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DIRECTOR'S MESSAGE

Dr. Jayanta Chakrabarti
Director,

Pollution Causes Cancer - Keep Environment Healthy

Environmental pollution has become a global phenomenon, with its impact clearly visible in many regions around the world. Now, more than a quarter-century later, the effects of pollution are manifesting in the rising number of cancer cases in our country. In India, 1.6 million new cancer cases are detected each year, but the country lacks the necessary workforce and infrastructure to adequately address this growing crisis.

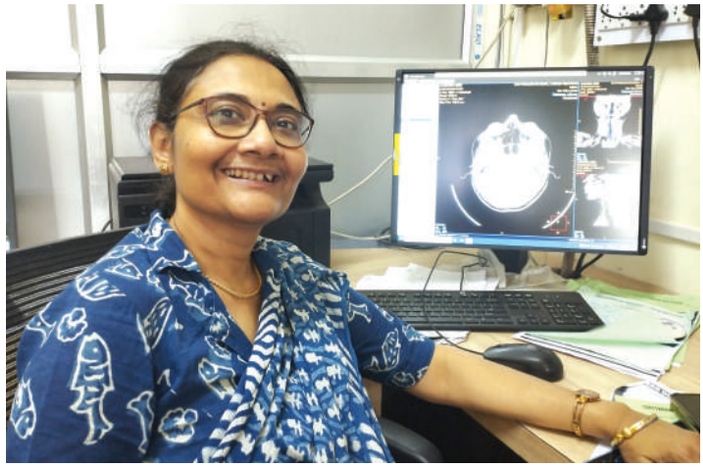
Environmental pollutants are major risk factors for various cancers, with lung cancer being the most prevalent, followed by urological cancers, hematological malignancies, head and neck cancers, and gastrointestinal cancers. This article aims to highlight the increasing threat of environmental pollution and the measures being implemented to combat it, supported by evidence of shifting cancer trends in gall bladder and lung cancers.

Post-liberalization rapid industrialization has led to a significant increase in the discharge of effluents into natural water bodies and rivers across the country. River water pollution due to heavy metals is a critical issue in most of India's major cities. According to the World Health Organization's Global Ambient Air Quality Database, the average air pollution levels in Indian cities are two to three times higher than the recommended safety levels. Consequently, it is only a matter of time before India's cities become the lung cancer capitals of the world.

In India, concerns about environmental pollution have traditionally focused on communicable diseases such as waterborne illnesses. However, it is now essential to recognize the link between environmental pollution and cancer risk in vulnerable populations. There is growing concern among the informed public across the country about the increasing pollution and its direct correlation with rising cancer rates. While smoking prevalence is higher among men, the rising incidence of lung cancer in women should be closely monitored to establish the connection between air pollution and lung cancer.

The common belief that the high incidence of breast cancer in urban women is due solely to sociocultural factors and increased estrogen exposure, without considering the significant role of pollution, represents a critical flaw in the research approach in India. Addressing environmental pollution not only offers inherent health benefits but also presents a substantial economic advantage by preventing cancer and saving valuable lives.

From Editors Desk



Dr. Suparna Mazumder,

Dear Readers,

The surroundings includes the areas where we breath, acquire, work, worship, and performance. It's made up of the air we breathe, the water we drink, the food we eat, and other conditions we may not control, but which can affect our health. The term environment includes air, water, and soil, but also substances and conditions in the workplace, schools, home, and other places people live, work, and play.The most significant risks of developing cancer come from lifestyle factors. However, exposures to certain human-made and naturally occurring chemicals in the environment may contribute to an individual's risk of developing cancer. Benzene, asbestos, vinyl chloride, radon, arsenic, and trichloroethylene are examples of toxic substances that can increase the risk of cancer when people are exposed to them.The International Agency for Research on Cancer (IARC) has classified these substances (and many others) as known human carcinogens. Some other chemicals have been shown to cause cancer in animals, but there is not enough evidence to show these chemicals cause cancer in people. These chemicals are classified by IARC as possible or probable (suspected) human carcinogens. The type and amount of exposure to harmful chemicals influences the risk of developing cancer.

An ounce of prevention is worth a pound of cure

Prof. Dr. Sankar Sengupta
Medical Superintendent and Head of Lab Services
Department of Laboratory Medicine,

Cancer, which is the second leading cause of death, is a group of disease involving abnormal cell growth with the potential to invade or spread to other parts of the body. There are about 14.1 million new cancer cases, 8.2 million cancer deaths and 32.6 million people living with cancer within 5 years of diagnosis in 2012 worldwide. In 1971, President Richard Nixon and the U.S. Congress declared war on cancer. In 2016, President Barack Obama launched the Cancer Moon-shot, a program to reduce cancer mortality and improve the lives of people with cancer.Cancer is a multifactorial disease. Most genetic factors and environmental factors such as viruses, bacteria, radiation and eating habits and chemicals increase the risk of developing cancer. 10-15% of all cancers are thought to be related to heredity, as for the rest, 85-90% of cancer have their roots in the environment and lifestyle. It is known that approximately 25-30% of tobacco, 30-35% of diet, 15-20% of infections and the remaining percentage of other factors like radiation, stress, physical activity, environmental pollutants, etc. cause cancer related mortality.

Heavy metals

Exposure to various chemicals and heavy metals depending on exposed dose, genetics, people's immune resistance and overall health status, age, the level of nutrition has been associated with risk of different cancers, including breast cancer, pancreatic, lung cancer, and gallbladder cancer etc. When metals get into the body through air, food, water, or dermal exposure, they exert their enzymatic and genotoxic effects on different organs. Some heavy metals such as arsenic, cadmium, chromium, nickel, and zinc are known as developing cancer. They bind to vital cellular components, such as structural proteins, enzymes, and nucleic acids. For instance, the effect of cadmium on the lung and prostate cancer has been determined. The toxicological effects of zinc were determined in experimental animals. Additionally, there may be a relationship between exposure to certain metal compounds and the risk of breast cancer. However, there is urgently needed the experimental animal studies, and epidemiologic studies associated metals with cancer.

