

## Araştırma / Research Article



## Kontrastsız MRG, insidental olarak saptanan menenjiomların izleminde bir alternatif olabilir mi?

### Can unenhanced MRI be an alternative following incidentally discovered meningioma?

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#### ÖZET

**Giriş ve amaç:** İnsidental olarak tespit edilen küçük menenjiomlar genellikle takip edilirler. Görüntüleme genellikle MR tercih edilmek üzere kontrastlı görüntüleme yöntemleri kullanılır. Son yıllarda özellikle gadolinyum bazlı kontrast ajanların kullanımı ile ilgili endişeler mevcuttur. Bu çalışmanın amacı kontrastlı T1A seriler ile T2A seriler arasında boyut açısından ölçüm farklılığı olup olmadığını araştırmaktır. **Gereç ve yöntem:** Ardışık 30 menenjiom hastasının (20 kadın 10 erkek, 33-85 yaş, ortalama 64.1 yaş) kontrastlı MR görüntüleri birbirinden bağımsız iki radyolog tarafından değerlendirildi. Menenjiom boyutları kontrastlı T1A ve T2E T2 sekanslarında her bir gözlemci tarafından üç boyut olacak şekilde ölçüldü. Üç boyutlu ölçümden  $A \times B \times C \times 0.52$  formülü ile ortalama volüm hesaplandı. Her bir sekans için gözlemciler arasındaki güvenilirlik ve her bir gözlemci için sekanslar arasındaki güvenilirlik hesaplandı. **Bulgular:** En sık menenjiom lokalizasyonu konveksite ve parasagittal bölge idi. Gözlemciler arası ve sekanslar arası güvenilirlik tüm karşılaştırmalarda mükemmeldi. Karşılaştırmaların sınıf içi korelasyon katsayıları 0,974 ile 0,997 arasında bulunmuştur. **Sonuç:** Takip edilmesi planlanan (yeri önceden bilinen) menenjiom olgularında böbrek fonksiyonları sınırdan veya bozuksa, böbrek fonksiyonları normal olsa bile kontrast kullanımı endişeleri bulunuyorsa yada çoklu kontrast kullanmanın yan etkilerinden kaçınmak isteniyorsa kontrastsız takipler bir alternatif olarak tartışılabilir.

#### ABSTRACT

**Objective:** Small meningiomas detected incidentally are usually followed. Contrast enhanced imaging (Magnetic Resonance Imaging-MRI- preferred) are often used for the meningioma following. In recent years, there have been concerns about the use of gadolinium-based contrast agents. The aim of this study is to investigate whether there is a difference in measurement between contrast enhanced T1W and the T2W series in MRI. **Materials and methods:** Contrast-enhanced MRI images of 30 consecutive meningioma patients (20 females, 10 males, age range 33-85 years, median age 64.1) were evaluated by two independent radiologists. Meningioma sizes were measured as three dimensions by each observer in contrast T1A and T2E sequences. The reliability between the observers for each sequence and the reliability of the sequences for each observer were calculated. **Results:** The most common meningioma localization was convexity and parasagittal region. Interobserver and intersequencial reliability was excellent in all comparisons. The intraclass correlation coefficient of the observer measurements ranging between 0,974 and 0,997. **Conclusion:** If the use of contrast is concerned, even if the renal function is borderline or abnormal, kidney functions are normal even in cases of meningioma planned for follow-up, unenhanced imaging follow-ups can be discussed as an alternative if side effects of using multiple contrasts are to be avoided.

#### INTRODUCTION

Meningiomas originate from the arachnoid meningeal cells. They account for 13-37% of all intracranial tumors (1). World Health Organization (WHO) has classified meningiomas into three groups depending on tumor grade and recurrence probability. WHO grade 1 tumor has a low recurrence rate and a low aggressive characteristic. WHO grade 2 is atypical meningiomas and WHO grade 3 is anaplastic meningiomas (2). They are diagnosed by computed

tomography and magnetic resonance imaging. Necrosis and hemorrhage are rare and 25% of them may be calcified. They usually show homogeneous and intense contrast uptake in contrast-enhanced examinations. There is an increase in the diagnosis of incidental meningioma due to increased use of neuroimaging (3, 4). In recent years, asymptomatic meningiomas have been diagnosed more frequently than those which are symptomatic (5). Although there are treatment options such as surgical resection, stereotactic radiosurgery,

and progesterone antagonist, follow-up without any treatment is also performed (4, 6-8). Slowly-growing, asymptomatic small meningiomas can be followed up (9). It is inevitable for these patients, who will be followed up for years, to have numerous contrast-enhanced MR imaging examinations. In recent years there have been publications suggesting that gadolinium-based MR contrast agents caused nephrogenic systemic fibrosis and accumulation in the brain (10). Therefore, it is recommended to put efforts in order to minimize the potential use of MR contrast agents (11).

The aim of this study is to investigate whether unenhanced MRI examinations would be an alternative to contrast-enhanced MRI examinations or not, by calculating the correlation between the measurements of contrast-enhanced MRI and unenhanced MRI sequences in known meningioma cases.

