

Comparison of Short-Term Surgery Outcomes Between Older and Younger Patients With Middle Third Parasagittal and Falx Meningioma

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Abstract

Background and Purpose

Middle third parasagittal and falx meningiomas can cause severe neurological deficits. The incidence of meningioma rises with age and comorbidities. Elderly patients may suffer from operative complications and recover more slowly than younger patients. The aim of this study was to assess the clinical characteristics and surgery outcomes between younger and elderly patients with meningiomas.

Methods

The patients of middle third parasagittal and falcine meningiomas operated from January 2011 and December 2019 were reviewed in this retrospective study. All lesions arose from the middle third of the falx or superior sagittal sinus (SSS). The complications, such as peritumoral edema, operative blood loss, and neurological deficit, and postoperative hospital stay, were compared between groups.

Results

Forty-three elderly patients and 63 younger patients were included in the current study. The elderly had larger and more aggressive lesions than younger individuals ($P=0.013$). Moreover, the aging group had severe peritumoral edema ($P=0.019$) and longer postoperative hospital stay ($P=0.009$) than younger patients, while the younger suffered from higher blood loss ($P=0.022$) and reoperation (3 vs. 1) at perioperative period. Furthermore, no significant difference was detected in the neurological deficit between the two groups ($p=0.97$).

Conclusions

Although severe peritumoral edema gave rise to larger lesions, elderly patients with the middle third of parasagittal and falcine meningiomas shared similar surgery outcomes as younger individuals. However, after considering all the factors, elderly patients were more likely to develop minor postoperative complications compared to younger ones.

Introduction

The incidence of parasagittal meningioma ranges from 16.8–30% among all intracranial meningioma [1, 2]. Parafalcine meningiomas account for about 8.5% of the intracranial meningioma [3], while falcine meningiomas represent approximately 9% of all intracranial meningiomas [4]. Parasagittal meningiomas are distinguished based on the anterior, middle, and posterior locations along the sinus [4]. Compared to the anterior and posterior third meningiomas, the third middle lesions cause motor function deterioration in the early disease stage and have a poor postoperative outcome. Regarding the discrepancy of physiological conditions, younger patients recover faster from operation than older patients [5]. In this study, we compared the clinical characteristics and surgery outcomes between older and younger middle third parasagittal and falx meningioma patients.

Parasagittal and falx meningioma involving the middle third is associated with a high incidence of motor function deterioration either as a symptom or during the postoperative period [4, 6]. Thus, preserving the venous system's integrity and cerebral cortex during surgical resection may be challenging [7]. Owing to the incidence of meningioma increasing with age and aging physiology and comorbidities, elderly patients might suffer from more operative-related complications and recover more slowly than younger patients [5].

The number of old people is increasing every year. According to some statistics, the proportion of the world's population >60 years in more developed regions will increase by 38% by 2050 [8]. Mental health and physical well-being are crucial during older age. The Middle third of parasagittal and falx tumors belong to a specific category of brain diseases. The central cortex may be easily damaged or oppressed by the lesions, leading to a series of neurological deficits [7]. It has been reported that age over 65 years is predictive of greater inpatient death, LOS, total charges, and some of inpatient complications [9]. However, opposite views were also reported by some other studies [5]. The aim of this study was to compare the short-term surgical outcomes of elderly patients (>60 years) affected by the middle third of parasagittal and falx meningioma to those of a contemporary cohort.

