Pediatric gliomas with special emphasis on RT

- Durable local control
- Survival
- Quality of life
- Multidisciplinary approach
Challenges in children....

• Broad spectrum of complex diseases
  — Own biology
  — Own natural history

• Optimal and ‘creative’ integration
  — Understanding disease
  — Understanding adverse consequences

• Not only to enter the realm
  — But also be successful
### Incidence

<table>
<thead>
<tr>
<th>Cancer</th>
<th>Incidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leukemias</td>
<td>32%</td>
</tr>
<tr>
<td>CNS Tumors</td>
<td>18%</td>
</tr>
<tr>
<td>Astrocytoma</td>
<td>10%</td>
</tr>
<tr>
<td>Medulloblastomas</td>
<td>4%</td>
</tr>
<tr>
<td>Ependymomas</td>
<td>2%</td>
</tr>
<tr>
<td>Others</td>
<td>2%</td>
</tr>
<tr>
<td>Lymphoma</td>
<td>13%</td>
</tr>
<tr>
<td>BST</td>
<td>12%</td>
</tr>
<tr>
<td>Neuroblastoma</td>
<td>8%</td>
</tr>
<tr>
<td>Wilms</td>
<td>6%</td>
</tr>
<tr>
<td>Retinoblastomas</td>
<td>3%</td>
</tr>
<tr>
<td>Hepatic</td>
<td>1%</td>
</tr>
<tr>
<td>Germ cell + others</td>
<td>7%</td>
</tr>
</tbody>
</table>

Rare compared to adult cancers
Nearly 1 in 5 located in the CNS
### Common brain tumors in children

**Relative Incidence**

<table>
<thead>
<tr>
<th>Supratentorial</th>
<th>50 – 55%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Astrocytoma</td>
<td>23%</td>
</tr>
<tr>
<td>Malignant gliomas</td>
<td>6%</td>
</tr>
<tr>
<td>Craniopharyngioma</td>
<td>6%</td>
</tr>
<tr>
<td>PNET &amp; others</td>
<td>4%</td>
</tr>
<tr>
<td>Pineal/GCT</td>
<td>4%</td>
</tr>
<tr>
<td>Ependymoma</td>
<td>3%</td>
</tr>
<tr>
<td>Oligodendroglioma</td>
<td>2%</td>
</tr>
<tr>
<td>Others [CPCs, gangliogliomas, etc]</td>
<td>2%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Syndrome</th>
<th>Location</th>
<th>Histiotype</th>
</tr>
</thead>
<tbody>
<tr>
<td>NF 1</td>
<td>NF1 (17q11)</td>
<td>Gliomas</td>
</tr>
<tr>
<td>NF 2</td>
<td>NF2 (22q12)</td>
<td>AN, meningiomas</td>
</tr>
<tr>
<td>Tuberous sclerosis</td>
<td>TSC1 (9q34)</td>
<td>SEGA</td>
</tr>
<tr>
<td>TSC1 (9q34)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TSC2 (16p13)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Li-Fraumeni</td>
<td>TP53 (17p13)</td>
<td>Medulloblastoma Astrocytoma</td>
</tr>
<tr>
<td>Li-Fraumeni</td>
<td>TP53 (17p13)</td>
<td></td>
</tr>
<tr>
<td>APC hMSH2</td>
<td></td>
<td>Medulloblastoma High grade glioma</td>
</tr>
<tr>
<td>Turcot</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Retinoblastoma I</td>
<td>RB1 (13q14)</td>
<td>Pineoblastoma</td>
</tr>
</tbody>
</table>

**Etiology**
- Mostly sporadic
- Neurocutaneous and other genetic syndromes
- Radiation induced meningiomas in later life

References:
- Louis et al. WHO classification 2007
- Mulvihiill et al. NEJM 1985; 312:1569-1570
Pediatric low grade gliomas
Diverse range

- Largely 3 groups
  - Pilocytic astrocytomas
  - DNET, PXA, SEGA, gangliogliomas
  - Astrocytoma, ODG (WHO Grade II), mixed
Clinical presentation

