

# **Surgical management of spinal meningioma**

**Thesis**

*Submitted for Partial Fulfillment of The Master degree (M.Sc.) in  
Neurosurgery*

**By**

**Mahmoud Ramadan Adly Ali**

**(M.B., B.Ch.)**

*Faculty of Medicine, Benisuef University*

*Supervised By*

**Prof. Dr. Sameh Ahmed Sakr**

*Professor of Neurosurgery,  
Faculty of Medicine, Cairo University*

**Prof. Dr. Mohamed Ahmed EL Beltagy**

*Professor of Neurosurgery,  
Faculty of Medicine, Cairo University*

**Dr. Mohamed Ahmed Hewedy**

*Lecturer of Neurosurgery,  
Faculty of Medicine, Benisuef University*

*Faculty of Medicine  
Cairo University*

**2016**

# التدخل الجراحى لعلاج الاورام السحائية بالحبل الشوكى

رسالة مقدمة من

**الطبيب/ محمود رمضان عدلى على**

بكالوريوس الطب والجراحة

كلية طب بني سويف

توطئة للحصول على درجة الماجستير

في

جراحة المخ والأعصاب

تحت إشراف

**أ.د. سامح أحمد صقر**

أستاذ جراحة المخ والأعصاب

كلية الطب – جامعة القاهرة

**أ.د. محمد أحمد البلتاجى**

أستاذ جراحة المخ والأعصاب

كلية الطب – جامعة القاهرة

**د. محمد أحمد هويدى**

مدرس جراحة المخ والأعصاب

كلية الطب – جامعة بني سويف

كلية الطب

جامعة القاهرة

2016

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

﴿ قَالُوا سُبْحَانَكَ لَا عِلْمَ لَنَا إِلَّا مَا عَلَّمْتَنَا

﴿ إِنَّكَ أَنْتَ الْعَلِيمُ الْحَكِيمُ

صدق الله العظيم  
الآية (32) سورة البقرة

# Contents

Contents	Page
----------	------

Acknowledgment	II
Abstract	III
List of figures	IV
List of tables	Vii
List of abbreviations	Viii
Introduction	1
Aim of work	3
Review of literature	4
Epidemiology	4
Anatomy	6
Pathology	26
Clinical picture	36
Investigations	44
Differential diagnosis	52
Treatment	61
Patients and method	80
Results	83
Case presentation	94
Discussion	107
Conclusion	110
Summary	111
References	113
Arabic Summary	121

# Acknowledgment

First of all, my deepest thanks go to God, for giving me the patience, power, and health to finish this work.

I am greatly honored to express my thanks and gratitude to **Prof. Dr. Sameh Ahmed Sakr**, Professor of Neurosurgery, Faculty of Medicine, Cairo University, for guidance great help encouragement and his creative support throughout the whole work up of this essay and for his valuable supervision of this thesis.

I am greatly honored to express my deepest thanks, gratitude and respect to my mentor **Prof Dr. Mohamed Ahmed ELBeltagy**, Professor of Neurosurgery, Faculty of Medicine, Cairo University, for his guidance, supervision, and continuous advice throughout this work.

I am deeply thankful to **Dr. Mohamed Ahmed Hewedy**, Lecturer of Neurosurgery, Faculty of Medicine, Benisuef University. for his extreme care, great effort and faithful supervision not only during this work but ever since I started my residency.

I am greatly honored to learn from their experience and wise counsel, and thankful for their for giving me some of their precious time.

Special thanks to my father, my mother, my wife and all my family for their support and great help for completing this work.

In conclusion, I wish to thank all my professors and colleagues for their help and co-operation.

# Abstract

Spinal meningiomas are the second common spinal tumor, they account for 25-46% of primary spinal cord tumors, It is proved that early surgical intervention is the best management for spinal meningioma.

The current prospective study was carried in Cairo university hospitals on 15 patients suffering from spinal meningioma which were diagnosed by clinical suspicion and radiological investigations, These cases were operated upon by surgical excision through posterior approach and the outcome of these cases and factors affecting the outcome are observed.

