

Metabolic Syndrome and Incidental Meningioma : A Cohort-Based Nested Case-Control Study

Hyun-Seung Lee, Yeon-Tae Jung, Dong-Kun Kim, Beom-Jun Kim, Yong-Taek Lee, Kyung-Jae Yoon,
Chul-Hyun Park, Yoonju Na*

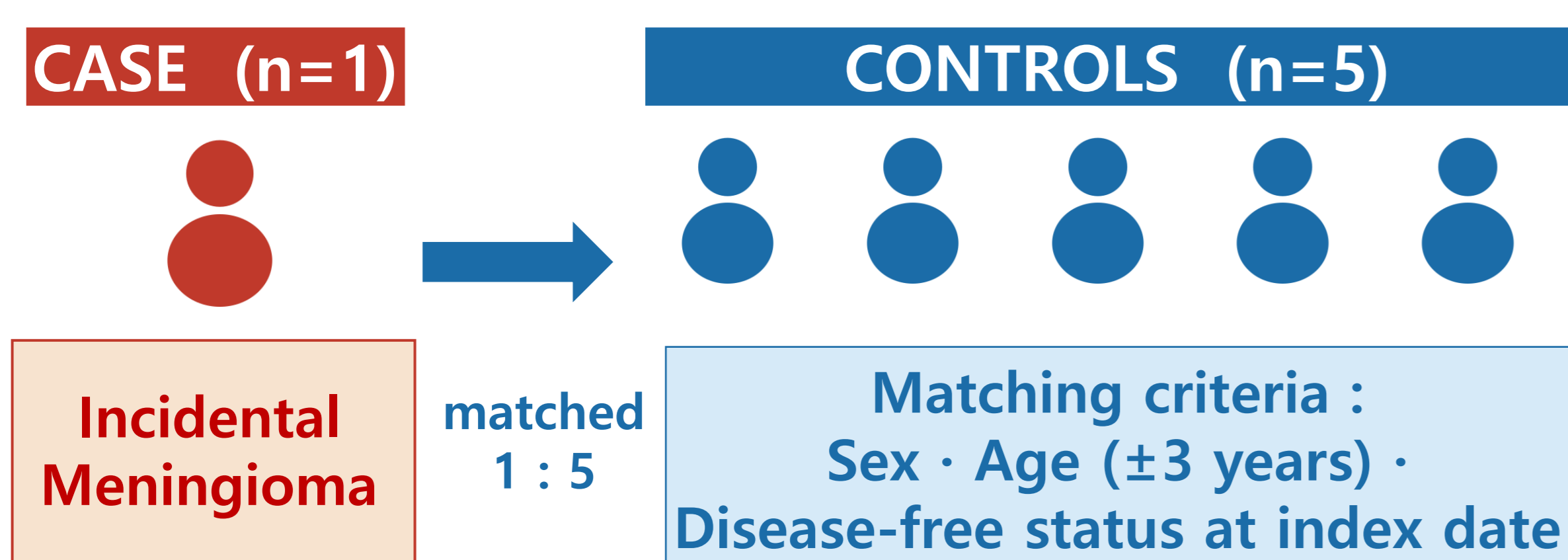
Department of Physical and Rehabilitation Medicine, Kangbuk Samsung Hospital, Sungkyunkwan University

Introduction

- **Meningioma** is the **most common** primary intracranial tumor, with **incidental detection** increasing due to widespread neuroimaging.
- **Meningiomas** typically follow a benign course; however, surgical treatment or tumor progression may result in motor, cognitive, and language impairments, underscoring the importance of early identification of modifiable risk factors.
- Recent studies conducted in Europe have suggested that **obesity and hypertension** are associated with increased meningioma risk, but evidence in Asian populations remains limited.
- We aimed to evaluate the association between **Metabolic Syndrome and its individual components** with **Incidental Meningioma** in a Kangbuk Samsung Health Study (KSHS) cohort.