Materials And Methods

Study design

This study was approved by the Ethics Committee of Guangdong 999 Brain Hospital, Medical College of JiNan University and was conducted in accordance with the latest revision of the Declaration of Helsinki. Data from patients with the middle third of parasagittal and falx meningioma, who underwent surgery in Guangdong 999 Brain Hospital from January 2011 to December 2019, were extracted from the hospital's electronic records. According to World Health Organization (WHO), those aged >65 years are defined as the elderly population in developed countries, while the definition in developing countries is >60 years. In the current study, all the subjects were Chinese; >60-year-old patients were classified into the elderly group, while those <60 years old into the younger group. Complications, such as symptoms, peritumoral edema, comorbidities, operative blood loss, and neurological deficit, postoperative hospitalization duration, and subgroup analyses were compared to investigate the differences between the two categories. According to the longest diameter of lesions, we classified tumor size into 3 categories: tiny (less than 2cm), median (2-5 cm), and giant (larger than 5cm) group. Operation blood loss was classified into 3 grades: general group (<400ml), medium group (400-1000ml), and massive group (>1000ml). Referring to previous literature [10], peritumoral edema was classified into 3 grades: negligible, mild, and severe. The extent of tumor resection was categorized according to the Simpson meningioma resection grade [11]. Since the majority of the patients underwent selective surgery and the duration between the admitting day and operating day varied in these patients, the length of postoperative hospital stay was selected as one of the events to evaluate surgical outcomes. The postoperative hospital stay deadline was defined as the day of discharging or transferring to other departments, such as oncology and rehabilitation.

Clinical management

All the patients underwent magnetic resonance imaging (MRI) and/or computed tomography (CT) scan within 2 weeks prior to surgery. MR venography (MRV), CT angiography (CTA), and digital subtraction angiography (DSA) were performed if necessary. Dexamethasone and/or mannitol were preoperatively administered to the patients

with severe peritumoral edema on T2-weighted MRI. The indications for emergency operation included cerebral hernia, cerebral or tumor hemorrhage, and rapid tumor progression. All the surgeries were performed by experienced surgeons. The surgical trajectory and position depended on whether the tumor was located in the anterior half or posterior half of the central falx. The surgical bone window depended on whether the lesion was unilateral or bilateral. An interhemispheric approach was taken on the non-dominant side in the patients with bilateral lesions.

Neuronavigation system (Brainlab, Germany), Cavitron ultrasonic surgical aspirator (Integra, USA), and electrophysiological monitoring (Cadwell, USA) were used as adjuncts to microsurgical tumor resection. The lesions were diagnosed according to “The 2016 World Health Organization Classification of Tumors of the Central Nervous System” [12]. All residual tumors and WHO II-III meningioma patients were recommended to receive adjuvant therapy treatment, including chemotherapy and radiotherapy.

Patient selection

Inclusion criteria were: (1) lesions located at middle third parasagittal and falx on the MRI; (2) diagnosed as meningioma according to the pathological results; (3) follow-up at 30-day, 90-day, and 1-year. Relapse patients who underwent the operation at another hospital were excluded.

Data collection

Clinical characteristics included age, gender, comorbidities, size of the tumor, imaging features, and symptoms (**Tables 1 and 2**). Treatment information included the operation approach, the volume of bleeding and transfusion, operation procedures, and adjuvant therapy. Postoperative outcomes included tumor size, postoperative peritumoral edema, complications, postoperative length of hospital stay, improvement of presenting symptoms, new neurological symptom(s), and cumulative mortality at 30-day, 90-day and 1-year. Postoperative complications included subdural hematoma, operative field bleeding, incision infection, pulmonary infection, and mortality. All data were collected through the hospital’s electronic patient record, containing hospitalization and outpatient review records, and phone call follow-up.

Table 1 Demographic characteristics and preoperative status of our study cohorts

	Elderly	Young	<i>P</i> -value
	(n=43)	(n=63)	
Age			
Mean ± SD	65.15±3.95	46.79±7.94	
Range	60–76	27–59	
Gender			
Female	28 (65.1%)	45 (71.4%)	
Comorbidities			
Hypertension	14 (32.6%)	9 (14.3%)	
Cardiovascular disease	7 (16.3%)	3 (4.8%)	
Diabetes mellitus	5 (11.6%)	1 (1.6%)	
Liver disease	3 (7%)	4 (6.3%)	
Renal disease	3 (7%)	2 (3.2%)	
Pulmonary disease	3 (7%)	2 (3.2%)	
Stroke	3 (7%)	0	
Other tumor	0	6 (9.5%)	
Other disease	5 (11.6%)	2 (3.2%)	
Size of tumor			0.013*
<2 cm	2 (4.65%)	16 (25.39%)	
2–5 cm	27 (65.11%)	34 (53.96%)	
>5 cm	14 (32.56%)	13 (20.63%)	
Dural tail sign	30 (69.7%)	40 (63.5%)	0.503
Sides involved			0.462
unilateral	33(76.74%)	52(82.54%)	
bilateral	10(23.26%)	11(17.46%)	
Sinus involvement	N=35(MRV)	N=46(MRV)	0.63
Complete	10(28.57%)	9(19.57%)	
Partial	12(34.29%)	17(36.96%)	
None	13(37.14%)	20(43.48%)	