In our study we have concluded that early diagnosis and early surgical intervention have better results as delay can lead to permanent neurological deficit. Postoperatively, remarkable improvements in neurological deficits were achieved, however risk factor as age, severe preoperative neurological deficit also if the tumor is ventral to the cord and calcified, surgery becomes challenged, have been considered as predictors of a poor surgical outcome, Also 3 predictor variables for recurrence were invasion of the arachnoid/pia, Simpson resection grade and histological tumor grade. .

Key words:

Neurosurgery - spinal cord - spinal meningioma - Outcome - Surgical intervention .

## List of figures

List of figures	Page
<b>Figure 1:</b> First cervical vertebra or atlas	<b>6</b>
<b>Figure 2:</b> Second cervical vertebra, from above	<b>7</b>
<b>Figure 3:</b> A cervical vertebra	<b>7</b>
<b>Figure 4:</b> Side view of a typical cervical vertebra	<b>8</b>
<b>Figure 5:</b> A thoracic vertebra	<b>9</b>
<b>Figure 6:</b> A lumbar vertebra from above and behind	<b>10</b>
<b>Figure 7:</b> the spinal cord coverings	<b>11</b>
<b>Figure 8:</b> ligaments of the spinal canal	<b>18</b>
<b>Figure 9:</b> Arterial supply of the spinal cord	<b>20</b>
<b>Figure 10:</b> Blood supply of the spinal cord	
(A) Arterial supply of the spinal cord.	<b>22</b>
(B) Venous drainage of the spinal cord.	<b>23</b>
<b>Figure 11:</b> Cross section in spinal cord	<b>25</b>
<b>Figure 12:</b> Microscopic picture for Meningothelial meningioma	<b>28</b>
<b>Figure 13:</b> H and E stain for a psammomatous meningioma.	<b>29</b>
<b>Figure 14:</b> H and E stain for a fibroblastic meningioma .	<b>29</b>
<b>Figure 15:</b> H and E stain for a transitional meningioma.	<b>30</b>
 <b>Figure 16:</b> Microscopic pictures for WHO grade II meningiomas :	 <b>31</b>
(A) Atypical meningioma with increased mitotic activity	
(B) clear-cell meningioma with clear.	
(C) chordoid meningioma .	
 <b>Figure 17:</b> Microscopic pictures for WHO grade III meningiomas :	 <b>23</b>
(A) Anaplastic meningioma	
(B) rhabdoid meningioma	
(C) papillary meningioma	
 <b>Figure 18:</b> Sagittal T2W MRI for typical dorsal meningioma.	 <b>33</b>
<b>Figure 19:</b> Sagittal T2W MRI for typical cervical meningioma.	<b>34</b>
<b>Figure 20:</b> Sagittal T2W MRI for Lumbosacral meningioma.	<b>35</b>
<b>Figure 21:</b> CT dorsal spine for intradural Ossified meningioma.	<b>44</b>
(A) sagittal section	
(B) axial section	

<b>Figure 22:</b> Sagittal MRI for dorsal meningioma :	<b>46</b>
(A) T1W: homogenous lesion slightly lower intense than the cord.	
(B) T2W: slightly hyper intense than that of the cord	
(C) with contrast : homogenous enhanced lesion .	
<b>Figure 23:</b> Sagittal T1W MRI for a dorsal meningioma.	<b>46</b>
<b>Figure 24:</b> Sagittal T1W MRI for dorsal meningioma :	<b>47</b>
(A) without contrast : isointense meningioma	
(B) with contrast : homogeneously enhances.	
(C) Axial : displacement of the cord to the left .	
<b>Figure 25:</b> MRI for extradural cervical meningioma :	<b>47</b>
(A) Sagittal T1W : isointense mass behind the odontoid.	
(B) Sagittal T2W : hypo intense than the cord.	
(C) sagittal T1W with contrast : homogeneously enhanced lesion.	
<b>Figure 26:</b> T1W MRI for recurrent en plaque dorsal meningioma	<b>49</b>
(A) Sagittal with contrast	
(B) axial with contrast	
<b>Figure 27:</b> MRI for dorsal Neurofibroma	<b>53</b>
<b>Figure 28:</b> images for a recurrent dumbbell cervical schwannoma	<b>54</b>
(A) Oblique X-ray of the cervical spine	
(B) coronal T1W MRI with contrast: enhanced schwannoma	
(C) CT demonstrates bony erosion on the right side	
<b>Figure 29:</b> MRI for Lumbar Schwannoma below conus	<b>54</b>
(A) Sagittal T1W: isointense to cord.	
(B) Sagittal T2W: slightly hyper intense to cord.	
(C) axial T2W MRI.	
<b>Figure 30:</b> Sagittal MRI for Myxopapillary ependymoma	<b>55</b>
<b>Figure 31:</b> T2W image MRI for "dermoid cyst"	<b>56</b>
<b>Figure 32:</b> MRI for arachnoid cyst	<b>57</b>
(a) T1W image : hypointense arachnoid cyst	
(b) T2W image : isointense arachnoid cyst	
<b>Figure 33:</b> MRI for the lumbar spine leptomeningeal disease.	<b>59</b>
<b>Figure 34:</b> Sagittal T2W MRI for lumbar Epidural Granuloma .	<b>60</b>
<b>Figure 35:</b> Sagittal T2,T1 and axial T1 MRI with contrast for a dorsal meningioma.	<b>74</b>



