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Craniotomy Tumor Removal for Brain Metastases of Hepatocellular Carcinoma : A Case Report

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ABSTRACT

Introduction: Brain metastases (BM) are the most frequent type of brain tumors in adults and are the leading source of neurological issues related to systemic cancers.

Case Description: Female, 49 years old, presented with decreased consciousness that occurred since 1 month before admission. Weakness of the right limbs is found. CT scan abdomen with contrast show hepatic segment VIII infarction. histopathological examination of hepatic tissue biopsy with the results of hepatocellular carcinoma MRI brain shows multiple lesions suggestive of brain metastasis.

Discussion: Patient was diagnosed with space occupying lesion on the frontotemporal dd brain metastasis dd orbital roof meningioma + multiple space occupying lesion intracranial on the left parietooccipital ec. brain metastasis + hepatocellular segment V, VI, VII, and VIII. Patients underwent craniotomy tumor removal to remove intracranial masses. The patient's postoperative condition showed improvement in the level of consciousness with GCS E4M5V3.

Conclusion. Craniotomy tumor removal provides several advantages for managing patients with brain metastases of hepatocellular carcinoma.

Keyword: Craniotomy, Brain Metastases, Hepatocellular Carcinoma

1. Introduction

Brain metastases (BM) are the most frequent type of brain tumors in adults and are the leading source of neurological issues related to systemic cancers. Although advancements in treatment have prolonged survival, the quality of life for these individuals often remains low due to neurological and cognitive challenges. It is estimated that 2% of cancer patients receive a diagnosis of BM concurrently with their primary cancer, with an annual occurrence of 24,000 cases in the U.S. However, the actual yearly incidence is probably over 100,000, as 8.5–9.6% of cancer patients will develop BM at some stage during their treatment. [1,2]

The spread of primary tumor cells to the central nervous system (CNS) is a complicated, multi-step process in which circulating cancer cells locate a favorable environment to establish a new cancer niche through interactions with the surrounding microenvironment. After a primary tumor metastasizes, cancer cells disseminate through the bloodstream, following the regional blood flow patterns in the brain—80% to the hemispheres, 15% to the cerebellum, and 5% to the brainstem.

For metastatic cells to settle in the CNS, they must cross the blood-brain barrier (BBB), which is a neurovascular structure composed of specialized cerebral endothelial cells linked by tight junctions. This barrier, along with pericytes, astrocytes, neurons, and microglia, regulates the exchange of substances between the CNS and the rest of the body, maintaining the delicate environment necessary for proper neuronal function. [2–4]

2. Case Description

Female, 49 years old, presented with decreased consciousness that occurred since 1 month before admission, this occurred suddenly after the patient had a seizure with a duration of >30 minutes. The seizure was cornered on the right leg and hand, after the seizure the patient was unconscious until now. The patient had a history of headache since the last 1 year which was felt increasingly aggravated and felt like pressing the entire head. Weakness of the right limbs is found since the last 1 year which is getting worse day by day. Language disorder was found since 1 month before admission. The patient has difficulty saying words. The patient has a history of hepatic abscess and uncontrolled hypertension. The patient had a history of laparotomy biopsy and laparaotomy exploratory abscess drainage. Physical examination revealed blood pressure 142/98 mmHg, GCS E4M4Vaphasia, and motor lateralization to the right. Other physical examinations were within normal limits. Laboratory examination showed that the patient was anemic (Hb 8.6 g/dl), hypernatremia (Na 150 mEq/L), hypokalemia (K 3.1 mEq/L), hypoalbuminemia (albumin 2.96 gr/dL), and increased tumor marker CA 19-9 (CA 19-9 = 68.9 U/ml).

3. Discussion

The patient underwent advanced imaging CT scan of the abdomen IVC with the results of dissecting the descending aorta to the proximal common iliac, truncus coeliacus, left renal artery, inferior mesenteric artery and left common iliac artery originating from the false lumen with the impression of hepatic segment VIII infarction (Figure 1). The patient underwent histopathological examination of hepatic tissue biopsy with the results of hepatocellular carcinoma.

