable.

Today, when I look around and see five extraordinary individuals standing with me as the pillars of this program, my heart is full. Watching them grow—not just as surgeons, but as compassionate professionals—has been one of the most rewarding experiences of my life. I could not be prouder of how far they have come, and of the team we have become.

6. Workshops and Conclaves

I believe that stagnation is nothing short of death—no matter the pace, there must always be movement, and it must be in a positive direction. Guided by this belief, I made every effort to ensure continued academic and clinical growth by organizing at least one annual Head and Neck Conclave, featuring live surgical demonstrations, high-spirited panel discussions, invited lectures, and scholarly paper presentations. Beyond this, I have always felt that postgraduate trainees must be exposed to real-world head and neck cancer care to truly appreciate the nuances of multi-modality management. With the invaluable support of our medical college ENT department, we initiated rotational postings to offer budding surgeons a bird's-eye view of the complex, collaborative journey involved in treating head and neck cancers—planting the seeds for a more informed and committed next generation.

Obstacles I Faced

Every obstacle tests the limits of our strength — and in enduring it, we discover that resilience is not about resistance, but renewal.

1. Late-stage presentation:

Most of our patients come from remote, economically challenged backgrounds. Social stigma, fear, and

ignorance often delay diagnosis, with many hoping the disease will resolve on its own. Yet, with the government strengthening healthcare infrastructure and improving connectivity, positive changes are slowly taking shape.

2. Poor awareness of tobacco and alcohol hazards:
Lack of education and awareness continues to fuel addiction-related cancers. Strong, sustained public health campaigns are urgently needed to change this mindset.

3. Need for de-addiction centres:
Dedicated, reformed de-addiction centres are vital for both individual and community healing. They not only treat addiction but also restore families, reduce crime, and rebuild social harmony — transforming despair into hope and dependence into strength.

4. Rehabilitation and employment:
Cancer survivors often face fatigue, psychological distress, and job loss after treatment. Comprehensive rehabilitation programs, coupled with flexible employment policies, can help them regain strength, confidence, and purpose. Life after cancer should be about renewal, not mere survival.

5. Lack of academic engagement:
Coming from a teaching background, I deeply miss the academic culture of reading, discussing, and mentoring. Without structured academics, ideas seldom grow — and that remains one of my greatest voids.

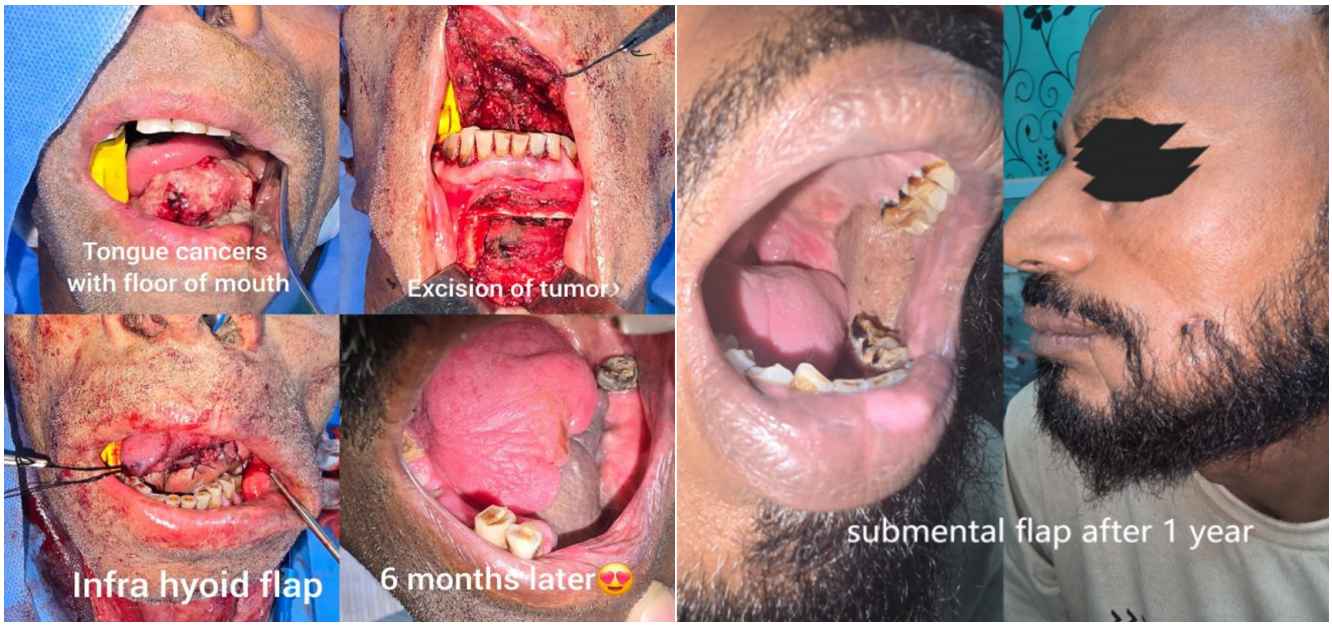
6. Emotional toll:
Cancer care often feels like a battle against time. Recurrences bring despair and helplessness, making bad days outnumber good ones. Over time, I've learned to focus on the present — to give my best, hold my patients' hands through their pain, and trust in divine grace.

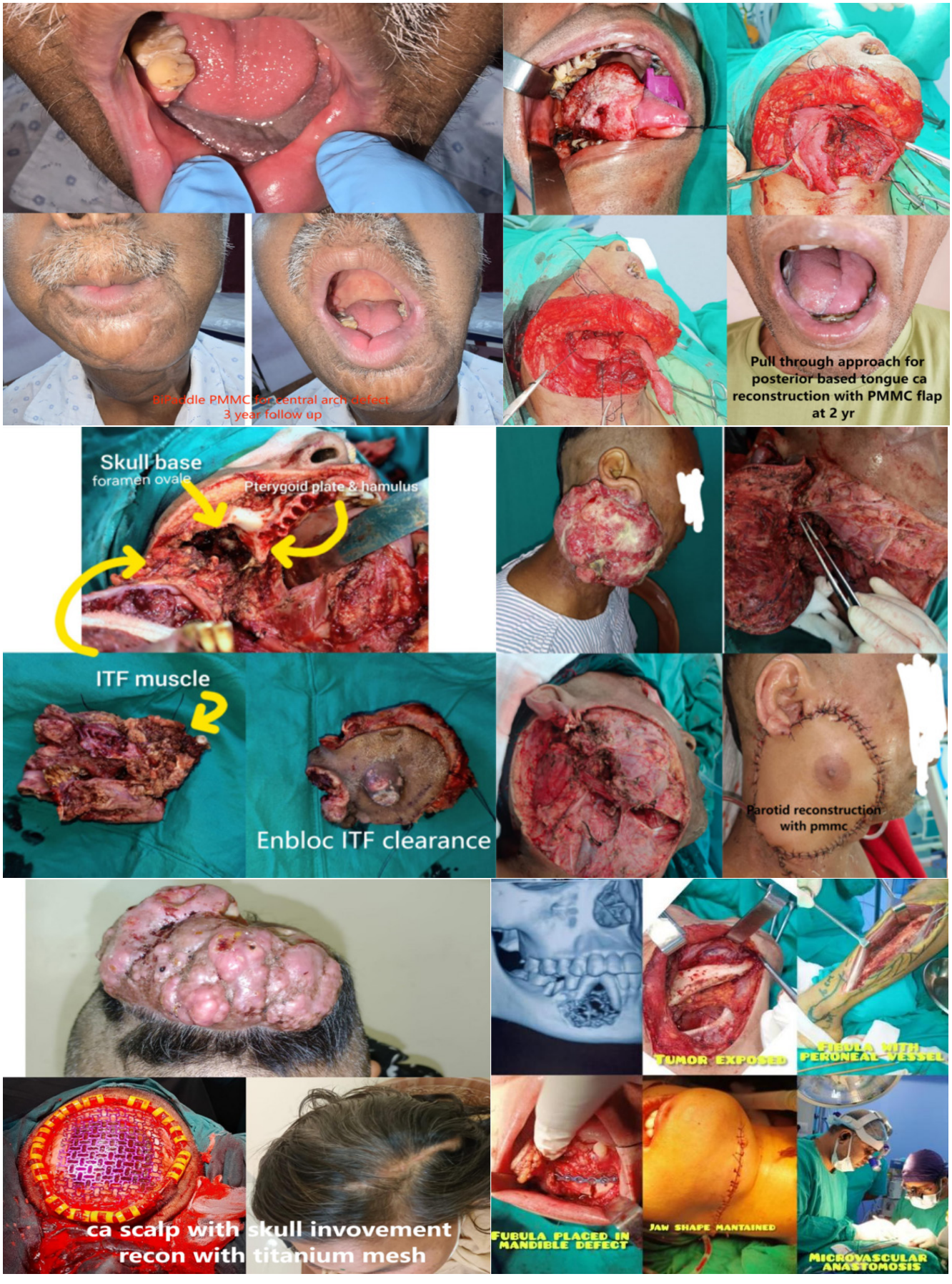
7. Professional recognition:
As a relatively young surgeon, gaining recognition from my mentors has been challenging. The road to earning their trust and matching their expectations is long — but it's a journey I embrace with humility and hope.

Things I Gained
I used to be an impatient soul, always frustrated that things were moving too slowly. But after three years in the field of oncology, I've learned to be calmer and more understanding of the world around me. The most important lesson this journey has taught me is that everything passes. When you find yourself in darkness, hold on — despair eventually fades. And when you stand at the peak of success and fulfillment, remember that this too will change. Life flows in cycles; all we can do is live in the moment, do our best with what's in our hands, and trust the rest to time.

All things said and done. I have miles to go before I sleep. *Hum abhi se keya batayein keya hamare dil mein hein!*

I hope all of you enjoy Mizoram—one of the most beautiful states of our country—and experience the warmth, hospitality, and vibrant culture of the AONEI Mizoram team. May you take back not only fond memories, but also meaningful insights and inspiration from the scientific sessions we share together. ■




BiPaddle PMMC for central arch defect
3 year follow up
Pull through approach for posterior based tongue ca reconstruction with PMMC flap at 2 yr
Skull base
foramen ovale
Pterygoid plate & hamulus
ITF muscle
Enbloc ITF clearance
Parotid reconstruction with pmmc
TUMOR EXPOSED
FIBULA WITH PERONEAL VESSEL
ca scalp with skull invovement
recon with titanium mesh
FUBULA PLACED IN MANDIBLE DEFECT
JAW SHAPE MANTAINED
MICROVASCULAR ANASTOMOSIS


1st H&N Oncology conclave 2023


2nd H&N oncology conclave 2024


3rd H&N Oncology Conclave 2025

Tumor Thermal Ablation in Oncology - from an Interventional Radiology Perspective

Dr. Gaurav Chayan Das, M.D., SR (PGIMER)
Interventional Radiologist, Guwahati Metro Hospital

Image-guided tumor ablation is a core domain of Interventional Radiology (IR), providing minimally invasive, organ-preserving oncologic therapy with curative and palliative intent. Contemporary guidelines now recognize ablation as a first-line or equivalent alternative to surgery in selected cancers.

Role of Interventional Radiology in Oncologic Ablation

As per NCCN and ESMO recommendations, all ablation procedures should be discussed in a multidisciplinary tumor board (MDT). There are some definite advantages of IR techniques-

- Image-guided tumor targeting & intraprocedural real time assessment
- Optimize ablative margins (≥5–10 mm)
- Minimize collateral injury to critical structures
- Integrate ablation with transarterial and systemic therapies

Technical Principles

The objective of ablation is complete tumor destruction with an adequate ablative margin (≥5–10 mm) to prevent local tumor progression.

Mechanisms of thermal ablation:

- Thermal coagulative necrosis (RFA, MWA)
- Cryo-induced apoptosis and microvascular injury

1. Radiofrequency Ablation (RFA)

Mechanism: Alternating current (375–500 kHz) causes ionic agitation → frictional heat → tissue temperature of 60–100°C → coagulative necrosis.

2. Microwave Ablation (MWA)

Mechanism: Electromagnetic waves (900–2450 MHz) cause oscillation of water molecules → rapid, homogeneous heating.

Advantages over RFA:

- Higher intratumoral temperatures
- Larger, faster and more uniform ablation zones
- Less susceptible to heat-sink effect

Preferred In:

- Larger liver tumors (3–5 cm)
- Perivascular lesions
- Lung metastasis

3. Cryoablation

Mechanism: Rapid freezing (–40°C or lower) → ice crystal formation → cell membrane rupture → microvascular injury during thawing.

Key Features:

- Ice ball is visible on CT/MRI
- Multiple freeze–thaw cycles
- Better pain control due to anesthetic effect of cold

Unique Complication:

- Cryoshock (rare, systemic inflammatory response)

Common Indications of ablation:

1. **Hepatocellular Carcinoma (HCC)**
   - First-line curative therapy for BCLC 0 and A lesions ≤3 cm
   - Alternative to resection when surgery contraindicated
   - Bridging/down staging before transplantation

2. **Liver Metastases (Colorectal Predominantly)**
   - Definitive local therapy in oligometastatic disease, ideal for ≤3 cm size lesion
   - Combination with systemic chemotherapy improves outcomes

3. **Lung Tumors- primary and metastasis**
   - Stage I NSCLC in medically inoperable patients
   - Pulmonary oligometastasis

4. **Renal Cell Carcinoma (RCC)**
   - Definitive therapy for T1a tumors
   - Nephron-sparing approach

Preferred Modalities

- Cryoablation (posterior tumors)
- RFA/MWA (anterior lesions)

5. **Bone Tumors and Metastases**
   - Pain palliation
   - Osteoid osteoma (gold standard)