* Mann–Whitney test were applied

Table 2 Intraoperative and postoperative outcome of the study cohorts

	Elderly (n=43)		Young (n=63)		P-value	
	Pre-	Postoperative	Pre-	Postoperative	Pre-	Postoperative
Symptoms						
Hemiparesis	18 (41.9%)	18 (41.9%)	12 (19%)	17 (27%)	0.10	0.11
Dizziness	15 (34.9%)	2 (4.7%)	24 (38.1%)	6 (9.5%)	0.736	0.469
Headache	11 (25.6%)	3 (7%)	34 (54%)	1 (1.6%)	0.004	-
Seizures	7 (16.3%)	2 (4.7%)	9 (14.3%)	1 (1.6%)	0.778	-
Emesis	6 (14%)	0	6 (9.5%)	0	0.48	-
Hemianesthesia	5 (11.6%)	4 (9.3%)	5 (7.9%)	6 (9.5%)	0.523	1.00
Speech disorder	2 (4.7%)	0	2 (3.2%)	0	0.672	-
Visual impairment	1 (2.3%)	0	3 (3.8%)	0	0.537	-
Others*	8	-	8	-	0.404	
New neurological deficits	-	7	-	11		0.874
Navigation	-	30	-	47		0.775
Peritumoral edema					0.019‡	0.015‡
Severe	14 (32.6%)	20 (46.5%)	10 (15.9%)	15 (23.8%)		
Mild	11 (25.6%)	14 (32.6%)	14 (20.6%)	25 (39.7%)		
Negligible	18 (41.9%)	9 (20.9%)	40 (63.5%)	23 (36.5%)		
Mean blood loss		374±322 mL	-	503±619 mL		0.022
Blood loss (No.)						
<400 mL (%)	-	27 (62.8%)	-	35 (55.6%)		
400–1000 mL (%)	-	13 (30.2%)	-	21 (33.3%)		
>1000 mL (%)	-	3 (7%)	-	7 (11.1%)		
Operative Complications					-	0.97
Operative field	-	3	-	4		

bleeding‡				
Subdural hematoma	-	3	-	3
Subdural effusion	-	1	-	3
Incision infection	-	0		2
cerebral infarction	-	1	-	1
Pulmonary infection		1		0
Dead	-	0	-	1
Postoperative length of stay #		17.25±5.8		13.50±3.8
				0.009

*Other symptoms include medical checkup, mild brain injury, decreased appetite, and sleeping disorder

†Tiny operative field bleeding was identified as normal

‡ Mann–Whitney test were applied

§Deadline of postoperative length of stay was the day discharged or transferred to the other department

Statistical analyses

All statistical analyses were performed using SPSS 23.0 (SPSS Inc., Chicago, IL, USA). Frequency distributions and descriptive statistics were calculated for all variables. The quantitative data of normal distribution were described by mean ± SD, and the differences between the groups were evaluated by an two sample t-test. The quantitative data of non-normal distribution was described by the median (range). The differences between groups were analyzed by Mann–Whitney U test. Chi-square and Fisher’s exact test assessed the qualitative data. *P*-value <0.05 indicated statistical significance.

Results

One hundred six patients were included in the study, 43 elderly patients (age 65.15±3.95 years, range: 60–76 years) and 63 younger patients (age 46.79±7.94 years, range: 27–59 years). There were more female patients (65.1% in the elderly group and 71.4% in the young group) than male patients.