Air pollution

Emissions from motor vehicles, industrial processes, power generation, the household combustion of solid fuel, and other sources pollute the ambient air across have global effect in the world. The chemical and physical features of ambient air pollution can vary according to sources of pollution, climate, and meteorology. In 1971, the US Clean Air Act was established and ozone, particulate matter, sulfur dioxide, nitrogen dioxide, carbon monoxide and lead were defined as air pollutants. Furthermore, 189 toxic and hazardous air pollutants have been identified. Exposure to ambient fine these air pollutants cause to acute illness such as vomiting, chronic diseases such as cancer, as well as immunologic, neurologic, reproductive, developmental and respiratory diseases. Exposure of these chemicals increases the risk of pleural and peritoneal tumors and lung cancer incidence.

Conclusion

The environmental risk factors including air, water, food pollutants cannot be prevented due to the fact that they are often part of normal life. It is known that environmental factors may cause or contribute to the development of cancer. However, studies that are more detailed are needed to determine the exact cause of a health effect. As a result, when a large number of studies have been performed, association of the actual risk of cancer with the environmental risk factors can be clearer.Preventing cancer before it occurs should be the highest priority and deserves an appreciably greater level of support. Many modifiable causes are now known, and programs to avoid or reduce several of those causes have been shown to be effective.

As Ben Franklin noted around 250 years ago, "An ounce of prevention is worth a pound of cure."

CHILDHOOD CANCER: Introduction, Myths Vs. Facts, Navigating the Nuances: Pediatric vs. Adult Oncology & Challenges

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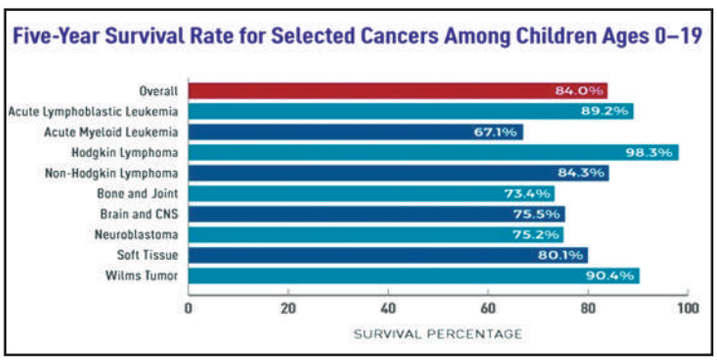
Pediatric Hemato- oncology is a specialized field focusing on children and adolescents, tailoring treatments to the unique biological and developmental needs of younger patients suffering from both hematological, solid malignancy as well as benign hematological disorders.

Childhood cancers represent a small but significant portion of total cancer cases, accounting for 3-4%. Often, these cancers are more advanced at the time of diagnosis compared to adult cancers. However, the prognosis is generally better, with a 70-90% cure rate due to effective treatment responses and protocols. Specifically in India, there is an estimated annual incidence of 40,000 to 50,000 new cases among children.



Effective management of pediatric cancer requires a multidisciplinary team of specialized health professionals, including oncologists, surgeons, radiotherapists, counselors, nutritionists, teachers, and physiotherapists, supported by robust institutional infrastructure, to ensure a complex yet prolonged treatment process with a highly curable and rewarding outcome.

MYTHS Vs. FACTS

- Myth: Survivors are disease carries and pose health risks to others

  Vs.

  Fact: Childhood cancer isn't contagious. It is not transmitted by a virus nor is it infectious. It's safe to interact with survivors.

- Myth: All survivors are genetically inferior and have fertility problems

  Vs.

  Fact: This isn't true for most survivors. Type of cancer and treatment determines fertility challenges.

- Myth: Childhood cancer survivors are cured. Survivors no longer need continuing follow up care

  Vs.

  Fact: Continuing follow up care remains important for survivors.

- Myth: Childhood cancer survivors will have a miserable, sad and dismal future. They can't ever have a normal life

  Vs.

  Fact: There is life and a future after cancer. Most survivors are able to return to school and regular activities.

- Myth: It's better if children and adolescents with cancer aren't told they have cancer

  Vs.

  Fact: They need to be informed to understand and feel empowered to take charge of their own well- being.

- Myth: Childhood cancer survivors will always carry the stigma of cancer in their adult life. They will always be discriminated against in society and in marriage and employment

  Vs.

  Fact: In most countries survivors are viewed as heroes and seen as living proof that childhood cancer can be conquered

Pediatric vs. Adult Oncology

Pediatric oncology and adult oncology are two distinct fields that, while sharing the common goal of treating cancer, differ significantly in various aspects. These differences are not just limited to the types of cancers that are prevalent in each group but also extend to the treatment approaches, success rates, and long-term management of patients.

Pediatric cancers in India present a unique profile, with an incidence of 50,000 cases annually compared to 14 lakh adult cases. Over 90% of these childhood cancers have no apparent cause and are predominantly embryonal, not epithelial, indicating a non-exogenous origin. They often manifest as blastomas or sarcomas rather than carcinomas, and are characterized by rapid growth. However, they typically respond well to chemotherapy, with dosages carefully calibrated based on the child's age, weight, and height.

In pediatric oncology, the enduring side effects of treatments necessitate lifelong monitoring due to children's ongoing development and heightened vulnerability.

Dr. Suman Paul Chowdhury
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Clinical trials for pediatric cancer face challenges due to low participation, necessitating tailored strategies that mitigate long-term impacts more significant in children than adults.

Challenges

Pediatric oncology in India faces critical challenges, including delayed diagnoses, a shortage of specialized medical staff, insufficient infrastructure, prevalent reliance on alternative treatments, financial barriers due to high costs and inadequate insurance coverage, all contributing to a high mortality rate among children with cancer.

While developed nations offer comprehensive care for pediatric cancer through specialized consortium, India is progressing with INPHOG, yet disparities in access and treatment remain.

