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TOPIC REVIEW

The role of tumor board conferences in neuro-oncology: a nationwide provider survey

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Abstract The tumor board or multidisciplinary cancer meeting (MCM) is the foundation of high value multidisciplinary oncology care, coordinating teams of specialists. Little is known on how these meetings are implemented in Neuro-oncology. Benefits of MCMs include coordination, direction for complicated cases, education, and a forum for communication, emerging technology, and clinical trials. This study identifies participation and utilization of neuro-oncology MCMs. A cross-sectional descriptive survey was dispersed through an internet questionnaire. The Society of Neuro-Oncology and the American Brain Tumor Association provided a list of dedicated neuro-oncology centers. All National Cancer Institute designated centers, and participants in the Adult Brain Tumor Consortium or the Brain Tumor Trials Collaborative were included, identifying 85 centers. Discussion included primary brain tumors (100%), challenging cases (98%), recurrent disease (96%), neoplastic spine disease (93%), metastatic brain lesions (89%), pre-surgical cases (82%), pathology (76%), and paraneoplastic disease (40%). MCMs were composed of neuro-oncologists, neurosurgeons, and radiation oncologists (100%), radiologists (98%), pathologists (96%), and clinical trial participants (64%). Individual preparation ranged from 15 to 300 min. MCMs were valued for clinical decision making (94%), education (89%), and access to clinical trials (69%). 13% documented MCMs in the medical record. 38% of centers used a molecular tumor board; however, many commented with uncertainty as to how this is defined. Neuro-oncology MCMs at leading U.S. institutions demonstrate congruity of core disciplines, cases discussed, and perceived value. We identified variability in preparation time and implementation of MCM recommendations. There is high uncertainty as to the definition and application of a molecular tumor board.

Keywords Glioma · Tumor board · Neuro-oncology · Oncology · Decision making · Multidisciplinary cancer meeting

Introduction

The management of patients with cancer involving the central and peripheral nervous system is complex requiring a coordinated team of specialists. The neuro-oncology tumor board is the foundation of coordinated specialized neuro-oncology care; however, little is known on how these meetings are structured or implemented. Multidisciplinary teams (MDTs) including healthcare disciplines essential to the care of a specified condition are the model of care for cancer management in much of the world [1]. Coordinated patient care is implemented through a multidisciplinary clinic setting or multidisciplinary cancer meeting (MCM) commonly referred to as a tumor board [2]. The American Society of Clinical Oncology (ASCO), the National Cancer Institute (NCI), and the European Society of Medical Oncology (ESMO) have identified MDTs as a cornerstone of high-quality cancer care [3, 4]. MCMs are a requirement by the American College of Surgeons Commission on Cancer (COC), Cancer Program Standards. As more than

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1500 cancer centers in the US are accredited by COC, this quality metric is of high importance [5]. COC accreditation requires 15% of all cases to be discussed at an MCM, and 80% of those discussions for prospective decision making [6]. MCM is the established best practice in cancer care in the United States and many countries throughout the world [1, 7, 8].

MCMs typically consist of medical oncologists, surgeons with specialty training, radiation oncologists, a nurse coordinator, and other healthcare providers such as social work and clinical trial representatives. Benefits of MCMs include efficient coordination of multiple providers, direction for complicated cases, open communication among care teams, education, increased adherence to published guidelines, and clinical trial access [9–12]. MCMs also provide the patient and caregiver with psychological well-being and reassurance that the treatment is reviewed by a group of specialists [13]. Increased utilization of molecular, genetic, and proteomic data in treatment decision making adds to the complexity of care [14]. MCMs have been used as a forum to review the application of emerging technology and therapeutics as well as to screen for clinical trial participation [15].