• Symptoms over extended time intervals
• Seizures
• Lateralizing neurologic signs
  – thalamic region tumors
  – increased intracranial pressure (i.e., headaches, vomiting)
• Suprasellar tumors typically occlude the foramen of Monro
  – Visual signs
  – Endocrine abnormalities
    • Midline suprasellar lesions
    • Diencephalic syndrome
• Pineal region tumors
  – Hydrocephalus by compressing the aqueduct of Sylvius
  – Parinaud syndrome
Low grade supratentorial astrocytomas

- Diverse group
- Diencephalon
  - Commonest site
- Management
  - variable and depends on
  - tumor location
  - patient age
  - presence of a genetic mutation
  - physician and parental preference
- Outcomes favorable

- Baseline examination
- Bloods
- Diagnostic imaging
  - Isodense on CT
  - Isointense on T1 MR
  - Hyperintense on T2 MR
  - JPAs enhance briskly, others do not
  - Scattered calcifications
  - Tumor cysts may be seen
- Post gadolinium T2 FLAIR most optimal sequence for voluming
- Ophthalmic/endocrine/neuropsychiatric evaluations
- Any other

Long-Term Outcome of 4,040 Children Diagnosed With Pediatric Low-Grade Gliomas: An Analysis of the Surveillance Epidemiology and End Results (SEER) Database
Outcomes

<table>
<thead>
<tr>
<th>Factor (reference level)</th>
<th>Death due to disease</th>
<th>Death from non-disease causes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>HR (95% CI)</td>
<td>P-value</td>
</tr>
<tr>
<td>Beam radiation, with or without implants or isotopes (no radiation)</td>
<td>3.9 (3.0, 4.9)</td>
<td>&lt;0.00001</td>
</tr>
<tr>
<td>Degree of radiation unknown (no radiation)</td>
<td>3.1 (1.7, 5.8)</td>
<td>0.0003</td>
</tr>
<tr>
<td>Primary site (cerebellum)</td>
<td>2.3 (1.6, 3.2)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Histology group (pilocytic astrocytoma)</td>
<td>2.2 (1.7, 2.8)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Age of diagnosis (≥2 years old)</td>
<td>2.0 (1.5, 2.8)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Subtotal resection, biopsy or no resection (total resection)</td>
<td>1.5 (1.01, 2.1)</td>
<td>0.04</td>
</tr>
</tbody>
</table>

- **Overall Survival (Only Tumor Deaths)**
  - **Never irradiated, all degrees of surgical resection**
  - **Received radiation, all degrees of surgical resection**

<table>
<thead>
<tr>
<th>% Survival</th>
<th>Years from Diagnosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>0</td>
</tr>
<tr>
<td>90</td>
<td>10</td>
</tr>
<tr>
<td>80</td>
<td>20</td>
</tr>
<tr>
<td>70</td>
<td>30</td>
</tr>
<tr>
<td>60</td>
<td>40</td>
</tr>
</tbody>
</table>

Limited by selection bias
More difficult to control tumors treated with RT
Second malignancies
Vasculopathy
Issues in survivors...

A growing population
CURE = Not merely absence of disease
Provide ‘functional cure’
Minimize need for support
Treatment[s] and the Team

• Surgery – Frequently cannot be entirely removed

• Radiation – Frequently employed alone or in combination
  – Late effects may be limited by conformity

• Chemotherapy – Cannot eliminate all tumor cells when used alone and sensitivity varies
Therapy
Surgery

- Amenable to resection
- Surgery – first & sole treatment
- Incidence of GTR – 90%
- Low recurrence rates
- CCG and POG
- 5 yr PFS after primary surgery - 92%
  - 95-100% for JPAs and gangliogliomas
  - 80% for grade II diffuse astrocytomas
- Eloquent cortex: decompression

- Location in diencephalon
  - Technically limited by deep location
  - Eloquent area
- Contemporary series
  - Reporting successful resection
- Occasional resection of diencephalic JPA
- CCG-POG study
  - PFS after surgery alone 50-60%
  - Wisoff et al. Neurosurgery, 2009
Chemotherapy