In conclusion, pediatric oncology is tailored to address the unique challenges that arise from treating cancer in children. From the types of cancers to the treatment protocols and long-term care, pediatric oncology considers the physiological and psychological needs of children to provide comprehensive care. The field continues to evolve with ongoing research and clinical trials aimed at improving outcomes and quality of life for young patients.

Recent advancements in Haematology

Dr Basab Bagchi,
Haemato Oncologist (Grade 1)

Advances in diagnostics

In the 90s the only tools available for diagnosing leukaemia and lymphomas were morphology and light cytochemistry.
Flowcytometry(FCM) and Immunohistochemistry(IHC) had revolutionized the diagnosis of haematological malignancies as it allows confirmation of diagnosis and lineage assignment.
Flowcytometry depends on the principle of hydrodynamic focusing and interrogaton of single cells with fluorochrome tagged antibodies by lasers of different wavelengths which get scattered in different directions , passes through optical filters and picked up by detectors (fig-1).

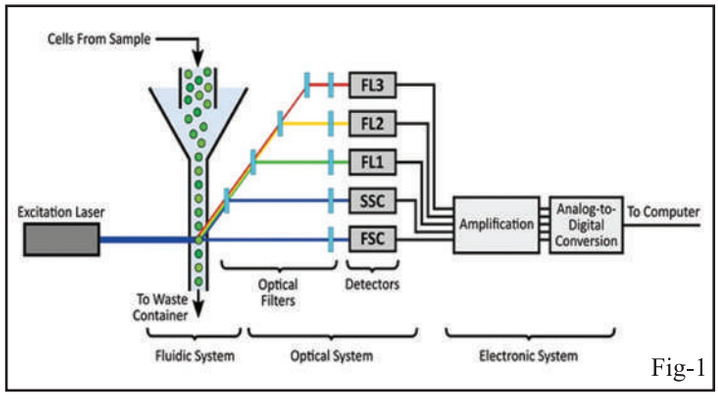

Fig-1

The most recent advances has been in molecular methods- qualitative and quantitive PCR, digital PCR, Sanger sequencing and next generation sequencing (NGS).

A marrow or peripheral blood should be routinely sent for molecular dx in all Acuteleukaemia cases. In AML cases RT-qPCR for NPM-1, FLT-3, CEBPA, RUNX-1, IDH-1/2, TP-53, KIT, RAS should be sent.

MRD in acute leukaemia cases can be measured by FCM, PCR, Digital PCR and NGS techniques.

FISH can effectively analyze cells in interphase stage with the help of fluorescently labeled probes targeted against specifc genetic sequences and is particularly useful in diagnosis of BCR-ABL, PML-RARA transcripts, translocations in Multiple myeloma, CLL and MDS. FISH for c-myc, bcl-2 , bcl6- helps to identify double hit lymphomas.

Newer Entities

1.Blasticplasmacytoid dendritic cell neoplasm (BPDCN)-A rare clinically aggressive haema-tological malignancy with cutaneous lesions, bone marrow involvement and leukaemic dissemination. Blasts are positive for CD4, CD56, HLA-DR, and CD123.

2. ETP-ALL/LBL-CD1a-, CD8-, absent or dim CD5 and presence one of the following myeloid (CD13, CD33, CD117, CD11b and) or stem cell(CD34, HLA-DR) markers.

3. Ph like ALL- Subset of high risk ALL cases which lack ph chromosome or BCR-ABL fusion but shares GEP with ph positive ALL suggestive of active kinase signalling.

Azacytidine + Venetoclax in AML

Many patients with acute myeloid leukemia (AML) are older than 65 years of age at time of diagnosis and are ineligible for intensive curative-intent approaches.

Patients in the azacitidine-venetoclax group compared to the azacitidine-placebo group had improved overall survival (median 14.7 vs. 9.6 months, $p < 0.001$), and higher CR/CRi rates (66% vs. 28%; $p < 0.001$), solidifying this regimen as the standard of care.

Venetoclax also being combined with various intensive chemo-therapies & with novel and targeted agents such as IDH or FLT3 inhibitors as well as oral HMAs

Reducing the early infection related mortality in Multiple Myeloma

Twelve weeks of fixed-duration levofloxacin prophylaxis reduced the occurrence of febrile episodes and deaths with a hazard ratio [HR] 0.66, (95% CI 0.51-0.86; $p = 0.0018$) when levofloxacin was delivered prophylactically compared to placebo.

Independent to levofloxacin, use of prophylactic low dose co-trimoxazolealso significantly reduced febrile infections and death

Iron Chelation in low and intermediate risk MDS

Myelodysplastic syndromes (MDS) are clonal hematopoietic stem cell disorders characterized by cytopenias and risk of progression to acute myeloid leukemia (AML).

TELESTO is the first prospective randomized double-blind placebo-controlled study testing the impact of iron chelation therapy with deferasirox on a composite endpoin, supporting the clinical benefit of chelation with deferasirox in low-risk and intermediate-1-risk MDS

Allo-HSCT- steroid refractory GVHD

Few randomized trials have been conducted in glucocorticoid-refractory aGVHDand Ruxolitinib is the only treatment showing a significant benefit in terms of sustained response(results REACH-2 trial in NEJM)

Role of CAR-T cells in R/R B-ALL and lymphoma

Chimeric antigen receptor-engineered T (CART) cells revolutionized the therapeutic paradigm of patients with B-cell lymphoid malignancies and acute lymphoblastic leukemia (B-ALL).

A more limited experience has been reported in patients with R/R B-ALL with complete remission rates as high as 68-93%, although relapse remains a major issue occurring in 40-50% of patients.

Three pivotal studies showed anti-lymphoma activity with overall response rates ranging from 59% to 83%.

