



Falcine Meningiomas: Analysis of the Impact of Radiologic Tumor Extensions and Proposal of a Modified Preoperative Radiologic Classification Scheme

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■ **BACKGROUND:** Although extensively studied, few papers have specifically addressed the surgical implications of horizontal and vertical tumor extensions in falcine meningioma (FM). The available classification systems do not address these tumor extensions and thus do not characterize FM in their entirety.

■ **OBJECTIVE:** To determine the influence of radiologic tumor extensions on the clinicroadiologic and surgical aspects of FM, propose a new preoperative radiologic scheme for these tumors, and report our surgical outcomes.

■ **METHODS:** Thirty-five patients with FM (mean age, 50.03 years; male/female ratio, 16:19) were classified into unilateral conventional (type I; $n = 17$), unilateral high (type II; $n = 9$) and bilateral FM (type III; $n = 9$) based on the coronal magnetic resonance imaging findings. We excluded the primary parasagittal meningiomas from our analysis.

■ **RESULTS:** Type II and III tumors were more common in males (unlike the overall cohort), presented more often with seizures, and were associated with less favorable postoperative outcomes. Preoperative motor weakness was almost exclusively seen with the unilateral tumors (type I/II). Preexisting weakness ($P = 0.02$) was a strong predictor of the likelihood of postoperative motor power worsening, the major surgical complication in our series ($n = 9$; 25.7%). New-onset postoperative weakness ($n = 2$) recovered completely, whereas worsening of the preexisting weakness showed only a partial improvement ($n = 6$).

■ **CONCLUSIONS:** The proposed classification scheme characterizes FMs comprehensively. Bilaterality and parasagittal extensions in FMs affect their clinical presentation, increase surgical difficulty, and influence the surgical outcome adversely. Preexisting motor weakness portends a poor postoperative motor outcome.

INTRODUCTION

Falcine meningiomas (FMs) are relatively uncommon but extensively studied tumors.¹⁻⁵ Although surgery remains the mainstay of treatment, stereotactic radiosurgery is assuming an increasingly important role in their management in the contemporary era.^{6,7}

The surgical outcome in FMs is largely dependent on the tumor location and its relationship with the adjoining vasculature, particularly the superior sagittal sinus (SSS). These tumors may have extensions along or perpendicular to their falcine attachment. However, these horizontal and vertical tumor extensions and their impact on the disease process have received little specific attention. Bilaterality and venous sinus encroachment in a craniocaudal direction increase the surgical complexities in FMs and thus demand specific operative considerations.

The existing classification schemes for FMs fail to consider these tumor extensions comprehensively.^{3,8,9} Thus, there is a need for a new classification scheme for the comprehensive description and categorization of FMs from a surgical perspective. Apart from appropriate characterization of the tumors, such a classification

Key words

- Contralateral
- Falx
- Outcome
- Parasagittal meningioma
- Surgery
- Venous sinus
- WHO grade

Abbreviations and Acronyms

- CEMRI:** Contrast-enhanced magnetic resonance imaging
CI: Confidence interval
FM: Falcine meningioma
OR: Odds ratio
PSM: Parasagittal meningioma

SSS: Superior sagittal sinus

TCR: Trigemino-cardiac reflex

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scheme may potentially facilitate selection of the most appropriate surgical approach as well as enable anticipation of the surgical difficulties. In this study, we propose a modified preoperative radiologic classification scheme for these tumors, discuss the pertinent operative nuances, and report our surgical results in the light of the proposed classification scheme.

