

# Development of an Integrated Subspecialist Multidisciplinary Neuro-oncology Service

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## Abstract

Traditionally, the poor outcome for patients with malignant brain tumours led to therapeutic nihilism. In turn, this resulted in lack of interest in neurosurgical oncology subspecialisation, and less than ideal patient pathways. One problem of concern was the low rate of tumour resection.

Between 1997 and 2006, 685 treated glioblastomas were identified. In the first four years only 40% of patients underwent tumour resection, rising to 55% in the last four years. Before revision of the pathway, the median length of hospital stay was 8 days, and 35% of patients received the results of their histology outside of a clinic setting.

A pathway of care was established, in which all patients were discussed pre-operatively in an MDT meeting and then directed into a new surgical neuro-oncology clinic providing first point of contact. This limited the number of surgeons operating on adult glioma patients and aided recruitment into research studies.

Now, three consultant neurosurgeons run this service, easily fulfilling IOG requirement to spend >50% of programmed activities in neuro-oncology. Nursing support has been critical to provide an integrated service. This model has allowed increased recruitment to clinical trials.

The introduction of this service led to an increase in patients discussed pre-operatively in an MDT (66% rising to 87%;  $P=0.027$ ), an increase in the rate of surgical resection (from 40% to 80%) and more patients being admitted electively (from 25% to 80%;  $P<0.001$ ). There was a reduction in the median length of stay (8 days reduced to 4.5 days;  $P<0.001$ ). For the cohort of GBM patients that went on to have chemoradiotherapy we improved median survival to 18 months, with 35% of patients alive at two years, comparable to international outcomes.

Implementing a specialist neurosurgical oncology service begins with understanding the patient care pathway. Our patients have benefitted from the culture of subspecialisation and the excellent inter-disciplinary working relationships that have been developed.

## Problem

Until about 7 years ago, the poor outcome for patients with malignant brain tumours, predominantly glioblastoma (GBM), meant that therapeutic nihilism pervaded the management of brain tumour patients in the United Kingdom. Radical resection of tumours was inevitably followed by recurrence within the resection bed, despite post-operative adjuvant therapy. This led to generations of surgeons questioning the role of glioma resection (1). As a result, the surgical management of brain tumours was considered part of general neurosurgery and subspecialised services for managing these patients were poorly developed.

Cambridge was no different from the rest of the United Kingdom. Patients were admitted to the neurosurgical unit as an emergency under the care of the on-call consultant who then decided on their management. This made treatment variable and dependent on the day the patient presented. Patients were often kept in the referring hospital until operating slots were available, and were therefore kept for a long time as inpatients. They were often transferred for neurosurgery late in the evening and only had the opportunity to discuss the operation on the morning of surgery. There was a lack of information for the patient and their family. Regularly, patients with resectable tumours were offered a tumour biopsy to make a

diagnosis. They were often kept in hospital until a histological report was ready and told of their diagnosis on the ward. The lack of interest also led to lack of recruitment to clinical trials. Overall care was consultant-centred rather than patient-centred.

## Background

The variation in practice and low levels of tumour resection were a concern to the clinical oncologists managing these patients. This was further highlighted by the EORTC/NCIN study in which 80% of patients had a tumour resected, setting the standard of clinical care for glioblastomas (2).

Although common in the USA and in parts of Europe since the early 1990s, subspecialisation in neurosurgical oncology was rare in the UK. There were a couple of subspecialists, usually with an academic interest, who were virtually always single handed and could manage only some of the patients in their region. Subspecialisation in surgical oncology had been shown to improve outcome in both breast and colonic cancer (3, 4) and also in paediatric brain tumours (5). Similar data does not exist in adult brain tumours. In fact, a single centre study from Edinburgh showed no improvement in survival in patients treated by a single-handed specialist neurosurgical oncologist (6).

