

## Improvements in Quality of Care Resulting From a Formal Multidisciplinary Tumour Clinic in the Management of High-grade Glioma

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### Abstract

**Introduction:** There is increasing belief that a formal protocol-based multidisciplinary care model should be adopted as an optimal care model in oncology. However, there is minimal outcome evidence to demonstrate an improvement in patient care. The aim of this study was to compare clinical quality outcomes between patients with high-grade glioma managed at one hospital using a formal neuro-oncology multidisciplinary tumour clinic (MTC) and a second hospital with a traditional on-call referral pattern (non-MTC). **Materials and Methods:** Patients with high-grade glioma managed radically with radiation therapy at 2 Singapore hospitals from May 2002 to May 2006 were entered into a prospective database. Patients were grouped into management via MTC or non-MTC. Four clinical quality indicators were chosen retrospectively to assess the variation in practice: a) Use of computed tomography (CT) or magnetic resonance (MR) imaging post-resection (POI) for assessment of residual disease; b) Commencement of radiation therapy (RT) within 28 days of surgery; c) Adjuvant chemotherapy use for glioblastoma multiforme (CTGBM) and d) Median survival. **Results:** Sixty-seven patients were managed radically, with 47 by MTC and by 20 by non-MTC. MTC patients were more likely to have POI ( $P = 0.042$ ), and CTGBM ( $P = 0.025$ ). Although the RT start time was similar for the whole cohort (60% versus 45%:  $P = 0.296$ ); for GBM patients, the RT start was earlier (63% vs 33%  $P = 0.024$ ). The median survival for the MTC group was 18.7 months versus 11.9 months for the non-MTC group ( $P = 0.11$ ). **Conclusion:** Clinical quality outcomes were significantly improved in patients with high-grade glioma managed in this neuro-oncology MTC.

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### Introduction

Multidisciplinary care has now been established as the optimal management principle for the majority of malignancies.<sup>1,2</sup> However, the model of multidisciplinary care, specifically the role of a formal multidisciplinary tumour clinic (MTC), remains unestablished outside of breast cancer care.<sup>2</sup> There is minimal evidence to quantitatively assess the potential benefits of this resource intensive service.<sup>3-5</sup>

In early 2003, a MTC specialising in neuro-oncology was established at the National Neuroscience Institute, following collaboration between a neurosurgeon, radiation oncologist, neuro-oncologist, neuroradiologist and clinical

nurse specialist. This formal clinic has been conducted on a fortnightly basis since January 2003, reviewing all new cases of central nervous system (CNS) malignancy diagnosed on the campus. As The Cancer Institute (TCI) provides radiation oncology services for 4 major Singaporean restructured hospitals (National University Hospital, Tan Tock Seng Hospital, National Neuroscience Institute and Alexandra Hospital), this allows a comparison to be made between care patterns of patients managed under a MTC format against those managed in a standard pattern of referral. This study reviews the potential impact of a MTC approach on the management of patients diagnosed with high-grade glioma.

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## Materials and Methods

The study is a retrospective review of patients diagnosed with CNS tumours, who have been entered into a prospective database at the Department of Radiation Oncology of TCI since May 2002.

### Patient Eligibility

Patients were included in the analysis if diagnosed with a high-grade glioma (WHO III and IV) and managed with radical intent with radiation therapy at TCI between May 2002 and May 2006. If management was via the Neuro-Oncology MTC then this was retrospectively recorded on the database, thus creating 2 main groups of patients for the analysis (MTC and non-MTC). For the hospital in which patients were managed by standard referral patterns (non-MTC), there was no specific subspecialisation and no discussion at a tumour board meeting.

The details of patients managed in these groups are outlined in Table 1. Data collected included patient, tumour and treatment-related factors. Performance status was defined as per the Eastern Co-operative Group (ECOG) scale. Type of surgery was determined from the surgical report and grouped as biopsy, subtotal and near total or gross total resection. Re-operation included any intracranial procedure performed within 30 days of initial surgery. Postoperative complication referred to any tumour or surgical-related effect that led to prolonged hospitalisation of more than 14 days.

### Principles of High-grade Glioma Management

Eight surgeons provided neurosurgical care at the participating hospitals over the time period of the study. 2 neurosurgeons attended the MTC clinic on a regular basis,

though at the MTC hospital all patients from other surgeons were presented. No formal written surgical protocols were present, though principles of preoperative MRI imaging and attempted gross total or near total resection of tumours in non-eloquent areas were evident.

Radiation therapy (RT) was uniformly provided by 1 radiation oncologist for the majority of patients across all centres, and this clinician attended the MTC. Written departmental RT protocols were present for glioma management, and all patients were treated by three dimensional (3D) conformal megavoltage RT.