• Been used with increasing frequency as a strategy to delay or avoid RT
  – Studied primarily in centrally located tumors in younger patients not amenable to resection
  – Ideal age – controversial
• COG looks at 10 years for trial eligibility for initial chemo
• Carboplatin and vincristine
  – First line therapy
  – Favorable control rates
  – Absence of serious toxicity
• Decision to proceed with chemotherapy or irradiation
  – Patient age
  – Clinical presentation
  – Multidisciplinary decision
  – Weighing risks and benefits with the family
• Possible radiation volumes versus chemotherapy as initial treatment
  – No confirmation that rate and durability of disease control following RT are independent of prior chemotherapy
Chemotherapy

• Chemotherapy - Carboplatin + VCR
  – for very young children to avoid/defer RT
  – Objective response rate (CR+PR): 42%
  – 5Yr PFS: 34%; OS: 89%
  – 5Yr RT free survival rate: 61% (French prospective study)

• RT – large residual, and/or progressive tumors
Radiation Therapy

- Established and effective
- Durable tumor response and disease control
- Pollack et al
  - 10 years after RT for incompletely resected hemispheric astrocytomas
  - PFS: 82% with RT vs 42% with surgery alone
  - No difference in OS
- Merchant et al, Phase II
  - EFS: 87% and 74% at 5y and 10y for 3DCRT with MR defined volumes
  - 90% OS at 10y

- Decreased volume of normal brain exposed to moderate or high doses of RT may help decrease serious late effects
- Accurate delineation
  - Addressing white matter tracts
  - Standard margin 10 mm
  - Suggestion that 5 mm margin in well demarcated lesions should be accurate when multimodality imaging is incorporated

Current indications for RT after near total excision
- Symptoms or signs that might improve with RT
- Postsurgical progression in a location not amenable to definitive second resection
Radiation Therapy

• Large CCG-POG low grade trial suggest that a significant number remain indolent for 3-5 years
  – PFS at 5 years: 55% after near total resection
  – Decision to observe children with residual astrocytoma should involve all specialties indicating the obligation to follow up and imaging

• RT can be initiated at progression
• Balances efficacy versus potential toxicity

• JPAs predominate in hypothalamic and OPT
  – Prolonged PFS after RT alone – reflects both indolence and efficacy
  – Survival > 80% at 10 y after RT are common

• In thalamic astrocytomas, pilocytic histology is less prevalent
  – 10 y survivals: 33-60%

• Gliomatosis cerebri or bithalamic astrocytomas
  – May represent supratentorial counterparts of infiltrating pontine astrocytomas
  – Progression often apparent after 1 year
Radiation Therapy

**Volume**

- Fusion of MRI with CT
- Define CTV as 1 cm anatomic expansion
  - Prospective study at St Jude’s dearth of marginal recurrences with this expansion
  - Additional 3-5mm for PTV
  - Careful review of all neuroimaging
  - Shrinking fields not typically used
- Assess cyst changes during treatment
- Tumors with subarachnoid seeding need craniospinal irradiation

**Dosage**

- Little definitive dose-response data specific for pediatric low grade gliomas
- Shaw et al
  - Advantage at doses > 53gy in conventional fractionation
  - Ironic that doses have been tested in adult low grade gliomas [EORTC,NCCTG,RTOG,ECOG]
- 50 – 54 Gy, conventional fractionation, optimal conformality
- Same dose level recommended throughout the pediatric age range
Radiation Therapy

**Technique**
- 3 D conformal RT remains maximally used
- Intensity modulated radiotherapy
- Stereotactic treatments

**Results**
- Quite favorable
  - Older children enjoy more favorable outcome
  - GTR consistently linked to better PFS
- Diverse histiotypes
  - Molecular and genetic classification near
- Addition of therapeutic radiation when indicated
  - 80% PFS at 10y
Conformal Radiation Therapy

- Any technique where dose conforms to target
- Limits dose to non-target tissues
- May decrease late morbidity
- Incorporates imaging modalities
  - Accurate definition of targets and critical normal structures
Optimal conformality impacts morbidity

