Interstitial Brachytherapy in Cervix - Advancements

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Objectives of the teaching session....

• To understand the concept of ISBT
• To list the Indications of ISBT
• To identify different applicators available
• To know the procedure, plan evaluation
• To understand the benefits with ISBT
Spread of cervical cancer
Very important.....
Intracavitary Brachytherapy

Interstitial Brachytherapy
Indications for ISBT

- Ca Cervix IIB (advanced) & beyond
  - If Partial Response
  - Bulky Parametrial Disease at Brachy
  - Post Op + Parametrium Positive
- Anatomic variations
  - Distorted Geometry (obliterated fornices)
  - Narrow Vagina
  - OS not identifiable/negotiable
- Vault Recurrence
- Reirradiation
Different applicators available
• Syed-Neblette

MUPIT (Martinez Universal Perineal Interstitial Template)
Vaginal mould brachy..impression after EBRT

Vienna Ring..type I and II

Tandem ovoids with freehand needles
Tulip applicators...add on with...

Fletcher  Henschke  Ring  Tulip flowers
Utretcht applicator

Venezia applicator
Selection of the applicator system
Medial third parametrial involvement
Tandem ring with straight needles
Tandem ovoids with freehand
Freehand ISBT
Both para, upto LPW on one side
Para involvement on both sides..
Vault Ca.. straight tandem, obturator with needles.
Vault Cancer with paracolpos..straight tandem, obturator with inner circle on right side on perineal template.
Unilateral paracolpos involved
Tandem/obturator...selective vaginal involvement
Vulva....obturator with additional wires at introitus
Recurrence in vagina
Plan evaluation...
Hyperdose sleeve...should not touch each other as much as possible
Rectum and Bladder evaluation..
**Prescription Dose Rx = 6.50 Gy**

### Plan Quality Indices

<table>
<thead>
<tr>
<th></th>
<th>TR WITHOUT NEEDLES</th>
<th>TR WITH NEEDLES</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (V100)</td>
<td>79.0 %</td>
<td>97.1 %</td>
</tr>
<tr>
<td>2</td>
<td>55.3 %</td>
<td>52.7 %</td>
</tr>
<tr>
<td>COIN</td>
<td>0.436</td>
<td>0.512</td>
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**Total Dose Volume for 6.50 Gray**

<table>
<thead>
<tr>
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<tbody>
<tr>
<td></td>
<td>64.58 cm³</td>
<td>83.52 cm³</td>
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</tbody>
</table>

**hrctv**

**Total Volume = 45.4 cm³, 4692 Control Points**

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<tr>
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<tbody>
<tr>
<td>V90</td>
<td>38.3 cm³ 84.5 Vol%</td>
<td>44.8 cm³ 98.7 Vol%</td>
</tr>
<tr>
<td>V100</td>
<td>35.8 cm³ 79.0 Vol%</td>
<td>44.1 cm³ 97.1 Vol%</td>
</tr>
<tr>
<td>V150</td>
<td>24.4 cm³ 53.9 Vol%</td>
<td>34.2 cm³ 75.4 Vol%</td>
</tr>
<tr>
<td>V200</td>
<td>14.3 cm³ 31.5 Vol%</td>
<td>17.3 cm³ 38.1 Vol%</td>
</tr>
<tr>
<td>D90</td>
<td>5.1 Gy 78.9 %Rx</td>
<td>8.1 Gy 124.5 %Rx</td>
</tr>
<tr>
<td>D98</td>
<td>3.9 Gy 60.3 %Rx</td>
<td>6.2 Gy 95.1 %Rx</td>
</tr>
<tr>
<td>D100</td>
<td>2.7 Gy 41.9 %Rx</td>
<td>4.4 Gy 68.3 %Rx</td>
</tr>
</tbody>
</table>

**bladder**

**Reference Volume = 97.9 cm³, 4746 Control Points**

<table>
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<tr>
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<tbody>
<tr>
<td>D2ccm³</td>
<td>4.6 Gy 61.6 %Rx</td>
<td>4.6 Gy 61.7 %Rx</td>
</tr>
</tbody>
</table>