METHODS

Patient Population

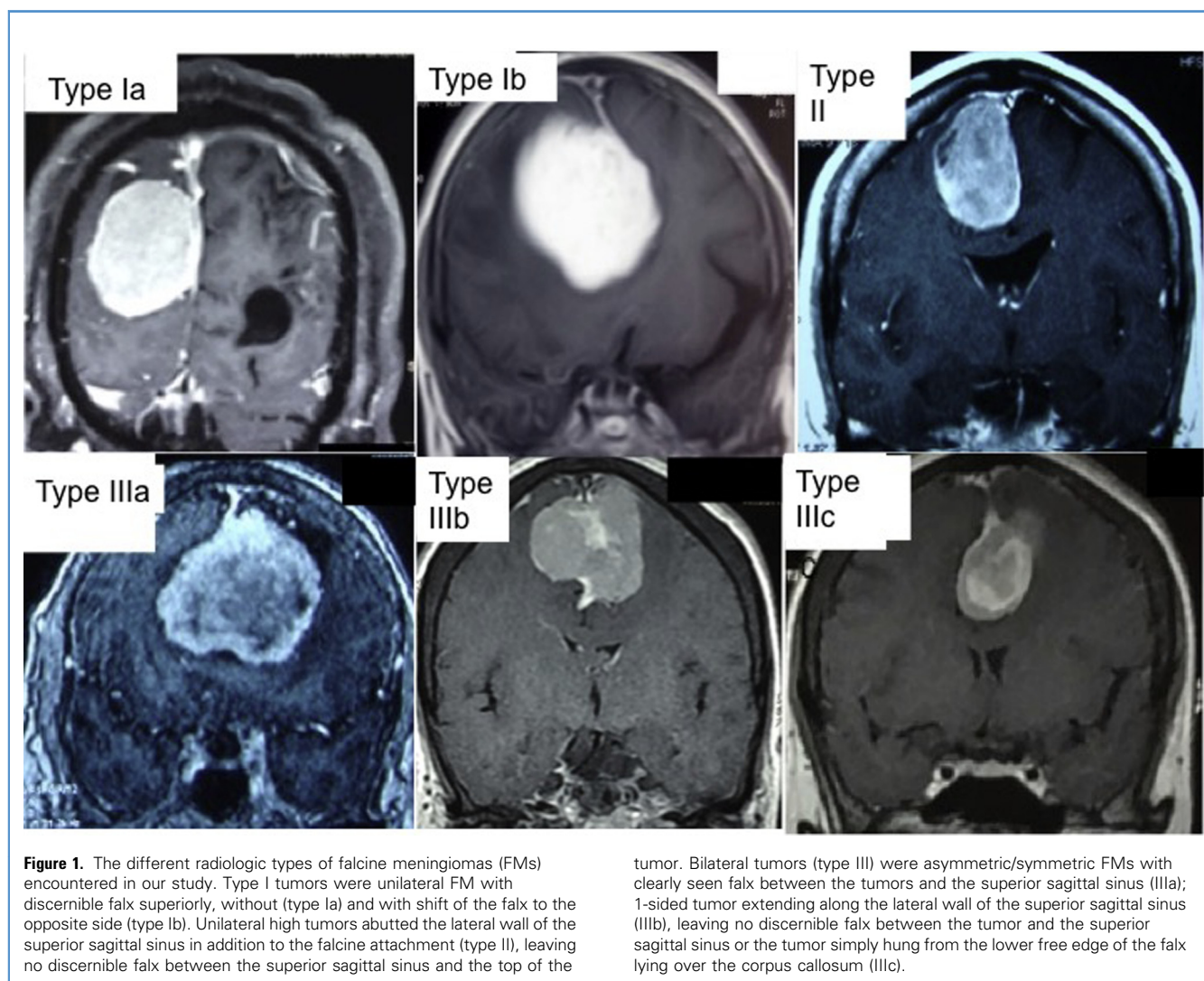
We studied 35 patients (mean age, 50.03 years; male/female ratio, 16:19) with histopathologically verified FM operated between 2010 and 2016 at a tertiary-care teaching hospital. Meningiomas based on the falx cerebri but away from the SSS (pure falcine; $n = 21$) as well as those FMs that abutted the inferior angle and/or the lateral wall of the SSS but still having their bases on the falx cerebri (falcine plus; $n = 14$) were included for this analysis. These high-riding falcine plus tumors are often considered as primary parasagittal meningiomas (PSMs), although in actuality these are FMs

with secondary parasagittal extension. Inclusion of these borderline tumors was one of the key aspects of our study because these have not been specifically analyzed in previous studies. Primary PSMs, having their epicenter in the parasagittal angle, were excluded. The study was approved by our institute ethics committee and informed consent was obtained from all patients.

Neuroimaging

Radiological evaluation involved contrast-enhanced magnetic resonance imaging (CEMRI) of the brain in all and magnetic resonance venography in selected cases (falcine plus). Based on the relationship of the tumor base with respect to the overlying calvarium, the tumors were categorized into anterior, middle, and posterior third FMs.⁸ In this study, we propose a new classification of these tumors based on the coronal sections of the preoperative CEMRI (Figure 1). This classification was a modification of the classification previously reported by Zuo et al.³

Type I. Unilateral conventional FM without (Ia; $n = 11$) or with (Ib; $n = 6$) shift of the falx cerebri to the contralateral side ($n = 17$).



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