CRISPR/Cas9 in beta thalassaemia and sickle cell disease

Using the CRISPR/CAS9 technology (fig-2) in healthy donors' CD34+ stem cells, it was possible to suppress the gene BCL11A and therefore to switch the haemoglobin production mostly in HbF

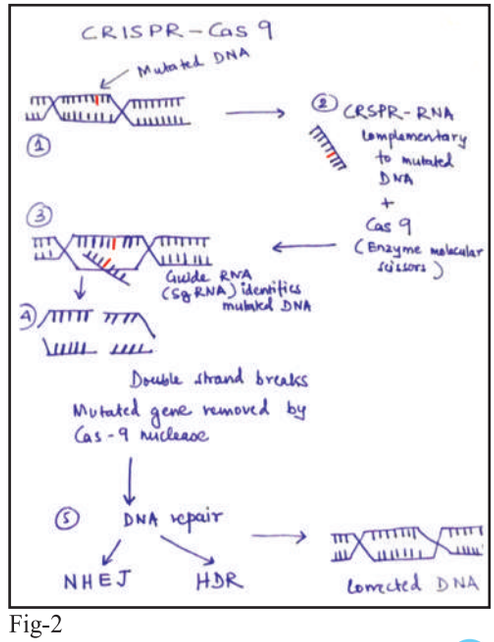

Fig-2

Preclinical animal free testings for Clinical trials: Pros and cons towards translational benefits

Sandip Ghosh
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Department of Neuroendocrinology
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Over the past two decades, preclinical research relying on animal models has been plagued by a failure to replicate consistent results, costing an estimated $28 billion USD per year. Potential therapeutics from preclinical studies entering phase I clinical trials exhibited a mere 10.4% approval rate between 2003 and 2014, and an even lower 6% to 7% rate between 2011 and 2017. A retrospective analysis revealed that the most common causes of termination in phase I and II trials since 2003 were a lack of efficacy (60%) and toxicity (30%). These disappointing outcomes of promising preclinical findings that fail to translate into effective human therapies have raised serious concerns within the scientific community, highlighting the pressing need to reassess approaches to studying human diseases and facilitating more efficient bench-to-bedside translation.A study on 129 cancer drug-indication pairs with accelerated FDA approval found 48 were converted to regular approval, some with less than 5 years for confirmatory trials. Endpoints used for conversion included progression-free survival (44%), overall survival (40%), response rate plus duration (10%), and response rate (4%). Alarmingly, one drug got regular approval despite a negative confirmatory trial. Of 46 pairs with ?5 years for confirmatory trials, 22% were withdrawn while 15% had ongoing trials after 6.3 years median. Between 2013-2017, withdrawal time for drugs lacking clinical benefit decreased from 9.9 to 3.6 years, but conversion time to regular approval increased from 1.6 to 3.6 years.

Over 100 million animals are used in laboratory experiments worldwide every year. These are only estimates; the exact number is unknown and could even be higher.The OECD's recent endorsement of a non-animal approach for identifying sensitizers marks a significant regulatory shift towards reducing animal testing. Developed by NIEHS researchers and collaborators, this method offers a credible alternative to traditional approaches. Led by NICEATM, the project involved international collaboration, resulting in the first globally recognized standard for employing non-animal methods. With regulations evolving, this signifies a crucial step forward in promoting humane testing practices and aligning regulatory frameworks internationally. The significant differences between animal and human anatomy and physiology mean that animal studies may not reliably predict the outcome of substances being tested on humans. For example, many potential drugs fail to show any results in humans, although they work on mice. In 1959, two scientists William Russell and Rex Bruch mentioned in their book about "3Rs principle". Of the 3Rs, "Replacement" refers to methods that replace the use of animals with non-animal methods where possible; "Reduction" refers to strategies or methods to use fewer animals to obtain sufficient data or maximum information per animal thereby reducing the number of animals being used; and "Refinement" refers to adopting practices to minimize stress on animals under study.To address the limitations of animal models, regulators have taken steps to promote the development and adoption of alternative methods. The FDA Modernization Act 2.0, signed into law in December 2022, permits the utilization of specific alternatives to animal testing, including cell-based assays, human induced pluripotent stem cells (iPSCs), organoids, organs-on-chips (OoCs), and advanced artificial intelligence (AI) methods such as generative adversarial networks (GANs) and language models. These alternatives can now be used to seek FDA exemptions for assessing drug safety and effectiveness during the preclinical phase. Similarly, India has also made changes to its drug testing laws and regulatory criteria. The New Drugs and Clinical Trial Rules, 2019, amended in 2023, now allow researchers to use non-animal and human-relevant methods, such as 3D organoids, organs-on-chips (OoC), and advanced computational methods, to test the safety and efficacy of new drugs. These changes reflect a growing recognition of the limitations of animal testing and the importance of finding more accurate and humane alternatives.

Various non-animal drug testing options have emerged as alternatives to traditional animal testing methods, offering significant benefits in disease modeling, drug screening, and personalized medicine. Organoids, miniature 3D structures replicating specific organs from human cells, hold promise across numerous diseases. For instance, brain organoids facilitate the study of neural development and disorders such as autism. Organs-on-chips, microfluidic devices mimicking organ functions with human cells, are instrumental in studying lung diseases, toxicity, and drug screening. 3D bioprinting, utilizing bio-inks of cells and fluids, has the potential to create functional tissues for drug testing and regenerative medicine. In cancer research and treatment, organoids and organ-on-a-chip (OoC) technology have become indispensable. OoC models have effectively developed diverse models of healthy and diseased tissues like the heart, kidney, liver, and lung, aiding in anti-cancer drug screening and toxicity assessment. Organoids have shown promise in various cancer types, including breast, bladder, colorectal, gastric, liver, ovarian, pancreatic, and prostate cancers. They address challenges posed by cancer heterogeneity and high mutation rates, providing valuable insights for in vitro drug testing. These alternative methods are particularly useful in studying and developing treatments for solid tumors. Organoids and organs-on-chips offer researchers insights into disease mechanisms, enable testing of potential drugs, and enhance the accuracy of drug screening before clinical trials.

