

KORELASI ANTARA DERAJAT *INTRATUMORAL SUSCEPTIBILITY SIGNAL* BERDASARKAN SEKUENS SWI PADA MRI DAN DERAJAT HISTOPATOLOGIS PASIEN MENINGIOMA

William Sumoro¹, Bambang Supriyadi², Evi Artsini², Sudarmanta², Anita Ekowati²

¹Residen, ²Staf Departemen Radiologi,
Fakultas Kedokteran, Kesehatan Masyarakat, dan Keperawatan Universitas Gadjah Mada

INTISARI

Latar Belakang: Meningioma adalah tumor intrakranial primer terbanyak dengan spektrum agresivitas biologis luas. Penentuan derajat histopatologis secara praoperatif penting untuk perencanaan terapi, namun saat ini masih bergantung pada pemeriksaan invasif. Sekuens *susceptibility-weighted imaging* (SWI) mampu mendeteksi perubahan mikrostruktur tumor melalui penilaian *intratumoral susceptibility signal* (ITSS) yang berpotensi menjadi biomarker noninvasif derajat keganasan.

Tujuan: Menilai korelasi antara derajat ITSS pada sekuens SWI MRI dengan derajat histopatologis meningioma berdasarkan klasifikasi WHO.

Metode: Penelitian analitik observasional dengan desain potong lintang menggunakan data retrospektif pasien meningioma usia >18 tahun yang menjalani MRI kepala dan pemeriksaan histopatologi di RSUP Dr. Sardjito periode September 2024–September 2025. Derajat ITSS dinilai secara semikuantitatif pada citra SWI. Analisis korelasi dilakukan menggunakan uji Spearman, serta dilakukan analisis regresi logistik multivariat untuk mengevaluasi faktor prediktor derajat tinggi.

Hasil: Sebanyak 60 pasien memenuhi kriteria inklusi. Karakteristik subjek penelitian didominasi oleh jenis kelamin perempuan (70%) dengan rentang usia 28-75 tahun. Uji reliabilitas penilaian derajat ITSS oleh dua radiologis independen menunjukkan tingkat kesepakatan yang sangat baik (*kappa Cohen* = 0.85). Terdapat korelasi sangat lemah arah positif antara derajat ITSS keseluruhan dengan derajat histopatologis ($\rho = 0,148$) dan tidak bermakna secara statistik. Tidak terdapat variabel (termasuk ITSS, volume tumor, dan batas tumor) yang terbukti sebagai prediktor independen derajat meningioma WHO II–III. Namun, analisis komponen ITSS menunjukkan bahwa komponen *hemorrhage* berasosiasi signifikan dengan meningioma derajat tinggi, sedangkan kalsifikasi berasosiasi dengan derajat rendah.

Kesimpulan: Derajat ITSS total tidak berkorelasi bermakna dengan derajat histopatologis meningioma. Namun, karakteristik komponen ITSS (*hemorrhage* dan kalsifikasi) memberikan informasi diagnostik tambahan yang relevan secara klinis.

Kata kunci: meningioma, SWI, ITSS, MRI, derajat tumor

CORRELATION BETWEEN THE DEGREE OF INTRATUMORAL SUSCEPTIBILITY SIGNAL ON MRI SWI SEQUENCE AND THE HISTOPATHOLOGICAL GRADE OF MENINGIOMA PATIENTS

William Sumoro¹, Bambang Supriyadi², Evi Artsini², Sudarmanta², Anita Ekowati²

¹Resident, ²Staff Radiology Department,
Faculty of Medicine, Public Health, and Nursing Universitas Gadjah Mada,
Yogyakarta

ABSTRACT

Background: Meningioma is the most common primary intracranial tumor with a wide spectrum of biological behavior. Preoperative grading is crucial for treatment planning, yet it still relies on invasive histopathology. Susceptibility-weighted imaging (SWI) enables detection of microstructural tumor changes through intratumoral susceptibility signals (ITSS), which may serve as a noninvasive biomarker.

Objective: To evaluate the correlation between ITSS grade on SWI MRI and histopathological grade of meningioma based on WHO classification.

Method: This retrospective cross-sectional study included adult patients with histopathologically confirmed meningioma who underwent brain MRI at Dr. Sardjito General Hospital between September 2024 and September 2025. ITSS was assessed semi-quantitatively on SWI images. Spearman correlation and multivariate logistic regression analyses were performed.

Results: A total of 60 patients met the inclusion criteria. The subject characteristics were predominantly female (70%) with an age range of 28-75 years. The reliability test for ITSS grade assessment by two independent radiologists showed excellent agreement (Cohen's kappa = 0.85). There was a very weak positive correlation between overall ITSS grade and histopathological grade ($p = 0.148$), which was not statistically significant. No variable, including ITSS, tumor volume, or tumor margin, was identified as an independent predictor of high-grade meningioma (WHO II–III). However, component analysis revealed that hemorrhagic ITSS was significantly associated with high-grade meningiomas, whereas calcification was associated with low-grade tumors.

Conclusions: Overall ITSS grade does not significantly correlate with histopathological grade of meningioma. Nevertheless, qualitative assessment of ITSS components provides clinically valuable information in preoperative evaluation.

Keywords: meningioma, SWI, ITSS, MRI, tumor grading