The full impact of MCMs on care decisions remains understudied and therefore is unclear. Research into the direct influence of MCMs on patient outcomes is difficult: Historical control studies are of limited value due to the continual progression of therapies and technology, and randomized studies are not feasible. Studies that investigate patient outcomes after implementation of MCMs often include multiple other changes to the implementation of patient management and are of limited interpretation. The impact of MCMs on management decisions is best illustrated in the breast cancer literature [16, 17]. Newman et al. reviewed the impact of MCMs on 149 breast cancer patients referred from external institutions and identified a change in surgical management in 52% of cases (77 of 149), with a 32% change in surgical management based solely on adherence to published guidelines [16]. Keating et al. reviewed the impact of MCMs on colorectal, lung, prostate, hematologic, and breast cancers diagnosed from 2001 to 2005 in 138 Veterans Affairs medical centers and did not identify significant improvement in adherence to published guidelines or overall survival [18]. Further investigation is needed regarding the impact of MCM composition, documentation, post-meeting communication, and institutional support as related to outcome measures [19].

Efforts are underway internationally to better understand models of multidisciplinary management and improve their function [11]. MCMs are particularly valuable in neuro-oncologic diseases as there are limited approved therapies or treatment guidelines. The goal of this study is to identify participation and utilization of neuro-oncology MCMs. To our knowledge, there are no publications describing the pattern of neuro-oncology MCM practice. In understanding how neuro-oncology MCMs are structured at leading academic institutions across the United States, we can improve current practice.

Methods

A cross-sectional descriptive survey design was used to collect data through an online-based questionnaire of neuro-oncology multidisciplinary care teams. We contacted 85 physicians identified to have leadership roles in neuro-oncology tumor board meetings at their respective institutions. Neuro-oncology centers were identified by contacting the Society of Neuro-Oncology and the American Brain Tumor Association. All NCI-designated cancer centers and institutions belonging to the NCI-funded Adult Brain Tumor Consortium (ABTC) or the Brain Tumor Trials Collaborative (BTTC) were invited to complete the survey. Study data were collected and managed using REDCap electronic data capture tools (Research Electronic Data Capture), a secure, web-based application designed to support data capture for research studies [20]. Three email invitations with a link to an internet-based survey open between November 18, 2015 and February 3, 2016 were sent to the physician director of each institution's brain tumor center. The study was approved by the Henry Ford Hospital Institutional Review Board.

The questionnaire

The instrument used for this study was an ad hoc online survey to assess neuro-oncology MCM implementation and practice. The questionnaire was created by the investigators after a comprehensive literature review and thorough discussion. The survey was vetted internally. After extensive review, 25 multiple-choice questions were agreed on with emphasis on demographics, type and number of cases presented, participation burden, and practitioner-perceived value of neuro-oncology MCMs.

Results

Of the 85 invited centers, 45 (54%) completed this study. One institution declined to participate stating they meet intermittently and do not have regularly scheduled tumor boards. To be considered an eligible response all survey questions had to be answered. Of the respondents, 84% were from a neurology background, 13% from medical oncology, and 2% from radiation oncology. Of the practice models, 36% reported an NCI-designated setting, 29% were from teaching hospitals, 24% were from University Hospitals, and 7% from private practice models; however, there is likely overlap in practice setting.

Institutions were invited to provide multiple answers regarding the tumor type reviewed, cases discussed, and the disciplines in attendance and case volume at MCMs (Table 1).

Some institutions delegated a 'director' of the tumor board, whereas others allowed individuals to present cases. Participant roles at MCMs included the disciplines presenting cases, the presentation of imaging, and whether pathology slides were presented. The inclusion of a molecular tumor board was assessed (Table 2). Only five centers had an individual presenting all MCM cases, with four of these five centers led by a neuro-oncologist.

Table 1 Tumor Board survey results: demographics and survey results of Tumor Board

