

# Intra Operative Radiotherapy News *In Tayside*



September 2005

Intraoperative Radiotherapy News

Issue 1



Welcome to the inaugural Intra Operative Radiotherapy (IORT) Newsletter.

The first IORT treatment was performed on 6th June 2004 and there have been a total of 28 patients treated since then, 15 with breast and 13 with brain cancer. Currently three different operating theatres have been assessed by Radiation Health and Safety and have been passed for the safe use of IORT.

We would welcome any comments, enquiries or questions.

The people to contact are:

[Caroline Ackland](#) or [Kris Armoogum](#)



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## What is IORT?

In general terms, intraoperative radiotherapy is a method by which radiotherapy treatment is delivered as a single, high dose in the operating theatre immediately after surgical resection of a tumour. The equivalence of using a single dose is borne out by the fact that the radiobiological effectiveness (RBE) of the PRS (Photon Radio Surgery) system is between 1.2 and 2.5. That is, the approximate physical IORT dose can be multiplied by a factor of 2.5 to determine the biologic effects. Funded by the Ninewells Hospital Cancer Campaign, Ninewells Hospital recently acquired four Zeiss Intrabeam™ Intraoperative Radiotherapy (IORT) treatment systems.



## Who is it suitable for?

We are currently treating patients with breast or brain cancer. Individual suitability and there are certain patient criteria to be met. Your oncologist is best placed to decide whether you are suitable for IORT.



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## What types of cancer do we treat with IORT?

We are currently treating breast and brain cancers. We are also investigating the feasibility of treating colorectal cancer and possibly cancers of the upper gastrointestinal (GI) tract.

## Why IORT instead of conventional radiotherapy?

IORT allows your cancer to be treated at one visit compared to up to 35 visits to hospital for external beam radiotherapy, with less/no side effects compared to external beam radiotherapy.

## The IORT Team

The key members of an effective IORT team include the surgeon, radiation oncologist, medical physicist, anaesthetist, nursing staff and pathologist. Although the basic concept of IORT is simple, the complexity arises where professionals from many different disciplines are involved in collaborative working. IORT requires a high level of coordination and an IORT nurse coordinator is invaluable. 



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## IORT Equipment

The Intrabeam™ System is a portable x-ray generator capable of delivering, during the surgical procedure, a prescribed therapeutic radiation dose directly to the tumour bed. The device itself weighs 1.62 kg, has dimensions 17.5 x 11 x 7 cm with a 3.2 x 100 mm long chromium nitride coated probe. The X-ray source (XRS) is powered by a portable, electronic control console. The PRS is supplied with a set of components, which facilitate accurate positioning of the XRS probe as well as quality assurance checks.



These x-ray sources generate very low energy x-rays, up to 50kV, and the dose fall off is rapid, ( $\sim 1/r^3$ ). The beam is accelerated through a high-voltage field (range 30-50 KV in 10 KV increments) and then passes through a deflection chamber to control beam position and thus assure beam straightness. The beam current is selectable (5, 10 20 and 40  $\mu$ A). After travelling down the evacuated, magnetically shielded probe, the electron beam strikes a thin gold target (1  $\mu$ m) at the probe tip producing x-ray photons whose mean effective

energies are typically in the 5-20 keV range. The distal 20 mm of the probe is fabricated from beryllium (0.5  $\mu$ m), which is transparent to very low energy x-ray photons.

The x-rays are emitted from the tip in a spherical symmetrical pattern resulting in a dose rate in tissue of approximately 120 Gy per hour at 10 mm from the probe tip. During treatment delivery, the entire probe is enclosed by a conical sheath at the end of which is a spherical applicator made of polyetherimide (C37H24O6N2). This has a glass transition temperature of 216°C, a density of 1.27 g.cm<sup>-3</sup> and is biocompatible. A range of applicator sizes, from 1.5 to 5.0 cm, is available for various sizes of tumour bed.

## IORT for Breast Cancer

The past 20 years have seen a distinct shift in the approach used in the treatment of breast cancer, away from radical interventions toward more conservative techniques. Randomised clinical trials have shown that breast conserving surgery allied to external beam radiotherapy compares favourably with more radical procedures such as mastectomy. However, the radiation fields still encompass all of the breast tissue - healthy and cancerous. Intraoperative radiotherapy avoids unnecessary treatment to the whole breast and delivers a critical dose to the tumour bed only.



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## IORT for Invasive Intracranial Malignancies



Intracerebral metastases are common and occur in up to 15% of cancer patients. The survival rates for malignant intracranial tumours are only about 7.5% at 2 years. Resection followed by postoperative radiation benefits patients with a solitary brain metastasis and no systemic disease. Post-operative radiotherapy is generally applied only once due to the limiting factors of brain tolerance and the detrimental nature of radiation.

The majority of relapses occur locally indicating that a more radical local treatment may have a higher probability of success. We have treated 12 patients with the Intrabeam™ system using highly focused x-ray beams centred onto a small volume of tumour. It has been found to be useful to give higher doses of radiation to tumours while minimising the dose to surrounding normal tissues. Patients diagnosed with intracranial primary or single secondary malignant tumours are considered for IORT.



## IORT for Colorectal Cancer

Bowel cancer, also known as colorectal cancer, is the third most common cancer in men, and the second most common cancer in women in the UK. Each year, there are 18,500 new cases of bowel cancer in men, and over 16,000 cases in women. Bowel cancer can occur anywhere in the colon or rectum (back passage). Cells lining the inside of the bowel are constantly dying and being replaced. A cancer arises when this process of renewal goes wrong. These abnormal cells can form a polyp and develop into cancer. If the cancer is not treated, cells can break away and spread to other parts of the body, often to the liver.

A feasibility study into treating rectal cancer using IORT is in progress at Ninewells Hospital.

## Patient Information Sheets

A link to patient info sheets will be placed here.

## Conferences and Meetings

[8th Biennial ESTRO Meeting on Physics and Radiation Technology for Clinical Radiotherapy \(Sept 2005, Lisbon\)](#)

[IPEM Annual Scientific Meeting \(Sept 2005, Glasgow\)](#)

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## Public Access

Public access to this Newsletter is via:

<http://www.medicalphysicist.co.uk/>

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