## Baseline Measurement

All data in our study was obtained retrospectively from the Eastern Cancer Registration and Information Centre (ECRIC) database and from the MDT database. Between 1997 and 2006 685 glioblastomas were treated. In the first four years of this period only 40% of patients underwent tumour resection. This increased to 55% in the last four years. By 2006, before these changes had been made, the median length of stay was 8 days, and 35% of patients received the results of their histology outwith a clinic setting. The median time between imaging showing a tumour and the post-operative MDT meeting was 23 days, most of which were spent in hospital.

## Design

It was clear that to improve consistency of management it would be necessary to limit the number of surgeons operating on adult glioma patients. The key to this was to establish a pathway of care in which all patients were discussed pre-operatively in an MDT meeting and then directed into the surgical neuro-oncology service. An outpatient surgical neuro-oncology clinic was set up as a first point of specialist contact and to aid recruitment into research studies. Support from oncology colleagues provided the pressure to ensure patients were managed in this way and strengthened links between neurosurgery and oncology within the Anglian Cancer Network. The changes in the process of care allowed us to better counsel patients and their families and provide them with appropriate information throughout the patient journey.

Our major concern was how other neurosurgical consultants would accept such a proposal. Most were happy to allow oncology patients to be managed in this way. A few were not and would block attempts to change practice. For that reason we set about change by 'evolution' rather than 'revolution'. We needed to demonstrate that we could provide 'added value' for patient care. The publication of the Improved Outcomes Guidelines in Brain Tumours in June 2006 provided justification and support this development (7).

## Strategy

Some baseline changes were made in the previous 10 years that provided the environment required to allow the neuro-oncology service to develop. In the mid 1990's Cambridge started to move toward subspecialisation within neurosurgery – earlier than many other units. Consultants with interests in pituitary tumours, paediatric neurosurgery, skull base tumours, neurovascular surgery and complex spinal surgery were appointed and were able to clearly show the value of providing specialised services to patient care. The second change was the development of a neuro-oncology MDT, was prompted by the publication of the Calman-Hine report (8) and NHS Cancer Plan produced in 2000 (9). The purpose of the MDT meeting was to ensure patients were treated in multidisciplinary teams according to recognised guidelines (10). This started in 2000 but did not discuss all patients – especially at the time of presentation. The publication of the Improving Outcomes Guidance (IOG) in 2006 was a major driver for changing and

enhancing MDT working. It also introduced the controversial requirement for surgeons treating these patients to be subspecialists, spending more than 50% of their programmed activities in neurosurgical oncology. This was used as a major driver and justification for service reconfiguration. Videoconferencing these MDT meetings between the neurosurgical and oncology teams (based at Addenbrooke's Hospital in Cambridge) and our two regional oncology centres (at Ipswich Hospital and the Norfolk and Norwich University Hospital) has developed closer links between the three centres.

In 2006 a specialist neuro-oncology clinic was set up on alternate weeks, in the afternoon following the MDT meeting. Initially established to aid recruitment to research studies, patients were soon directed to this clinic to facilitate their clinical care. A number of neurosurgical consultants were keen for patients referred under their care to be managed by this service. The growth of this service led to this clinic being run weekly and the appointment of a clinical lead for surgical neuro-oncology in September 2007 and an additional neurosurgeon with a subspecialist interest in April 2008. The three consultants running this service and clinic fulfil the IOG requirement for spending >50% of programmed activities in neuro-oncology.

The referral pathway initially allowed for other consultants to retain neuro-oncology patients, but over time the numbers dropped, as this was seen to be outside the normal pathway, until 2008 when all malignant tumours were brought into this service. The development of awake surgery and intra-operative stimulation brain mapping, the use of intra-operative carmustine wafers and 5-aminolevulinic acid (5-ALA)-guidance to maximise the degree of surgical resection of these tumours all confirmed the need for subspecialisation.

Nursing support has been critical to provide an integrated service. The surgical neuro-oncology service is supported by a clinical nurse specialist and a clinical nurse practitioner who act as key workers for these patients. They work closely with clinical nurse specialists in oncology in the three Cancer Centres (Addenbrooke's, Ipswich and Norfolk and Norwich Hospitals). These specialist nurses provide information to patients, can help signpost patients to relevant rehabilitation/supportive services, and act as point of contact to the service. Over time each unit has put together a library of information for patients so they are kept informed at all stages on the treatment pathway.