Variable	Response	N = 45
Diagnoses reviewed	Primary brain tumors	45 (100%)
	Metastatic brain lesions	40 (89%)
	Spine (primary and metastatic)	42 (93%)
	Paraneoplastic	18 (40%)
	Non-CNS disease	7 (16%)
	Other	7 (16%)
Cases discussed	Not yet diagnosed/pre-surgical	37 (82%)
	Recurrent disease	43 (96%)
	Challenging cases	44 (98%)
	Radiology review	40 (89%)
	Stable patients	9 (20%)
	Other	8 (18%)
Disciplines in attendance	Neuro-oncology	45 (100%)
	Neurosurgery	45 (100%)
	Radiation oncology	45 (100%)
	Radiology	44 (98%)
	Pathology	43 (96%)
	Fellows, residents, students	42 (93%)
	Clinical trials team	29 (64%)
	Geneticist	6 (13%)
	Behavioral health	4 (9%)
	Social work	4 (9%)
	Other*	8 (18%)
Frequency of tumor board meetings	Weekly	36 (80%)
	Bi-monthly	6 (13%)
	Monthly	2 (4%)
	Twice per week	1 (2%)
Number of active participants	11–15	15 (33%)
	16–20	12 (27%)
	21–25	6 (13%)
	26–30	2 (4%)
	31–35	1 (2%)
	40+	1 (2%)
Average volume of cases discussed	1–5	6 (13%)
	6–10	17 (38%)
	11–15	13 (29%)
	16–20	6 (13%)
	21–25	1 (2%)
	26–30	2 (4%)

*Nursing, mid-level providers, neuropsychology, neuro-ophthalmology, administration, and pediatric disciplines

Table 2 Tumor Board survey results: participant roles

Variable	Response	N = 45
Disciplines presenting cases	Neuro-oncology	43 (96%)
	Medical oncology	20 (44%)
	Neurosurgery	37 (82%)
	Radiation oncology	32 (71%)
	Radiology	4 (9%)
	Pathology	4 (9%)
	Fellows and residents	27 (60%)
	Other	3 (7%)
Who presents the patient's imaging (MRI, CT, PET)?	Neuro-oncology	8 (18%)
	Neurosurgery	6 (13%)
	Radiation oncology	4 (9%)
	Radiology	43 (96%)
	Residents and students	1 (2%)
	Other	0 (0%)
Pathology slides presented	Yes	34 (76%)
Use of molecular tumor board	Yes	17 (38%)

Eighty percent of tumor boards met weekly, with 13% meeting bi-monthly and less than 5% meeting at other intervals. Centers who met weekly (n = 36) were compared to centers who met less frequently for time spent in tumor board preparation, duration of tumor board, and number of participants. The differences between weekly and other intervals for these measures were not significant. Table 3 details the participation of satellite centers, duration of tumor board, individual preparation time for MCMs, organization of cases to be presented, and MCM follow-up. The association between the centers' weekly volume and the number of cases reviewed at tumor board was not significant (r = 0.11, p = 0.46, Spearman correlation coefficient).

Ninety-four percent of centers strongly agreed or agreed that tumor board is valuable in clinical decision making, with 7% neither agreeing nor disagreeing. When asked the perceived value of tumor board as a conduit for clinical trial access, 69% reported either strongly agreed or agreed, while 24% did not agree or disagreed. Eight-seven percent of institutions reported the education of fellows, residents, and students as a value point.

Table 3 Tumor Board survey results: resources and organization

Variable	Response	N = 45
Duration of Tumor Board	30 min	1 (2%)
	60 min	29 (64%)
	90 min	11 (24%)
	120 min	4 (9%)
Time typically spent in preparation	15 min	18 (40%)
	30 min	8 (18%)
	1 h	7 (16%)
	2 h	4 (9%)
	3 h	1 (2%)
	4 h	2 (4%)
	5+ h	2 (4%)
	Other	3 (7%)
Satellite center participation	No	29 (64%)
	Yes, affiliated satellite locations	11 (24%)
	Yes, outside institutions	2 (4%)
	Yes, video conferencing is used	6 (13%)
	Other comments	7 (16%)
Organization of cases to be presented	Electronic medical record	6 (13%)
	Independent database or form	12 (27%)
	Care team responsibility	21 (47%)
	Other	6 (13%)
Follow-up action after tumor board	Tumor board notes in medical record	19 (42%)
	Physician contact with patient	38 (84%)
	Contact by RN coordinator	23 (51%)
	Contact by clinical trials team	15 (33%)
	Contact by medical assistant	6 (13%)
	No further contact from the board	3 (7%)

When asked "Do you use a molecular tumor board," 38% of centers reported yes. Records from tumor board are the responsibility of the care team presenting the case at 7% of sites. 13% of centers record tumor board information in the Electronic Medical Record, and 27% have an independent database.