Chemotherapy management was provided by a team of 2 neuro-oncologists at the MTC hospital, while at other hospitals the care was provided by the general medical oncology service with no CNS subspecialisation. The role of adjuvant chemotherapy was influenced by the meta-analysis suggesting a benefit of adjuvant chemotherapy in high-grade glioma and the European multicentre Phase II and III studies demonstrating a benefit with temozolomide in glioblastoma multiforme (GBM).<sup>6-8</sup>

### Structure of the MTC

The MTC is conducted on a fortnightly basis and involves new and routine follow-up patient consultations. The duration is 3 hours, though the initial hour involves a joint chart and imaging review of all patients booked into the clinic. In attendance are all the 3 specialty clinician groups, as well as neuroradiologist, clinical nurse specialist and clinic manager. This joint discussion also allows for protocol development, research initiatives and literature updates. For the remaining 2 hours, patients are seen by the relevant clinician(s) for their individual care, with the support team coordinating care. Other aspects of the MTC include email forums regarding patient care issues, a patient support group and continuing medical education (CME) forums.

### Endpoints of Patient Quality Care

Three clinical quality indicators were chosen to assess clinical pathway outcomes from each of the 3 specialty teams involved in patient management. Each of the

Table 1. Clinical Characteristics of the Patients with High-grade Glioma (n = 67)

	Total group	MTC (n = 47)	Non-MTC (n = 20)	
Age <55 years	55%	55%	55%	P = 0.59
Gender Male	62%	57%	70%	P = 0.25
“Private” financial status	25%	21%	35%	P = 0.36
ECOG PS 0,1	48%	40%	65%	P = 0.67
Pathology				
WHO 3	39%	38%	40%	
WHO 4	61%	62%	60%	P = 0.55
Tumour size <5cm	51%	51%	50%	P = 0.57
Gross or near total resection	42%	40%	45%	P = 0.64
Reoperation	6%	6%	5%	P = 0.65
Postoperative complication	27%	32%	15%	P = 0.36

ECOG: Eastern Co-operative Group; MTC: multidisciplinary tumour clinic

Table 2. Clinical Quality Indicator Outcomes for Patients Managed Under the MTC and Non-MTC Groups

	Total group	MTC	Non-MTC	
Postoperative imaging	77%	85%	59%	P = 0.042
Time from surgery to RT				
Median (days)	28	27	30	
All start <28 days	55%	60%	45%	P = 0.296
GBM start <28 days	61%	72%	33%	P = 0.024
Chemotherapy use in GBM	44%	55%	17%	P = 0.025

GBM: glioblastoma multiforme; MTC: multidisciplinary tumour clinic; RT: radiation therapy

indicators is based on clinical evidence to suggest that implementation may be related to improved patient outcome. A survival endpoint was also chosen for assessment of outcome.

1. Use of postoperative CT or MRI imaging within 5 days for all patients managed with attempted resection.<sup>9,10</sup>
2. Time in days from surgical procedure to commencement of RT.<sup>11</sup>
3. Use of adjuvant chemotherapy in WHO Grade IV glioma.<sup>8</sup>
4. Median survival.

#### Statistical Methods

Patient data were entered into a Microsoft Access database and analysed using SPSS v12.0. The association of patient, tumour and treatment variables with the clinical quality endpoints was analysed by Chi-square tests. The median survival was calculated using the Kaplan-Meier method, with the effect of MTC analysed by log rank test.<sup>12</sup>

#### Results

Sixty-seven adult patients with high-grade glioma were managed with radical intent at TCI radiation oncology during the study period. Forty-seven patients were managed in the MTC and 20 outside the MTC structure. Patient details in both groups are outlined in Table 1. The median follow-up of the total group was 10.5 months, while for surviving patients it was 11.1 months (2.1 to 45.7). The majority of the patients had pathology categorised as WHO Grade IV or GBM (41 patients or 61% of study group). The remainder were categorised as WHO Grade III pathology, principally anaplastic astrocytoma or anaplastic oligodendroglioma. The patient characteristics between the MTC and non-MTC study groups were equivalent (Table 1).

#### Use of Postoperative Imaging

Fifty-two patients were managed with attempted radical resection and were thus eligible for assessment of residual disease by postoperative imaging. Eighty-six per cent of MTC patients had imaging performed in the first 5 postoperative days compared to 59% of non-MTC patients ( $P = 0.042$ ).

#### Time From Surgery to Commencement of RT (Table 2)

The median time from surgery to commencement of RT was 28 days (range, 13 to 59) for the total patient group. In the MTC group, 60% commenced RT within 28 days compared to 45% of those in the non-MTC group ( $P = 0.29$ ). There were no differences in the characteristics of patients receiving RT earlier with regard to age, financial status, ECOG, postoperative complication rate or re-operation. For the patient group with GBM, more patients

in the MTC group commenced RT within 28 days compared to those in the non-MTC group (63% versus 33%;  $P = 0.024$ ).