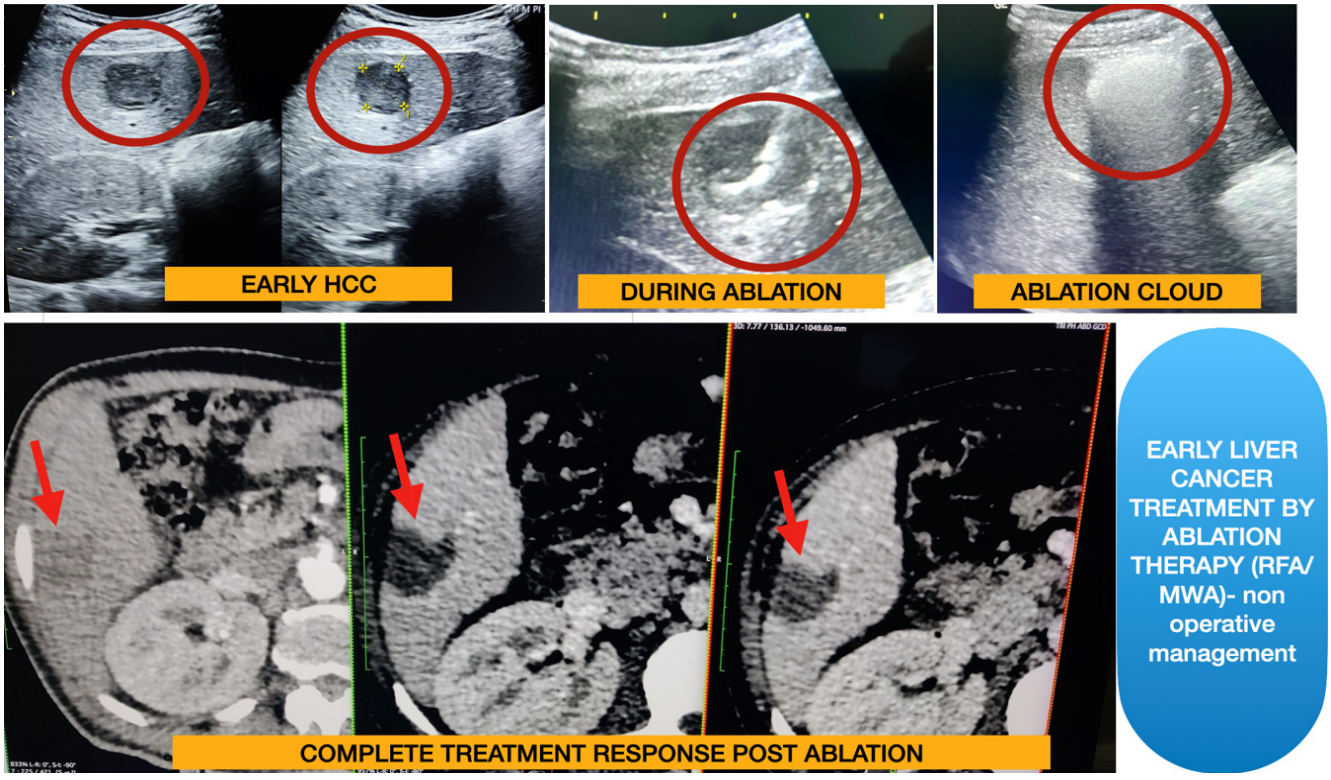


Fig: Case of early HCC (2.8cm) in segment 6 : treated by RFA

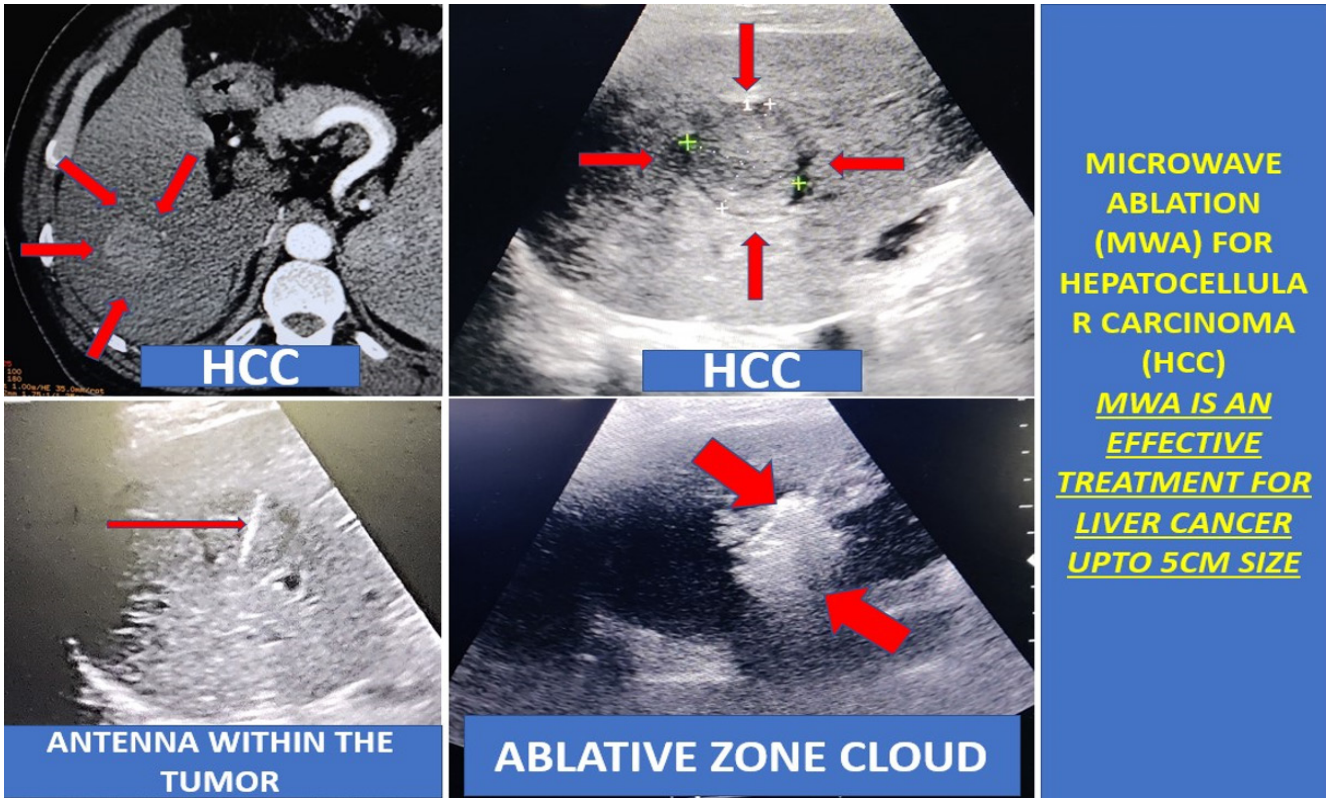


Fig: case of HCC (4cm) in right lobe- treated by MWA

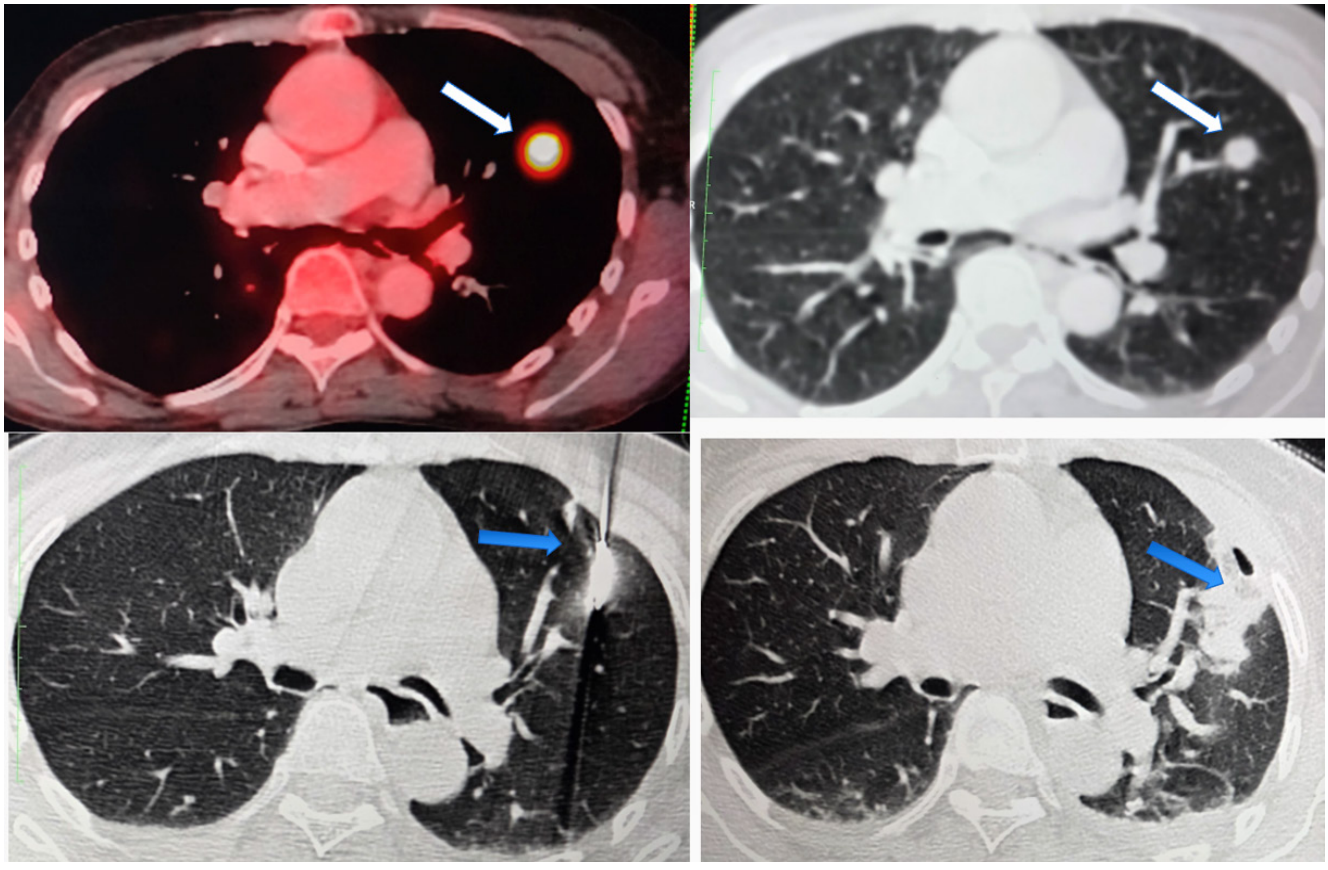


Fig: Post operative colorectal primary malignancy with single lung metastasis- treated by MWA

Complications and Management:

Complication	IR Management
Bleeding	Embolization, compression
Pneumothorax	Aspiration, chest tube/ pigtail
Thermal Injury	Hydrodissection, gas dissection
Post-ablation syndrome	Supportive care

Conclusion

Tumor ablation offers curative and organ-preserving oncologic therapy. Optimal outcomes require technical precision, modality selection, and integration into multidisciplinary cancer care. ■

Sentinel Lymph Node (SLN) mapping in Endometrial Cancer using Indocyanine Green Dye : 'The new kid on the block'.

Dr Karthik Chandra Bassetty, Dr Debabrata Barmon, Dr Upasana Baruah, and Dr Dimpy Begum
Department of Gynaecology Oncology, Dr. B. Borooah Cancer Institute, Guwahati

Introduction:
The prevalence of endometrial cancer is slowly increasing in the lower-middle-income countries, with India reporting 17420 new cases and 6845 deaths as per GLOBOCAN 2022. [1] Endometrial cancer is surgically staged with hysterectomy, bilateral salpingo-oophorectomy, and lymph node evaluation, forming the mainstay of management.

Systematic pelvic and paraaortic lymph nodal dissection increases the perioperative morbidity, cost and surgery duration, while the overall survival and disease-free survival are not changed. [2,3] The role of nodal dissection is primarily to tailor adjuvant treatment since involvement of nodes necessitates adjuvant chemotherapy and radiotherapy[4]. Sentinel Lymph Node (SLN) sampling was first described in 1996 and is now considered an alternative to comprehensive lymphadenctomy.

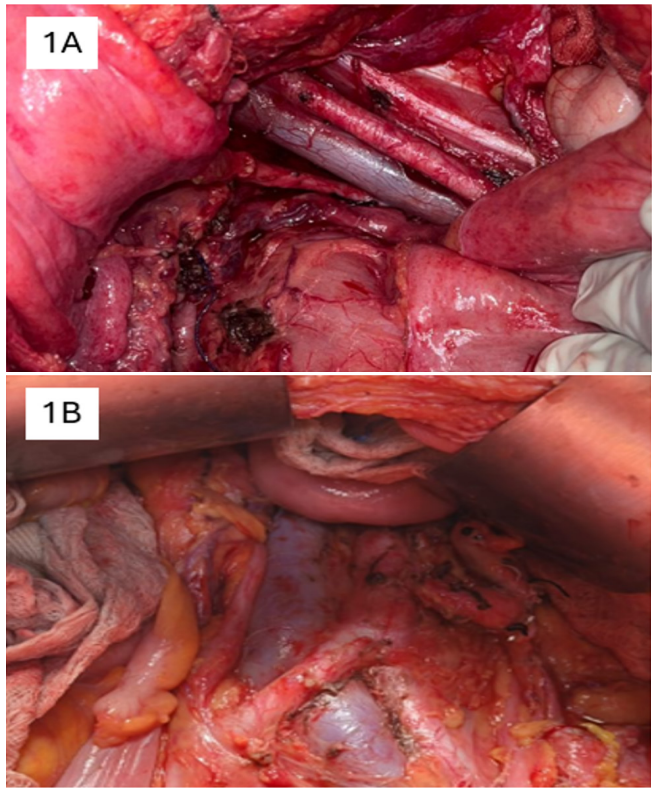
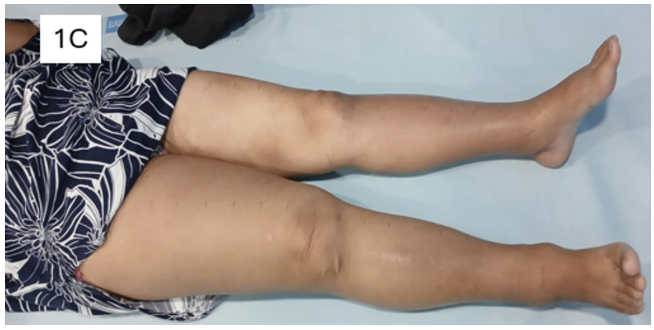
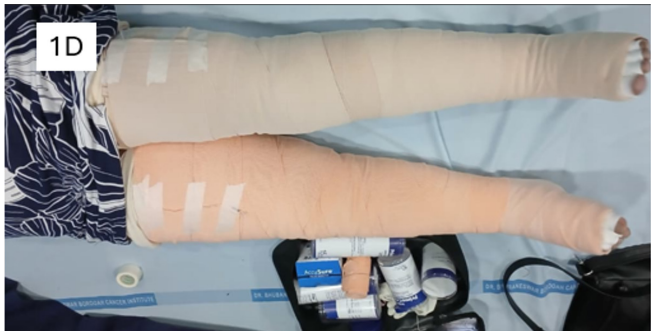


Figure 1: Figure 1A and 1B show complete pelvic and para-aortic lymphadenectomy. The patient later developed lymphedema (1C) and underwent medical treatment (1D) for the same and recovered uneventfully.





Concept of Sentinel lymph node:
A sentinel is a soldier or guard whose job is to stand and keep watch. A sentinel lymph node is the first draining lymph node from the tumor. If no malignancy is detected in the sentinel node, no further lymph nodal dissection is required. If malignancy is detected in the sentinel node, then the patient can be treated with adjuvant therapy.

Indocyanine green(ICG) dye:
Indocyanine green is the latest dye used in sentinel lymph node detection, as shown in *Figure 2*. Detection rates are increased when the ICG dye concentration used is 0.5 mg to 1.25 mg/mL. The advantages of ICG are as follows:

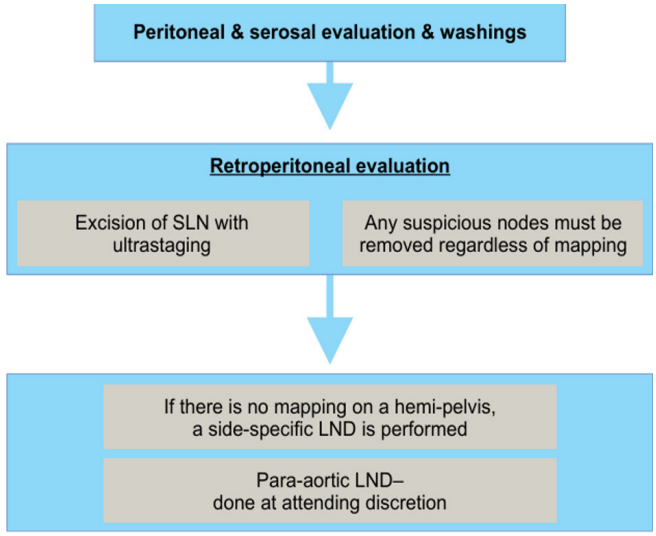
1. Less time pressured system.
2. Increased bilateral detection rates.
3. Lower false negative rates.
4. Excellent safety record.
5. Low allergy reactions(< 0.05%).
6. Low cost.
7. Real-time visualization.

