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Role of surgery in brain metastases

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Abstract

Brain metastases remain the commonest type of brain tumour, being four times more common than primary brain tumours. Although surgical intervention may be recommended for one of various reasons in the management of these tumours, including but not limited to conformation of diagnosis, relief of mass effect, improvement of neurological status and prolongation of survival, the guidelines for management of brain metastases remain largely subjective and therefore controversial. Herein the authors have attempted to review some of the existing evidence on role of surgery in the management of brain metastases and have presented their selected guidelines for the readers.

Keywords: Brain metastasis, Microsurgery, Radiosurgery, Whole brain radiotherapy.

Introduction

Treatment strategies for brain metastases depend on several factors. Some patients may be candidates for whole brain radiotherapy (WBRT), while others may require surgical resection followed by WBRT or local radiation therapy. Stereotactic radiosurgery (SRS) has added another dimension to the management of these lesions. Surgery has a definite role in management as in select cases it provides or confirms diagnosis, relieves intracranial mass effect, improves symptoms, and may also improve survival, all with low morbidity and mortality rates.[1] It is generally agreed upon, that to benefit from surgical intervention, a patient with brain metastases must have reasonable medical fitness, with a systemic disease process amenable to benefit from local central nervous system (CNS) tumour control.[2] The objective of this review is to discuss the role of surgery in the treatment of brain metastases. Although there is substantial literature on this topic, the authors have mentioned few key articles only.

Review of Evidence

At a time when surgery was not considered an option for management of brain metastases, MacGee et al., reported better quality of life and survival after surgical resection of solitary or single lung metastasis.[3] Patchell et al., in one of the most cited papers on this topic, reported longer median survival (40 vs. 15 weeks) after surgical resection with radiation therapy (XRT) of single metastasis compared to XRT alone.[4] Similar results were also reported by Sause et al, in a retrospective review with longer survival in the patients having surgical resection and XRT compared to XRT alone in solitary brain metastasis.[5] Swayaet al., in another landmark paper, also concluded that surgery was superior to SRS in prolonging life, with better local control of the disease.[6] Muacevic et al., in their retrospective review of management of solitary metastasis of less than 3.5 cm diameter concluded that result of surgery with WBRT is comparable to SRS in local tumour control rate.[7] Zacet et al, reported results of 20-years experience of surgical management of brain

Table: Management recommendations for patients with brain metastases.

Consider systemic therapy when:
1. BM from highly chemotherapy-sensitive PT
2. BM found on screening MRI with planned systemic treatment
3. BM from PT with identified molecular alteration amenable to targeted therapy
4. Other therapeutic options have been exhausted and there is a reasonable drug available
Consider WBRT when:
1. CNS and systemic POD, with few systemic treatment options and poor PS
2. Multiple (> 3-10)* BMs, especially if PT known to be radiotherapy sensitive
3. Large (> 4 cm) BM, not amenable to SRS
4. Postsurgical resection of a dominant BM with multiple (> 3-10)* remaining BMs
5. Salvage therapy for recurrent BM after SRS or WBRT failure
Consider SRS when:
1. OM (1-3) or multiple BMs,* especially if PT is known to be radiotherapy resistant
2. Postsurgical resection of a single BM, especially if $\geq$ 3 cm and in the posterior fossa
3. Local relapse after surgical resection of a single BM
4. Salvage therapy for recurrent OM (1-3)* after WBRT
Consider surgical resection when:
1. Uncertain diagnosis of CNS lesion(s)
2. 1-2 BMs, especially when associated with extensive cerebral edema
3. Dominant BM in a critical location
No treatment is recommended when:
1. Systemic POD, with few treatment options and poor PS

Abbreviations: BM: brain metastases; MRI: magnetic resonance imaging; OM: oligometastases; POD: progression of disease; PS: performance status; PT: primary tumor; SRS: stereotactic radiosurgery; WBRT: whole-brain radiation therapy.

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metastases from melanoma and concluded that surgical resection along with WBRT improved survival and quality of life in these patients.[8] However other authors such as Neill et al.,[9] have argued that for single brain metastasis of different cancers like lung, genitourinary, gastrointestinal and melanoma, surgical resection compared to SRS followed by low dose WBRT, does not improve survival. Yoo et al.[10] report results of 'microscopic total resection' compared with 'gross resection', describing 'total resection' as extension of resection to a depth of 5-mm after gross resection and confirming tumour free limits by frozen section. This is only possible in non-eloquent areas. They compared 43 patients with another group of 51 patients with eloquent-situated brain metastases who underwent conventional gross-total resection. The two-year recurrence rates were 63.2% and 29.1% favouring the microscopic total resection group ($p< 0.003$) Shimony et al.,[11] in their recent article, have reported earlier resolution of peri-tumoural oedema with surgery compared to SRS, resulting in earlier improvement in symptoms and reduction of steroid use Lin X et al.,[12] have published their recommendations on clinical decision-making in treatment of brain metastases. These recommendations are based on an extensive literature review and we find them well balanced (Table-1).

Conclusion

The authors conclude that for certain patients with brain metastases; surgical resection is a useful option as it improves function and survival. However, patient selection remains the most important aspect of management. Extended resection, or microscopic total resection, may have a role in improving outcomes even further, but it needs to be studied in more detail. The authors strongly recommend multidisciplinary team meetings for combined decision-making in patients with brain metastases.

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