Original Article

Management of single metastatic tumor in the posterior fossa

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ABSTRACT

Background: About 20% of all intracranial metastases occur in the posterior fossa, 25-50% is single, involving mainly cerebellum, and only small percentage (about 2%) of lesions concern brain stem, more rarely pineal region, or cerebellopontine angle. Metastasis in the posterior fossa is poorly tolerated because it can rapidly develop hydrocephalus, brain stem compression, upward transtentorial herniation, so it carries poorer prognosis than supratentorial metastasis, if left untreated. The best treatment options of single metastatic posterior fossa tumors are still debated, with the literature showing benefits of all three major treatment modalities—surgical resection, whole brain radiation (WBR), and stereotactic radiosurgery (SRS). Objectives: The aim of this work was to evaluate the outcome of the surgical resection of single metastatic posterior fossa tumors followed by further adjuvant treatment. Patients and methods: This was a prospective study including 20 patients of histopathology proven single posterior fossa metastasis fulfilling the prognostic criteria of surgery, which were: Karnofsky performance score ≥70, size of the metastatic mass (diameter of the mass ≥1 cm) and the primary tumor is controlled. Brain stem metastasis was excluded in addition to lymphoma or germ cell tumor (radio or chemosensitive). The patients underwent surgical excision and referred to the oncologists for further adjuvant treatment. Results: Out of the 20 patients included in the study, 14 were males and 6 females ranging from 41 to 72 years of age (average 57 years). There was no immediate postoperative mortality. Only 15% of cases had postoperative complications that did not require another surgery. 30% of cases were hydrocephalic, 5% of cases only required ventriculo-peritoneal shunts and the rest passed without shunting. 80% of our cases survived over 9 months with adjuvant therapy. Conclusion: Surgical excision of single metastatic posterior fossa tumor is a safe and beneficial procedure and helps avoid CSF diversion provided that specific prognostic criteria were adopted, which are Karnofsky performance score, extracranial metastasis, activity of the primary, histology of the primary and radiological features (size and location) of the lesion.

Keywords: Cerebellar metastasis, cerebrospinal fluid (CSF) diversion, hydrocephalus, whole brain radiotherapy (WBRT), stereotactic radiosurgery (SRS)

Introduction

About 20% of all intracranial metastases occur in the posterior fossa, 25-50% is single, involving mainly cerebellum, and only small percentage (about 2%) of lesions concern brain stem, more rarely pineal region, or cerebellopontine angle[1,2]. Metastasis in the posterior fossa is poorly tolerated because it can rapidly develop hydrocephalus, brain stem compression, upward transtentorial herniation, so it carries poorer prognosis than supratentorial metastasis, if left untreated[1,2]. The best treatment options of single metastatic posterior fossa tumors are still debated, with the literature showing benefits of all three major treatment modalities—surgical resection, whole brain radiation (WBR), and stereotactic radiosurgery (SRS)[1,2,3].

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Patients and Methods

This is a prospective study of twenty patients presented with single metastatic tumor in the posterior fossa in 2014. Patients included in this study had single posterior fossa lesion, proven by histopathology to be metastatic, Karnofsky performance score ≥70 and the maximal diameter of the mass ≥1 cm. Patients excluded from this study having more than one mass in

the posterior fossa, single posterior fossa mass not proven to be metastatic, patients with Karnofsky performance score <70, brain stem masses, if the maximal diameter of the mass <1 cm, masses proven to be lymphoma or germ cell tumor (radio and chemo sensitive).

The included patients were undergone surgery in Cairo University Hospitals. For each patient, a full history, full clinical examination, routine laboratory investigations, CT scan and MRI brain, metastatic work up (chest X ray, CT chest, CT abdomen and bone scan) were done. Median suboccipital craniectomy was used in all cases. Patients were operated in prone position. Linear suboccipital skin incision was made from external occipital protuberance to mid cervical region, incision of ligamentum nuchae, neck muscles were separated and retracted laterally. One or two burr holes were placed at upper part of occipital squama and extend the craniectomy to foramen magnum and rostrally to inferior edge of transverse sinus. Dura was opened in a Y shaped configuration in midline approaches. Complete excision was the goal of surgery. Complete clinical assessment to monitor the preoperative manifestations, development of new manifestations after surgery and development of postoperative complications, was done. Imaging the patients postoperatively via CT or MRI brain to ensure tumor removal, either total or partial, and to exclude surgical complications as hematoma in tumor bed or hydrocephalus was also carried out. There were long term follow up of the patients after their discharge from the hospital and referral to the oncologist for 3-9 months, routine imaging after 3 to 6 months and following their survival rate.