Figure 2: ICG dye used for sentinel lymph node detection.

Preparation and injection technique used in our institute:
First, we prepare the stock solution by diluting the ICG vial with 10 ml of distilled water. 1 ml of the stock solution is diluted with 4ml of sterile water to obtain a solution of 0.5 mg/mL. After induction of anesthesia with the patient in lithotomy position,1 ml of the ICG dye solution is inserted at the 3 o'clock and 9 o'clock positions (both superficial and deep injection) of the cervix using a spinal needle.

Sentinel lymph node algorithm:
The MSKCC(Memorial Sloan Kettering Cancer Centre) algorithm [5] is used for sentinel lymph nodal detection, as shown in *Figure 3*.

Figure 3: MSKCC sentinel lymph nodal algorithm.

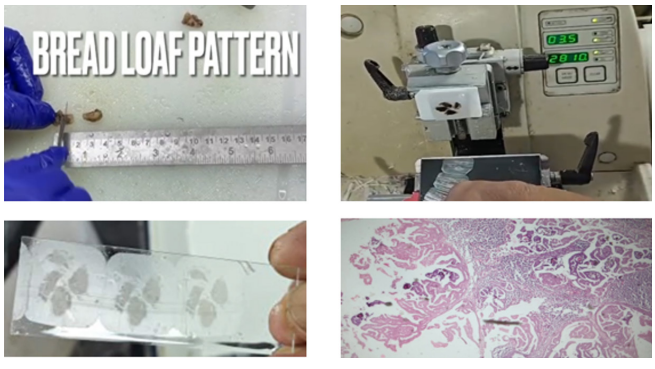


Certain key factors which increase the sentinel nodal detection are:

1. Good injection technique.
2. Keep the surgical field clean.
3. Perform the SLN mapping before the hysterectomy.
4. Search for the lymphatic pathways i.e. upper and lower paracervical pathways and less common pathways.

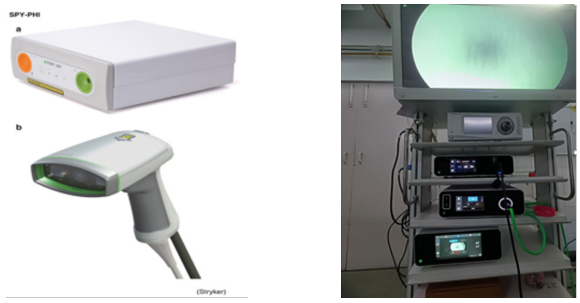
Ultrastaging:
Ultrastaging is a new technique of deeper sectioning and the use of special immunohistochemistry stains. The lymph nodes are thin-sectioned at 50-250 micrometers at the equator plane, either in bread loafing or longitudinal slicing, as shown in *Figure 4*. The initial slide is sent for conventional histopathological examination(HPE). If the initial HPE is negative, then use of IHC markers like AE1-AE3 and pan-Mel is mandated.

Figure 4: Figure showing the process of ultrastaging in which the node is first cut in a broad loaf pattern, followed by further sectioning and final histopathological slide showing malignant cells.



SLN systems available:
Both the open SPY PHI system and the Laparoscopy system are available in BBCI, as shown in *Figure 5.*

Figure 5: Open SPY-PHI and Laparoscopy system for SLN mapping.



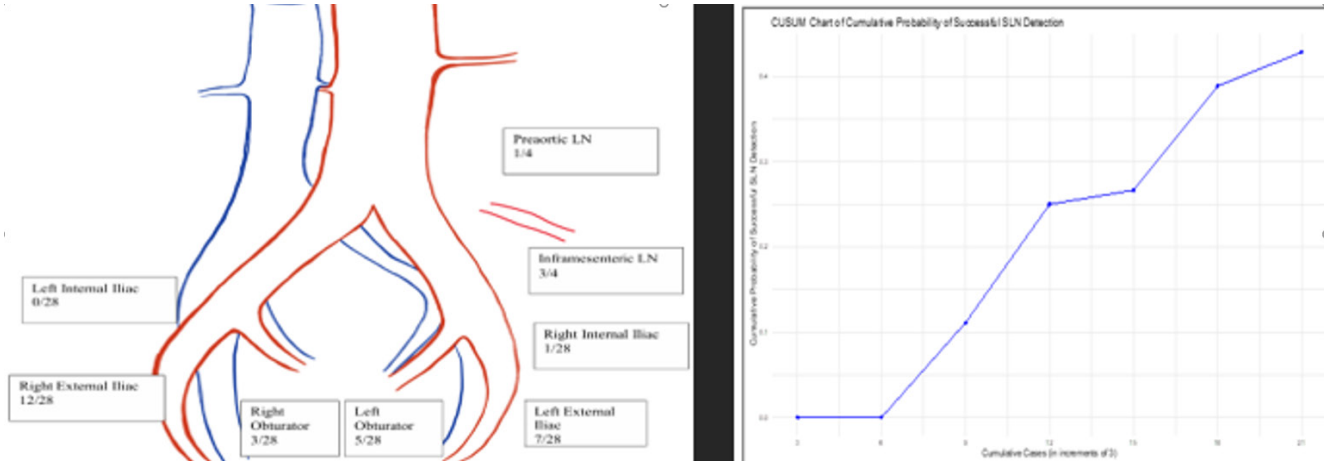
Evidence supporting the role of SLN in endometrial cancer:
Table 1 shows the various studies supporting the role of Sentinel nodal dissection in endometrial cancer.

Sl. No	Study	Description	Results	Conclusion
1	SENTI ENDO[6]	Stage I-II endometrial cancer Tc 99m and patent blue	Sensitivity 84% NPV 97% 5% paraaortic nodes Ultra staging detected metastases in 8%	SLN upstaged 10% of low risk and 15% of intermediate risk patients
2	FIRES[7]	Stage I endometrial cancer ICG dye used	86% successful mapping Sensitivity 97.2% NPV 99.6%	SLN can safely replace LND in staging
3	SHREC[8]	Stage I-II High risk endometrial cancer ICG dye	Sensitivity 98% NPV 99.5% Bilaterally mapping 95%	SLN can replace LND in HREC
4	SENTOR[9]	SLN in intermediate and high-grade endometrial cancer ICG dye	Sensitivity 96% FN 4% 25% patients had LN outside the traditional boundaries or needed IHC	SLN viable option for surgical staging

Abbreviations: NPV Negative predictive value, ICG Indocyanine green, LN Lymph node, FN False negative, SLN Sentinel lymph node, HREC High risk endometrial cancer.

Indications for SLN mapping in endometrial cancer:
SLN mapping in endometrial cancer in low and intermediate-risk endometrial cancer is performed as a standard, whereas in high-risk histologies it can be considered.

Our experience with ICG SLN mapping:
We recently validated our SLN protocol in our institute. A pilot study in which 20 patients were included, of which 85% patients had a successful detection and 55% had bilateral detection. Three patients required reinjection of dye. No false negatives were noted. We observed improved bilateral successful SLN detection after the 9th case which plateaud after the 18th case as shown in *Figure 6*.



Conclusion:

Sentinel lymph node mapping with ICG in endometrial cancer is a novel technique which has been validated and is performed routinely at Dr. Bhubaneshwar Borooah Cancer Centre. Adoption after validation of one's technique, when coupled with ultrastaging and periodic audit of the final histopathological report, can definitely reduce the morbidity of comprehensive lymphadenectomy in endometrial cancer. ■

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Precision in the Shadows: Implementing High-Sensitivity 12-color FC-MRD assay

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1. Introduction:
The survival rates for childhood B-cell Acute Lymphoblastic Leukemia (B-ALL) have seen a monumental rise globally; however, the challenge remains in identifying patients at high risk of relapse early in the treatment cycle. Minimal Residual Disease (MRD) monitoring has emerged as the single most powerful prognostic tool to guide risk-adapted therapy. In North-East India, the implementation of high-sensitivity MRD was historically hindered by resource constraints and a reliance on low-color (4–6 color) flow cytometry. By transitioning to a 12-color, high-event acquisition protocol aligned with the ISCALL (Improving Survival in Childhood ALL in India) framework , our laboratory has successfully bridged this diagnostic gap. This feature details the technical evolution required to achieve ultra-sensitive diagnostics and the rigorous analytical standards now in place.

2. Pre-Analyticals: The "First Pull" Mandate
The accuracy of ultra-sensitive MRD is fundamentally limited by the quality of the input material. Literature consistently demonstrates that hemodilution is the primary cause of false-negative MRD results. To achieve a sensitivity of 2-in-106 (0.0002%), denominator" (the total number of viable nucleated cells) must be robust and representative. The First-Pull Requirement: Our protocol strictly mandates the use of the first-pull bone marrow aspirate for MRD analysis. Subsequent pulls often contain significant peripheral blood contamination, which dilutes the marrow-resident blast population.

- Viability Standards: We have established a non-negotiable threshold of >85% viability. High proportions of apoptotic or necrotic cells introduce non-specific binding of monoclonal antibodies and increased autofluorescence, which can mask rare residual blast events.

- Bulk Lysis Technique: To process the large volumes required for 5–10 million event acquisition, we utilize a specialized bulk-lysis pre-analytical step. This allows for the concentration of nucleated cells while efficiently removing erythrocytes, ensuring the instrument is not "clogged" by irrelevant events.

3. Analytical Strategy: 12-Color Design and the Delphi Consensus
Standardization across India was achieved through the Delphi 1 and 2 surveys, which harmonized technical and analytical aspects of B-ALL MRD. Our lab's 12-color configuration is a direct evolution of these consensus guidelines.

A. The Backbone and the Aberrant (LAIP/DfN)
The 12-color panel is designed around a core backbone of CD19, CD10, CD34, CD38 and CD45. These markers

allow for the precise identification of the B-cell lineage and the mapping of normal maturation pathways (hematogones). To identify the "Leukemia-Associated Immunophenotype" (LAIP), we incorporate an expanded suite of markers:

- **CD304 (Neuropilin-1):** A highly specific marker for distinguishing malignant blasts from normal B-precursors.
- **CD73 & CD123:** Frequently overexpressed in B-ALL, providing a clear "Difference from Normal" (DfN) signature.
- **CD81 & CD22:** These markers often show altered expression levels (dim or bright) in leukemic clones compared to the predictable expression seen in regenerating marrow.

B. The Role of Nucleic Acid Dyes: SYTO 13 and SYTO 16

In the quest for 0.0002% sensitivity, the calculation of the "Correction Factor" is critical. Traditional flow cytometry assumes all events in the gate are cells; however, debris and platelets can falsely inflate the denominator.

- **SYTO 13 / SYTO 16:** Specifically deployed for low-level MRD scenarios. These dyes ensure that we are only counting "true" cells. If the correction factor reveals that only 60% of the acquired events are nucleated cells, the MRD percentage is adjusted upward to reflect the true disease burden. This precision is vital when a patient's clinical risk category hinges on the difference between 0.009% and 0.011%.

4. Computational Rigor: Kaluza and Boolean Gating

Handling data files exceeding 5 million to 10 million events presents a significant computational challenge. Standard analysis software often lags or crashes under such loads.

We utilize Kaluza Analysis Software, which is engineered for high-content flow data. The primary advantage of Kaluza in our workflow is the ability to perform complex Boolean Gating. This logic-based gating (e.g., Population A AND Population B NOT Population C) allows us to systematically exclude every possible normal population and artifact until only the aberrant blast population remains. This "cleaning" of the data is what makes 2-in-106 (0.0002%) detection statistically reliable.

5. Navigating the Shadows: Mimics and Artefacts

As we move into the realm of ultra-sensitivity, the "shadows"—or artefacts—become more prominent.

Hematogone Mimicry: During marrow regeneration (post-chemotherapy), hematogones expand rapidly. These cells express CD10, CD19, and CD34, closely mimicking blasts. High-sensitivity MRD requires the use of markers like CD58 and CD304 to identify the subtle "maturation shift" that separates these normal precursors from malignant ones.

- **Tandem Dye Breakdown:** PE-Cy7 or APC-H7 dyes can degrade, leading to false-positive signals in the PE or APC channels. In such scenarios, a few hundred "stray" events caused by dye breakdown can be misinterpreted as a residual clone. Constant monitoring of compensation and lot-to-lot antibody consistency is mandatory.
- **Non-Specific Binding & Debris:** Non-viable cells and platelets can bind antibodies non-specifically. The inclusion of SYTO dyes and "dump gates" is the only reliable way to ensure these artifacts do not contaminate the MRD gate.

6. Clinical Implications:

Identifying MRD at ultra-low levels as low as 0.0002% (2-in-106) with accurate quantitation up to 0.001% (1-in-105), which are closely equivalent to existing molecular methods is not merely a technical exercise; it is a clinical necessity.

1. **Early Warning:** Detecting persistent clones at ultra low levels often precedes a morphological relapse by weeks or months.
2. **Therapeutic Pivot:** Under the ISCALL implementation study, these findings allow for the early introduction of blinatumomab or other targeted therapies, sparing the patient the toxicity of a full-blown relapse.
3. **Prognostic Certainty:** A "true zero" provides clinicians and families with a much higher degree of confidence regarding long-term remission.

7. Conclusion

The implementation of 12-color B-ALL MRD monitoring in North-East India proves that geographical and resource limitations can be overcome through technical rigor and adherence to national consensus standards. By combining high-quality "first-pull" samples, the analytical power of Kaluza software, and the precision of SYTO dyes, we are providing our pediatric patients with a level of diagnostic excellence that matches the best centers worldwide. ■

Largest HPV Vaccination by Pratishruti Trust of Assam

Dr. Gayatri Gogoi
Professor, Department of Pathology, Assam Medical College, Dibrugarh

Cervical cancer is second most cancer of females which takes life one woman in every 8 minute in India. In 99% cases of cervical cancer, the proven cause is high risk Human papilloma virus sub-types such as HPV 16, 18 etc. in case of virus infections for long period of time. However it causes some other cancers in men and women although the burden is not as high as cervical cancer.

Dr Gayatri Gogoi a well known cancer Researcher and Professor ,assisted by Sadiqah kouser an MBBS student of AMCH Dibrugarh conducted survey on HPV Vaccination awareness and willingness among 160 students of Upper Assam in the beginning of 2025. The survey was to assess awareness, hesitancy, and willingness toward HPV vaccination among students of high schools and college level. The study aimed to highlight the need for proactive and large scale vaccination initiatives to prevent HPV-related diseases, including cervical cancer.

The survey, which gathered responses from various participants, revealed that lesser than 1% of respondents had taken the HPV vaccine. While asked who were aware about vaccine can prevent still why they did not get it, then 60.1% stated they had not had the opportunity to do so, and 39.9% unaware of the vaccine altogether.

While further evaluating their concern and barriers majority of them cited high cost as a major barrier, while a smaller percentage expressed concerns about side effects or uncertainty about its necessity.

It was further asked about their interest in subsidized vaccination encouragingly, 88.1% of unvaccinated respondents showed interest in receiving the HPV vaccine if available at a subsidized rate.