The common symptoms in the elderly group were hemiparesis (41.9%), followed by dizziness (34.9%), headache (25.6%), and seizures (16.3%). The speech disorder (4.7%) and visual impairment (2.3%) were seldom presented as chief complaints; 3 elderly patients visited our clinic due to light brain injury. Among younger patients, the common symptoms were headache (54%), dizziness (38.1%), and hemiparesis (19%). Postoperatively, hemiparesis (41.9%) was the most frequent symptom in the elderly group, while those in the younger groups were hemiparesis (27%) and dizziness (9.5%). New neurological deficits occurred in 7 young patients and 11 elderly patients (*P*=0.874).

All the patients underwent brain MRI check, except for one 42-year-old woman who underwent an emergency operation after performing CTA of the brain. 69.7% (n=30) of the elderly patients and 63.5% (n=40) younger

patients showed classic dural tail signs; the difference was not significant ($P=0.503$). Two young patients displayed brain lesions (<2 cm) without any symptoms during a medical checkup. Furthermore, superior sagittal sinus (SSS) blockage was found in 18/80 (10/35 elderly vs. 9/47 younger) patients undergoing MRV check. Moreover, 12 vs. 17 patients presented SSS compressed or involved by the lesions in the elderly and younger groups, respectively.

Also, 32.56% (n=14) elderly patients had giant meningioma, compared to only 20.63% (n=13) in the younger group ($P=0.013$). A significant difference was found in both preoperative and postoperative peritumoral edema between the two groups (Table 2). Preoperatively, severe peritumoral edema was revealed on the radiological findings in 32.6% and 15.9% of patients in the elderly and younger groups, respectively ($P=0.019$). Postoperatively, the ratio increased to 46.5% and 23.8% in the two groups, respectively ($P=0.015$). For all patients, 60% (6/10) WHO grade II and III patients revealed severe postoperative peritumoral edema as compared to 29.6% (29/98) in WHO grade I patients ($P=0.001$, Table 3).

Table 3
Comparison of post-operative peritumoral edema based on histological subtypes and size of the tumors

Peritumoral edema	Elderly (n=43)			Young (n=63)			P-value
	Negligible	Mild	Severe	Negligible	Mild	Severe	
WHO grade							0.001*
Grade I	9	13	15	21	24	15	
Grade II-III	0	1	5	2	1	0	
Size of tumor							0.007¥
<2 cm	1	0	1	9	6	1	
2–5 cm	7	10	10	12	17	5	
>5 cm	1	4	9	2	2	9	
* Chi-square test was applied on assigned data							

¥ Mann–Whitney test were applied

The most common comorbidities in the elderly group were hypertension, accounting for 32.6%, followed by cardiovascular disease (16.3%), diabetes mellitus (11.6%), and liver disease (7%), while those in the younger group were hypertension (14.3%), other tumors (9.5%), and liver disease (6.3%). Simultaneous tumors occurred in 5 (all female) young patients, among whom a 48-year-old woman had two tumors (fibroid and osteoma of the tibia) in the past. Another young patient was affected by glioblastoma (WHO grade IV) and fibrous meningioma (WHO grade I) simultaneously. SSS involvement was found in 12 (27.3%) and 13 (20.63%) patients in the elderly and younger groups ($P=0.63$), respectively.

A volume of 503 ± 619 mL (range: 100–3300 mL) mean blood loss operation was significantly higher in the younger group than in the elderly patients (mean: 374 ± 322 mL, range: 100–1400 mL) ($P=0.022$). Furthermore, 7 (11.1%) cases of young patients underwent massive blood loss compared to 3 (7%) cases in the elderly group.

Elderly patients spent an average of 17.25 ± 5.8 days at the Neurosurgery Department after the operation, which was significantly longer than that by the younger group (13.50 ± 3.8 days) ($P=0.009$).