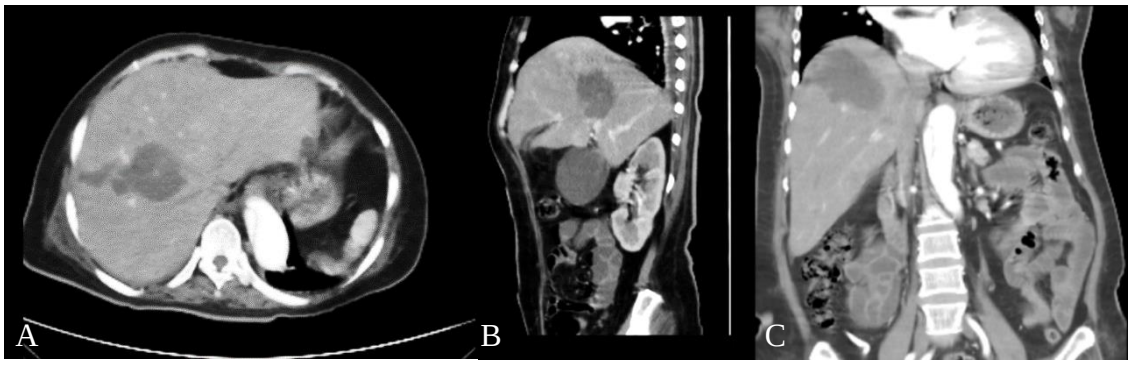

Figure 1. CT scan Abdomen IV Contrast. (A) Axial, (B) Sagittal, (C) Coronal

The patient underwent MRI examination of the brain IVC (Figure 2) with the results showing a broad based extra axial mass with a left anterior fossa that was T1 hypointense, T2 hyperintense after contrast administration giving homogeneous strong obstruction accompanied by a dural tail size + 4, 1 x 4.5 x 2.8 cm with perifocal edema compressing the right lateral ventricle and ventricle III causing a midline shift to the right by + 0.3 cm with the impression of meningioma causing sub falx herniation towards the right and multiple lesions suggestive of brain metastasis. Based on the examination results, the patient was diagnosed with Space Occupying Lesion on the Frontotemporal dd Brain Metastasis dd Orbital Roof Meningioma + Multiple Space Occupying Lesion Intracranial

on the left parietooccipital et causa Brain Metastasis + Hepatocellular Segment V, VI, VII, and VIII. Patients underwent Craniotomy Tumor Removal to remove intracranial masses (figure 3). The patient's postoperative condition showed improvement in the level of consciousness with GCS E4M5V3.

Neuroinflammation and the improper regulation of the tissue damage response, which lead to increased blood-brain barrier permeability and the recruitment of immune cells, have recently been associated with the progression of cerebral metastasis. Most cerebral metastases arise from hematogenous spread to the brain tissue, but it is also common for metastases to occur in other areas, such as the leptomeninges (pia and arachnoid), dura mater, and skull. Consequently, 80% of brain metastases are located in the cerebral hemispheres, where blood flow is the highest, while 15% and 3% occur in the cerebellum and basal ganglia, respectively. Within the brain tissue, brain metastases are frequently found at the junction of gray and white matter, particularly in the "watershed areas" of arterial circulation. [5, 6]