The majority of respondents expressed strong support for inclusion the HPV vaccine in routine immunization programs. These findings emphasize the urgent need for greater awareness campaigns, accessibility initiatives, and government-supported vaccination drives to ensure widespread protection against HPV-related diseases.

With the above findings of the survey Dr. Gayatri Gogoi, , strong advocates of community driven cancer awareness campaigns of North East India designed and conceptualized a project to initiate in consultation with Pratishruti cancer and palliative Trust . The objective of the project was to create wide scale awareness about the need of HPV vaccination to prevent cervical cancer in particular as well as HPV related other tumours. At the same time, project planned to ensure availability of vaccines at a half the price than hospital setting .

The question-Answers sessions were done after every batch of HPV vaccination beneficiaries enrolled before proceeding to vaccination .The first drive was flagged off at Dibrugarh by Pratishruti with Indian Medical Association Dibrugarh and Federation of Obstetrics and Gynaecological Society of India, Assam on 6th March

at Dibrugarh IMA house . Then it continues to carry many vaccinations drives in Guwahati with Nemcare Hospital , Dhemaji, Jorhat at Satyam Hospital, Sibsagar and Diphu at DMCH, Nalbari at IHA House, Tezpur at Sankara Hospital and Research Centre, Nagaon at SIMS Hospital , Morigaon at Maternity Multispeciality Hospital , Tinsukia with Rotary Club for last 7 months and now it has reached upto 3000 vaccines. Dr. Rina Ahmed, Dr. Gourangie Gogoi, Dr. Sikha Sarma, Dr. Vandana gupta, Dr. Bihari Agarwal, Dr. Ajanta Deuri, Dr Rakhi Shyam, Dr Malabika Saikia, Dr Jyotika Boidya ,Dr Anjan Rajkonwar etc are few of them among many leading the drive . Ms. Manjula Agarwal, Ms. Panna Bharali ,Jayshree Gogoi, Sewali Chetia , Utpala shrutikar , Shabina Yasmin , Deepika bordoloi Asmita Kalita Mouchumi Gogoi, Karabi Hazarika are some them spearheading as the coordinators of various districts.

As Cervavac, a quadrivalent vaccine is now available after Serum Institute of India has started producing in much lower cost giving a significant cost effectiveness than ever before allowing easy affordability. After Indian indigenous CERVAVAC HPV vaccine approved by Drug Controller General of India in 2022 the price of vaccines are affordable for greater population. At 9 to 14 year age group requires 2 vaccine in a gap of 6 months and 15 to 26 years age group requires 3 doses in 0 day, 2nd month and 6th month schedule.

As per record this is the largest HPV vaccination coverage by a non profit making organization in India in a shortest period of time of 7 months. Pratishruti has been giving free vaccination to daughters whose mothers affected by cervical cancer and as well as selected economically weaker other cancer affected poor families .

It must be emphasized that there are 100s of cancers types but not all cancers can be prevented but cervical cancer has an answer to prevent by HPV Vaccines. It can be also be prevented by screening tests for early detection which should be done in a periodic interval. Many hospitals and doctors, health care workers and volunteers from different districts of Assam are involved in this mission.

Nagaon District Administration adopted a significant move to prioritize HPV vaccination programs, enhance affordability, and educate the public on its benefits of HPV vaccination among public. Mr. Debasish Sarma known for his extraordinary effort for cancer related together with Pratishruti and Nagaon Medical College Hospital . Cancer impact was a point of discussion and public were sensitized in the 15th August parade ground while vaccinating free sponsored by Deepsikha Foundation and subsidized vaccines too 100 beneficiaries .

It should also be stated that HPV vaccines are being given by practitioners in few of hospitals in Assam. However, it will not be able to cover the eligible age groups till the government integrate into universal immunization.

It is noteworthy to mention that MLA of Gohpur constituency of Assam, Mr. Utpal Borah has been highly motivated to organise free vaccination of 40 girls of his constituency on 28th December.

India announced HPV vaccination for girls as a national priority in the 2024 Union Budget, with a phased, school-based rollout targeting 9–14-year-olds. This is critical as India accounts for nearly 20% of global cervical cancer cases and would need to vaccinate ~68 million girls initially.

WHO's 2022 recommendation for a single-dose schedule is highly relevant for India. Strong evidence, including a large Indian cohort followed for 15 years, shows that a single dose provides vaccine efficacy (~95%) and long-term antibody persistence comparable to two or three doses. Modelling suggests that a single-dose strategy could avert nearly one million cervical cancer cases and achieve elimination targets more cost-effectively than two doses. Strong evidence, including long-term Indian data, shows that a single-dose HPV vaccine provides protection comparable to two or three doses. A single-dose strategy would be more affordable, simpler to deliver, and could prevent nearly one million cervical cancer cases. With the launch of the indigenous Cervavac vaccine, India should adopt a pragmatic approach—such as extended dosing intervals and rapid evaluation of a single-dose schedule—to accelerate cervical cancer elimination and maximize public health impact.

This exemplary initiative by Pratishruti under visionary leadership of Dr Gogoi has disseminated widespread movement across Assam enabling other partners to continue vaccination . Pratishruti cancer and Palliative Trust is an organization who serve in the field of cancer and Palliative care .it will keep one step ahead of target set by World Health Organization. ■

Reference:

Www.pratishruti.org
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Analogy between Cancer and the Beehive : Malignancy as a Superorganism

Dr. Duncan Khanikar
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Introduction
Cancer is often described as a breakdown of cellular order, but modern biology reveals that tumours are not merely chaotic masses. Instead, they are highly organised communities with significant heterogeneity, functioning much like a beehive—a beehive with its own social hierarchy and survival tactics. This article provides an understanding of cancer's growth, resilience, and resistance to treatment through an analogy with the beehive.

Cooperation and Individuality
Major evolutionary transitions occur when independent entities cooperate to form a new, higher-level individual. Consider transitions such as single cells forming multicellular organisms or solitary insects becoming social colonies. In this context, a beehive is a superorganism in which individual bees function like specialised cells. Similarly, a tumour is a community of specialised cell types that cooperate to persist—much like a hive within its host. Tumours contain diverse cell types — stem like cells, immune cells, stromal cells — that interact in organised ways.

Order Within Malignancy: Swarm Intelligence
Tumour cells self-organise and remodel the microenvironment. Tumours establish decentralised control via local chemical signalling. Both beehives and tumours recreate their environments: bees build wax combs, while tumours secrete extracellular matrix components and recruit stromal cells to support growth and resist immune attack.

The Queen Bee and Cancer Stem Cells
The core principle of organisation applies to both hives and tumours. Central to both hives and tumours is a division of labour. In bees, the queen is the sole reproductive individual, while workers perform specialised tasks. Tumours mirror this with a hierarchy: cancer stem cells (CSCs) function as the "queen," driving long-term growth and resisting therapy, while most cancer cells are short-lived "workers".

- Queen Bee vs. Cancer Stem Cell (CSC): The queen's longevity and control over reproduction parallel the self-renewal and immortality of CSCs. Standard treatments often fail to target CSCs, resulting in tumour relapse—like removing worker bees while the queen remains alive.

- Worker Bees vs. Differentiated Cancer Cells: Like worker bees, most tumour cells are specialised and readily discarded; this cellular diversity helps tumours endure stress. Their diversity allows the tumour to adapt and survive under stress.

Epigenetics and Plasticity
Bee division is based on diet and epigenetics — larvae that eat royal jelly become queens. Similarly, the microenvironment and signalling pathways determine the cell fate. Tumour cells can even differentiate into stem-like cells under stress, echoing the plasticity seen in bee societies.

Both superorganisms excel at resource management. Through trophallaxis, bees share food, ensuring colony members are nourished. Tumours display "metabolic symbiosis," where different cell populations exchange metabolites to survive in hostile environments. Hypoxic (oxygen-poor) cells produce lactate, which oxygen-rich cells use for energy, mirroring the hive's efficient distribution of resources.

The structure of a beehive, including wax combs and food stores, plays an essential role. In cancer, the tumour microenvironment (TME) plays a similar role. Cancer-associated fibroblasts (CAFs) build and remodel the extracellular matrix, support tumour growth, and shield cancer cells from therapy. Targeting components of the TME, such as CAFs or immune-modulating elements, could disrupt this 'hive' structure and improve treatment efficacy.

Metastasis and Swarming
Metastasis remains the deadliest feature of cancer because it spreads to distant organs. This process resembles bee swarming, in which a portion of the colony splits off to form a new hive. Tumour cells migrate collectively, often carrying supportive cells with them, which help them survive and establish new tumour sites.

Communication: Pheromones, Exosomes, and Quorum Sensing
Superorganisms depend on constant communication. Bees use pheromones to support social order; tumours use exosomes—tiny vesicles that carry signals—to coordinate growth, suppress the immune system, and prepare distant sites for metastasis. Understanding this communication can inspire new therapeutic strategies that disrupt tumour cohesion.

Social Parasitism: The Cape Honeybee
The Cape honeybee (Apis mellifera capensis) gives a real-world example of "social cancer." These bees invade other colonies, mimic queen pheromones, and reproduce without contributing to the hive—mirroring how cancer cells exploit their host.

Evolutionary Insights
Cancer can be understood as a breakdown of cooperation—a regressive shift to a more primitive, self-centred state. Although the beehive analogy emphasises organisation, it might oversimplify the complex evolution and genetic diversity of tumour cells. By understanding tumour evolution and adaptive mechanisms, we can gain a richer understanding of cancer's intricacies and work to develop improved therapeutic options.

Therapeutic Implications

Traditional cancer therapies often fail because they target the bulk of tumour cells rather than the organisational structure. The beehive analogy suggests new strategies:

- Target the "queen" (CSCs): Eliminate the source of tumour regeneration.
- Disrupt communication: Block signalling pathways and exosome release to halt tumour regrowth.
- Starve the hive: Inhibit blood vessel growth and metabolic support.

Conclusion
Viewing cancer through the lens of superorganisms, such as beehives, reveals its true complexity. A small population of cancer stem cells acts as a protected reproductive core — self-renewing and therapy-resistant — while the tumour mass is largely composed of differentiated, glycolytic cells that perform most of the invasion and growth. By shifting focus from simply "killing cells" to disrupting the tumour's organisation and communication, we may discover more effective ways to combat malignancy. ■

Between the Protocol and Parenthood

Dr. Venkata Pradeep Babu Koyyala
Senior Medical Oncologist, Tezpur

That year, the rains in Nagaland were heavy and steady. They pounded on tin roofs and turned the paths into soft, red mud. At Amala's place, the rain became like a second clock, marking the days in long, wet stretches. Neighbors stopped by with kind gestures, like dropping off veggies from their gardens. The church choir sang for her, their voices rising over the hills, a comforting routine, like faith put into practice.

Amala, 32, was expecting twins, seven months along. She held her belly like it was a precious promise, not needing to explain it to anyone. Her family was already dreaming of the future: two names, two cries, two little ones filling their house with life.

Then everything fell apart.

The twins were gone before they even got started. Grief didn't come in a dramatic way. It was more like fog, settling over everything – the kitchen, the bed, the quiet spaces between words.

Roko, her husband, tried to be strong in the way men are taught: handling papers, making calls, brewing tea, making sure everyone was fed and that traditions were followed. But even strength gets tired. At night, when he thought Amala was asleep, he'd quietly break down in the dark, sobbing softly, as if whispering his pain would stop it from spreading. Amala heard him anyway. Grief makes you extra sensitive.

People offered comfort, and of course, advice, some kind, some not so much.
God has a plan.
You should have been more careful.
You shouldn't have climbed those stairs.
You shouldn't have carried that.
The advice kept coming, like the rain, constant, unwanted, and way too sure of itself.

Amala grew quiet, in a way that worried everyone. Not an angry silence, but a withdrawn one, as if her voice had gone away with her children.

Weeks later, when the rain turned into a drizzle, she went to the stream to do laundry. The water was icy cold on her hands, and the stones under her feet were slippery. She moved carefully, her body still recovering.

That's when she felt it.

A lump in her breast – hard, not painful, and not moving the way she thought it would. It felt more like a fact than a symptom. She froze, her fingers still wet, staring at the stream, as if it held the answers.

At first, she tried to reason with herself, like many people do, using what she knew about the body to calm herself down. Pregnancy changes things, milk glands swell, hormones mess with everything. She told herself it was normal and would disappear if she just waited.

Because waiting felt easier than dealing with another medical issue.

But the lump stayed there, stubborn and calm, like it had all the time in the world.

That night, Roko noticed her wince while changing. He didn't push her or make a big deal out of it. He just said gently, Let's go to Dimapur, just to get it checked.

Amala almost said no. Not now. Not again. But then she remembered how quickly later can become never. She nodded.

The hospital smelled like disinfectant and waiting. Families held files in plastic sleeves. People spoke quietly. Somewhere, a baby cried – a normal, everyday sound that reminded Amala, cruelly, of what she didn't have anymore.

Roko's love was shown in practical ways. He stood in lines, carried the file, and made sure Amala ate, even when the food tasted like cardboard. He didn't say, Be strong. He hated that phrase. It sounded like telling someone who was already drowning to just keep swimming.

He was also carrying a weight that wouldn't go away. Where they came from, having kids wasn't just a wish, it was what was expected, with everyone eager and smiling. People didn't ask Do you want kids? They asked, When?

In the waiting room, he held her hand and made the only promise that mattered now that everything felt uncertain:

Whatever happens, we'll face it together.

The tests went the way they usually do: exam, scan, then the words that make your mouth go dry.

We need a biopsy.

Amala's father tensed up. The old fear, passed down through generations, was still there: If you mess with cancer, it spreads. The doctor addressed it right away, not by scolding, but by explaining calmly and clearly.

A biopsy doesn't spread cancer, he said, looking right at the family. It tells us what we're dealing with. If we don't know what it is, we might not treat it right.

The biopsy itself was quick – a sharp poke, a brief moment of discomfort. The waiting was the hard part. Every time the phone rang, Amala's stomach tightened. At church, she lit candles with shaky hands and whispered a prayer that wasn't fancy, just honest:

God, give me another chance to be a mom.

When the results came back, the room felt too quiet.

It's DCIS, the doctor said. Ductal carcinoma in situ.

The word carcinoma sucked the air out of the room. The doctor didn't let the silence turn into a disaster.

Basically, he said, it means there are abnormal cells inside the milk ducts. 'In situ' means 'in its place.' It's not invasive. It's a problem because it can turn into invasive cancer over time. But if we catch it now and treat it, the chances of a good outcome are high.

He outlined the plan – Surgery, Radiation and Hormonal therapy based on the risk.

Amala listened carefully, and the question she asked wasn't about dying.

Doctor, if I need tamoxifen, does that mean I can't get pregnant?

The doctor knew what young patients worry about: cancer treatment messes with your life plans. Counseling is just as important as the medicine.

Tamoxifen is a hormone treatment, not chemo, he said. It can lower the chance of the cancer coming back, but you can't be pregnant while taking it. You have to use birth control. If you want to get pregnant, you have to stop taking tamoxifen for a while before trying.

Amala didn't look away. Tell me more.

This was when the facts, usually talked about in meetings, had to be explained in a way that a grieving young woman could understand without falling apart.

There was a study about this, he said. It was called the POSITIVE trial, and it looked at women who had hormone-positive breast cancer and wanted to get pregnant. They stopped taking their hormone therapy for a while to try to get pregnant, and then they went back on it afterward. It seemed to be safe.