Accompanying intraoperative photograph for the tumor	
<b>Figure 36:</b> Intraoperative photo for dorsal meningioma .	<b>75</b>
<b>Figure 37:</b> (Chart): Level of the tumor	<b>83</b>
<b>Figure 38:</b> (Chart) Tumor incidence by age group	<b>84</b>
<b>Figure 39:</b> (Chart): distribution by sex	<b>85</b>
<b>Figure 40:</b> (Chart) Clinical Symptoms and signs on initial examination	<b>87</b>
<b>Figure 41:</b> (Chart) Extent of surgical resection	<b>88</b>
<b>Figure 42:</b> (Chart) Clinical results	<b>93</b>
<b>Figure 43:</b> Postoperative complications	<b>93</b>
<b>Figure 44:</b> preoperative MRI and CT for dorsal meningioma	
(A) T1-weighted sagittal MRI with contrast.	<b>96</b>
(B) T1-weighted sagittal MRI without contrast.	<b>96</b>
(C) T2-weighted sagittal MRI.	<b>97</b>
(D) T2-weighted axial MR image.	<b>97</b>
(E) T1-weighted axial MR image with contrast	<b>98</b>
<b>Figure 45 :</b> Intra-operative findings of spinal meningioma excision.	<b>98</b>
<b>Figure 46 :</b> Post-operative MRI showing mass removal at D11-D12 level.	
(A) Post-operative T2W MRI.	<b>99</b>
(B) Post-operative sagittal T1W MRI.	<b>99</b>
(C) Post-operative sagittal T1W MRI with contrast	<b>100</b>
(D) Post-operative axial T1W with and without contrast.	<b>100</b>
<b>Figure 47 :</b> Pre-operative cervicodorsal MRI dorsal meningioma at D1,2,3.	
(A) sagittal T1W with contrast	<b>103</b>
(B) sagittal T1W without contrast	<b>103</b>
(C) sagittal T1W without contrast	<b>104</b>
(D) Axial T2W image with contrast .	<b>104</b>
<b>Figure 48 :</b> postoperative cervicodorsal MRI	
(A) T1W and T2W sagittal without contrast cervicodorsal MRI.	<b>105</b>
(B) T1 and T2 sagittal with contrast cervicodorsal MRI.	<b>105</b>
(C) T2W Axial with contrast after excision of the tumor.	<b>106</b>

# List of Tables

		Page
<b>Table 1</b>	British Medical Research Council (MRC) grading system	<b>43</b>
<b>Table 2</b>	The Simpson grade of meningioma resection	<b>70</b>
<b>Table 3</b>	Level of the tumor	<b>83</b>
<b>Table 4</b>	Tumor incidence by age group	<b>84</b>
<b>Table 5</b>	distribution by sex	<b>85</b>
<b>Table 6</b>	Clinical symptoms in relation to location of the tumor	<b>86</b>
<b>Table 7</b>	Clinical symptoms and signs on initial examination	<b>87</b>
<b>Table 8</b>	Extent of surgical resection	<b>88</b>
<b>Table 9</b>	British Medical Research Council (MRC) grading system	<b>89</b>
<b>Table 10</b>	Functional outcome of motor power using British Medical Research Council (MRC) grading system	<b>91</b>
<b>Table 11</b>	Clinical results postoperative	<b>92</b>
<b>Table 12</b>	Pathological classification	<b>92</b>
<b>Table 13</b>	Postoperative complications	<b>93</b>