While animal testingalternatives offer a significant shift towards cruelty-freetesting, there are also challenges to be addressed, including limited predictability, cost and time constraints, regulatory hurdles, lack of standardization, and incomplete understanding. Animal alternatives offer significant benefits but it is important to consider the drawbacks. One of the cons is the limited predictability of these alternatives compared to animal models. Despite advancements, alternative methods may not fully replicate the complexity of whole organisms, resulting in limitations in accurately predicting human responses. Furthermore, the development and validation of these alternative methods can be time-consuming, expensive, and lack standardization across laboratories or research institutions. Regulatory hurdles, such as the requirement for traditional animal testing in some cases, can also slow down the adoption of alternative methods. Additionally, the incomplete understanding of complex biological processes presents a challenge as these alternative methods may not fully capture all relevant factors involved in predicting human responses to drugs or chemicals.

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Olfactory Rehabilitation Post Total Laryngectomy

Dr. Rajdeep Guha
Surgical Oncology Head & Neck

With the advent of organ preservation protocol, most early and intermediate stage Laryngeal Cancers are treated with Radiation or CTRT. However, Total Laryngectomy remains the standard of care for advanced Laryngeal Cancer, and post RT failures.

The focus in post laryngectomy rehabilitation has primarily been Voice Rehabilitation. However, loss of olfaction is a major disability post Total Laryngectomy (TL), leading to changes in dietary satiety. In a study by Gordana et al in 2014, Olfaction was not possible in 30.5% patients and remained affected in 51.4% cases. Decreased gustatory abilities were seen in 26.7% cases and dysgeusia in 11.4% cases. 50.5% of patients were affected by loss of olfaction. Loss of smell can lead to decreased ability to detect dangers like fire or spoiled food and also impede social connections. (Boesveldt et al, 2017)

The long-termdisability of upper airway leads to permanent changes in Olfactory mucosa if not adequately rehabilitated. In a study published by DenizKaraoglu in 2017, the nasal mucosa was seen to atrophy and lower scores obtained by smell identification tests compared to non-patient control arm.This study confirms similar findings of a study of Magnetic Resonance Imaging of the Olfactory Bulb (OB) done in 2011 by B Veyseller et al. where smaller OB volumes were recorded post TL.

Olfaction is measured bythe University of Pennsylvania Smell Identification Test (UPSIT), Sniffin'Sticks, Dynamic Olfactometry and Field Inspection. In an article published by Yuko Nishiya et al in 2022, comparing olfaction by T & T Olfactometer and Jet Stream Olfactometer in post laryngectomy patients, they concluded that the odourblowing test was superior to odoursniffing test, concluding that active airflow was crucial for olfaction rather than mere blowing a scent.

Olfactory rehabilitation in Post Laryngectomy is done by Nasal Airflow Inducing Maneuvers (NAIM). Retronasal airflow pathway is utilized for inducing airflow in the nose to aide smell perception. The maneuver is similar to "polite yawn" movement of the lip and palate.The patient is taught to "yawn with closed lips" by the speech and swallow therapist and is easily learnt by most patients. In a study by Hilgers et al, a 30 min session could convert approximately 46% of patients from nonsmellers to smellers. In a study by Bogdanov, the NAIM maneuver was combined with Tracheo-Esophageal Prosthesis usage and nasal expiration. In a series by Saedi et al, the participants experienced and improvement of sense of smell in 61% and a significant improvement in appetite. In a study by Manestar in 2012, the minimum airflow required to perceive smell by NAIM was 60cm3/s. Continued usage of NAIM improved the olfactory acuity as concluded in a Swedish trial.It is recommended to start the rehabilitation early and follow it up by reinforcement sessions at 3, 6 and 12 months by Brigit et al.

Teaching the Nasal Airflow Inducing Maneuvers should be included in all post-laryngectomy rehabilitation programmes.

Food safety is important during and after cancer treatments

Debolina Banerjee
Dietician , CNCI,

Neutropenia is a common complication during cancer treatment. Neutropenia is diagnosed by a routine complete blood count (CBC). A blood test named absolute neutrophil count (ANC)helps to determine the body's ability to fight off infection.An ANC of less than 1500 cell/microliter is defined as mild Neutropenia,Count less than 1000 cell/microliter is considered moderate and less than 500 cell /microliter represents the severe neutropenia.

The major dose-limiting toxicity of most cancer chemotherapy regimens is neutropenia. This results in hospitalizations, antibiotic costs, reduced quality of life, infectious morbidity, dose reductions, and treatment delays that compromise efficacy and outcomes, and result in some deaths: 75% of chemotherapy-related mortality.

G-CSF or pegfilgrastim is widely used for primary or secondary prevention of neutropenia to decrease morbidity and mortality of febrile neutropenia. The immune system is often weakened by cancer treatments, making the body more susceptible to foodborne illnesses.

Patient should be counselled and educated on the prospect of neutropenia and its prevention. Good hand hygiene and personal management of patient, caregiver and clean surrounding is one of the key managements. Healthy food choices, food handling and cooking method (avoiding raw food or uncooked food) can minimise considerable chances of infection.The best advice for neutropenic patients is to follow food safety guidelines as indicated by govt, scientific societies and hospitals. Food can be source of infection as they may contain harmful organism.

The neutropenic diet is also called sterile diet, low microbial diet or a low bacterial diet. Variation of neutropenic diet are a sterile diet where food is sterilised by canning, baking, autoclaving or irradiation, a low bacteria with good hygiene maintenance ,and well cooked food and or a modified house diet which is a regular diet with an omission of fresh fruits and vegetables.

The recommendation committee proposes following precautions, following neutropenic diet to prevent nutritional deficiency the diet plan may be ensure adequate supply of all macro and micro nutrients along with all food groups.

Recommendation:

- Advise frequent hand washing and keep kitchen surface and utensil clean.Instead of using soap bar for washing utensils use liquid soap.
- Advise the avoidance of raw and undercooked animal products including egg,meat,fish poultry.
- Wash all fresh fruits thoroughly before eating.
- Ensure proper temperature for cooking, cooling and reheating. Eat food immediately, once served.
- Check expiration dates on all packaged food.
- Prevent cross contaminatio between raw and cooked food.
- "When in doubt ,throw out" and "No oldy and moldy".