He kept it clear and simple because that's the most caring way to explain things when it comes to cancer.

The POSITIVE trial was about invasive cancer, not

DCIS, he said. But if your DCIS is ER-positive and we think you need hormone therapy, the same rules apply: no pregnancy on tamoxifen, a break before trying to get pregnant, a plan, regular checkups, and going back on the medication if you still need it.

He was honest. He didn't try to make things sound better or worse than they were.

This doesn't get rid of the risks, he told them. It just helps us manage them.

Not a one-day decision

They didn't figure everything out in one afternoon. After a loss like that, life doesn't just go back to normal. Between appointments, Amala went back to church, letting the music wash over her. She sat by the hills and listened to the cicadas. At night, she and Roko talked a little bit at a time – sometimes crying, sometimes just staring at the ceiling.

Everyone had something to say, as usual. Someone suggested herbal cures. Someone said to keep it a secret. Someone whispered that surgery spreads the cancer. Someone told her to finish everything first, as if there was a set date for when this would all be over.

Amala realized that everyone has an opinion when it comes to a young woman's body.

What she needed wasn't more advice. She needed a plan that took into account both her health and her desire to be a mother.

So, the doctors focused on treating the cancer first, following the guidelines, and keeping a close eye on things. And if hormone therapy was needed, they explained it in a way that made sense for a young woman: not a life sentence, not a casual pause, but a clear plan with rules.

No pregnancy while on tamoxifen.

Birth control while on therapy.

A break before trying to get pregnant.

A reason for stopping or delaying treatment, and a plan for checkups.

A promise to go back on the medication if needed.

The doctor also explained something that people often get wrong when they hear non-invasive.

DCIS doesn't mean you don't need checkups, he said. It means we caught something early. Checkups are how we keep it from becoming a bigger problem.

On rainy nights, when the tin roof made the same noise, Amala still heard the sound that used to mean only loss. But now it also meant something else – strength, and the slow process of building a future, one step at a time.

For hormone receptor–positive disease, we now have a good reference point: taking a break from treatment is not always a bad idea if it is carefully planned and monitored. For DCIS, the evidence is not as clear – but in patients who need hormone therapy, we can apply the same safety rules and detailed counseling.

Because young patients aren't just choosing treatments.

They're choosing their futures. ■

Training in Head and Neck Surgery at BBCI : Beyond Skills, Towards Responsibility

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Training in Head and Neck Surgical Oncology is often perceived primarily through the lens of operative complexity and technical expertise. At Dr B. Borooah Cancer Institute (BBCI), Guwahati, however, training is consciously shaped to extend far beyond surgical proficiency. Equal importance is placed on sensitising residents to the human realities of cancer care—learning to see the patient behind the disease, to recognise the profound physical, emotional, and social cost of malignancy, and to approach oncologic decision-making with empathy, responsibility, and reflection. This deliberate emphasis on humanising cancer care is one of the defining pillars of training at the institute and plays a crucial role in shaping residents not only as technically competent surgeons, but as thoughtful and compassionate clinicians.

As a tertiary referral centre for the Northeast, BBCI manages a large volume of head and neck cancer patients, many presenting with locally advanced disease. This translates into extensive and diverse surgical exposure for trainees. Residents are routinely involved in assisting and performing oral cavity cancer resections, comprehensive neck dissections, thyroidectomies, total and partial laryngectomies, and parotidectomies. Exposure also includes advanced skull base procedures such as temporal bone malignancies, orbital exenterations, and maxillectomies.

Surgical training at BBCI is characterised by constant evolution to remain aligned with contemporary oncologic practice. Free flap reconstruction has now become a regular and integral component of head and neck surgery, with residents routinely assisting in microvascular reconstructions. On average, approximately five free flap procedures are performed each week for head and neck cases, providing invaluable exposure to advanced reconstructive principles, teamwork, and postoperative care. Equal emphasis is placed on reconstruction as a natural extension of oncologic clearance, with residents gaining hands-on experience in a wide range of local and regional flaps performed by the head and neck team. The recent introduction of routine intraoperative nerve monitoring during thyroidectomies for identification and protection of the recurrent laryngeal nerve further reinforces a strong culture of patient safety and surgical precision.

The consistently high case load of both surgical and non-surgical cases ensures repeated exposure to core oncologic principles, enabling residents to develop confidence, anatomical familiarity, and sound clinical judgment.They are actively involved in outpatient evaluation, endoscopic assessments, diagnostic biopsies, staging workup, and multidisciplinary treatment planning. This involvement allows them to

participate meaningfully in clinical decision-making and longitudinal patient management.

A distinctive aspect of Head and Neck training at BBCI is the extensive exposure to nasopharyngeal carcinoma. Owing to the higher incidence of this disease in the Northeastern region, particularly in states such as Nagaland, the institute manages a substantially larger number of nasopharyngeal cancer cases compared to many other parts of India.

Beyond operative exposure, the department consistently reinforces sensitisation to the broader dimensions of oncologic care through longitudinal involvement in patient management. Residents participate in preoperative counselling, postoperative rehabilitation, and long-term follow-up, fostering an appreciation of speech and swallowing outcomes, nutritional rehabilitation, psychosocial impact, and quality of life considerations unique to head and neck cancer patients. This experience teaches trainees to think beyond surgery and keep the patient at the centre of care.

A strong culture of critical self-evaluation supports this clinical and surgical training. Regular intradepartmental reviews in the form of monthly surgical audits, along with interdepartmental Disease Management Group (DMG) discussions and mortality meetings, ensure continuous appraisal of outcomes and practices. These structured forums promote transparency, accountability, and collective learning, enabling the department to consistently refine its approach and remain aligned with evolving evidence and standards of care.

Academic engagement forms a core pillar of training at BBCI. A structured academic schedule comprising weekly seminars and weekly journal clubs, followed by focused discussions, ensures sustained interaction with current literature and emerging advances in head and neck oncology. These activities cultivate critical thinking and support the translation of evidence into everyday clinical practice.

A defining strength of the department lies in its faculty structure. Over the three-year residency, trainees rotate and work closely under the six professors in the department. Each faculty member brings a distinct surgical philosophy, teaching style, and clinical perspective, exposing residents to a rich diversity of approaches. Despite these individual differences, the faculty function as a cohesive and harmonious team, united by shared values and mutual respect. Over time, this environment fosters a strong sense of belonging, and by the end of training, residents feel deeply integrated into the unit.

Training at BBCI also extends beyond the hospital setting. Recognising the high burden of substance abuse and its strong association with head and neck cancers in the region, the institute actively engages in cancer awareness, prevention, and early detection initiatives. Faculty members and residents regularly participate in outreach programs, screening camps, and health education activities conducted in remote and underserved areas of the Northeast. These efforts emphasise prevention of tobacco- and areca nut–related cancers, early symptom recognition, and timely referral, reinforcing the role of the surgeon not only as a clinician, but also as an advocate for community health. Training in the Head and Neck Department at Dr B. Borooah Cancer Institute represents a balance between surgical excellence, academic discipline, empathy, and social responsibility—preparing residents for independent practice and leadership while grounding them in the values central to oncology. ■

Learning is a Continuum

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It has been seven years since I returned to Guwahati after my superspecialty training in surgical oncology and joined Dr. Bhubaneswar Borooah Cancer Institute in late September 2018. Since then, I have maintained patient diaries, my faithful companions to clinical practice. From time to time, I revisit their pages. What I find there is more than clinical chronology; they are quiet repositories of lived lessons, patiently etched in ink. In the late evenings, or in the dead of night, a quiet vellichor often settles in as I turn those pages.

Within those entries lie reflections on the natural course of the disease and the humbling recognition of both the utility, and, at times, the futility, of earnest, occasionally overambitious surgical endeavour. Beneath the terse lingo of the handmade notes reside the unpenned memoirs—poignant accounts of the burden borne by patients and caregivers, and of the inevitability of loss. They echo discussions with peers across surgical and other specialties, moments of measured self-appreciation and honest self-doubt, the exhilaration of success and the ache of failure, and, above all, the gradual evolution of my own mental framework and understanding of cancer as a whole.

One of my favourite narratives traces back to 2019, when an elderly gentleman walked into my OPD with stage IV colon cancer and multiple bilobar liver metastases. Through sequential, cancer-directed treatments, he was eventually rendered disease-free. Today, when he walks into my OPD as an octogenarian, he brings me immense joy.

In the same year, a young girl required a total pelvic exenteration with bilateral laterally extended resection, for an advanced rectal cancer. Despite two stomas, her attitude towards life was highly positive. Unfortunately, in three years, she developed lung metastases and despite multiple cancer-directed treatments, which included pulmonary metastasectomy with chest wall resection, the disease had a mind of its own, progressing relentlessly till the eighteen months that she could pull through.

In 2020, an elderly gentleman came with a poor performance status with uncontrolled hematuria and pelvic pain due to a large prostate cancer infiltrating almost the entire urinary bladder and the rectum. He underwent a total pelvic exenteration with pubic bone resection and recovered well to come back to the OPD with a smile, relieved from the distressing symptoms, and unbothered about the two stomas he had to maintain consequent to the surgery. He actively came for follow up for three more years.

In early 2019, a 54-year-old gentleman, who underwent subtotal gastrectomy with D4 lymphadenectomy, had high volume nodal disease (35 nodes were positive out of 63 harvested, with perinodal spread) including non-regional stations (14, 16 and 17) and he continued to be disease-free after 3 years of follow up.

I could go on and on, as the stories seem infinite now, but there has to be an end for this time. The usual tendency is to label certain cases as 'outlier' with

scientific reasoning tempered by oncological outcomes from higher levels of evidence. To the one patient in question, the 'outlier' outcome is providential. To the clinician, it becomes part of his working memory and personal bias. I acknowledge that bias is inevitable and dual-edged and not simply something to be eliminated. There are so many things that determine the clinical outcomes and looking at each and every entry as a case study bears fruit. Everything is of contextual relevance. Staying abreast of all important present and upcoming evidence is uncompromisable. Conviction about the correct way to manage a complex clinical scenario is essentially judgement derived from such mental repositories and easy or rather vivid call backs. The counter-argument may be to eliminate such biases with artificial intelligence (AI) -aided efficiency in decision-making with adaptive clarity. However, AI does not truly eliminate bias but rather redistributes it. My meta-cognition regarding this tension is itself a testament to the discipline of maintaining a logbook—not merely as a record, but as a conscious effort to audit experience, recognise bias, and refine judgement.

Until 2023, my surgical practice remained rather broad-based. From the middle of that year, however, focus was formally forged by the adoption of the disease management group (DMG) based approach by the institution. My current subspecialties include colorectal, hepatopancreatobiliary and genitourinary cancers, bone and soft tissue tumours, and paediatric solid tumours—a transition that reflects not contraction, but growing clarity. This has enabled me to meaningfully work towards expansion and refinement of surgical services in the current domain. This has included a high percentage (above 90%) of minimally invasive surgery (MIS) for colorectal cancers including complex bTME resections, MIS for retroperitoneal nodal dissections, MIS for radical cholecystectomy and liver transections and uniform, high compliance, adoption of enhanced recovery after surgery (ERAS) protocols with redoubtable confidence. Initial unpublished audits have shown a tangible difference in hospital stay, morbidity rates and pain scores, the significance of which will be subsequently reported in formal publications. Similarly, the use of VEIL essentially eliminates wound breakdown seen with open inguinal dissections, and thus lesser hospital stay and readmissions. A "no see, no clamp" technique of partial nephrectomy, where the procedure is performed through a "mini-incision" with no vessel dissection (and no clamping, that is, non-ischemia technique) has been successfully replicated several times, with excellent patient recovery. In a 'difficult' case of retroperitoneal lymph node dissection (RPLND), the IVC was repaired with free peritoneal patch and the success of the procedure is an experience that will come in handy in desperate times. The use of the "tubeless technique" for MIS (VATS) pulmonary metastasectomy for solitary peripheral lung metastasis for bone and soft tissue sarcomas, where the patient is "not intubated and does not need an intercostal chest drain" and can be discharged on the same day (single day discharge, SDD) has engendered much desired enthusiasm. The acquisition of the TEO platform has enabled me to perform TAMIS (transanal minimally invasive surgery) procedures for benign tumours of the rectum. I am currently using indocyanine green (ICG) to understand the pattern of lymphatic spread, including aberrant ones, in cancers of the colon and rectum. Especially gratifying has been the steady progress seen with the volume and spectrum of limb salvage surgeries. The use of biological reconstruction for the same has increased in a measured manner.

Learning, I have come to realise, is neither episodic nor finite. It is a continuum—shaped by patients, steered by technology, tempered by outcomes, and refined through rumination. This brief reflection is a tribute to every unnamed patient who stands as the protagonist of each narrative preserved in my diaries. They will continue to educate me for as long as I remain a conscious practitioner, because surgery is not merely a career choice; it is a way of life. ■

Surface Guided Radiation Therapy (SGRT): A New Safety Layer in Precision Radiotherapy

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Introduction

Precision radiotherapy has advanced rapidly with intensity-modulated techniques, image-guided radiotherapy (IGRT), stereotactic treatments, and adaptive workflows. However, as geometric margins shrink, the consequences of setup errors, intrafraction motion become proportionally greater. In this context, accurate patient positioning and continuous monitoring are no longer optional—they are essential components of safe radiotherapy practice.

Surface Guided Radiation Therapy (SGRT) addresses this need by continuously monitoring the patient's external surface in real time, enabling rapid setup and verification of patient posture, and automated motion gating or beam-hold when predefined tolerances are exceeded. This article outlines the principles of SGRT, its clinical applications, integration with IGRT, and its role as an additional safety layer in modern radiotherapy.

Why Another "Safety Layer" Is Needed in Modern Radiotherapy

Modern radiotherapy is a paradox: it is more accurate than ever, yet increasingly unforgiving. Margin reduction (PTV, PRV) and hypofractionation amplify the impact of even small geometric deviations. Key vulnerabilities include:

- Setup uncertainty despite utilisation of immobilisation techniques, particularly in breast, thoracic, and pelvic treatments.
- Intrafraction motion, including respiratory motion, swallowing, and discomfort-related shifts.
- Workflow complexity, driven by time pressure, multiple isocenters, and increased reliance on automation.
- Event prevention risks, such as incorrect patient orientation, erroneous couch shifts, or unintended posture changes.

Although IGRT remains the gold standard for internal anatomy verification, it is inherently intermittent. A clear gap exists for continuous monitoring—this is precisely where SGRT adds value.

What Is SGRT?

SGRT uses a camera-based optical system to generate a three-dimensional map of the patient's surface. This surface is compared in real time with a reference surface acquired during simulation or treatment planning. The system calculates deviations in six degrees of freedom (6DoF):

- Translations: x, y, z

- Rotations: pitch, roll, yaw

It provides:

- Real-time guidance during setup, and
- Continuous intrafraction monitoring, with configurable thresholds to trigger beam-hold, gating, or alerts.

These deviations are displayed instantly, allowing therapists to correct setup errors and detect motion during beam delivery. SGRT complements IGRT by improving initial setup accuracy and enhancing intrafraction motion surveillance.

Key Advantages of SGRT

- No additional exposure to ionising radiation for imaging.
- Touch less, tattoo less, open mask/mask less setup that improves patient comfort and experience.
- Improved setup reproducibility with early detection of translational and rotational errors.
- Real-time intrafraction motion monitoring, increasing confidence in precision delivery.
- Strong support for breath-hold techniques, especially for left-sided breast radiotherapy to reduce cardiac dose.
- Potential reduction in repeat imaging and repositioning corrections.
- Better documentation and auditability of setup stability across fractions.