Discussion

MCMs in neuro-oncology demonstrate homogeneity of core member participation, cases discussed, and that members clearly perceive them as valuable. We identified variability in preparation time, method of recording recommendations, and high uncertainty as to the definition and application of a molecular tumor board. Understanding the key components of a tumor board will lay the foundation to improve current practice patterns.

Neuro-oncology MCMs discussed primary brain tumors (100%), neoplastic spine disease (93%), and metastatic central nervous system lesions (93%), at multiple points in the disease process, with little variation. Less than half of MCMs reviewed paraneoplastic conditions (40%). Discussions emphasized surgical planning (82%), radiology interpretation (89%), challenging cases (96%), and recurrent disease management (96%).

A primary objective of the survey is to identify core specialties present at neuro-oncology MCMs and establish a standard of attendance for a complete tumor board. There is broad consensus that neuro-oncology tumor boards always include a neuro-oncologist, neurosurgeon, radiation oncologist, radiologist, and pathologist. The majority of MCMs have participation from a clinical trials team (64%) as well as fellows, residents, and students (93%). Groups that are rarely represented include geneticists 13%, behavioral health 9%, and social work 9%. Nursing participation questions were not included in the survey; however, 13% of institutions commented that nursing staff and advance practice providers participate in MCMs. Further study into the role of nursing in MCM and group dynamics (i.e., how MCMs are managed, member opportunity to provide input, and non-physician participation) is needed. A systematic review by Lamb et al. found tumor boards with active nursing participation were more likely to incorporate the patient's function and treatment wishes into decision making, as opposed to groups without nursing input whose recommendations closely reflect biomedical data [8]. When nursing input is included, MCMs are perceived as higher value by MCM members [8]. MCM discussions without clear understanding of the patient's clinical status have been identified as a limitation to a successful and efficient MCM, resulting in repeat discussions and reduced recommendation adherence [8]. A cornerstone of a functioning MCM and an effective team is the ability of all participants to voice their opinion in a safe and conscientious environment [21].

Imaging studies such as magnetic resonance imaging, positron emission tomography, and computed tomography were presented by radiologists in 96% of institutions and less frequently by neuro-oncologists (18%), neurosurgeons (13%), or radiation oncologists (9%). Interpretation of imaging studies in neuro-oncology has become increasing complex with dedicated guidelines for neuro-oncology and most recently immunotherapy treatment regimens [22]. With immunotherapy, anti-angiogenic agents, and viral based therapies, imaging interpretation often requires insight of applied treatments [22].

Neuro-Oncology MCMs at participating institutions reviewed in-system cases 64% of the time; however, many expressed a willingness to review outside cases. Twenty-four percent allowed affiliated satellite centers to participate, 13% utilized video conferencing, and only 4% allowed non-affiliated participation. All centers invited to take this survey participate in clinical trials. Limited access for external providers to participate in the meeting may reflect the proprietary nature of clinical trials and investigational therapeutics. Closed MCM discussions do not necessarily reflect an accessibility barrier if there is opportunity to submit external cases for review and recommendations are made to the referring providers. One respondent commented, "anyone is allowed to submit cases for review, free of charge."

No consistent method of organizing patients to be discussed at MCMs or record of recommendations was identified in this survey. Of the centers surveyed, only 13% recorded MCM information into the electronic medical record. Forty-seven percent of institutions designated MCM documentation to the individual presenting the case. Ideally, MCM providers are able to seamlessly transfer care throughout stages of disease from diagnosis to end of life or survivorship [12]. Many clinicians that play an integral role in the patient's management, such as primary care physicians, referring community oncologists, and behavioral health specialists, are unable to attend the meetings. Without clear documentation of the challenges and recommendations presented at MCMs, key providers in the care continuum are left uninformed. Further, documenting the cases to be reviewed at MCMs may provide an opportunity to prepare for the discussion and improve efficiency of the meeting. Participation in MCMs establishes a medicolegal responsibility by the providers present for the recommendations made in their area of expertise [23]. Without documentation for the entire care team to review, the added value of education and communication are lost.