The younger group presented more operative complications, such as subdural effusion, incision infection, operative field bleeding, and subdural hematoma, than the elderly (Table 2). The operative field bleeding and subdural hematoma have the highest frequency of operative complications in both elderly ($n=3$) and younger groups ($n=3$). One 56-year-old woman died on day 2 after the operation; her primary chief complaint was repeated seizures for 3 years. An aneurysm clip was used to prevent bleeding of ruptured SSS in a 65-year-old male who suffered an 1800-mL blood loss during the surgery for resection of a huge meningioma involving SSS.

Pathologically, WHO grade I, II, and III meningiomas affected both groups, albeit no pathological difference was observed ($P=0.154$, Table 4). Simpson grade I and II resection achieved 88.3% ($n=38$) and 90.47% ($n=57$) success in the elderly and younger groups, respectively ($P=0.787$). A residual tumor (Simpson grade III and IV) was found in 5 (11.63%) and 6 (9.52%) patients in the two groups, respectively ($p=0.787$). Moreover, 5 patients rejected further treatment. Two patients in each group experienced tumor recurrence.

Table 4
Surgery outcome and further treatment of the study cohorts

	Elderly	Young	P-value
	(n=43)	(n=63)	
WHO grade I			
Transitional	18 (41.9%)	33 (%)	
Fibrous	8 (18.6%)	15 (%)	
Psammomatous	5 (11.6%)	1 (%)	
Meningothelial	3 (7%)	9 (%)	
Angiomatous	2 (4.7%)	1 (%)	
Microcystic	1 (2.3%)	0	
Metaplastic	0	1 (%)	
WHO grade II atypical	4 (9.3%)	2 (%)	
Grade III anaplastic	2 (%)	1 (%)	
WHO grade II-III	6	3	0.154
Simpson grade (%)			0.787
I-II	38 (88.3)	57 (90.47)	
III	2 (4.65)	4 (6.35)	
IV	3 (6.97)	2 (3.17)	
Adjuvant therapy			
Radiotherapy	7	11	0.874
Chemotherapy*	0	1*	
Reoperation (non-recurrent)	1	3	
Tumor recurrence	2	2	
* Nimodipine was used on a young who was diagnosed as anaplastic subtype			

Discussion

In this study, we compared the differences in short-term surgery outcomes between younger (<65 years old) and older patients (>65 of age) patients with middle third parasagittal and falx meningioma. The incidence of meningioma increases with age, with the peak incidence between the 6th and 7th decade of life [13]. Our data suggested that the elderly have more comorbidities, including hypertension, diabetes mellitus, liver disease, renal disease, pulmonary disease, and cardiovascular disease, compared to the younger patients; however, the

operative complication rate was similar in the two groups ($P=0.97$). Simultaneous tumors occurred in 5 younger patients, all females. One of them had uterine fibroid and osteoma on the left tibia, while the other four had uterine fibroid, renal clear cell carcinoma, thyroid carcinoma, and glioblastoma, respectively. Multiple primary brain tumors with different histological types occurring in the same patient are extremely rare, and only a few such cases have been reported thus far [14, 15]. Tunthanathip reported 6 cases of simultaneous multiple, primary brain tumors, predominantly in aging patients. In this study, one patient (a 55-year-old woman) presented with meningioma and glioblastoma.

Large meningiomas (>5 cm) were likely to occur in elderly patients, accounting for nearly 32.56% (14/43) as compared to 20.63% (13/63) in the younger group ($P=0.013$). Large meningiomas usually arise in an area of maximal brain compliance [16]. Cerebral atrophy facilitates maximal brain compliance in aging patients, and the symptoms do not appear until the lesion oppresses the central cortex. Furthermore, aged Chinese individuals tend to refuse to see the doctor before their health worsens due to the fear of discovering additional health problems. Some studies showed that the size of this neoplasm is indicative of the factors of fear and denial that occur in many patients, thereby delaying detection and therapy [17, 18].