High-Value Clinical Indications

SGRT can be applied across multiple tumor sites, with particularly high impact in:

- Breast Radiotherapy (especially DIBH): Improved breath-hold reproducibility and chest wall consistency, supporting cardiac sparing in left-sided disease.
- Head and Neck Radiotherapy: Enhanced setup precision in the setting of anatomical changes, shoulder variation, and weight loss during treatment, possibility of open face mask immobilisation in claustrophobic patients.
- SRS/SBRT and Hypofractionation: High dose per fraction requires exceptional accuracy; SGRT strengthens setup confidence and intrafraction monitoring.
- Re-irradiation: Tight OAR constraints and limited margins benefit from an added safety layer.
- Anxious, elderly, or paediatric patients: A faster, non-contact setup experience can improve compliance and reduce motion.

SGRT and IGRT: Complementary, Not Competing

A common misconception is that SGRT can replace IGRT. In reality:

- **IGRT answers:** "Is the tumor or critical anatomy where we think it is?"
- **SGRT answers:** "Is the patient positioned—and staying positioned—as intended?"

Best practice follows a layered approach:

1. Use SGRT for initial setup to achieve a near-correct pose efficiently.
2. Use IGRT for internal anatomy verification (CBCT/kV/MV as site appropriate).
3. Use SGRT for continuous intrafraction monitoring, particularly for long treatments, breath-hold, and high-precision techniques.

This strategy reflects modern safety engineering principles, emphasising independent checks at multiple workflow stages.

Training and Workflow Design

The effectiveness of SGRT depends on:

- Staff familiarity with surface artefacts (hair, clothing, reflective materials).
- Consistent immobilisation and indexing practices.
- Clear standard operating procedures (SOPs) defining stoppage rules when motion exceeds thresholds.

SGRT as a New Service Addition at BBCI

In our department, the recent installation of the LUNA 3D SGRT system represents the practical implementation of the SGRT principles outlined above. In this early phase, the system has been particularly beneficial for pelvic and breast setup, improving positioning consistency and workflow. Successful implementation relies on a multidisciplinary approach involving Radiation Oncologists, Medical Physicists,

Radiation Therapists (RTTs). Key elements include structured training, workflow standardisation, quality assurance checks, and phased expansion from high-yield indications to broader clinical use.

As clinical experience expands and technologists gain greater proficiency, we plan to broaden its application and develop site-specific SOPs to integrate SGRT more systematically into routine practice.

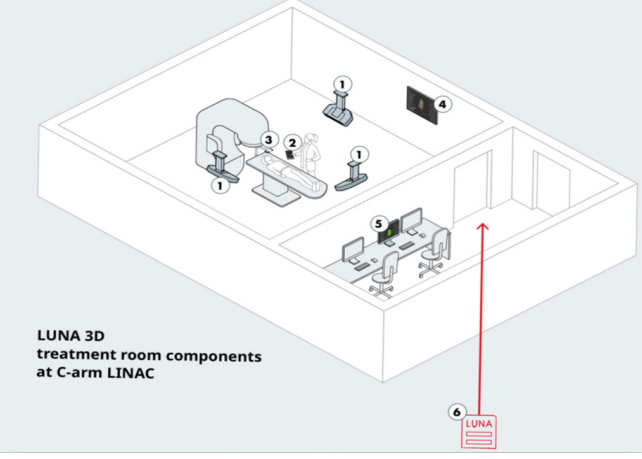

Image: Schematic diagram showing components of a SGRT system

1. ***Camera Pod*** *– Captures the patient's surface in real time for positioning and motion tracking.*
2. ***Therapist Tablet*** *– Provides mobile control of the SGRT system at the treatment couch.*
3. ***Patient Coaching Screen*** *– Guides patients during breath-hold and improves reproducibility.*
4. ***In-Room Setup Screen*** *– Displays live positioning data and motion status during setup and treatment.*
5. ***Control Room Workstation*** *– Main operator console for monitoring and managing SGRT during delivery.*
6. ***LUNA 3D Server*** *– Central hub for system communication, data storage, and secure access.*

SGRT as an Error Prevention and Quality Improvement Tool

SGRT functions as a practical error-prevention layer, enabling early detection of setup deviations and continuous monitoring of intrafraction motion. This aligns well with contemporary quality initiatives such as incident learning systems, peer review, and continuous performance improvement. In high workload environments, consistent and objective setup verification becomes especially valuable. ■

Invasive Fungal Infections and Antifungal Stewardship: Combating the threat of fungal fury!

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Abstract
Invasive fungal infections (IFIs) represent a growing challenge in modern clinical practice, particularly among immunocompromised and critically ill patients, both of which are very common among patients with cancer. High morbidity and mortality, diagnostic complexity, limited therapeutic windows, and rising antifungal resistance contribute to their clinical significance. This article reviews the epidemiology, classification, diagnostic criteria, antifungal pharmacology, and principles of antifungal stewardship, with emphasis on therapeutic drug monitoring and institutional treatment protocols. An integrated approach combining timely diagnosis, appropriate antifungal selection, and stewardship-driven optimization is essential to improve patient outcomes.

Introduction
Invasive fungal infections have emerged as a major nosocomial threat in tertiary-care hospitals. Prolonged intensive care unit (ICU) stays, increasing use of immunosuppressive therapies, hematopoietic stem cell transplantation, and complex oncologic treatments have expanded the population at risk. Opportunistic fungi such as Candida and Aspergillus species account for a substantial proportion of IFIs. Notably, invasive candidiasis and aspergillosis are associated with high long-term mortality, approaching 60–75% in selected high-risk cohorts. The economic burden of prolonged hospitalization and expensive antifungal therapy further amplifies their impact. [1,2]

Classification of Fungal Infections
Fungal infections are traditionally classified based on the depth of tissue involvement into superficial, cutaneous, subcutaneous, and systemic infections. From a clinical standpoint, systemic and subcutaneous infections are of greatest relevance due to their association with immunosuppression and high mortality. Fungi may also be classified taxonomically, which has therapeutic implications owing to intrinsic and acquired antifungal resistance patterns. [1,2]

Diagnostic Considerations in Invasive Fungal Infections
Accurate and timely diagnosis of IFIs remains challenging. Clinical manifestations are often nonspecific, particularly in immunocompromised hosts. Diagnostic criteria categorize IFIs into proven, probable, and possible disease based on a combination of host factors, clinical features, imaging findings, and mycological evidence. [3]

Non-culture-based diagnostic assays have significantly improved early detection. Biomarkers such as serum and bronchoalveolar lavage galactomannan and 1,3-β-D-

glucan play an important role in screening, diagnosis, and treatment monitoring. Rapid identification systems for Candida species from blood cultures facilitate earlier targeted therapy. Nevertheless, diagnostic limitations continue to necessitate empiric and pre-emptive treatment strategies in high-risk patients. [4,5]

Antifungal Agents: Classification and Mechanisms of Action

Antifungal drugs may be classified according to their mechanism of action, chemical structure, or site of infection.

Mechanism-Based Classification

- Echinocandins inhibit fungal cell wall synthesis and include caspofungin, micafungin, and anidulafungin.
- Polyenes, such as amphotericin B and nystatin, increase fungal cell membrane permeability by binding to ergosterol.
- Antimetabolites, notably flucytosine, inhibit nucleic acid synthesis.
- Allylamines, including terbinafine, inhibit ergosterol and lanosterol synthesis.
- Azoles inhibit ergosterol synthesis and are subdivided into imidazoles and triazoles. Systemic triazoles include fluconazole, itraconazole, voriconazole, and posaconazole.

Resistance Considerations

Intrinsic resistance is an important determinant of antifungal choice. Candida krusei is resistant to fluconazole, while Cryptococcus, Trichosporon, and Rhodotorula species demonstrate resistance to echinocandins, with some also resistant to fluconazole. Understanding species-level susceptibility is essential for effective therapy.

Antifungal Stewardship

Antifungal stewardship is a core component of antimicrobial stewardship, aimed at optimizing antifungal use through appropriate selection, dosing, duration, and route of administration. Stewardship programs seek to improve clinical outcomes while minimizing toxicity, costs, and the emergence of resistance.

Key stewardship activities include development of prescribing guidelines, diagnostic support, therapeutic drug monitoring, de-escalation from broad-spectrum to targeted therapy, and education of healthcare providers. Challenges unique to antifungal stewardship include diagnostic uncertainty, complex immunocompromised hosts, and relatively limited historical data compared with antibacterial stewardship. [5]

Therapeutic Drug Monitoring

Therapeutic drug monitoring (TDM) is particularly relevant for azole antifungals due to variable pharmacokinetics, narrow therapeutic indices, and significant drug–drug interactions mediated by cytochrome P450 enzymes. Voriconazole exhibits marked interpatient variability, necessitating routine monitoring to avoid subtherapeutic exposure or toxicity. Dose adjustments guided by trough levels improve target attainment and clinical outcomes. Similar principles apply to posaconazole and other systemic azoles, while routine TDM is not currently recommended for isavuconazole. [2, 4]

Institutional Protocols and Clinical Application

Institution-specific antifungal protocols tailored to patient populations are integral to stewardship. In hematopoietic stem cell transplant units, echinocandins are commonly used during conditioning, followed by azole prophylaxis post-conditioning. Escalation to amphotericin B is reserved for suspected or refractory fungal infections. In leukemia patients, early initiation of voriconazole is preferred, whereas antifungals are not routinely used in solid tumor patients without specific risk factors.

In the ICU setting, antifungal therapy is guided by immune status, suspected source of infection, hemodynamic stability, and biomarker results. Empiric therapy is often justified in high-risk patients with septic shock or prolonged neutropenia, with subsequent de-escalation based on diagnostic findings.

Management of Invasive Aspergillosis

Voriconazole remains the drug of choice for invasive pulmonary aspergillosis, with liposomal amphotericin B and isavuconazole as alternatives. Treatment duration typically ranges from 6 to 12 weeks, depending on immune recovery. Prophylaxis with posaconazole is recommended for patients with prolonged neutropenia and additional risk factors. Salvage therapy may involve combination antifungal treatment, surgical intervention, and modulation of immunosuppression.[6]

Future Directions and Emerging Antifungals

The development of newer antifungal agents offers promise for resistant and refractory infections. However, their optimal integration into clinical practice will depend on robust stewardship frameworks, post-marketing surveillance, and outcome-based evaluation.

Institutional Antifungal Strategy and Definitions

At our institute, antifungal prophylaxis and treatment strategies are risk-adapted and guided by contemporary recommendations from the Infectious Diseases Society of America (IDSA), the European Conference on Infections in Leukemia (ECIL), and the European Society for Blood and Marrow Transplantation (EBMT). Invasive fungal infections (IFIs) were classified as proven, probable, or possible according to the revised European Organisation for Research and Treatment of Cancer–Mycoses Study Group Education and Research Consortium (EORTC–MSGERC) criteria. [1-6]

In the Bone Marrow Transplant (BMT) unit, antifungal prophylaxis is phase-specific. During the conditioning phase, caspofungin is routinely administered to avoid pharmacokinetic interactions associated with azole antifungals, particularly with cyclophosphamide. Following completion of conditioning, patients are transitioned to posaconazole prophylaxis during the post-transplant neutropenic period. Escalation to liposomal amphotericin B is undertaken in patients with suspected or probable IFI who demonstrate persistent fever despite broad-spectrum antimicrobial therapy, prolonged neutropenia, or radiological findings suggestive of IFI on computed tomography.

Among patients with acute leukemias (AML/ALL), antifungal prophylaxis with voriconazole is initiated upfront from the time of diagnosis, reflecting the anticipated depth and duration of immunosuppression. In contrast, routine antifungal prophylaxis is not employed in patients with lymphoma, multiple myeloma, or solid tumors, unless clinically indicated based on evolving risk factors or suggestive clinical features.

Antifungal therapy in the intensive care unit (ICU) is individualized and driven by disease severity, hemodynamic status, and the suspected source of infection. In patients presenting with septic shock or high clinical suspicion of candidemia, echinocandins or amphotericin B are preferred as initial therapy. For suspected pulmonary fungal infections, voriconazole is used as first-line treatment, with escalation to amphotericin B in cases of clinical or radiological progression while on azole therapy.

Across all patient categories, antifungal decision-making is informed by the degree of immunocompromise, probable site of infection, and adjunctive biomarker assessment. Serum 1,3-β-D-glucan and galactomannan assays are incorporated into diagnostic algorithms to support early identification of IFI and guide timely therapeutic escalation, consistent with EORTC–MSGERC-based diagnostic criteria.

Essential, Achievable and Aspirational Antifungal Stewardship Activities

Stewardship Activity Level	Description
Essential	Development of institutional treatment pathways or bundles for antifungal prophylaxis and empiric therapy Antifungal prescription review for drug-drug interactions Handshake rounds or post-prescription review and feedback Intravenous to oral transition program Local surveillance and reporting of IFD to prescribers
Achievable	Rapid non-culture-based diagnostic test Provide timely antifungal susceptibility testing results Specific comments to guide therapy and antifungal dosing Timely TDM reported to AFS team and clinicians Review of autopsy reports and patient outcomes systematically to assess for undiagnosed IFDs and/ or underutilization of antifungal agents
Aspirational	Participate in regional or national surveillance systems Individualized patient risk assessment Optimize use of point-of-care microbiological tests Utilize personalized TDM-dose adaption Incorporate advanced radiologic approaches for invasive aspergillosis (CT pulmonary angiography, FDG PET/CT)

Performance Measure
Mortality (or for prophylaxis, fungal-free survival
Length of stay
Clinical responses (treatment success, stable disease, failure)
Appropriate choice of antifungal agent, dose, route, duration
Time to (targeted/ optimal) therapy

Adherence with practice guidelines
Persistent culture positivity/time to culture resolution
Recurrent or breakthrough infection
Performance of quality measures (ophthalmologic examination, galactomannan testing, follow- up cultures performed)
Therapeutic drug monitoring performed/achievement of the therapeutic levels

Conclusion

Invasive fungal infections continue to pose a significant clinical challenge, particularly in critically ill and immunocompromised patients. Effective antifungal stewardship—anchored in accurate diagnosis, appropriate agent selection, therapeutic drug monitoring, and timely de-escalation—is essential to improving outcomes and limiting resistance. A coordinated clinical and laboratory approach, supported by institutional protocols, remains central to the successful management of IFIs.■

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Establishing a Pediatric Onco-Surgery Unit : An Anesthesiologist's Perspective from a Resource-Evolving Center

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Abstract
The establishment of a pediatric onco-surgery unit is a complex, multidisciplinary process that extends beyond surgical expertise alone. From an anesthesiologist's standpoint, it requires meticulous planning, specialized infrastructure, trained manpower, and seamless coordination among multiple stakeholders to ensure safe perioperative care. This article outlines our institutional experience in developing pediatric onco-surgical services within an existing disease management framework, highlighting strengths, challenges, and future aspirations.

Introduction
At our hospital, pediatric oncology care is delivered through a dedicated disease management group that oversees children throughout their treatment journey. Within this framework, the development of a pediatric onco-surgery unit has been a gradual yet purposeful evolution. While infrastructure and equipment form the visible foundation, outcomes ultimately depend on coordinated teamwork, perioperative preparedness, and a child-centric approach to care.