Role of Medical Physicist in Radiotherapy

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Dept. of Medical Physics, CNCI.

Radiotherapy is one of the principal modalities used in the treatment of cancer using ionizing radiation. Radiotherapy has its origin shortly after the discovery of X-rays and radioactivity at the end of 19th century. At the beginning external beam radiotherapy was mainly based on orthovoltage X-rays to treat superficial tumors. After 1950's Megavoltage X-ray therapy has grown with the development of Medical linear accelerator facilitating treatment of deeper lesions. Here comes the major role of a medical physicist in the concurrent development of the fields of dosimetry, treatment planning and radiation safety.

Medical physics is the application of physics to medicine and biology.Medical physicistsassume a crucial position in the field of radiotherapy service as a whole. The physicistworks as a team member along with the Radiation oncologists, Radiotherapy technologists and othersin the department.

The essential responsibility of the qualified Medical Physicist is to ensure the safe and effective delivery of radiation to achieve a diagnostic and therapeutic result as prescribed in patient care. The main subfields of medicalphysics are:

- Therapeutic Radiological Physics
- Diagnostic Radiological Physics
- Medical Nuclear Physics
- Medical health physics

A new radiotherapy installation starts under the supervision of a physicist and he plans radiotherapy room design, procurement of standard and type approved equipment as per the guidelines of Atomic Energy Regulatory board (AERB) in India. The first and foremost responsibility of a physicist is to establish radiation safety in a radiotherapy department.

Over the years radiotherapy advances through observations and clinical trials. The expertise of a Medical Physicist in the physics of radiation, helps to assure conformal dose delivery in tumor and optimizing dose in normal tissues. Determination of physical characteristics of treatment procedures including type of radiation, beam energy, Selection of a beam direction, beam weightage, calculation of dose output relies solely on the knowledge of Radiation Physics.

A Medical Physicist designs treatment plan for conventional radiotherapy, 3D conformal radiotherapy (3DCRT), Intensity modulated radiotherapy (IMRT), Volumetric Arc therapy (VMAT), Stereotactic Body Radiation Therapy (SBRT), Stereotactic Radio Surgery (SRS), Stereotactic Radiotherapy (SRT) and carry out patient dosimetry for the verification of accurate dose delivery as per plan. Besides, quality checks are done for all radiotherapy machine periodically (daily, monthly and annually).

Other than External beam radiotherapy Medical Physicistsplay a major role in Brachytherapy involving implanted radioactive source in patient's body (Intracavitary, Interstitial, Intraluminal and Surface mould etc.).

Medical physicists work in clinical, academic or research institutions as science professionals. Apart from the core responsibility of clinical work and radiation safety, they are actively involved in the process of human resource development through education and training. They contribute to research and development aimed at enhancing quality of treatment through the application of cutting-edge technology. Medical physicists are effectively contributing to the improvement of quality, safety and cost effectiveness of healthcare services through patient-centric initiatives. These initiatives require proactive engagement, expert guidance, and meticulous oversightto ensure the optimal performance of advanced radiation generating machines,dosimetryequipment and computerized treatment planning system. As per the regulatory body, medical physicists are the essential and mandatory requirement for a radiotherapy department.

Extracorporeal Radiotherapy: Affording Alternatives of Implant in Bone Sarcoma

Dr Koustav Mazumder
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Department of Radiation Oncology,

Extracorporeal radiotherapy (ECRT) is a specialized form of radiation therapy where a patient's bone or organ is surgically removed, irradiated outside the body, and then reimplanted. This technique, also known as extracorporeal irradiation, was developed to treat malignancies that are localized but difficult to manage with standard radiation therapy or surgery alone. This technique aims to deliver high-dose radiation directly to the tumor while preserving the surrounding healthy tissues and maintaining the structural and functional integrity of the affected organ or bone. ECRT has been particularly valuable in orthopedic oncology for treating bone sarcomas. It was first described in 1968 by Spira and Lubin.

When a cancer is closely attached to the bone, it is difficult to separate the tumor from the bone. By virtue of it, we have to excise the whole attached bone and put an implant there.

Custom-made implants provide the advantage of immediate weight bearing and ambulation but are expensive, and issues regarding loosening, wear, and breakage remain. In place of the implant, if the adjoining bone remains viable, we could place that bone. A problem arises as the tumor is attached to the bone, and from the tumor, recurrence might occur very quickly. So, after taking out the adjoining bone, if we can irradiate it in a high dose and put it back in the same place, then it would be regarded as a biological reconstruction, which is a cost-efficient and more durable reconstruction option.

Indications for Extracorporeal Radiotherapy

ECRT is typically indicated in the following situations: Primary bone tumors, particularly high-grade osteosarcomas, Ewing's sarcoma, and other bone malignancies where limb preservation is a priority. In the case of recurrent bone tumors, when there is a recurrence of cancer in previously treated areas, conventional surgery and radiotherapy are less effective. Even in metastatic bone disease, where metastases are isolated and amenable to surgical resection, tumors are present near critical structures, and traditional radiotherapy would risk significant damage to surrounding healthy tissues.

Our experience at the Chittaranjan National Cancer Institute

A 28-year-old gentleman presented with limping for the last six months. On biopsy, it has been proven that he is suffering from osteosarcoma of the right pelvic bone; on radiological examination, it was only confined to the pelvic bone (non-metastatic). After three cycles of chemotherapy, the patient was taken up for surgery. After excising the residual tumors, surgeons took out the pelvic bone. As a radiation oncologist, I was there at the operation theatre when it was taken out of the body. The residual tumors are meticulously removed from the bone and wrapped with Vancomycin-soaked gauze. After that, we placed it in a plastic container and fixed the bone well at the base of the container. We also put some soaked gauze and a towel over it and closed the lid, maintaining proper sterilization steps. This was done to prevent any kind of movement inside the container.