A previous study that investigated 42 patients with primary intracranial meningioma of all locations found preoperative peritumoral edema in 47.6% of patients >65 years old [10]. Our subgroup analyses demonstrated that giant intracranial meningioma invades the vital neurovascular structures and causes severe peritumoral edema. Furthermore, giant meningioma patients revealed severe peritumoral edema incidence rate than patients with medium and tiny meningioma. Severe edema was not detected in patients with tiny meningioma. In a study of 80 giant intracranial meningiomas, only 12.5% (n=10) cases revealed severe peritumoral edema [19]. The 80 lesions were localized at the skull base (n=57), convexity (n=17), and falx/parasagittal (n=6). Thus, we deduced that giant intracranial meningioma located at the middle third parasagittal and falx meningioma in elderly patients would have the highest frequency of severe peritumoral edema than any other subgroup.

Histological subtypes are related to peritumoral edema. Herein, we compared the postoperative peritumoral edema based on histological subtypes. We discovered that peritumoral edema was significantly larger in patients with grade II and III meningiomas than grade I meningiomas. The elderly patients showed severe peritumoral edema based on the histological grade. In a study of 240 cases, Ressel *et al* reached a similar conclusion [20]. However, the study diagnosed 26.1% (n=29) of the elderly cases as grade II and grade III meningioma at any intracranial site. On the other hand, in the current study, only 13.95% of the aging patients with middle third parasagittal and falx meningioma were diagnosed as grade II and grade III meningioma. This discrepancy indicated that middle third parasagittal and falx are not likely to be involved in grade II and grade III meningioma as compared to other locations.

Rapid advances in neurosurgical techniques and perioperative care have improved safety and reduced tumor resection-related mortality. However, parasagittal and falx meningioma resections remain a challenging task for neurosurgeons worldwide. So far, many different neurosurgical techniques have been applied [6, 21-26]. Karthigeyan *et al* used a modified unilateral approach to resect mid-third giant bilateral falcine meningiomas [6]. In order to minimize any potential surgery-induced damage, the study chose the side of the non-dominant hemisphere to create a surgical window. Furthermore, the tumors were excised through an oblique anterior or a posterior trajectory instead of directly working over the major draining veins and eloquent brain. In a previous study, we utilized this approach to resect deep and tiny falx meningioma. Neuronavigation has been widely

applied in neurosurgery [27, 28]. Bir *et al* [29] analyzed 517 cases of meningiomas and concluded that interactive surgical navigation is a useful tool in the operative management of intracranial meningiomas; it can decrease the recurrence rate, blood loss, and length of stay and improve the RFS and performance status. In addition, neuronavigation should be used for small (<2 cm) and deep tumor falx meningioma, or else it would be rather time-consuming to seek out the tumor, thereby causing substantial damage to the brain. All tiny meningiomas were completely resected. In the current study, neuronavigation was applied in most patients as adjuncts to microsurgical tumor resection, and all the tiny meningioma were resected. There was no difference between the two groups according to the neuronavigation application ($P=0.775$). We proposed that giant parasagittal can be easily identified by the neurosurgeons through anatomical markers rather than the assistance of neuronavigation. Giant meningiomas often have a wide basement on the falx, increasing the difficulty of radical resection. Despite the large size, the tumors could be successfully removed from the unilateral side [6].

Operative blood loss is a critical parameter for evaluating the surgical effect. Surprisingly, in the current study, the blood loss was substantial in the younger group, which could be attributed to the wide surgical field and fewer vessels destroyed in the elderly as a result of cerebral atrophy. Furthermore, less blood loss in the elderly may be the benefit from stricter indication and consummated preoperative preparation. SSS involvement was the most common reason for massive blood loss. A total of 9 young patients lost more than 800 mL of blood, of whom 7 (77.8%) had SSS involvement, while among the elderly, 2 (40%) patients showed SSS involvement in 5 massive blood loss patients. The closure of the middle and posterior thirds of the superior sagittal sinus carries a significant risk of cortical venous infarction. Surgeons must choose between two operating strategies: to attempt a total meningioma removal, restoring the venous outflow; or to leave residual meningioma and await sinus occlusion by the tumour and the development of collateral flow[30]. In some studies [31, 32], patches, bypasses were recommended to reconstruct the damaged veins but not aneurysm clips as they are known to be susceptible to secondary thromboses [31, 32]. In the current study, if SSS was damaged during the operation, venous reconstruction was performed using patches or bypasses. An aneurysm clip was used on the sinus wall to reconstruct the ruptured SSS in a 65-year-old man who underwent an 1800-mL blood loss during surgery to resect a huge meningioma involving the third middle SSS. Subtotal resection is one of several alternatives when the operation facing great risks[33].

