

Surgical removal of multiple brain metastases through an image-guided single stage procedure

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Introduction

Cerebral metastases are the most common brain tumor. Almost 30% of cancer patients develop cerebral mets and often these are the first sign of a primary neoplasm out of the central nervous system. More than 50 % of patients harbor multiple metastases.

Figure 1 presents a case in which surgery was not indicated and figure 2 shows positioning, skin incisions and craniotomies in a patient affected by 3 metastases from lung cancer.

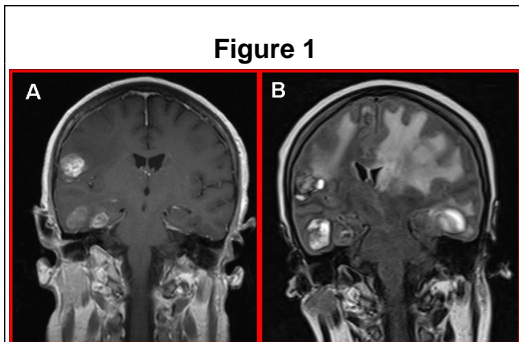
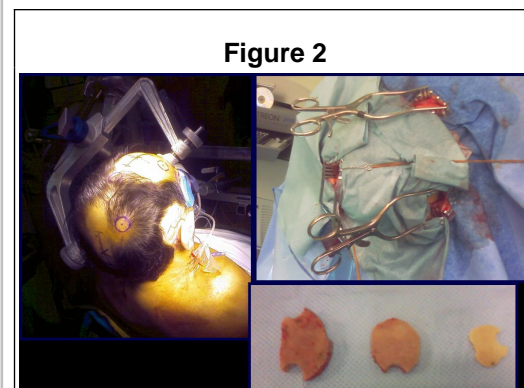


Figure 1
A 55 y.o. female patient presenting at our Department with sub-acute right side hemiparesis. A) 3 months before a coronal T1-weighted MR with i.v. paramagnetic contrast showed 3 brain metastasis (1 right frontal and 2 right temporal) from melanoma; at that time the patient was neurologically intact; she was recommended not to undergo surgery and was sent for radiotherapy. B) a coronal FLAIR MR done at time of hospital admission showing multiple lesions (total number: 9) on both hemispheres, some of those with recent bleeding and significant perifocal edema. The patient was not operated.

Methods

Between January 2010 and December 2011, 21 patients affected by multiple brain metastases were referred to our neurosurgical department. Indications for surgery were: A) Karnofsky performance status (KPS) > 70. B) Unknown or controlled primary tumor. C) Age < 75. Out of the 21 patients, 12 underwent surgery and 9 were found not suitable for surgery and were referred back to the oncologist. 3 patients were harboring lesions of unknown origin. The number of lesions per case in the patients that were operated were as follows: 2 in seven cases, 3 in two cases, 4 in two cases and 5 in one case. The primary aim of surgery was to remove in a single stage procedure lesions causing symptoms and/or too big to be treated by other modalities. Small lesions (< 1 cm) were not treated surgically, but with radiotherapy or radiosurgery. All procedures were performed with neuronavigation assistance (figure 3). During surgery, in all cases, all craniotomies were performed before the dural opening to avoid brain shift and decrease in neuronavigation accuracy.



Results

Surgery was uneventful for all 12 patients. Pathological examination confirmed metastases in all cases and revealed the primary disease in the three patients with unknown primary tumor (2 melanomas and 1 lung cancer). The patient harboring 5 lesions was actually affected by 2 metastases and 3 meningiomas (figure 4); she was the only patient affected also by non metastatic disease. Mean hospitalization after surgery was 4 days. All patients were able to begin further treatment at the time indicated by the referring oncologist.

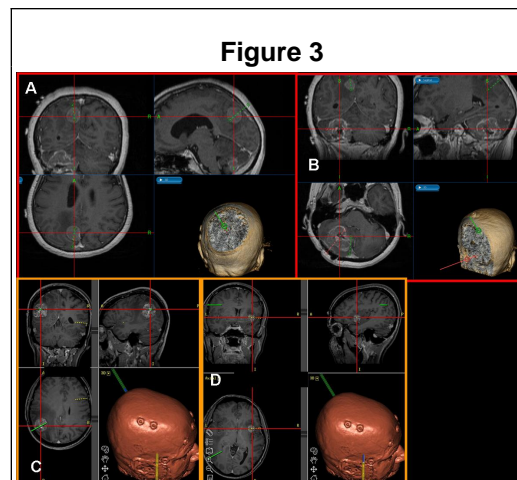
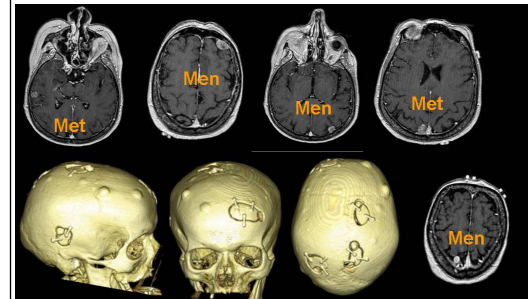


Figure 3
A and B: Neuronavigator (Medtronic, Stealth S7) surgical plan for removal of a left cerebellum and a left parietal mets in a 64 y.o. female patient affected by colon adenocarcinoma. C and D: Neuronavigator (Medtronic, Stealth Treon) surgical plan for removal of a left parietal and a right insular mets in a 45 y.o. female patient affected by melanoma.

Figure 4



A 69 y.o. female patient affected by breast cancer harboring 5 cerebral lesions, all removed in a single stage image-guided surgical procedure. On preoperative axial T1-weighted MR with i.v. paramagnetic contrast the results of pathological examination are shown (Met: metastases. Men: meningiomas) and postoperative 3D CT scan shows the sites of the craniotomies.

Conclusions

Patients affected by multiple brain metastases in good neurological conditions with unknown or controlled primary disease, even if thought not suitable for surgery due to lesions number or localization, should be referred to the neurosurgeon for evaluation. Single stage image-guided surgery for these patients is often feasible and safe. This allows patients to have occupying space lesions removed, to alleviate/cure symptoms and to begin further treatment as soon as possible.

Learning Objectives

1. Identify patients candidate for surgery;
2. Pre-plan surgery with neuronavigation system