Our technician took the container to the CT simulator room to take a planning CT scan. Our medical physician team made an excellent plan in our virtual planning system. We placed the container on the radiation couch and managed to deliver 50 Gy in a single fraction. We have the FFF technology in our Linear Accelerator Radiotherapy Machine, and by virtue of it, we were able to deliver so much dose in just 6 minutes. The container was then handed over to the surgery team, and then they put the bone back inside the body.

At present, patients are taking their chemotherapy medicines according to the schedule and walking without any support.

Thank you to our surgical oncologist team, Dr. Abhishek Nandi (Orthopaedics Oncosurgeon), Dr. Sagar Sen (Surgical Oncologist), the Onco-Anaesthesia team led by Dr. Deepa Chakrabarti, the team of medical physicists led by Dr. Dilip Roy, and the team of radiotherapy technicians. Special thanks to Dr. Chandrani Mallik (medical oncologist) and in Charge of Radiation Oncology, CNCI, Newtown, Dr. Amitabh Ray.

In developing countries like India, where implants are too costly, extracorporeal radiotherapy indeed provides a better quality of life as well as survival for the unfor-tunate patients who are suffering from bone sarcoma.

Human Microbiome and Cancer

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Historical accounts linking cancer and microbes date as early as four millennia ago. Post establishment of the germ theory of infectious diseases, clinical research of microbial influences on cancer began in 1868, when William Busch reported spontaneous tumor regressions in patients with Streptococcus pyogenes infections. Over the next century, the role of bacteria in carcinogenesis and cancer therapy was discounted due to poor reproducibility, erroneous microbiological claims, and severe toxicity in patients. However, these provided some of the first crude demonstrations of cancer immunotherapy. Contemporaneously, the viral theory of cancer began to flourish, spurred by the 1911 discovery of Rous Sarcoma Virus (RSV), which transformed benign tissue into malignant tumors in domestic fowl. The subsequent decades-long search to find a virus behind every human cancer ultimately failed, and many cancers have been fundamentally linked to somatic mutations. Now the field is encountering intriguing claims of the importance of microbes, including bacteria and fungi, in cancer and cancer therapy.

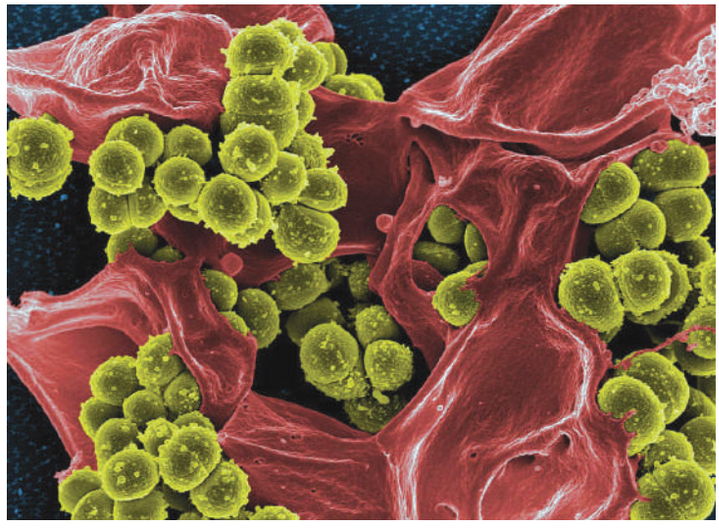
The microbes that crowd our guts, skin and respiratory tracts have a profound impact on how our bodies function in health and disease. The microbiome of trillions of bacteria, fungi and viruses intermingles with each person's cells, influencing human biology in ways we have barely begun to understand. Incorporating the contribution of the microbiome to cancer development and prevention will lead to a more complete understanding of cancer and may shed light on strategies to halt or mitigate those contributions.

This complex community of microbes contains thousands of species and varies enormously from person to person. Its members protect us against pathogens, fine-tune our immune systems, shape how we use nutrients and produce a host of chemicals that affect the functions of our cells.

We have come to realize that the microbiome can also hasten or slow cancer development as well as influence our response to anticancer therapies. Manipulating this intricate ecosystem may one day help us prevent or treat cancer and other diseases.

Advanced genome technologies now make it possible to analyze microbial DNA to characterize communities that live in and on our bodies and how they relate to disease. We know that these communities are not stable because their members change as we alter our diets, spend time in new environments or take a course of antibiotics. Cancer, too, can affect the composition of a person's microbiome. Efforts are underway to determine how factors such as inflammation, tumor development and progression and cancer therapy change a person's microbiome.

With new tools for molecular analysis, we can now extend our studies beyond surveying the microbiome and work toward a deeper understanding of what microbes do and how they interact with other cells. To gain a complete picture of the biological impact of these communities, it will be critical to investigate the genes present in different microbiomes and the vast range of chemicals that their members produce. Such studies will be complemented by work in animal models where investigators can carefully manipulate the composition of the microbiome to explore the mechanisms by which its members influence inflammation, immune activity and other processes. Another priority is to investigate the mechanisms that microbes and human cells use to communicate with one another. Once we understand how these communications work, it may be possible to interrupt or modify them to alter biological processes.



Maybe most importantly, a patient's microbiome influences their response to cancer treatment. Researchers already know that a microbiome's composition can modulate both the effectiveness of different therapies as well as their associated side effects. For example, certain types of immunotherapy work best when patients have highly diverse communities of gut microbes. Identifying ways in which the microbiome affects the response to specific anticancer therapies will require extensive sequencing of microbial DNA and sophisticated bioinformatics analyses. Understanding these relationships is expected to help clinicians identify the best treatment for every patient and may suggest ways we can modify individuals' microbiomes to improve outcomes.

We cannot be certain of what we will find as we explore the relationship between cancer and the human microbiome. However, elucidating its complexity is an immense opportunity that could uncover new aspects of cancer biology and find new ways to improve patient care.

