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Clinical study

Meningioma in the elderly: Characteristics, prognostic factors, and surgical strategy

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ABSTRACT

Meningioma is one of the most common intracranial tumors. It has the features of benign and slow growing. We focused on the meningioma in the elderly, retrospectively analyzed 528 valid meningioma patients, including 115 (21.8%) patients older than 65 years old. The elderly patients were shown to have significantly larger tumor diameter (mean [±SD] 43.4 ± 18.0 mm) comparing with the young group (mean [±SD] 37.6 ± 16.5 mm, $p < 0.01$). Post-operative KPS was significantly lower in the elderly group (mean [±SD] 79.64 ± 26.37) than the young group (mean [±SD] 88.81 ± 17.36, $p < 0.01$). Multivariate regression of post-operative KPS scales at discharge and 6 months follow-up showed operative complications, pre-operative comorbidities, tumor diameter, and challenging location had a significant impact on the outcome. However, tumor blood supply, Simpson grades, pathology, and pre-operative symptoms were shown to have less impact on the post-operative KPS scale. The outcome for meningioma in elderly patients was affected by factors related more to the safety of the operation than characteristics of the tumor. Therefore, rather than achieving total resection, conservative and safety preferential treatment strategies should be regarded as a higher priority for better quality of life.

1. Introduction

Meningioma is the most common intracranial extra-axial tumor in the adult. The incidence is approximately 30% of all intracranial tumors [1,2] and population-based studies indicate an overall incidence of 7.61/100,000 [3]. Over 90% of meningiomas are WHO grade I, which are benign and typically have a low growth rate. Meningiomas can cause mass effect associated with neurological deficit, seizures, nonspecific headache, and dizziness. Also up to 40–80% of the tumors are incidentally found [4,5] and meningiomas are found in about 3% of autopsy reports for patients over 60 years old [6].

The optimal result of the surgery for meningiomas is Simpson grade I resection without any neurovascular sacrifice or newly developed symptoms. For lesions in critical locations such as the petroclival or ventral foramen magnum regions this can be challenging; in some cases the surgeon must choose between subtotal resection and the risk of producing new neurological deficits.

As the average life expectancy increases, there are also increasing concerns over conditions affecting modern elderly citizens. Treatment needs to be more precise and accurate because quality of life is of paramount importance for most elderly patients. Post-operative complications should be avoided in any circumstance as they are closely related to the quality of life. We can classify complications into two broad categories: operative and non-operative. Operative complications, which are highly associated with the surgical strategy and skill, are mostly due to operative damage to brain tissue or neurovascular complexes. Operative misadventures can produce such negative sequelae as intracranial hematoma, hydrocephalus, and focal neurologic deterioration. Non-operative complications, such as infection, atelectasis, and deep venous thrombosis are highly associated with patients' general condition, underlying disease and nursing [7].

Abbreviations: WHO, World Health Organization; GOS, Glasgow Outcome Scale; KPS, Karnofsky Performance Scale; CNS, central neurological system; CTA, Computed tomography angiography; MRA, Magnetic resonance angiography; CMH, Cochran–Mantel–Haenszel; MRI, Magnetic Resonance Imaging; CCI, Charlson Comorbidity Index; GSS, Geriatric Scoring System; CRGS, Clinical-Radiological Grading System; SKALE, Sex, Karnofsky Performance Scale, American Society of Anesthesiology Class, Location of Tumor, and Peritumoral Edema grading system.

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Non-operative complications are usually transient and can improve under proper treatment.

The surgical strategy for elderly meningioma patients can be controversial and different from that of younger adults. The brain parenchyma for the elderly patients can be atrophic and create more room for accommodation of tumor growth. The greater prevalence of underlying diseases and worse general condition in the elderly raise more risk for them as patients. To improve the post-operative outcome and to increase the quality of life, we need a thorough understanding of the special considerations for surgery for meningioma in elderly patients.

We collected the data of meningioma patients in our institute, analyzed the data for comparison between elderly and younger group, investigated specifically for the elderly patients, and drew conclusions regarding the factors affecting the final outcome for the elderly.

2. Material and methods

2.1. Patient population

We reviewed and collected all consecutive meningioma patients from January 2007 to June 2014 in the neurosurgical department of Renji Hospital, Shanghai. Clinical notes, scans and surgical reports were reviewed. Patients were classified into elderly group and young group using the cut-off age of 65 years old. Gender, tumor locations, pre-operative symptoms, pre-operative comorbidities, Simpson grades, pathologic grades, operative complications, Glasgow Outcome Scale (GOS) and Karnofsky Performance Scale (KPS) at discharge and at 6 month follow-up were collected, classified and analyzed.