**rectum**

**Reference Volume = 46.9 cm³, 4976 Control Points**

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<tr>
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<th>TR WITHOUT NEEDLES</th>
<th>TR WITH NEEDLES</th>
</tr>
</thead>
<tbody>
<tr>
<td>D2ccm³</td>
<td>2.7 Gy 41.6 %Rx</td>
<td>2.7 Gy 41.6 %Rx</td>
</tr>
</tbody>
</table>
ISBT Execution
Our data..2020,JCB,(70 pts)

- LC ..87% at 2 yrs
  - D90 ..70-86 Gy
  - D2cc rectum...64 Gy
  - D2 cc sigmoid ..48 Gy
  - D2cc bladder ..70 Gy
### Results for ISBT

**Table 4. Comparison of EQD$_2$ and local control**

<table>
<thead>
<tr>
<th>Study (no. of patients)</th>
<th>Total dose EBRT + BT</th>
<th>$D_{90}$ CTV$_{HR}$ [Gy]</th>
<th>Bladder $D_{2cm^3}$ [Gy]</th>
<th>Rectum $D_{2cm^3}$ [Gy]</th>
<th>Local control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Murakami et al. [3] (209)</td>
<td>50 Gy + 6 Gy × 4 fractions</td>
<td>74.2</td>
<td>71.0</td>
<td>67.5</td>
<td>87.8% at 3 years</td>
</tr>
<tr>
<td>Kannan et al. [5] (47)</td>
<td>45 Gy + 3.75-5 Gy × 5 fractions</td>
<td>70-79</td>
<td>70.83</td>
<td>65.79</td>
<td>61% at 2 years</td>
</tr>
<tr>
<td>Lee et al. [20] (68)</td>
<td>45 Gy + 3.9 Gy × 7 fractions</td>
<td>73.6</td>
<td>67.1</td>
<td>64.6</td>
<td>86% at 2 years</td>
</tr>
<tr>
<td>Souza et al. [24] (47)</td>
<td>45 Gy + 4.6 × 4 fractions or 9.2 Gy × 2</td>
<td>70.2</td>
<td>61.6</td>
<td>63.2</td>
<td>68% at 3 years</td>
</tr>
<tr>
<td>Villalba et al. [25]</td>
<td>50 Gy + 4 Gy × 6 fractions</td>
<td>75.8</td>
<td>79.8</td>
<td>75.3</td>
<td>88% at 3 years</td>
</tr>
<tr>
<td>CT (34)</td>
<td></td>
<td>78.6</td>
<td>77.1</td>
<td>69.90</td>
<td></td>
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<tr>
<td>MRI (25)</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bailleux et al. [27]</td>
<td>46 Gy + 7 Gy × 3 fractions</td>
<td>82.9</td>
<td>76.8</td>
<td>66.4</td>
<td>86.8% at 2 years</td>
</tr>
<tr>
<td>CT (16)</td>
<td></td>
<td>84.8</td>
<td>74.5</td>
<td>64.3</td>
<td></td>
</tr>
<tr>
<td>MRI (17)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Present study (70)</td>
<td>45 Gy + 6.5 Gy × 4 fractions</td>
<td>77</td>
<td>70</td>
<td>64</td>
<td>87.14% at 2 years</td>
</tr>
</tbody>
</table>

*EQD$_2$ – equivalent dose in 2 Gy, CT – computed tomography, MRI – magnetic resonance imaging, CTV$_{HR}$ – high-risk clinical target volume, $D_{2cm^3}$ – dose received by 2 cm$^3$ volume, $D_{90}$ – dose received by 90% of the volume*
To Summarise....

- ISBT effectively covers all types of targets for cervical cancer
- Delivers minimal dose to rectum, bladder, Sigmoid
- Applicators have seen tremendous improvement over the years and are patient friendly
- Computerised plans permit quick planning and evaluation
- All the above have resulted in better therapeutic ratio

- We at our place do train doctors for ISBT with cadaveric practice to overcome inhibition to do ISBT.
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Thank You .....happy learning.....