One major advantage we found from the reconfigured service was the provision of access to patients for research. When patients were admitted as an emergency there was insufficient time to obtain informed consent for research and give patients sufficient time to think about participation. This was a major limitation to surgical/pre-operative research. Reviewing patients pre-operatively the MDT meeting can highlight potential patients who could be approached in the surgical neuro-oncology clinic. Patients then have at least a week to think about participating in these studies. This model has allowed an increased recruitment to clinical trials and the development of new studies such as an NIHR-funded observational study of tumour invasion (MALTINGS study, UKCRN 8596) as well as innovative Phase I trials examining questions such as

penetration of a hypoxia-targeting prodrug into GBM (11) or the safety of combining 5-ALA guided fluorescence resection with intraoperative local delivery of chemotherapy (carmustine wafers) funded by Cancer Research UK/Samantha Dickson Brain Tumour Trust (GALA-5; CRUK/10/009). This has been presented as a platform for developing surgical research (figure 1) (12).

Introduction of day of surgery admission (DOSA) and the opening of a DOSA unit in 2011 lead to the need to pre-admit patients. This has provided another opportunity to discuss the operation with patients and answer questions. It also provides opportunity to consent to clinical trials and has further reduced length of stay.

## Results

The full results of this intervention have been described in detail previously (11). In summary we compared the results of a six-month period in 2006 before the introduction of the service and two time points after the introduction in 2008 and 2009. Our analysis showed that the introduction of this service has led to an increase in patients discussed pre-operatively in an MDT (66% rising to 87%;  $P=0.027$ ), an increase in the rate of surgical resection (from 40% to 80%) and more patients being admitted electively (from 25% to 80%;  $P<0.001$ ). There was a reduction in the median length of stay (8 days reduced to 4.5 days;  $P<0.001$ ). Patients were now told their diagnosis in the private surroundings of a clinic room (up to 100% from 65% in 2006;  $P<0.001$ ). The total time from diagnostic imaging to post-operative MDT remained unchanged (median = 23 days) showing that this system had not introduced delays.

For the cohort of GBM patients with the best prognostic factors who went on to have chemoradiotherapy, median survival was 18 months, with 35% of patients alive at two years. These figures are comparable with the EORTC/NCIN study (2) and show how service reconfiguration can optimise patient care leading to improved clinical outcomes in a routine setting that are similar to those in a clinical trial.

See supplementary file: ds1932.jpg - "FIGURE - pathway"

## Lessons and Limitations

From our experiences we have learnt that implementing a specialist neurosurgical oncology service begins with understanding the patient care pathway. Our experience shows that very few of these patients need to be in hospital once they have had appropriate investigations and have been medically stabilised. Patients and their families prefer to stay out of hospital and welcome the idea of being managed as an outpatient. Patients who require in-patient care and are too unwell to be seen as an outpatient rarely have a good enough performance status to consider aggressive therapy, and often best served with supportive care.

Moving to an outpatient-based practice we have shown a reduced length of stay together with reduced treatment costs. In 2006 the median cost of in-patient care was £2096 reducing to £1316 in 2009 after our service reconfiguration.. This extra money has been used

in Cambridge to reinvest in patient care. It helps to fund 5-ALA-guided surgery, which improves the extent of resection, which has been demonstrated to improve survival in this patient group.

## Conclusion

It is clear that our service and our patients have benefited from subspecialisation. This means that most glioblastoma patients are now treated by a dedicated surgical neuro-oncology service. Demonstrating 'added value' in the form of specialist surgical techniques and volume and quality of clinical research has ensured that the service has continued to evolve. One major factor that has ensured success of this process is the excellent inter-disciplinary working relationships that have developed.

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## Declaration of interests

Nothing to declare

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