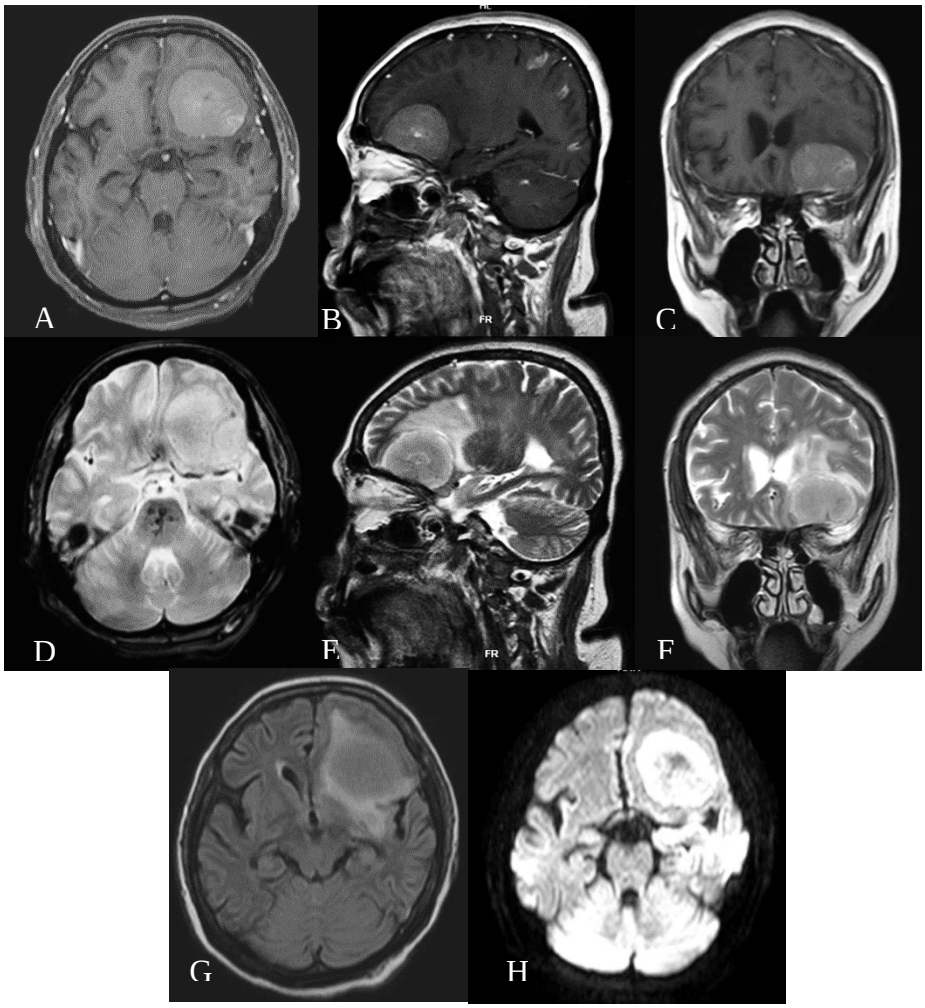

Figure 2. MRI Brain IV Contrast. (A) T1 axial with contrast, (B) T1 Sagittal with contrast, (C) T1 Coronal with contrast, (D) T2 Axial, (E) T2 Sagittal, (F) T2 Coronal, (G) FLAIR, (H) DWI

Contrast-enhanced MRI (CEMRI) is considered the definitive method for diagnosing brain metastases, as it is more sensitive than contrast-enhanced CT (CECT) in distinguishing metastases from other brain lesions. In pre-contrast T1-weighted images, brain metastases generally appear iso- or hypointense, except for hemorrhagic lesions and non-hemorrhagic melanoma metastases, which may show hyperintensity. The intensity of brain metastases can vary in pre-contrast T2-weighted

imaging, but most parenchymal lesions appear as hyperintense spots on fluid-attenuated inversion recovery (FLAIR) imaging. Due to the absence of blood-brain and blood-tumor barriers, brain metastases usually exhibit enhancement on contrast-enhanced T1-weighted images unless they contain non-enhancing cystic or hemorrhagic components.[7]

Although it is the most invasive approach, surgical intervention provides several advantages for managing patients with brain metastases. First, the surgical removal of metastatic lesions can alleviate symptoms caused by mass effect and increased intracranial pressure, particularly in cases resistant to corticosteroids. This procedure can also enable the removal of large tumors requiring decompression, which may lead to improvements in neurological and cognitive functions. Additionally, the tissue collected during surgery can serve for diagnostic confirmation, particularly important for patients without a previously identified primary cancer. Moreover, genomic analyses of brain metastases, along with corresponding primary tumors and other extracranial metastases, have shown that brain metastases often contain potentially actionable driver mutations unique to them. Consequently, targeted therapies aimed at these mutations could enhance survival rates for patients with brain metastases.[8, 9]