Infrastructure and Equipment
Our existing operating theatre has been utilized for pediatric oncologic surgeries, supported by pediatric-specific anesthesia workstations, ventilators, and monitoring systems. However, a significant challenge has been the limited availability of pediatric-sized surgical instruments and active warming devices, underscoring the importance of size-appropriate equipment in preventing perioperative complications.

Advanced monitoring plays a pivotal role in managing complex surgeries. Invasive arterial pressure monitoring is routinely employed for major procedures associated with anticipated blood loss, fluid shifts, and hemodynamic instability. Point-of-care testing, depth of anesthesia monitoring, and ultrasound guidance—particularly for vascular access, fluid therapy, and postoperative assessment—have enhanced perioperative decision-making.

Appropriately sized resuscitation equipment, including airway devices, defibrillators, and emergency drugs for all pediatric age groups, is already well established at our institute.

Creating a Child-Friendly Environment
A child-friendly environment significantly influences perioperative anxiety and overall satisfaction. While our preoperative and recovery areas currently lack dedicated play therapy zones and child-oriented decor, this remains a priority for future development. Encouragingly, a strong multidisciplinary effort has been made to minimize preoperative fasting and improve perioperative comfort, even in the absence of ideal physical spaces.

Human Resources and Training
The backbone of pediatric onco-surgery lies in a well-trained, cohesive team comprising oncosurgeons, anesthesiologists, pediatric medical oncologists, intensivists, nurses, nutritionists, and physiotherapists. Regular workshops, simulation-based training, and continuing medical education programs—conducted at both regional and national levels—have strengthened our preparedness for pediatric airway management, difficult intravenous access, and crisis scenarios. Case-based discussions within the pediatric disease management group further enrich collective learning. Our team at BBCI has the requisite personnel and the hope is that excellence in this domain will be the by product of experience over time.

Preoperative Assessment and Optimization
Children with malignancies frequently present with complex physiological challenges. Nutritional assessment is integral, given the high prevalence of malnutrition and its implications for anesthetic pharmacology and wound healing. A dedicated nutritionist ensures early identification and optimization of nutritional deficits.

Prior exposure to chemotherapy or radiotherapy necessitates careful evaluation of cardiac, hepatic, and renal function. Risk stratification is performed collaboratively, with individualized perioperative planning based on systemic involvement. Psychological preparation, including counselling and parental support, is offered on a case-to-case basis to reduce perioperative stress.

Intraoperative and Postoperative Pain Management
Multimodal analgesia forms the cornerstone of pain management, with frequent use of regional techniques such as caudal and epidural blocks to minimize opioid exposure. Although a dedicated pediatric acute pain service is not yet established, postoperative pain is effectively managed through close collaboration among oncosurgeons, anesthesiologists, pediatric medical oncologists, and intensivists. Early pain control facilitates faster recovery, early feeding, improved satisfaction, and reduced hospital stay.

Postoperative Care and Rehabilitation
Postoperative management includes the availability of high-dependency or intensive care beds for children undergoing major procedures. Emphasis is placed on judicious fluid therapy, adherence to enhanced recovery after surgery (ERAS) principles, early mobilization, physiotherapy, and tailored nutritional support. Collaboration with physiotherapists and occupational therapists supports early rehabilitation and functional recovery.

Research and Future Directions
Participation in clinical research and the development of pediatric-specific anesthesia protocols are emerging priorities. These efforts aim to refine evidence-based practices suited to regional needs and resource settings.

Oncosurgeon's perspective
The clinical workload in pediatric onco-surgery at BBCI is substantial and steadily increasing. The unit performs over 100 major paediatric oncologic surgical procedures annually across multiple anatomical subsites. The patient population represents a particularly challenging age spectrum, ranging from infants as young as 2 months to adolescents up to 18 years of age. This wide variability in age, body size, and weight necessitates meticulous surgical planning and precise technical execution. Managing such heterogeneity places significant demands on surgical expertise, requiring exceptional patience, fine motor dexterity, and adaptability to ensure optimal oncologic and functional outcomes across all paediatric age groups. The lion's share of major surgeries have been limb salvage surgeries for paediatric bone tumour. The major challenge is the growing child and challenges of limb length discrepancy with surgeries involving the resection of growth plates. Other major surgeries include nephrectomies for Wilm's tumour, resections of neuroblastomas (at times requiring multivisceral resections) and other retroperitoneal tumours like rhabdomyosarcomas, wide excision of extremity soft tissue tumours, gonadal and extragonadal germ cell tumours, thymic tumours, pulmonary metastases of bone and soft tissue sarcomas, head and neck sarcomas, orbital tumours and paediatric gastrointestinal cancers (which have a particularly aggressive clinical course). The paediatric oncoanesthesia team has been forthcoming in all forms of vascular access, particularly in infants, including Hickman's lines and babyports (chemoports), with the able assistance of one another (the surgeon helps the anesthetist and vice versa).

Conclusion

Establishing a pediatric onco-surgery unit is a formidable yet deeply rewarding endeavor. From the anesthesiologist's perspective, it demands not only technical expertise but also adaptability, compassion, and sustained teamwork. Even within evolving resource settings, a committed multidisciplinary approach can significantly enhance surgical safety, improve outcomes, and ultimately elevate the quality of life for children battling cancer. ■

Role of Brachytherapy in Lower Eyelid Cancer

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Eyelid tumours are uncommon and represent 5-10% of all skin cancers. Basal cell carcinoma (BCC) is the most common histological type representing 90% of all cases followed by squamous cell carcinoma (SCC), and less frequently by sebaceous cell carcinoma (SbCC), Merkel cell tumour and melanoma.

The most common localization is the lower eyelid (50-60%) and medial canthus (25-30%). Basal cell carcinoma are slow growing tumours with a metastatic rate ranging from 0.003 to 0.5% but they can be locally invasive infiltrating the lid margin or the lachrymal glands producing functional disability.

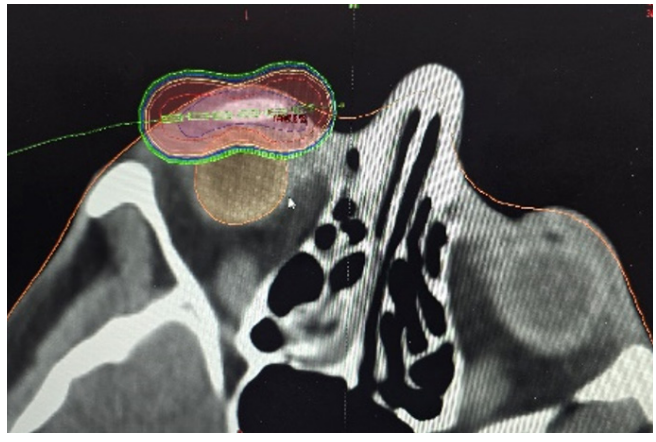
Squamous cell carcinoma is more aggressive than BCC: about 5% are metastatic and in these patients 5-year survival rate is only 25-40%.

Many treatment approaches are available: surgery, radiotherapy, cryotherapy, curettage, electro dissection, photodynamic therapy, and laser ablation. Surgery is considered the gold standard therapy, and the treatment aims are definitive tumour control and preservation of the functional structures.

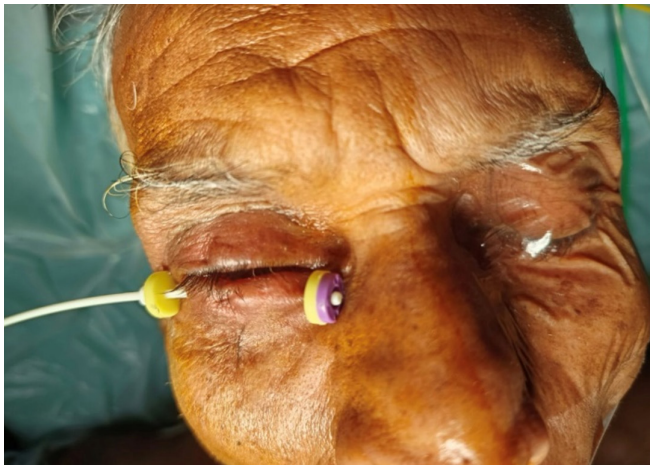
Radiotherapy is also a good alternative if preservation of functional structures is not possible with surgery.

Brachytherapy (BT) might be a better therapeutic option due to intrinsic advantages, including high radiation dose concentration into the tumour and rapid dose fall-off at target periphery with optimal sparing of normal tissues in these sensitive structures in shorter treatment time.

Herein we show a case of Lower eyelid Squamous cell carcinoma treated by Radical Brachytherapy in the month of April 2025 at Barpeta cancer centre.

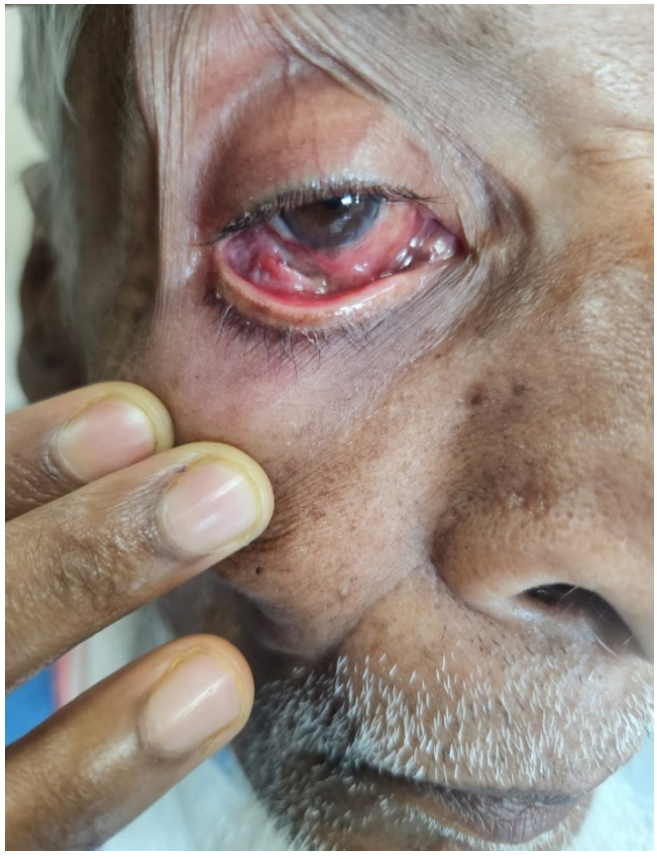


Planning Image



OT procedure-Catheter placement

Post-Treatment Imaging



Pre-Treatment Imaging

Lung SBRT

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SBRT refers to delivery of large doses of radiation to a small treatment volume. Usually employing multiple beams, using a small number of fractions casually five fraction or less. This approach is remarkably effective at tumor sterilization, presumably due to greater radio biologic efficacy. Fletcher et al predicted that using convention fraction size of 1.8 GY to 2 GY, doses of 100 GY or higher might be required for the sterilization of most NSCLC tumors. These doses are not routinely achievable with conventionally fractionated RT in medically inoperable patient without excessive toxicity. SBRT is recommended for patient who are medically inoperable or who refuse to have surgery after thoracic surgery evaluation. SABR has achieved primary tumor control and Overall Survival. SABR is also an appropriate opinion for patient with high surgical risk [able to tolerate sub lobar resection but not lobotomy (age >75 years), poor lung function]

SABR is most used for tumor up to 5 cm in size, through selected larger Isolated tumor can be treated safely if normal tissue constraints are respected. The high dose intensity and conformity of SABR requires minimizing the PTV.

For centrally located tumors (defined variably as withing 2 cm of the proximal bronchial tree and or abutting mediastinal pleura) and seen ultra central tumors (defines as abutting the proximal bronchial tree) 4 - 10 fraction risk adapted SABR regimens appears to be effective and safe, while 54-60 GY in 3 fractions is unsafe and should be avoided.

Commonly used dose prescriptions are 1 fractions of 30-34 GY T1 lesions, not close to chest wall, non-central.

3 fractions of 18 GY: T1 lesions not close to chest wall, non- central.

5 fraction of 11 GY: T1 lesions with broad chest wall contact and T2 lesions.

8 fraction of 7.5 GY centrally located tumor.

As per Shiue k et al published in JIO 2018 one dose for all Histology. No difference in long term toxicity on comparing Single fraction vs Four fraction with 5-year tumor control rates are similar. Toxicity can be of acute (<6weeks) or late toxicity (>6weeks). Acute Toxicities are Fatigue, cough, dyspnea, pneumonitis, esophagitis, Dermatitis, and chronic toxicities are Persistent cough/ Dyspnea, Radiation pneumonitis, Brachial plexopathy, Esophageal stricture, fistula, vasculopathy.

After SBRT some patients receive Adjuvant chemotherapy if tumor size >4cm or else patients are followed up.

Follow-up with either CT or PET-CT every 3months for 3years, then 6months for 2years, later routine Follow-up.■

Journey of Hemato Oncology in the North-Eastern States

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Introduction

Hemato-Oncology as a specialty of Oncology has evolved over many years in the north eastern region of India to its present state where patients are getting complete care. Till recently patients had to travel to far off places outside the state to get treatment for patients with hematological malignancies. Different types of Hematological malignancies are acute leukemias, lymphomas, multiple myeloma, chronic leukemias like CLL & CML, Myeloproliferative neoplasm (MPN), Myelodysplastic Neoplasms (MDN) etc and can occur at any age groups starting from the one-day old to the elderly. Most of these malignancies are either curable or can be kept under complete remission for a long time resulting in functional cure. Many of these hematological malignancies however present as medical emergencies and unless immediate care is available, patients do die in the initial period only. Therefore, easily available adequate care is of utmost necessity for the cure of blood cancer patients.

The Journey

With the starting of the 1st Hematology unit in 1987, under the department of Medicine following the the initiatives and efforts put in by Professor Amrit Kumar Bhattacharyya and subsequently by late Dr DN Das and Professor PK Gogoi ,Hematology Oncology care in the north east started taking shape; it became an independent department in 2002 and now has a full fledged department with 40+ indoor beds for treating cancer patients, specialized hematoOncology clinics (fig 1) on different days of the week and its own Hematopathology division. Bone marrow Transplantation also is ongoing in the department with more than 50 transplantations being undertaken in the last couple of years. In terms of cancer research in hematological malignancies the department has collaborated with IIT, Guwahati, Gauhati University and NIPER.

In cancer care, AMCH had the only Radiotherapy Unit with facility for radiotherapy to cancer patients; hematological cancer patients like lymphomas were treated under Medicine department. Bhubaneswar Barooah Cancer Institute (BBCI) was the only cancer center in the entire north east till recently; it was started in the 70s; initially the department of Medical Oncology treated mostly solid cancers. After the BBCI being brought under department of atomic energy (DAC), Hemato-oncology as a speciality has been started under the department of Medical Oncology. BBCI also has started BMT facility and all kinds of transplantations are ongoing at the moment.

Both Department of Clinical Hematology GMCH and Hemato-Oncology AT BBCI has been associated

with Hematoogy Cancer Consortium, a research organization of Hematological malignancies.

Assam Cancer Care Foundation has also started giving HematoOncology cancer care across Assam through its different center and a dedicated Hemato oncolgy set up has also been started in the State Cancer Institute at Guwahati.

With the establishment of AIIMS, Guwahati with its department of Hematology, Hematology Cancer care has also been started there.