High precision conformal radiotherapy employing conservative margins in childhood benign and low-grade brain tumours

Rakesh Jalali\textsuperscript{a,*}, Ashwini Budrukkar\textsuperscript{a}, Rajiv Sarin\textsuperscript{a}, Dayananda S. Sharma\textsuperscript{b}

CLINICAL INVESTIGATION

FACTORS INFLUENCING NEUROCOGNITIVE OUTCOMES IN YOUNG PATIENTS WITH BENIGN AND LOW-GRADE BRAIN TUMORS TREATED WITH STEREOTACTIC CONFORMAL RADIOTHERAPY

Rakesh Jalali, M.D.,* Indranil Mallick, M.D.,* Debnarayan Dutta, M.D.,* Savita Goswami, M.Sc.,† Tejpal Gupta, M.D.,* Anusheel Munshi, M.D.,* Deepak Deshpande, Ph.D.,† and Rajiv Sarin, F.R.C.R.*

Departments of *Radiation Oncology, †Clinical Psychology, and ‡Medical Physics, Tata Memorial Centre, Mumbai, India
Optimal conformality
Impacts morbidity

- Left temporal lobe
  - >13% volume receiving > 80% dose (43 Gy)
  - >24% volume receiving > 50% dose (27 Gy)

- Right temporal lobe
  - No significant correlation between dose and drop in IQ

- Normal brain
  - No correlation

- Hippocampus

- RTOG Atlas
- Fuse the 3D-SPGR MRI and the treatment-planning CT
- 5 mm expansion zone
## Conformal Radiation Therapy

<table>
<thead>
<tr>
<th>Technique</th>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 D conformal RT</td>
<td>Widely available, limits dose</td>
<td>Exit dose treats normal tissues</td>
</tr>
<tr>
<td>IMRT</td>
<td>High dose region follows the tumor closely</td>
<td>Considerable low dose to normal brain tissue</td>
</tr>
<tr>
<td>SRT with arc photons</td>
<td>High dose region follows the tumor closely</td>
<td>Exit dose treats normal tissues</td>
</tr>
<tr>
<td>Radiosurgery</td>
<td>Precise delivery</td>
<td>Limitation: single #</td>
</tr>
<tr>
<td>Brachytherapy</td>
<td>Sources inside cavity</td>
<td>Dosimetry less certain</td>
</tr>
<tr>
<td>Proton RT</td>
<td>Holds promise</td>
<td>Expensive</td>
</tr>
<tr>
<td></td>
<td>No exit dose issues</td>
<td>Limited availability</td>
</tr>
</tbody>
</table>
Conformal radiotherapy
Pre treatment Simulation
Conformal Radiation
Child care...
Conformal Radiation
Radiotherapy Chain...
Conformal Radiotherapy
Modalities of Image Fusion

CT
- Bone information
- Limited soft tissue information
- Crux for calculations

MRI
- Soft tissue
- Limited bone information
- Multiplanar
- CBV/ Spectroscopy
- Diffusion/ Perfusion
- Sequences

PET/ SPECT
- Functional
- Response
- Hypoxia marker
- Prognostication

Angiography
- DSA
- CT angio
- MR angio
- Vascular anatomy
Conformal Radiotherapy - Chain

PHYSICAL PATIENT

- CT Room
- Lasers
- Skin markers
- Images
- Bone
- Tumor
- Delineation
- Margin
- Planned beam

TREATMENT PLAN

- Treatment room
- Lasers
- Skin markers
- Bone
- Tumor
- Beam
- Accelerator
- Treatment room

Checked by imaging
Newer Technology
Impact and need

• While much has changed in technology
  – Certain principles remain unchanged
  – Excellent functional outcomes and QOL
  – IQ, Endocrine sparing, Vision, Hearing*

• Pay respect to historical information

• Due deference to controversies
  – Margins can possibly be reduced in certain tumors**

• Cancers are curable, stakes are high
  – Blend of technology and emerging knowledge
  – Improve quality and quantity of the life saved