Subjects & Methods

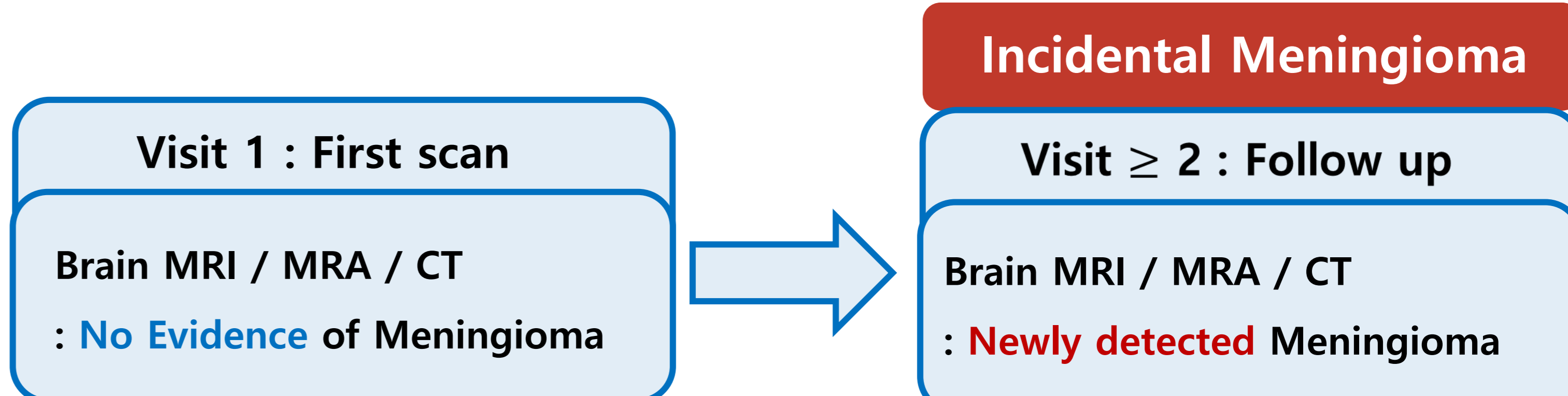
Cohort-based nested case-control study



Statistical analysis

- Conditional logistic regression : to evaluate the association between Metabolic syndrome and its individual components and the risk of incidental meningioma.
- Adjusted for age, smoking, alcohol, history of coronary artery disease, BMI, CES-D, LDL-C, IPAQ category.

Incidental Meningioma was defined



Metabolic syndrome was defined

- Korean-modified NCEP-ATP III criteria (Table 1).
- Three or more positive index above criteria were determined as metabolic syndrome.

Table 1. Diagnostic criteria for the clinical diagnosis of metabolic syndrome (NCEP-ATP III)

Category	Details
Abdominal obesity	Waist circumference (≥ 90 cm in male, ≥ 85 cm in female)
HTN	≥ 130 mm Hg systolic BP or ≥ 85 mm Hg diastolic BP or treatment of previously diagnosed hypertension
High TG	TG: ≥ 150 mg/dL
Low HDL	HDL: < 40 mg/dL in male, < 50 mg/dL in female
High Fasting glucose	Fasting glucose ≥ 100 mg/dL or treatment of previously diagnosed type 2 DM

Results

Table 2. Baseline characteristics of study population

Characteristics	Total (n=631)	Control (n=524)	Meningioma [†] (n=107)	* P value
Number of subjects (n)	631	524	107	
Age (years)	44.57 (9.08)	44.58 (9.07)	44.51 (9.21)	0.942
Sex (male)	347 (55.0)	288 (55.0)	59 (55.1)	>0.999
Height (cm)	167.10 (8.90)	167.12 (9.00)	167.03 (8.46)	0.930
Weight (kg)	67.21 (13.57)	66.98 (13.48)	68.36 (14.00)	0.337
Waist circumference(cm)	82.89 (9.84)	82.69 (9.83)	83.89 (9.89)	0.252
BMI(kg/m ²)	23.91 (3.48)	23.82 (3.42)	24.34 (3.79)	0.162
Fat mass (kg)	18.36 (6.71)	18.23 (6.59)	18.99 (7.29)	0.283
Percent body fat (%)	27.11 (7.02)	27.04 (7.00)	27.49 (7.14)	0.547
Smoking status				0.710
Never smoker	301 (49.3)	249 (49.2)	52 (50.0)	
Former smoker	211 (34.6)	178 (35.2)	33 (31.7)	
Current smoker	98 (16.1)	79 (15.6)	19 (18.3)	
Alcohol intake (g/day)	9.29 (15.61)	9.38 (16.24)	8.88 (12.15)	0.773
Vigorous exercise(days/week)	0.91 (1.54)	0.88 (1.51)	1.04 (1.66)	0.347
Comorbidities				
Hypertension (%)	86 (13.7)	73 (14.0)	13 (12.1)	0.732
Diabetes mellitus (%)	28 (4.4)	23 (4.4)	5 (4.7)	>0.999
Dyslipidemia (%)	134 (21.3)	111 (21.2)	23 (21.5)	>0.999
Coronary artery disease(%)	8 (1.3)	6 (1.1)	2 (1.9)	0.894
Laboratory findings				
Total cholesterol (mg/dL)	196.97 (36.82)	195.58 (37.55)	203.79 (32.32)	0.036*
LDL-C (mg/dL)	127.63 (35.11)	126.33 (35.78)	133.98 (31.00)	0.040*
HDL-C (mg/dL)	59.05 (15.54)	59.13 (15.09)	58.63 (17.65)	0.758
Triglycerides (mg/dL)	127.59 (89.30)	126.86 (92.50)	131.18 (71.80)	0.649
Fasting glucose(mg/dL)	98.83 (20.54)	98.53 (19.84)	100.31 (23.73)	0.416
SBP(mmHg)	111.18 (13.33)	111.14 (13.41)	111.36 (13.03)	0.876
DBP(mmHg)	71.98 (10.04)	71.89 (10.05)	72.41 (10.02)	0.627
HbA1c (%)	5.67 (0.71)	5.65 (0.68)	5.76 (0.87)	0.129
CESD (score)	7.14 (7.72)	7.17 (7.75)	7.00 (7.63)	0.837
CUXOS (score)	32.93 (13.27)	32.44 (13.10)	35.90 (14.06)	0.122
KOSS (score)	37.19 (11.56)	37.04 (11.85)	38.20 (9.41)	0.639