Private facilities like Health City Hospital and Apollo Excelcatre hospital gives Hemato-oncology service to its patients.

Besides Assam, Manipur also has started dedicated Hematology Oncology care in the state including Bone Marrow transplantation under the leadership of Dr Banashree , Dr Anil Irom Singh at JNIMS, and Dr Linda at RIMS.

Even though the other north eastern states do not have dedicated Hemato_oncology care, patients with Hematological malignancies get treatment under Medical Oncology or Radiation Oncology.

Conclusion

With the starting of DM Programm in the department of Clinical Hematology, hopefully we shall see more and more dedicated centers with complete HematoOncology care across north east of India.

Day	Monday	Wednesday	Thursday	Saturday
Clinic	Leukemia/MDN	Multiple Myeloma /Lymphoma	CML/MPN	BMT Clinic

Fig 1: Special Clinics run by Department of Clinical Hematology

Next Generation Immunohistochemistry - Advancing Precision in Diagnostic Pathology

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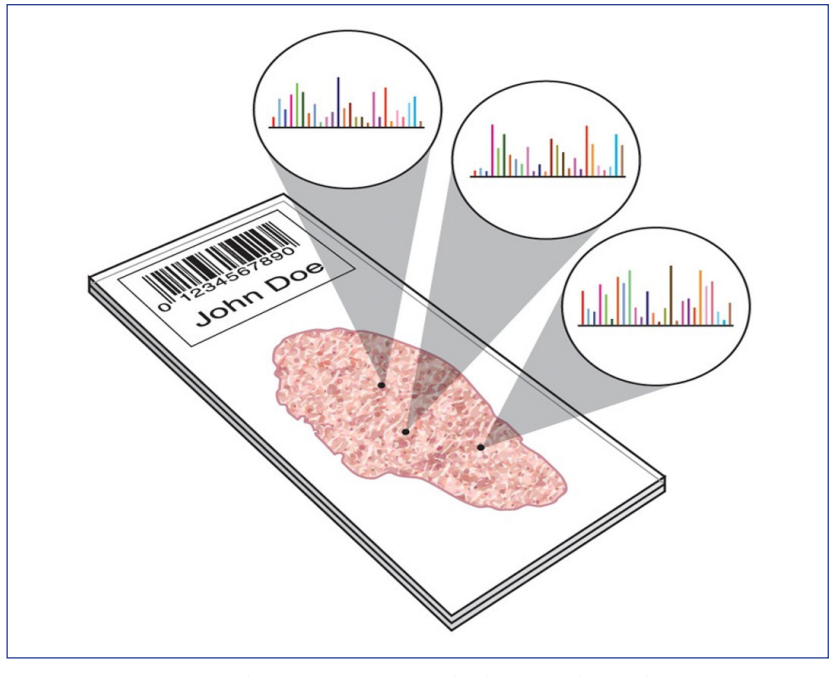
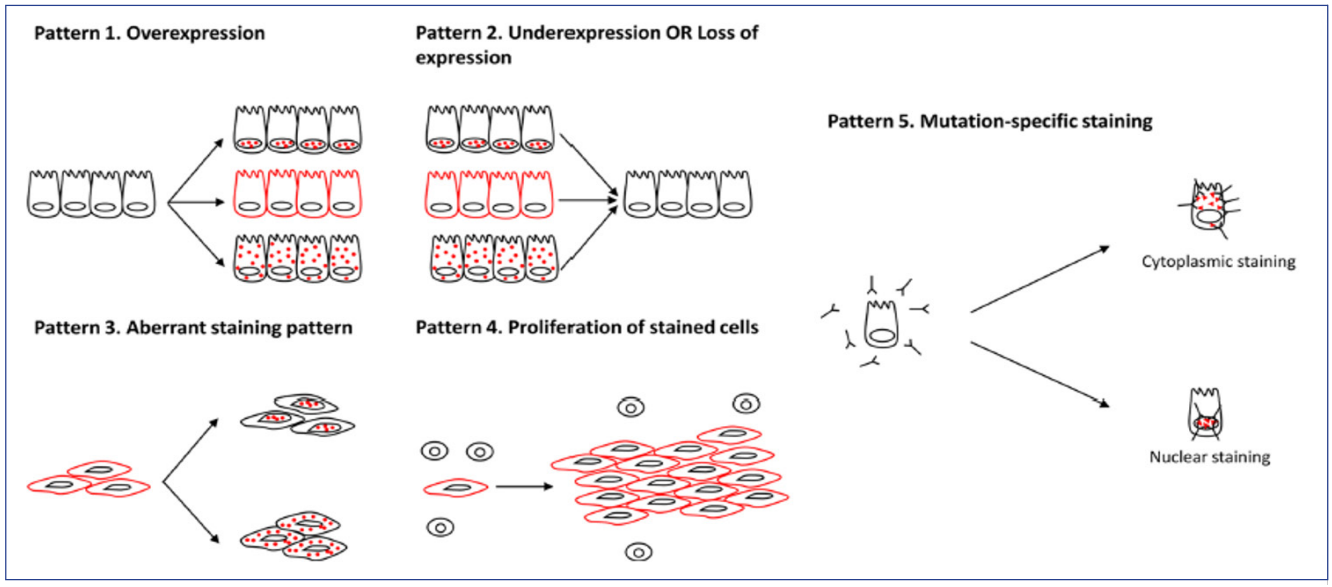
Introductionofimmunohistochemistry [IHC] was based the presumed relationship between immunogen and the antibody generated against it. Consistent staining of the appropriate subcellular compartment provides evidence that target antigen is likely present. Traditionally, application of this modality is restricted in identification of lineage specific antigen in case of tumour with morphological overlapping. With the evolving role of oncopathologists and the emergence of molecular alteration in diagnosis, age old concept is replaced by modern application in assessments of chromosomal alterations. IHC based molecular surrogate is potential alternative in resource limited setting as initial work up to identify the protein end product resulting from diverse DNA based genetic events like chromosomal translocation, point mutation and amplification.[1]

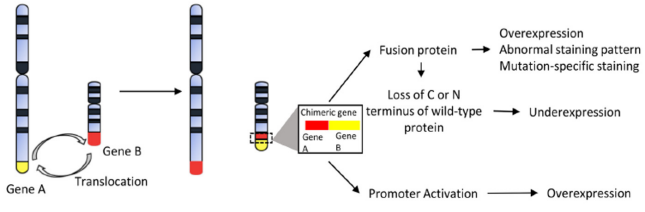


Overexpression, underexpression and abnormal localisation are the principle pattern of alteration. Protein products can be mutation specific also.



I. Overexpression:

Gene translocation and copy number alteration are the crucial genetic abnormality that leads to protein overexpression. Two classic forms of chromosomal translocation result in neoplastic transformation. In majority instances, breakpoint is located within the encoding component and a novel fusion protein, the so-called chimeric protein, is generated. Rarely, the gene translocation spare encoding compartments and is translocated near the highly active regulatory element like MYC.



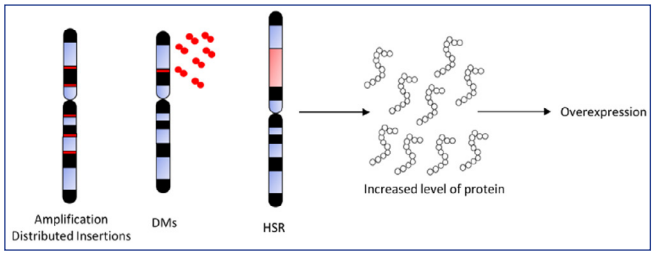
One third of soft tissue neoplasms are translocation associated and can be identified by demonstration of specific fusion protein by newly developed immunohistochemistry markers. ***[Table 1]***

Table 1: Next generation IHC marker for detection of fusion products[2-6]

Protein	Most Common Gene Fusions	Tumor Types
ALK	Various ALK Fusions	Epithelioid fibrous histiocytoma
		Kinase-altered spindle cell neoplasms (rare)
		Inflammatory myofibroblastic tumor (60%)
BCOR	BCOR::CCNB3	Sarcomas with BCOR genetic Alterations
CAMTA1	WWTR1::CAMTA1	Epithelioid hemangioendothelioma
CCNB3	BCOR::CCNB3	Sarcomas with BCOR genetic alterations
DDIT3	FUS::DDIT3, EWSR1::DDIT3	Myxoid liposarcoma
ERG	EWSR1::ERG	Ewing Sarcoma (5%)
FLI1	EWSR1::FLI1	Ewing Sarcoma (95%)
FOS	FOS::VIM, FOS::?	Proliferative fasciitis / myositis
		Epithelioid hemangioma
FOSB	ZFP36::FOSB	Epithelioid hemangioma
	SERPINE1::FOSB, ACTB::FOSB	Pseudomyogenic hemangioendothelioma
FOXO1	PAX3::FOXO1, PAX7::FOXO1	Alveolar rhabdomyosarcoma
GLI1	ACTB::GLI1, MALAT1::GLI1, PTCH1::GLI1	GLI1-altered mesenchymal tumors (pericytoma, plexiform fibromyxoma, gastroblastoma, nested glomoid neoplasm)
NUT	MXI1::NUTM1, MXD4::NUTM1, MGA::NUTM1	NUTM1-rearranged sarcoma
PATZ1	EWSR1::PATZ1	PATZ1-rearranged sarcoma
PAX3	PAX3::MAML3	Biphenotypic sinonasal sarcoma
ROS1	Various ROS1 fusions	Inflammatory myofibroblastic tumor (5%)
SS18-SSX	SS18::SSX1, SS18::SSX2	Synovial sarcoma
SSX (C-terminus)		
TFE3	ASPSCR1::TFE3	Alveolar soft part sarcoma
	YAP1::TFE3	YAP1::TFE3 hemangioendothelioma

Protein	Most Common Gene Fusions	Tumor Types
TRK	ETV6::NTRK3	Infantile fibrosarcoma
	Various NTRK1, NTRK2, and NTRK3 fusions	Inflammatory myofibroblastic tumor (5%)
		Kinase-altered spindle cell neoplasms
STAT6	NAB2::STAT6	Solitary fibrous tumor
WT1 (C-terminus)	EWSR1::WT1	Desmoplastic small round cell tumor
YAP1 (C-terminus) (lost)	YAP1::MAML2	Nodular necrotizing fibroblastic tumor
	YAP1::TFE3	YAP1::TFE3 hemangioendothelioma

Apart from fusion, copy number alteration results in protein overexpression. Extrachromosomal double minutes (DMs), intrachromosomal homogenously staining regions (HSRs), widely distributed amplified regions are the three major forms of gene amplification.



HER2 gene amplification in breast carcinoma is the prototypical example of this type of molecular aberration.[7] Other organs affected by similar alteration are lung, adrenal and soft tissue.

Table 2: Next generation IHC detecting copy number alteration[8,9]

Protein	Molecular alteration	Type of tumour
HER2	Amplification	Invasive breast carcinoma
EGFR	Amplification	Non small cell carcinoma of lung
MYCN	Amplification	Neuroblastoma
HER2	Amplification	Adenocarcinomas of the stomach, gastroesophageal junction, and distal esophagus
FGFR2	Amplification	Gastric adenocarcinoma
CDK4	Amplification	Well-differentiated liposarcoma
		Dedifferentiation liposarcoma
		Intimal sarcoma
GLI1	Amplification	GLI1-altered mesenchymal tumors
MDM2	Amplification	Well-differentiated liposarcoma
		Dedifferentiation liposarcoma
		Intimal sarcoma
MYC	Amplification	Postradiation angiosarcoma

Single nucleotide variation or deletion majority time leads to underexpression. But TP53 mutation indirectly leads to protein overexpression resulting from reduction of degradation process attributed by low MDM2. Serous endometrial carcinoma, high-grade ovarian serous carcinoma, and oral cavity carcinoma show this type of alteration.

II. Underexpression

We considered loss of expression and underexpression under the same spectrum resulting from protein loss due to point mutations, gene deletions and loss of heterozygosity.

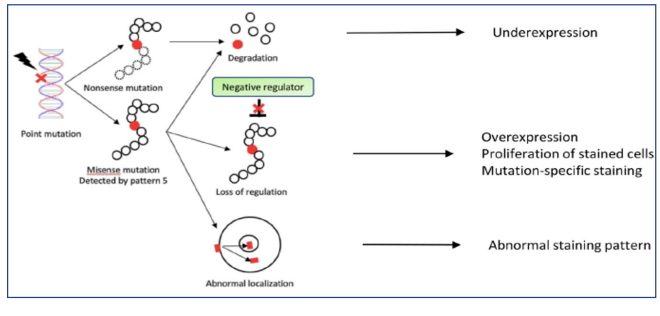
Mutations can be of missense type or micro-deleterious, or truncating in nature. These mutated proteins are not well processed post-translationally prompting degradation.

Table 3: Next generation IHC detecting small nucleotide variation[10,11]

Protein lost	Molecular alteration	Type of tumour
ATRX	Point Mutation	Diffuse gliomas
BAP1	Monosomy	Malignant mesothelioma Melanocytic tumour
DPC4	Deletion	Pancreatic Ductal adenocarcinoma
RB1	13q deletion	Mammary-type myofibroblastoma, Cellular angiofibroma, Spindle cell/ pleomorphic lipoma, pleomorphic myxoid liposarcoma, Atypical spindle cell lipomatous tumor
E-cadherin	Truncating mutation of CDH1	Gastric adenocarcinoma

III. Abnormal Localisation of Protein:

Genetic abnormalities may contribute to altered localization of the corresponding protein. Immunohistochemically, the affected protein is stained in a different pattern.



IHC for β-catenin reflects complex molecular alterations prompting its relocation from cytoplasm to nucleus.[12]

IV. Mutation Specific Immunohistochemistry:
These IHC markers are highly sensitive and specific for corresponding genetic alteration.

Table 4: Next generation IHC markers for detection of point mutation[13,14]

IHC markers	Molecular alteration	Type of tumour
G34W	Mutations in H3-3A	Giant cell tumour of bone
K36M	Mutations in H3-3A	Chondroblastoma
antibody VE1	BRAFV600E	Melanoma, Colorectal Carcinoma
IDH1R132H	IDH1R132H	Adult glioma
H3K27M	Mutations in H3F3A	Paediatric glioma

V. When Negative is Positive: Role of IHC in syndromic cases:
Recognition of at-risk kindreds enables screening for hereditary cancer pre- disposition syndromes. Oncopathologists play a critical role in the recognition of proband. Next generation IHC has emerged as a simple, efficient and cost-effective alternative of molecular testing.

Table 5: Next generation IHC in detection of syndrome.[15-19]

IHC Markers	Molecular Alteration	Syndrome Associated
MSH2, MSH6, PMS2, MLH1	Mismatch repair protein alteration	Hereditary nonpolyposis syndrome
SDHB	SDHA, SDHAF2, SDHB, SDHC and SDHD	Familial succinate dehydrogenase-related pheochromocytoma/ paraganglioma syndromes
FH	FH gene alteration	Hereditary leiomyomatosis and renal cell cancer
Parafibromin	CDC73	Hyperparathyroidism-Jaw Tumor Syndrome

Next generation immunohistochemistry has transformed diagnostic pathology by bridging morphology and molecular genetics. Its expanding role as a molecular surrogate enhances diagnostic precision, guides targeted therapy, and supports hereditary cancer screening making it an indispensable tool in modern oncopathology. ■

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