* Merchant et al IJROBP 2006, 210 - 221
** Merchant et al JCO 2009, 3598 - 3604
Craniopharyngioma

- Benign tumors of epithelial origin
  - Believed to arise from remnants of the Rathke pouch in the suprasellar region
  - <20 yrs
  - 5-15% of primary tumors in children
  - Almost always adamantinomatous

- Treatment
  - one of the most controversial issues in pediatric neuro-oncology
  - Matson's classic 1969 neurosurgical text
  - complete resection in 44 of 57 children
  - 10 of the 44 required more than one surgical procedure to achieve GTR
  - 60% local failure after resections

- Similar numbers were reported in Yasargil's series published two decades ago
- Partial excision+RT: 10 – 33% local failure

- Volume
  - Both cystic and solid component + 5 mm margin
  - 50 – 54 gy @1.8 gy per fractions over 5.5 weeks

Important to monitor the cyst during image guided treatment delivery
Pediatric Image Guided Conformal Radiotherapy
TMC_Overview_demography

- May 2011 – October 2014
  - 135 patients treated
  - 117 evaluable
  - Analyzed: November 2014
- CNS
  - Commonest 53%
- Age
  - 0.5 – 18 years
  - Median: 8 years
- Gender
  - Male: 65% (76)
  - Female: 35% (41)
Pediatric Image Guided Radiotherapy at TMC
Imaging frequency across 117 patients

- Thermoplastic
- Vacuum bag
- Thermoplastic + vacuum bag
- None

IGRT Frequency

Sites

- Brain
- HN
- Thorax
- Abdomen
- Extremity

- None
- Daily
- Biweekly
- Weekly

Thermoplastic
Thermoplastic + vacuum bag
Vacuum bag
None

- Both
- Vol
- Planar
Pediatric Image Guidance
Before we begin

- Concerns?
- Image gently
- Image wisely

- Read the manual
- Closed circuit monitoring
- Planned treatment setup fields and corresponding reference images
  - Image verification system
  - 4D Console running
- Vendor software
  - 2D/2D or
  - 3D/3D matching
- OBI must be calibrated
- ALARA
Current status of pediatric image guidance

Practice patterns of photon and proton pediatric image guided radiation treatment: Results from an International Pediatric Research Consortium


PTV expansions not very different

Prevalent, site specific variability, limited reporting of imaging dose, warrants attention...
Plan your imaging please
Correlation between Previous and New CBCT Modes

<table>
<thead>
<tr>
<th>Previous Mode Name [OBI 1.3]</th>
<th>Present Mode Name [OBI 1.4]</th>
</tr>
</thead>
<tbody>
<tr>
<td>n/a</td>
<td>Low dose head ✔</td>
</tr>
<tr>
<td>Low dose 150 cm Bow tie [Head]</td>
<td>Standard dose head</td>
</tr>
<tr>
<td>Standard dose 150 cm Bow tie [Head]</td>
<td>High quality head</td>
</tr>
<tr>
<td>Standard dose 150 cm Bow tie [Body]</td>
<td>Pelvis</td>
</tr>
<tr>
<td>n/a</td>
<td>Pelvis spot light</td>
</tr>
<tr>
<td>Low dose 150 cm Bow tie [Body]</td>
<td>Low dose thorax ✔</td>
</tr>
</tbody>
</table>

- New CBCT modes *only* calibrated for *either* full fan or half fan acquisition
- All head and pelvis in low dose modes
  - 200 degree gantry rotation [half scan acquisition]
  - Reduces dose
  - Reduces scan acquisition time
## Current status of pediatric image guidance

