Image-guided brachytherapy for cervix cancer at Norfolk & Norwich University Hospital (NNUH)

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BACKGROUND:
- Standard treatment for locally advanced cervix cancer consists of concomitant external beam radiotherapy (EBRT) and cisplatin-based chemotherapy followed by brachytherapy.
- In response to guidance published by GEC-ESTRO in 2005-2006, conventional brachytherapy has been superseded by 3D image-guided brachytherapy (IGBT), enabling greater dose conformity and improved local tumour control.
- NNUH implemented IGBT in 2007 using CT planning and tandem-ovoid applicators.

AIMS:
1. Assess quality of IGBT practice at NNUH against RCR guidance.
2. Compare outcomes of patients treated with IGBT at NNUH versus Vienna, a leading IGBT centre in Europe.

STANDARDS | TARGETS
---|---
**PRACTICE** | • Equivalent dose in 2Gy fractions (EQD2) to 90% of the high-risk clinical target volume (HR-CTV D90) to be ≥75Gy.
  • EQD2 to the most exposed 2cc (D2cc) of organ at risk (OAR) to be ≤95Gy for bladder, ≤75Gy for rectum, ≤75Gy for sigmoid.
  • Overall treatment time to be ≤50 days.
  • 100% of cases meeting each standard.

**OUTCOMES** | • Local tumour control rates for tumours ≤5cm and >5cm to be comparable to Vienna.
  • Actuarial 3-year rates within 10% of Vienna figures.

METHODS:
- Retrospective audit of patients with locally advanced cervix cancer who received IGBT at NNUH during the period 2007-2013.
- Data collected from patient clinical records and radiotherapy physics departmental database.

PRACTICE

OUTCOMES

PATIENT CHARACTERISTICS 2007-2013:
- Median age 49 (range 22-79).
- 80% squamous cell carcinoma, 16% adenocarcinoma, 4% mixed.
- 55% of tumours ≤5cm and 45% >5cm at diagnosis.
- 51% pelvic lymph node-positive and 49% node-negative at diagnosis.
- 5% FIGO stage IB, 2% FIGO stage IIA, 73% FIGO stage IIB, 15% FIGO stage IIB, and 5% FIGO stage IVA.
- All received EBRT, either 45Gy/25# (89%) or 50.4Gy/28# (11%). 98% received concomitant cisplatin chemotherapy.
- All followed up for a minimum of 12 months.

RESULTS: PRACTICE

<table>
<thead>
<tr>
<th></th>
<th>HR-CTV D90 ≥75Gy</th>
<th>Bladder D2cc ≤95Gy</th>
<th>Rectum D2cc ≤75Gy</th>
<th>Sigmoid D2cc ≤75Gy</th>
<th>Overall treatment time ≤50 days</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st audit 2010</td>
<td>67%</td>
<td>100%</td>
<td>100%</td>
<td>90%</td>
<td>29%</td>
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<tr>
<td>ACTIONS TAKEN</td>
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<td>MRI planning introduced in September 2010</td>
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<td>Tandem-ring applicators introduced in October 2010</td>
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<td>Interstitial needles introduced for selected cases in June 2013</td>
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<td>3-day procedure introduced in July 2012</td>
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</table>

RESULTS: OUTCOMES

**LOCAL CONTROL RATES**

<table>
<thead>
<tr>
<th></th>
<th>TUMOURS ≤5cm</th>
<th>TUMOURS &gt;5cm</th>
<th>ALL TUMOURS</th>
</tr>
</thead>
<tbody>
<tr>
<td>NNUH: ACTUARIAL 3-YEAR LOCAL CONTROL RATE</td>
<td>93%</td>
<td>80%</td>
<td>87%</td>
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<tr>
<td>VIENNA: ACTUARIAL 3-YEAR LOCAL CONTROL RATE</td>
<td>98%</td>
<td>92%</td>
<td>95%</td>
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CONCLUSIONS:
**PRACTICE:**
- Improvements in performance against all standards have been observed at NNUH as a result of actions taken between 1st audit 2010 and re-audit 2014.
- Possible contributory factors include:
  - Lower HR-CTV D90s achieved at NNUH (mean 82Gy ± standard deviation 8Gy) compared to Vienna (mean 93Gy ± standard deviation 13Gy), reflecting difference between RCR guidance (minimum D90 ≥75Gy) and GEC-ESTRO guidance (minimum D90 ≥85Gy).
  - Interstitial needles used in fewer cases at NNUH (5%) than Vienna (44%).

**ACTION PLAN:**
- Implement strategies to improve dose delivery and distribution particularly to tumours >5cm e.g. greater use of interstitial needles and measurement of EQD2 dose to 98% of HR-CTV (HR-CTV D90) as well as HR-CTV D90.
- Identify persisting factors contributing to treatment delays.
- Re-audit practice and outcomes in 2016.

REFERENCES:
4. The role and development of afterloading brachytherapy services in the United Kingdom. London: The Royal College of Radiologists.