A significant difference in the postoperative hospitalization duration was found between the two groups. Despite substantial blood loss in the younger group, they recovered faster than the aging patients. Supposedly, the aging physiology and comorbidities increase the duration of recovery in aging patients than younger patients [5]. Elderly patients tended to have more operation complications than younger patients; yet, no significant difference was observed (39.53% vs. 38.09%, $P=0.932$). The most common operation complications included neurological deficits, operative field bleeding, and subdural hematoma. The present study showed that younger patients have more severe and fatal complications than elderly patients. Four younger patients underwent craniotomy operation to remove the hematoma or abscess as compared to one in the elderly. Neurological deficit is a vital factor in evaluating the surgery outcome of middle third parasagittal and falx meningioma patients. In the current study, 41.9% ($n=18$) elderly patients experienced hemiparesis at the 1-year follow-up as compared to 27% ($n=17$) in the younger group without a statistical difference ($P=0.11$). Nakamura *et al* compared the surgical treatment of cerebellopontine angle meningiomas between 21 elderly (aged >70 years) and 65 younger patients and found no significant difference in the surgical complication rate [34]. Roser *et al* [35] compared 43 elderly (aged >70 years) patients with skull base meningiomas to 89

controls and showed that the surgical morbidity in skull-based meningioma surgery was not related to the age of the patient. However, several studies obtained different results [5, 36, 37]. This discrepancy may construe stringent criteria for selecting appropriate candidates [38] for surgery in some studies, while other studies might apply loose criteria. Furthermore, in the current study, the heavy blood loss might increase the complication rate in the younger group. In the current study, a 56 year-old-woman died; her primary complaint was repeated seizures for 3 years. Thus, we deduced that this patient died of severe epilepsy, which caused secondary cerebral ischemia and hypoxia. Taken together, it can be inferred that elderly patients are more likely to develop minor postoperative complications than younger ones, but none of those complications are life-threatening events, which is consistent with Poon *et al* [5].

The pathological subtypes of 2 recurrent patients in the elderly group were transitional and atypical, respectively, while the 2 cases in the younger group were transitional and anaplastic, respectively. Magill reported 67 recurrent non–skull base meningiomas with 35 (52.2%) lesions locating at middle 3rd sagittal plane[13]. Middle third parasagittal and falx meningioma operation should apply by experienced surgeons with more patience and surgical technique.

Limitations

Firstly, this study's retrospective nature limits the ability to determine the degree of resident involvement in surgery. Furthermore, this is a single-center study, and the number of patients was not sufficient to deduce a convincing conclusion.

Conclusion

In the current study, we found that elderly middle third parasagittal and falx meningioma patients tend to be affected by larger and more aggressive lesions than younger individuals. The older group was associated with severe peritumoral edema and longer postoperative hospital stay than young patients, while the younger group experienced more bleed loss and reoperation at the perioperative period; albeit no significant differences were detected in the neurological deficits, complications, and recurrence rate between the two groups. After considering all factors, elderly patients were more likely to develop minor postoperative complications than the younger ones but were not more prone to life-threatening events. The elderly patients need timely imaging checks to receive appropriate treatment.

Declarations

Ethics Statement

The study was conducted with the approval of the Ethics Committee of The, Guangdong 999 Brain Hospital, Medical College of JiNan University. And the patient has signed informed consent.

Conflicts of interest/disclosures

The authors declare that they have no financial or other conflicts of interest in relation to this research and its publication.

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