#### Use of Adjuvant Chemotherapy in GBM

For patients with WHO Grade IV glioma, 55% of MTC patients received adjuvant temozolomide therapy compared to 17% of non-MTC patients ( $P = 0.025$ ). The patient characteristics of those who received chemotherapy were equivalent to those receiving RT alone with regard to age ( $P = 0.210$ ), financial status ( $P = 0.147$ ) and type of surgery ( $P = 0.417$ ). However, the chemotherapy patients had better ECOG performance status ( $P = 0.051$ ), with 56% being ECOG 0 or 1 versus 44% of patients not receiving chemotherapy.

#### Median Survival

The median survival of the total study population was 17.2 months with no significant difference between the two groups (Fig. 1). The median survival for the MTC group was 18.7 months versus 11.9 months for the non-MTC group ( $P = 0.11$ ). For the 41 patients with GBM, the respective median survivals were 16.4 and 12.8 months ( $P = 0.29$ ).

#### Discussion

This study demonstrates that a formalised multidisciplinary clinic structure in neuro-oncology is associated with improvements in specific measurable aspects of quality of care. This may result from an improved co-ordination of patient care, clinical protocols, team-related communication or simply motivated specialised clinicians involved in the MTC. This study cannot determine whether the benefit in quality of care is specifically related to the MTC structure or subspecialisation by clinicians. However, the benefit of coordinated multidisciplinary case management may be inferred from the results.

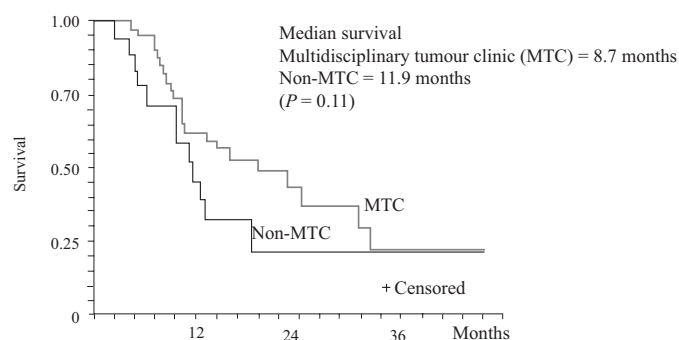


Fig. 1. Median survival of patient groups – MTC ( $n = 47$ ) and non-MTC ( $n = 20$ ).

As the measurable clinical quality indicators chosen had an evidence base reflecting improved cancer control, it is therefore hoped that these improvements will result in optimal patient outcomes. Similarly, there are other quality endpoints such as patient satisfaction, that may arise from a MTC management structure which are either immeasurable or beyond assessment in this patient cohort.

Internationally, multidisciplinary care teams in cancer management have been recommended as an optimal method to improve efficiency and quality of cancer care.<sup>3</sup> Although the model of multidisciplinary care may differ between cancer units, general principles exist which define this approach.<sup>4</sup>

1. Specialists work together in teams to make consensus recommendations regarding the options for care of patients.
2. Optimal management is recommended in accordance with guidelines and standard protocols endorsed or developed by the site-specific clinical team.
3. A regular tumour board, case conference or clinic is undertaken to discuss individual patient management.
4. The team collects appropriate clinical information for audit purposes.

An ideal MTC model would capture all patients diagnosed with a particular cancer to be registered onto a prospective database, managed under set protocols with standardised methods of follow-up to allow outcomes to be assessed prospectively. This formal MTC could then expand to include not only clinicians related directly to patient diagnosis or care, but also integrate with members of supportive care services, allied health teams and the research community.

Formal MTCs have a potential role in the management of specific malignancies, though it is in the care of patients with breast malignancy that the structure has been most accepted.<sup>4,5</sup> Multidisciplinary care is considered the optimal care pathway for breast cancer, but there has been minimal short-term data to provide some quantitative evidence of the benefit.<sup>3</sup> This becomes relevant for funding bodies as the MTC often will require a patient care coordinator (either clinical nurse specialist or clerical staff), a dedicated clinic site and specialist clinician manpower hours. Long-term changes in patient outcomes, such as locoregional control or survival, may be assessed only years after its introduction; however, it will be difficult to quantitatively measure the direct contribution of the MTC to the benefit. Examples in literature are few and often relate to increasing subspecialisation effects rather than to a formal MTC. A Scottish study compared the survival of female breast cancer patients who had been treated by specialist and non-specialist teams and reported that the 5-year survival rate was 9% higher and the 10-year survival rate was 8% higher

for patients cared for by specialist surgeons.<sup>13</sup> Thus, in the absence of specific cancer outcome measures, clinical quality indicators may be chosen as surrogates for patient care benefits.