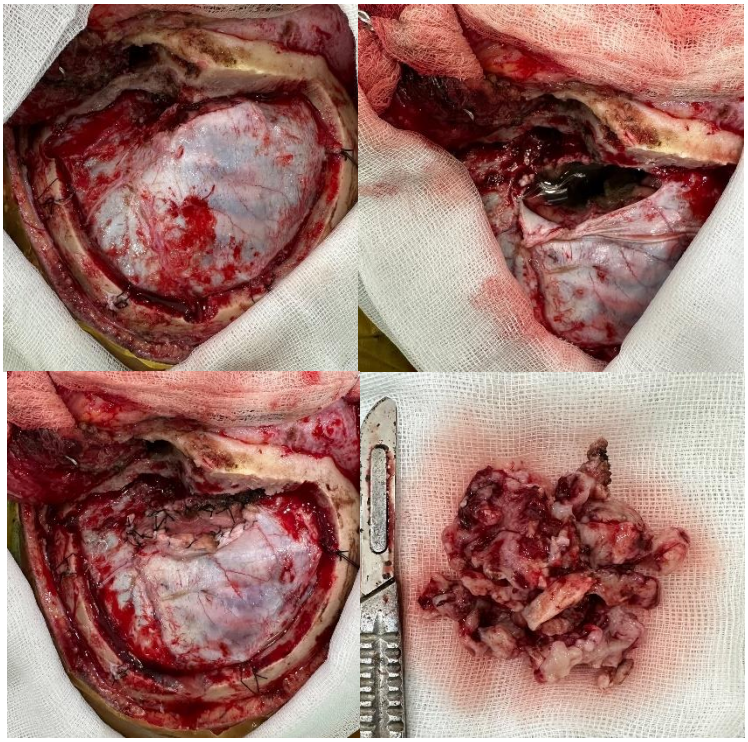

Figure 3. Durante Craniotomy Tumor Removal

In various retrospective studies, surgical metastectomy has demonstrated a notable increase in survival time (more than 3 months compared to less than 2 weeks) for patients with Brain metastases from hepatocellular carcinoma (BMHCC) when compared to best supportive care. Surgery is advised for younger patients, those with a limited number of lesions (3 or fewer), and individuals with a favorable Karnofsky performance status (KPS). Additionally, surgery is suggested to alleviate symptoms in patients with a single large metastasis (greater than 3 cm) that exerts a considerable mass effect (such as a 1-cm midline shift). While it may not provide a survival advantage, it is generally believed to enhance quality of life.[10]

In cases of recurrent brain metastases, several factors affect survival benefits: (1) a recurrence time of more than 200 days, (2) the number of lesions (whether single or multiple), (3) Recursive

partitioning analysis (RPA) classification, and (4) the thoroughness of resection. Aggressive surgical removal can lead to significant neurological impairments, particularly when lesions are situated in critical brain areas. En bloc resection, which entails completely removing the tumor while preserving the brain-tumor interface without breaking the tumor capsule, is favored over piecemeal resection to reduce the chances of recurrence and spread.[2, 11]

One study of 13 patients show median overall survival after brain metastasis diagnosis of 2.83 months. Median survival did not differ significantly between patients with intraparenchymal brain metastases (median survival 2.30 months) and those with skull or dural metastases (median survival, 6.60 months).[12]

4. Conclusion

Craniotomy tumor removal provides several advantages for managing patients with brain metastases of hepatocellular carcinoma Surgery is advised for younger patients, those with a limited number of lesions (3 or fewer), and individuals with a favorable KPS. En bloc resection was superior than piecemeal resection to reduce recurrence and spread.

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