

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

L Harihar, RJ Wade, D Biswas, V Currie

Colney Centre, Norfolk & Norwich University Hospital, Colney Lane, Norwich NR4 7UY

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- In response to guidance published by GEC-ESTRO in 2005-2006^{1,2}, conventional brachytherapy has been superseded by 3D image-guided brachytherapy (IGBT), enabling greater dose conformity and improved local tumour control.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:

- Assess quality of IGBT practice at NNUH against RCR guidance^{3,4}.
- Compare outcomes of patients treated with IGBT at NNUH versus Vienna⁵, a leading IGBT centre in Europe.

STANDARDS

PRACTICE^{3,4}

- Equivalent dose in 2Gy fractions (EQD2) to 90% of the high-risk clinical target volume (HR-CTV D90) to be $\geq 75\text{Gy}$.
- EQD2 to the most exposed 2cc (D2cc) of organ at risk (OAR) to be $\leq 95\text{Gy}$ for bladder, $\leq 75\text{Gy}$ for rectum, $\leq 75\text{Gy}$ for sigmoid.
- Overall treatment time to be ≤ 50 days.

OUTCOMES⁵

- Local tumour control rates for tumours $\leq 5\text{cm}$ and $>5\text{cm}$ to be comparable to Vienna.

TARGETS

- 100% of cases meeting each standard.

- 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

- 1st audit 2010: 24 patients treated between January 2007 and May 2010.
- Re-audit 2014: 31 patients treated between June 2010 and December 2013.

OUTCOMES

- Audit 2014: 55 patients treated between January 2007 and December 2013.

PATIENT CHARACTERISTICS 2007-2013:

- Median age 49 (range 22-79).
- 80% squamous cell carcinoma, 16% adenocarcinoma, 4% mixed.
- 55% of tumours $\leq 5\text{cm}$ and 45% $>5\text{cm}$ 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 IIIB 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.

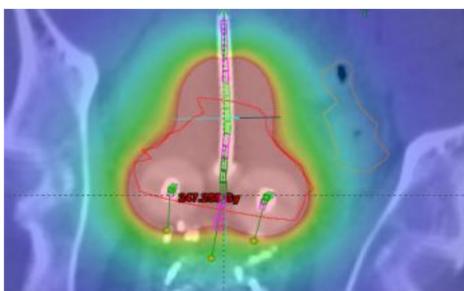


Figure 1: Example of dose distribution on planning CT using tandem-ovoid applicator.

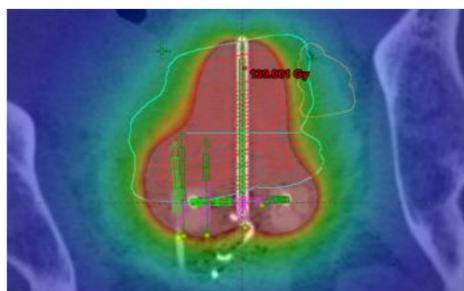


Figure 2: Example of dose distribution on planning MRI using tandem-ring applicator and interstitial needles.

RESULTS: PRACTICE

	HR-CTV D90 $\geq 75\text{Gy}$	Bladder D2cc $\leq 95\text{Gy}$	Rectum D2cc $\leq 75\text{Gy}$	Sigmoid D2cc $\leq 75\text{Gy}$	Overall treatment time ≤ 50 days
1st AUDIT 2010	67%	100%	100%	90%	29%
ACTIONS TAKEN	<ul style="list-style-type: none"> MRI planning introduced in September 2010 Tandem-ring applicators introduced in October 2010 Interstitial needles introduced for selected cases in June 2013 				3-day procedure* introduced in July 2012
RE-AUDIT 2014	97%	100%	100%	100%	68%

*Main treatment delays during 1st audit occurred between outpatient IGBT fractions; therefore pathway created for IGBT delivery over 3-day inpatient admission.

RESULTS: OUTCOMES

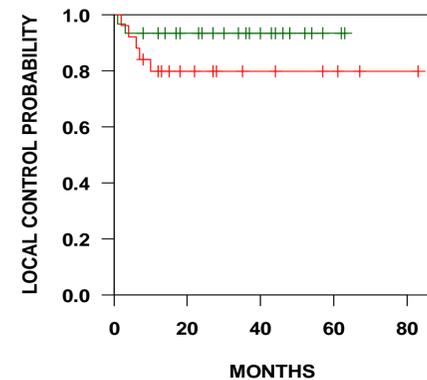


Figure 3: Kaplan-Meier curve of probability of local tumour control against follow-up time in months.

--- Tumours $\leq 5\text{cm}$ (n=30)
--- Tumours $>5\text{cm}$ (n=25)

Logrank test: p=0.16

	TUMOURS $\leq 5\text{cm}$	TUMOURS $>5\text{cm}$	ALL TUMOURS
NNUH: ACTUARIAL 3-YEAR LOCAL CONTROL RATE	93%	80%	87%
VIENNA: ACTUARIAL 3-YEAR LOCAL CONTROL RATE⁵	98%	92%	95%

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.

OUTCOMES:

- Local tumour control rates at NNUH are comparable to Vienna for small tumours, but not as good for large tumours.
- Possible contributory factors include:
 - Lower HR-CTV D90s achieved at NNUH (mean 82Gy \pm standard deviation 8Gy) compared to Vienna (mean 93Gy \pm standard deviation 13Gy), reflecting difference between RCR guidance (minimum D90 $\geq 75\text{Gy}$) and GEC-ESTRO guidance (minimum D90 $\geq 85\text{Gy}$).
 - 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 $>5\text{cm}$ e.g. greater use of interstitial needles and measurement of EQD2 dose to 98% of HR-CTV (HR-CTV D98) as well as HR-CTV D90.
- Identify persisting factors contributing to treatment delays.
- Re-audit practice and outcomes in 2016.

REFERENCES:

- Haie-Meder C et al. Radiother Oncol. 2005;74(3):235-45.
- Potter R et al. Radiother Oncol. 2006;78(1):67-77.
- Implementing image-guided brachytherapy for cervix cancer in the United Kingdom. London: The Royal College of Radiologists, 2009.
- The role and development of afterloading brachytherapy services in the United Kingdom. London: The Royal College of Radiologists, 2012.
- Potter R et al. Radiother Oncol. 2011;100(1):116-23.