<table>
<thead>
<tr>
<th>Author</th>
<th>Site</th>
<th>Equipment</th>
<th>Imaging</th>
<th>Errors</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zhu, 1999</td>
<td>Brain (22)</td>
<td>-</td>
<td>Daily port</td>
<td>Head frame &lt; 4mm</td>
<td>? Imaging dose</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Vacuum bag &lt; 4mm</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Beltran, 2010</td>
<td>Brain (15)</td>
<td>Siemens M Vision IBL-MVCBCT 1cGy/scan</td>
<td>MVCBCT Daily pre and post treatment</td>
<td>Intrafraction 0.04mm</td>
<td>Interfraction motion resulted in 0.4% of TCP loss</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Interfraction 0.12mm</td>
<td>NTCP change: &lt; 5%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Panandikar</td>
<td>Abdomen (20)</td>
<td>4DCT</td>
<td>33mGy/scan 400 mA 120KV 0.5-1s</td>
<td>&lt;9 years 5-25mm</td>
<td>age, height diaphragmatic motion</td>
</tr>
<tr>
<td>2012</td>
<td></td>
<td></td>
<td></td>
<td>&gt;9 years 5-52mm</td>
<td></td>
</tr>
</tbody>
</table>

12 studies, reporting use, some comment on imaging dose, most on margins
Pediatric Image Guided Radiotherapy at TMC
Brain as a sub site (n = 45)

<table>
<thead>
<tr>
<th>Direction</th>
<th>Mean (mm)</th>
<th>Systematic Error (Σ)</th>
<th>Random Error (σ)</th>
<th>PTV margin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lateral (mm)</td>
<td>1.18</td>
<td>1.49</td>
<td>0.78</td>
<td>4.29</td>
</tr>
<tr>
<td>Longitudinal (mm)</td>
<td>0.34</td>
<td>0.96</td>
<td>0.76</td>
<td>2.94</td>
</tr>
<tr>
<td>Vertical (mm)</td>
<td>1.14</td>
<td>1.52</td>
<td>0.76</td>
<td>4.34</td>
</tr>
<tr>
<td>Rotation (°)</td>
<td>0.11</td>
<td>0.42</td>
<td>0.77</td>
<td>1.58</td>
</tr>
</tbody>
</table>

**Departmental policy: 5mm PTV*, reposition if rotation > 3 degrees and patience**

<table>
<thead>
<tr>
<th>Shifts</th>
<th>Daily Imaging</th>
<th>Intermittent Imaging</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SE (Σ)</td>
</tr>
<tr>
<td>Lateral (mm)</td>
<td>0.88</td>
<td>1.33</td>
</tr>
<tr>
<td>Longitudinal (mm)</td>
<td>0.42</td>
<td>0.76</td>
</tr>
<tr>
<td>Vertical (mm)</td>
<td>0.89</td>
<td>1.33</td>
</tr>
<tr>
<td>Rotation (°)</td>
<td>0.12</td>
<td>0.28</td>
</tr>
</tbody>
</table>

No significant difference; lesser imaging dose; better optimization of machine time
Remember…. A finite percentage need anesthesia
Conformal Radiation
Clinical examples

12 Y F
Germinoma
Surgery
WVI after CT
IMRT: Tomotherapy
36 mo NED

18 Y M
LGG II
Contra: deaf
IMRT: Tomotherapy
IPSI cochlear sparing
42 mo VGPR
Job in SBI Nagaland
Emerging technology with promise

Proton radiotherapy for pediatric tumors: review of first clinical results
Barbara Rombi**, Sabina Vennari**, Lorenzo Vinante**, Daniele Ravanelli** and Maurizio Amichetti**

Main advantage
Spare intermediate to low dose to healthy tissues

Several centers over the last decade
Benefit in varied tumor sites
Evidence gradually becoming more robust
Expensive, limited availability
When used judiciously
Optimal technology offers more than just treatment
It optimally rehabilitates a child to society

Cognitive Appraisal of childhood cancer and adherence to health advice: A mixed methods prospective study on the interaction of child-parent-doctor triad (CARE study)

Investigators: Dr. Soumitra Shankar Datta, Consultant Child & Adolescent Psychiatrist, Dept of Palliative Care & Psycho-oncology; Dr. Arpita Bhattacharyya, Consultant Paediatric Haematologist; Dr. Rimpa Achari, Consultant Radiation Oncologist; Dr. Mammen Chandy, Consultant Haematologist and Director, Tata Medical Centre, Kolkata