Pre-operative symptoms were classified as no symptom (incidental), intracranial hypertension (headache, dizziness, nausea and vomiting), neurological deficits, and epilepsy. Location, diameter, tumor blood supply, Simpson grading, and pathologic grading are analyzed as part of the intrinsic factors for the tumor and surgery. Location was classified as convexity (minimal risk), skull base (high risk) and others (para-sagittal, falcine, torcular, and ventricular, low risk). Blood supply was classified into five grades by reviewing preoperative CTA or MRA and subjective intraoperative appearance. Operative complications are classified as peripheral neurological deficits, cranial nerve deficits, seizure, infarction, hemorrhage and CNS infection.

2.2. Comparison between different age groups

We analyzed and compared the different features between the young and elderly groups, the tumor diameters, pre-operative symptoms, comorbidities, post-operative complications, and immediate post-operative GOS and KPS scale in two groups were analyzed and compared. We performed CMH test for GOS scale and rank sum test for KPS scale.

2.3. Multivariate regression analysis of outcome for the elderly group

Then we focused on the elderly group, a multivariate regression of risk factors analysis was carried out, with the KPS scale representing the outcome and the quality of life, which was reviewed at discharge and at 6 month follow-up. At 6 month post-operative evaluation, 21 elderly patients were lost follow-up thus 94 patients were included for the second regression. Factors including pre-operative symptoms, pre-operative comorbidities, location, diameter, blood supply, Simpson grades, and operative complications were analyzed. Statistical analysis was performed by SAS-9.3.

2.4. Review of the current scoring systems for outcome evaluation

We systematically searched and reviewed existing scoring systems for the outcome evaluation of meningioma patients. Then summarized the factors that the scoring systems focused on, which were regarded to have negative impacts on the final outcome.

3. Results

3.1. General information

We collected 661 meningioma cases from January 2007 to June 2014 in the neurosurgical department of Renji Hospital, Shanghai. 133 cases were deleted from the database due to a variety of reasons such as loss of evaluation at discharge (69), missing details of patient notes (28), imaging tests (32) and surgery reports (4). 528 valid intracranial meningioma patients were included in for our study for a period of 7 years. 115 (21.8%) patients were over 65 years old, and 413 (78.2%) of them were under 65. There were 381 (72.2%) female and 147 (27.8%) male patients. 304 (57.6%) of all patients presented with the symptoms as "intracranial hypertension", 203 (38.4%) of them presented neurological deficit and 113 (21.4%) had chief compliant as seizure. 51 (9.7%) meningiomas were found incidentally. 41 (7.8%) meningiomas were recurrent cases. 263 (49.8%) of the all cases underwent a Simpson grading I resection, 172 (32.6%), 31 (5.9%) and 62 (11.7%) cases underwent a Simpson grade II, III and IV resection, respectively. Pathological reports showed 504 (95.5%) WHO-I meningiomas.

51 (9.7%) new developed peripheral neurological deficits, 18 (3.4%) new cranial nerve deficits, 8 (1.5%) seizure, 20 (3.8%) infarction or hemorrhage, and 8 (1.5%) CNS infection were reported as operative complication. Fig. 1 demonstrated the score distribution of GOS and KPS scales in all cases as calculated at the time of discharge; over 90% of patients scored 4 and 5 for GOS scale and over 60 for KPS scale. In the elderly group, 21 patients lost follow-up at 6 month post-operatively, the average follow-up period was 14.8 ± 10.1 (range 3–46) months. 1 patient deceased 2 months after discharge because of deteriorated neurological function caused by intracranial hemorrhage; 1 patient deceased after discharge because of massive myocardial infarction. For the elderly, the mortality and morbidity rates are 3.9% and 20.4%, respectively; 6 month mortality rate is 5.2%.

3.2. Comparison of elderly and young group

Table 1 shows the result of the comparison between the two groups. Tumor diameter for elderly group was significantly larger than the younger group (43.4 ± 18.0 mm vs 37.6 ± 16.5 mm, $p < 0.01$). While Chi-square test showed no significant difference for pre-operative symptoms for intracranial hypertension (OR 0.72 (0.49–1.09), $p = 0.12$), seizure (OR 1.10 (0.67–1.80), $p = 0.72$), or neurological deficits (OR 1.25 (0.82–1.90), $p = 0.30$). The elderly group was shown to have significantly higher incidence of pre-operative comorbidity than the young group (OR 2.72 (1.74–4.25) $p < 0.01$). The elderly group was shown to have significantly higher incidence of post-operative peripheral neurological deficits, while no significance was shown for new cranial nerve deficits, seizure, infarction or hemorrhage and CNS infection between the two groups. CMH test for GOS and rank sum test for KPS shows significant difference for outcome between the two groups ($p < 0.01$ for both tests).

3.3. Multivariate regression analysis of outcome for the elderly group

In elderly group, we ran 2 multivariate regressions for KPS scale at discharge and at 6 months follow-up to see which factors would affect the outcomes of the elderly patients. For the KPS scale

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