The clinical quality indicators used in this study were selected because of an established evidence base relating to cancer outcome. The surgical clinical quality indicator (CQI) of postoperative imaging within 5 days was chosen not only because it excludes the presence of postoperative complications, but also because the determination of residual tumour after a resection provides prognostic information and a baseline to guide response to further therapy.<sup>10</sup> Consistent studies have demonstrated a survival advantage in the group of patients who have a macroscopic (or >90%) resection, and in accessible regions of the brain the postoperative imaging may guide whether there is a need for immediate re-operation.<sup>9</sup> One of the key features of the neuro-oncology MTC structure is that the neuroradiologist attends to carefully detail of the postoperative imaging in comparison to the initial imaging. The subsequent multidisciplinary discussion allows the attending neurosurgeon to appreciate the potential benefit of the postoperative imaging for the other speciality teams; and thus influence the individual neurosurgeon's practice to perform this investigation routinely in subsequent patients. This quality initiative allows the surgeon to assess whether the extent of resection has been optimal, and also provides the radiation oncologist detailed information as to the target volume that is to be covered. Follow-up imaging is directly compared to the postoperative imaging, as areas of residual disease may be more likely to be enhanced in the initial period following adjuvant RT.<sup>14</sup> The utilisation of MR spectroscopy may further enhance this assessment, although further data are still required to determine how much further information this provides to a standard gadolinium enhanced MRI.<sup>15-17</sup>

A delay in commencement of adjuvant RT after surgery has been demonstrated to have an impact on median survival. In this study, the risk of death increased by 2% for each day of waiting for radiotherapy.<sup>11</sup> This is hypothesised to relate to tumour repopulation that is known to occur in tumours with short doubling times such as in the larynx and cervix, and would be consistent in GBM. One of the advantages demonstrated by the improved co-ordination of care in the MTC model in breast cancer practice has been a reduction in treatment delays, either resulting from knowledge of treatment protocols, improved communication pathways or the presence of the clinic coordinator.<sup>3</sup> The reduction in delay demonstrated in the neuro-oncology model may even have more biological impact than breast cancer, given the pathological features of GBM.

The third CQI chosen involved the use of adjuvant

chemotherapy in patients with GBM, which has been demonstrated to increase median and 2-year survival in the large EORTC trial.<sup>8</sup> The MTC model allowed a focus for patients to receive a clear explanation of the role of chemotherapy, not only from the neuro-oncologist involved, but also from all members of the medical team and the clinic nurse coordinator. The joint discussions at the MTC allow for a regular forum to update members of the experiences of patients being managed. Similarly, the MTC also allows a CME programme to be facilitated to improve members knowledge base regarding the other subspecialties. Chemotherapy usage, specifically temozolomide, has not only logistical issues regarding the integration with RT, but also poses a financial burden on the patient. The specialised delivery under the MTC model allows these issues to be reduced, thus potentially increasing the utilisation of chemotherapy, as demonstrated in this data.

The above CQIs demonstrate a potential measurable improvement over patient care, which may lead to longer-term outcome benefits. These can be considered in formulating a business model for development funding of a MTC. However, the MTC may also produce improvements in care which are less measurable, but still quite apparent in patient care. Patient satisfaction can be enhanced because of the MTC model of joint patient review at one site, minimisation of investigations being duplicated, presence of a central site for care coordination and presence of specialised support services.<sup>3,18</sup> Clinicians may see the benefits in communication pathways being optimised, the presence of protocol-based treatment delivery, and a focal point for CME, audit and research activities. It can enhance opportunities for role development, an example being the presence of the interactive neuroradiologist, a role that cannot be achieved by teleradiology services.<sup>19</sup>

A disadvantage, however, is the need for clinician commitment to a regular timetabled clinic in a condition in which the patient volume may be low. If expanded to multiple MTC subspecialty clinics, manpower funding issues will be more significant to the overall health system. This could be viewed negatively. However, the subspecialty commitment may allow healthcare providers to develop new opportunities for patient care as well as new funding models. If the potential clinical quality improvements are consistent with this study, and coordination of care allows more convenience, then patient groups may be attracted to this model of care despite an initially higher charge for the service.

## Conclusion

This MTC model in neuro-oncology care provided potential measurable advantages in clinical quality delivery over a more standard on-call referral system. Despite

potential increased clinician commitment and care coordinator funding, a formal centralised MTC model of care delivery may result in clinical quality improvements in other small subspecialty sites.

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