## List of abbreviations

<b>CT</b>	Computed tomography
<b>EMG</b>	Electromyography
<b>Gd</b>	Gadolinium contrast
<b>H and E</b>	Hematoxylin and eosin stain
<b>LL</b>	lower limb
<b>MEP</b>	Motor-evoked potentials
<b>MRI</b>	Magnetic resonance imaging
<b>SSEP</b>	Somatosensory-evoked potentials
<b>UL</b>	upper limb
<b>WHO</b>	World Health Organization

## Introduction

Spinal meningiomas are the second common spinal tumor, they account for 25 - 46% of primary spinal cord tumors they represent 7.5 - 12.7% of all meningiomas of the body, they are slowly growing, well circumscribed tumors, mostly benign in nature, arising from the arachnoid "cap" cells of the arachnoid villi in the meninges.<sup>(23)</sup>

Commonly arise between the fifth and seventh decades of life, more frequently in females, 75 - 85 % of them arise in women, most frequently present in dorsal spine followed by cervical then lumbosacral spine.<sup>(5)</sup>

The first reported successful resection of a spinal meningioma was in 1888 by Sir Victor Horsely and Sir William Gowers. While they initially described their spinal tumor as a fibromyxoma, the term "meningioma" that is now universally employed was introduced by Harvey Cushing. Cushing and Eisenhardt defined removal of a spinal meningioma as "one the most gratifying of all operative procedures" With modern imaging, the delay in the diagnosis of spinal meningiomas has been significantly shortened.<sup>(10)</sup>

Tumor location is one of the most important factors affecting the clinical outcome. Spinal meningiomas are usually localized lateral to the spinal cord, but 15 - 27% of cases are located anteriorly and constitute a surgical challenge.<sup>(28)</sup>

As the majority of spinal meningiomas are benign, well circumscribed, surgery is the treatment of choice; offers the potential for "cure" without the need for further treatment, however risk factor as age, severe preoperative neurological deficit also if the tumor is ventral to the cord and calcified,

surgery becomes hazardous and may damage the cord have been considered as predictors of a poor surgical outcome. <sup>(10)</sup>

## **Aim of the work**

The aim of this study to review the literature about the spinal meningiomas, their incidence, clinical picture, the best management, and reveal the factors affecting surgical outcome.

## EPIDEMIOLOGY

Meningiomas represent the second common spinal tumors; represent 25 - 46% of all primary intraspinal tumors, most of them are intradural, the fraction of entirely extradural meningiomas range from 3 - 9%.<sup>(72)</sup>

The relative ratio of meningiomas to nerve sheath tumors, however, varies by population. While the incidence of meningiomas and nerve sheath tumors is about equal in the Western population, in Asian populations, schwannomas are more common and have been reported with ratios of almost 3.8 - 1 in China and 3.9 - 1 in Japan.<sup>(30)</sup>

There is a female predominance, with spinal meningiomas 75 - 85% of meningiomas arise in women. This female predominance has been postulated to be due to sex hormones or the existence of various other receptor types (steroid, peptidergic, growth factor and aminergic) that may contribute to tumor formation.<sup>(7)</sup>

Spinal meningiomas can be found in any age group, but they most frequently present between the fifth and seventh decades of life.<sup>(57)</sup>

Their distribution within the spinal axis varies, with the majority located within the dorsal spine; 76 - 84% of spinal meningiomas are found in the dorsal region.<sup>(16)</sup>

In the cervical region, the incidence of spinal meningiomas is 14 -27%. While meningiomas are the most common benign tumor found at the foramen magnum, low cervical meningioma are rare. The majority of these are located in the high cervical region. The incidence in the lumbar spine is 2 - 14%,