Results

Out of 20 patients in the study, 14 were males and 6 females, ranging from 41 to 72 years of age (average 57 years).

Table 1: Age distribution

Age (years)	Incidence from the 20 patients
<50	1
50-59	11
60-69	6
≥70	2

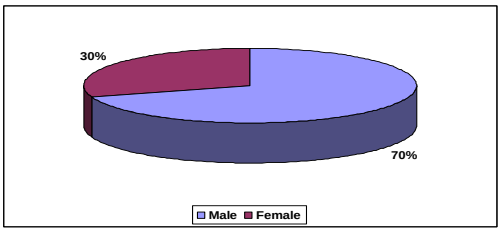

Figure 1: Sex distribution

Clinical symptoms were often multiple at presentation, and commonly were those caused by increased intracranial pressure. Presenting manifestations of intracranial metastases included headache (100%), ataxia (75%), nausea/vomiting (30%), visual changes (25%) and disturbed conscious level (5%). All the cases had tumor mass in the cerebellum, brain stem masses were excluded, cerebellopontine angle, pineal region and dural metastatic masses have not been met. Due to late presentation of the patients in Egypt to the medical service, all the tumors were ≥ 3cm in maximal diameter, ranged from 3 cm to 5 cm. 60% of masses 3 cm, 25% of masses 4 cm and 15 % of masses 5 cm.

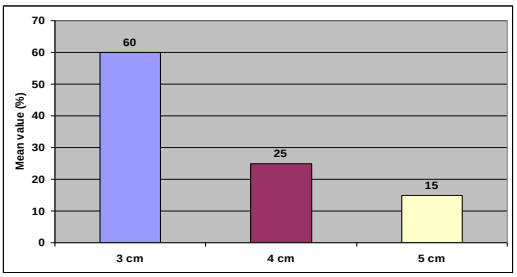

Figure 2: Tumor size in maximal diameter

30% of the patients had hydrocephalus with presentation preoperatively. In one case (5%), it was necessary to insert a ventriculo-peritoneal shunt as a lifesaving procedure. In other cases, after total removal of the tumor, follow up images showed resolved hydrocephalus.

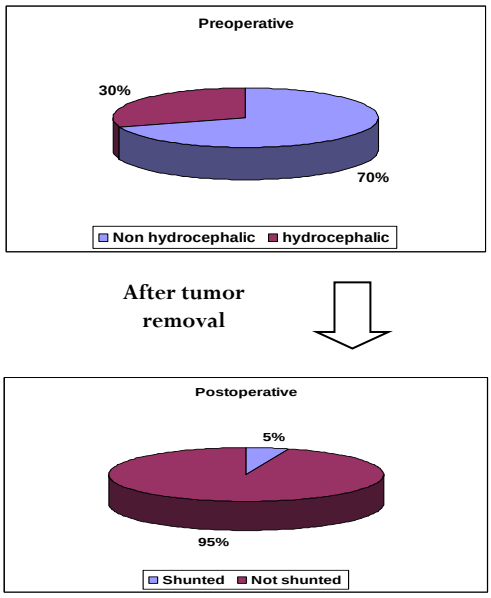

Figure 3: Effect of tumor removal on hydrocephalus

Out of the twenty patients in our series, complications were observed in three patients (15 %), two patients developed pseudomeningocele (10%) and one patient developed wound infection (5%), all of them have not required an additional operation. No symptomatic postoperative hematoma developed in any surgical case. Primary site of tumor metastases included lung (45%), gastrointestinal tract (25%) breast (10%), a case of adenocarcinoma of prostate (5%), a case of leiomyosarcoma of uterus (5%), a case of renal cell carcinoma (5%), and in one case the pathology was not conclusive (5%).