Table 3. Association between Metabolic syndrome and its Individual components with Incidental Meningioma

Subgroup	Multivariable-adjusted OR (95% CI)		
	Model 1	Model 2	Model 3
Total			
Non metabolic syndrome group	1.00 (ref)	1.00 (ref)	1.00 (ref)
Metabolic syndrome group	1.75 (1.01–3.06)	1.53 (0.79–2.99)	1.41 (0.71–2.79)
Individual Metabolic Syndrome components			
Abdominal obesity^a			
Control group	1.00 (ref)	1.00 (ref)	1.00 (ref)
Case group	1.32 (0.81–2.17)	0.83 (0.42–1.66)	0.78 (0.38–1.57)
HTN^b			
Control group	1.00 (ref)	1.00 (ref)	1.00 (ref)
Case group	0.84 (0.46–1.54)	0.67 (0.35–1.27)	0.67 (0.35–1.29)
High TG^c			
Control group	1.00 (ref)	1.00 (ref)	1.00 (ref)
Case group	1.33 (0.78–2.26)	1.22 (0.69–2.16)	1.14 (0.63–2.06)
Low HDL^d			
Control group	1.00 (ref)	1.00 (ref)	1.00 (ref)
Case group	1.85 (1.01–3.41)	1.44 (0.71–2.89)	1.37 (0.67–2.81)
High Fasting glucose^e			
Control group	1.00 (ref)	1.00 (ref)	1.00 (ref)
Case group	1.32 (0.82–2.12)	1.22 (0.73–2.02)	1.12 (0.67–1.89)
Obesity (BMI≥ 25 kg/m²)			
Control group	1.00 (ref)	1.00 (ref)	1.00 (ref)
Case group	1.26 (0.79–2.02)	0.86 (0.41–1.79)	0.85 (0.41–1.79)

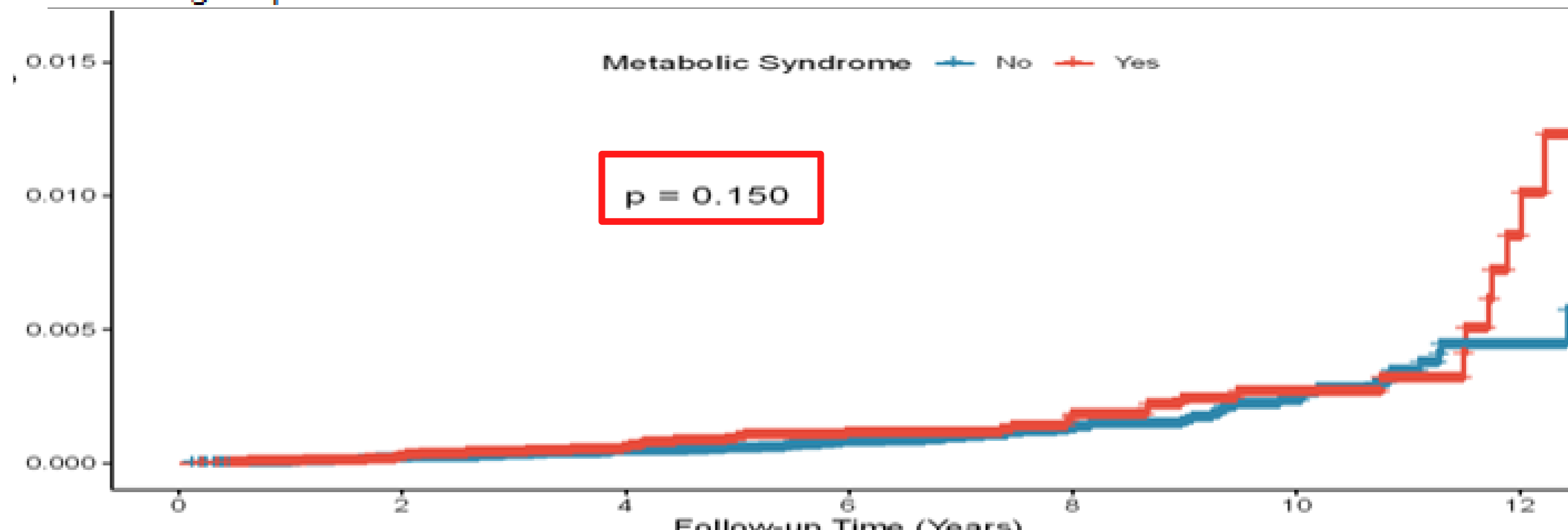


Figure 1. Kaplan-Meier curves of cumulative meningioma incidence by Metabolic syndrome status (log-rank $p=0.150$).

Conclusion

- **Metabolic Syndrome and its individual components** were **not independently associated** with **Incidental Meningioma** after multivariable adjustment, contrasting with prior European cohort findings.
- Further studies with subgroup analyses by Metabolic syndrome duration and other risk factors are warranted.