PICC-An Important Device in Oncology Care

Arpita Mukherjee
Staff Nurse (Haematooncology)

As Oncology treatment is long term therapy most of the time its difficult to manage caring a patient only with peripheral intravenous catheter because of repeated blood transfusion, multiple drug therapy, administration of chemotherapy or other irritant and vesicant drugs, multiple sampling needs, TPN administration etc. To overcome these issues, we opt for Central Venous Access Devices.

Choice of CVAD varies acc to the duration and type of treatment.

1. Central Venous Catheter- mainly used for short term Rx for days to a week.

2. Hickman line or tunneled catheter- It may be single or double lumened. It's used for long term treatment like in BMT setting.

3. PICC or non-tunneled catheter- like Hickman it can also be single or double lumened. We can use it for intermediate term use like 6months to 1 year. It is most preferable for long term chemotherapy pts, pediatric generations.

4. Implanted port or chemo port- it's also used for delivering chemotherapy without altering pt's body image.

What is PICC:

It is a peripherally inserted central catheter made up of soft flexible poly urethane or silicon materials. They are inserted through peripheral veins of upper arm (Basilic, Cephalic, Brachial and veins of antecubital area including branches of median cubital and cephalic vein at or below the ante cubital crease) and advanced to a tip position at or above the junction of SVC and RA. Tip placement confirmation is must before its first use either by fluoroscopy guided insertion or post insertion chest XRAY.

INDICATIONS:

1. Intermediate or long-term therapy i.e. drug, infusion or chemotherapy.

2. CVP monitoring

3. Intravenous therapy or infusions with no limitations in terms of osmolarity and pH.

4. TPN administration

5. Poor venous access.

6. Continuous sampling needs(For critical care or hematology pts) ADVANTAGE:

1. It's relatively easy to insert.

2. Insertion can be done at the bedside by a nurse or radiologist trained in the procedure.

3. Pain free once inserted.

4. Suitable for continuous or intermittent therapies

5. Avoid repeated puncture. Can be done under local anesthesia only.

6. Pt can keep it up to 1 year if maintained properly.

7. Chances of CRBSI is less compared to other CVADs.

8. Can be used for pediatric pts also.

9. Ease for repeated sampling.

DISADVANTAGE:

1. Abnormal venous anatomy may prevent insertion.

2. High maintenance- require regular dressing and flushing.

3. Restricted activities in some extent of the affected arm

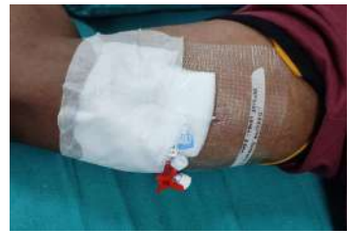
4. Altered body image.

Complications:

Signs & Symptoms	Possible Cause	Directions	Prevention
Drainage, redness, pain, swelling around insertion site, fever and chills	Infection	Call doctor or IV nurse	Use sterile technique, keep sterile dressing over site, wash hands prior to procedure
Arm or shoulder swishing in ear on same side of the body wher catheter is located while medication given	Catheter change position	Call doctor or IV nurse. Do not inject any solutions into catheter until talking with doctor or nurse	Inject flushing / locking solution slowly
Inability to inject	Catheter clotted or kinked	Call doctor or IV nurse	Completely fill catheter lumen with locking solution between treatments. Flush catheter well before and after medications. Tip verification at time of insertion if indicated. Use of appropriate catheter securement device.
Leaking from external catheter	Breaking catheter material, hub separation	Call the doctor or IV nurse. Fold catheter together below leaking area and tape securely.	Do not use alcohol or acetone. Do not pull-on catheter.
Pain on injection	Inflammation of vein	Call doctor or IV nurse	Medications should be given slowly.

5. In case of improper maintenance there is a high risk for blood stream infections.

6. All patients can't afford it due to high expense.



Post Insertion Care and Maintenance:

The goal of implementing appropriate policies and procedures for care and maintenance of PICC is to avoid the occurrence of Post insertion complications.

For Newly Inserted PICCs:

- Restrict arm movements for first 24 hours to minimize bleeding
- Apply a pressure bandage directly on the occlusive dressing to avoid redressing the insertion site frequently in the first 24hrs.
- First dressing to be changed after 24hrs then in weekly intervals.

Confirming placement is very much important before each use by:

- Checking the backflow before administering anything through the lumens.
- Measurement of PICC length from insertion site to catheter hub and it should be compared with the data recorded during insertion procedure.
- X-ray confirmation before its first use after insertion.

Nursing Responsibilities of pts having PICC line:

A nurse should assess the following bundles daily while caring a pt with PICC:

- Daily review of need of line
- Hand hygiene
- Scrubbing the hub with 70% alcohol
- The presence of transparent dressing.
- Assessment of insertion site for any pain, redness, swelling, discharge from the site.
- Displacement / migration of catheter
- Proper line securement
- Dressing changed in its optimal condition or not.
- Assess for presence of any complications those are mentioned previously.
- Next due date, outside length to be mentioned clearly during each dressing.

Flushing:

Always flush in pulsating manner (Push pause techniques) to create turbulence in the lumen of the catheter, remove debris and avoid blockage of the catheter.

Flush weekly when the line is not in use.

When to remove PICC:

- When there is no need of catheter
- When blood CS is positive sent through PICC line but peripheral CS is negative (A paired cultural to be sent to confirm.)
- There is no back flow despite trying all corrective measures to prevent occlusion.
- Swelling, pain, redness, discharge at the insertion site.
- Catheter migration more than 2cm in or out.

Therefore, PICC is very useful device for oncology patients but it needs an expertise care and maintenance throughout its stay otherwise it may lead to serious complications. So as an oncology nurse we should take appropriate PICC care to enhance its effectiveness with minimal or no complications.

Herbal Garden

1. Lemongrass is widely used as a natural remedy for digestive issues,
2. Lavender may be useful for anxiety,
3. Ajwain
4. Basil improves overall immunity

Picture courtesy: **Sutanuka Jana**

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