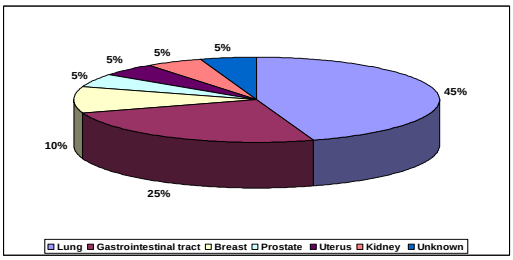

Figure 4: Primary site of the tumor

All the cases underwent surgery were referred to the oncologist for adjuvant management, 100% of the cases received whole brain radiotherapy, 16 cases received chemotherapy (80%), a case of breast adenocarcinoma received hormonal treatment and a case of prostatic adenocarcinoma received antiandrogen treatment. The last case was referred to the oncologist and the feedback was not available. Three months' survival rate was 100% of the followed cases, 90% of cases survived to six months and 80% of cases survived to nine months.

Discussion

Posterior fossa metastases by nature of their location can prove life threatening if untreated. Patients may deteriorate within days, from intracranial hypertension and/or brain stem compression[1,2]. This may also be the scenario in patients undergoing radiation for cerebellar lesions, with increased swelling and acute hydrocephalus[3]. Surgery should be strongly considered in patients harboring large lesions with significant edema and neurological symptoms. The first large series published was conducted by Fadul et al., in 1987, encompassing 59 patients[4]. Sixteen of the patients underwent surgical decompression in addition to radiation and steroids, the remaining received radiation and steroids alone. Surgical results proved disappointing with two patients died postoperatively and two developed meningitis. Additionally, reported survival time was similar in the surgical and non-surgical groups, questioning the benefit of surgery in patients with cerebellar metastases[4]. Ampil et al. described their experience in 45 patients from 1981 to 1993. Eleven of the patients underwent surgery followed by radiation, the remainder underwent radiation alone. When comparing surgery and radiation to radiation alone, they found a much longer survival time in the surgery group (median survival time of 15 months versus 3 months)[5]. The largest study is that of Yoshida which was published in 2008, which included 109 patients from 1990 to 2005[6]. Patients either received radiation alone, surgery alone, or both. The group found that surgery combined with radiation conferred improved prognosis and that surgery alone proved more beneficial than radiation alone[6]. In the article presented by Pompili et al., the authors made note of the complications encountered in 44 patients undergoing resection of cerebellar metastases[7]. Of the nine significant complications encountered, eight included cerebellar hematomas which required evacuation and one occipital infarct believed to be a result of retraction[7]. One common factor among these nine patients was a tumor dimension greater than 3 cm. From a surgical perspective, the authors utilized both a trans-tentorial occipital approach and a suboccipital approach, and found that hematomas were a complication of both approaches[7]. From the previous studies, appropriate management of patients with single metastatic posterior fossa tumor requires an assessment of prognostic factors in order to maximize survival and neurologic function including: age, performance status (most commonly designated by the Karnofsky performance status score, primary tumor type, and systemic tumor activity (controlled versus uncontrolled). Of these, the Karnofsky performance score and systemic tumor activity have consistently been shown to be the major determinants of survival[8]. In our series, there was no mortality and only 15% has postoperative complications which resolved by conservative treatment. Also, no symptomatic postoperative hematoma developed in any surgical case. We feel there are several explanations to address our low complication rates compared to those found in the literature. Our group emphasized the importance of preoperative preparation, intraoperative hemostasis and postoperative care. In our series the survival rates of cases underwent surgery followed by adjuvant treatment were satisfactory compared to survival rates in the literature of cases treated only with chemo or radiotherapy without surgery. In our study, most of patients with preoperative hydrocephalus were able to avoid permanent CSF shunting following surgical resection. Our data suggests that surgery reverses hydrocephalus in the majority of patients with hydrocephalus, eliminating the need for further surgery and possible complications that may arise from placement of a ventriculo-peritoneal shunt (i.e malfunction, infection, hemorrhage). From a technical standpoint, surgery is a safe and efficient way to treat cerebellar metastases in the hand of an experienced surgeon. Surgery shortens the need for corticosteroid therapy, provides immediate symptomatic relief, and many times avoids the requirement of a ventriculo-peritoneal shunt[1]. We advocate such procedures in patients medically fit for surgery. Several limitations exist in our study. We would like to stress the importance that by surgical resection, we can avoid the need for ventriculo-peritoneal shunts in these patients and the problems associated with this process.

Conclusion

Surgical resection of single posterior fossa metastasis is a safe and beneficial procedure, and is effective in the treatment of hydrocephalus in the majority of patients and to avoid the need for a shunt following surgical resection, which limits the immediate and sequential complications affiliated with ventriculo-peritoneal shunts.

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