Simply meeting is not enough to improve quality of care [12, 24]. The editorial by Douglas Blayney suggests that feedback loops and follow-up action must be incorporated into the MCM rubric for an effective meeting. It is essential that members are comfortable providing input and know their opinion is valued. Professional and organizational support may influence MCM function and efficacy [18, 25]. An effective MCM is a dynamic entity requiring communication between provider and patient in the context of an institutional culture of multidisciplinary support [12].

We found dramatic variability in the time spent preparing for MCMs. For these meetings to be effective providers must be available to participate and have time to prepare [8, 25]. Tumor boards have evolved from retrospective case reviews for the education of house officers into the prospective multidisciplinary meetings we know today [12, 26]. MCMs should be accessible with the ability to add patients to the discussion, share patient history, and record recommendations [25]. Protected time to participate and prepare for MCMs improves efficiency and the quality of the meeting. The time spent by individual respondents in preparation for MCMs varied from 15 min (40%) to more than 5 h (4%). Time spent at tumor board is of significant direct financial cost with limited data available supporting increased revenue or clinic efficiency associated with MCM [27]. A correlation between dedicated time to prepare for MCMs and outcome as measured by adherence to recommendations or frequency of cases that require repeat presentation is worthy of further investigation.

Several institutions reported the importance of molecular and genetic data in MCM decision making; however, how to incorporate this data is unclear. Many clinical trials include molecular data as inclusion criteria and the 2016 World Health Organization glioma tumor classification integrates molecular data into diagnosis [28]. Respondents were asked if they utilize a molecular tumor board. The definition of a molecular tumor board was frequently met with uncertainty. Several centers acknowledged the integral value of molecular data for treatment decisions; however, most denied a distinct molecular tumor board. Establishing a definition and implementation strategy for a dedicated molecular tumor board is of value. Further investigation is needed to (1) define a molecular tumor board, (2) understand the current extent disease-state-specific molecular data is utilized in treatment decisions, (3) provide consensus recommendations for molecular data utilization in neuro-oncology MCMs, and (4) identify key cases for a dedicated molecular tumor board. We found unanimous support for MCMs as a valuable entity. The benefits of MCMs in the literature irrespective of disease state include coordination of care, management direction for complicated cases, open communication amongst providers, access to clinical trials, medical education, and psychological well-being of provider and patient [29]. This data is in line with the majority of literature supporting MCMs as a value-added component to a comprehensive center. Isolating appropriate patient outcome measures as a direct effect of MCM participation is difficult. Prospective trials are not feasible and would defy current cancer center practice guidelines [6].

Several limitations to this survey should be acknowledged. Only centers with established avenues for neuro-oncology care were included. Significant geographic and resource limitations exist for patients with neuro-oncologic disease. Multiple states did not have an identified cancer center that met the required criteria to participate. Seventy-three percent of respondents were of primary neurology training, whereas many neuro-oncology patients in the community setting are primarily cared for by medical oncologists and neurosurgeons. Further investigation is warranted to assess the decision-making influence of MCMs when the participation of core members is limited. The efficacy of MCMs in the community setting may be significantly different and was not assessed in this survey.

Conclusions

MCMs or tumor boards are commonly used in the management of neuro-oncology patients. Our results demonstrate homogeneity of MCM core member participation (neuro-oncology), cases discussed, and perceived value of the meeting. We identified marked variability in preparation time, method of recording recommendations, and high uncertainty as to the definition and application of a molecular tumor board. Clarification as to the current practice of multidisciplinary care in neuro-oncology is needed to develop solutions for MCMs lacking key members and in resource-limited settings. Further study into neuro-oncology tumor board implementation and management at non-academic centers, the role and impact of nurses, the integration of molecular data, and the effects on patient outcome is of importance.

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Compliance with ethical standards

Conflict of interest Dr. Walbert serves on the advisory board of Novocure.

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