## METHODS

The approval for this study was obtained from the Ethics Committee of our institution. Hospital records were retrospectively screened and the images of 30 consecutive patients undergone contrast-enhanced MR imaging and clinically suspected of meningioma

were retrospectively evaluated. The cases only with unenhanced MRI examination were not included in the study.

The cranial examinations of all cases were performed with the 3T MRI device (Siemens Skyra, Erlangen Germany). The standard examination protocol consisted of axial TSE T2W, T1W and FLAIR, sagittal and coronal TSE T2W, and axial and sagittal T1W sequences following contrast substance administration. Axial and sagittal TSE T2W and axial and sagittal contrasted TSE T1A sequences were used to standardize the evaluation. The scan parameters of the sequences are given in Table 1.

The MR images of the patients were evaluated at different times by two radiologists who were unaware of each other. The evaluations were performed at the Syngovia workstation (Siemens, Germany). To assess intra-observer reliability, the measurement was repeated by the same radiologist a week later. The tumor sizes were measured in contrast-enhanced T1W (CE T1W) and TSE T2W sequences by each observer so as to be three-dimensional (Figure 1). As defined in the literature, the mean volume was calculated from the three-dimensional measurement with the formula of  $A \times B \times C \times 0.50$  (12). Calculated volumes were recorded.

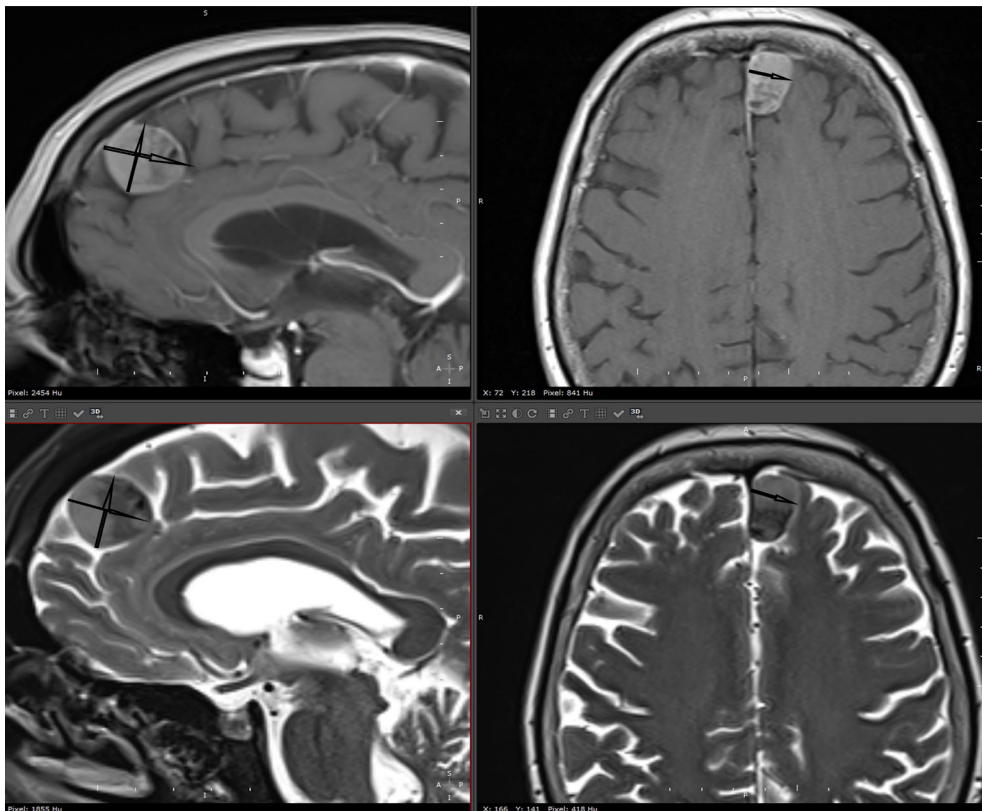


Figure 1. Measurement technique is shown. Contrast enhanced T1W sequence (upper row) and FSE T2W sequence (lower row) were measured all three dimension.

## STATISTICAL ANALYSIS

The reliability between the observers for each sequence (interobserver) and the reliability of the sequences for each observer (intersequencial) were calculated. Intraclass correlation coefficients (ICCs) and 95% confidence intervals were calculated to assess between observers measurements. All statistical analyses were done using IBM SPSS statistic version 22.

## RESULTS

The mean age of a total of 30 cases included in the study was 64.1 years (33-85 years of age). Of the cases, 20 were female (the mean age is 65.35 years) and 10 were male (the mean age is 61.6 years). Of the lesions, 14 were on the right (46.7%), 14 were on the left (46.7%), and 2 were in the midline (6.6%). According to their localizations, of the lesions, eight were convexity (26.66%), eight were parasagittal (26.66%), five were cerebellopontine angle (16.67%), four were sphenoid wing (13.33%), two were quadrigeminal cistern (% 6.67), one was tentorial (3.33%), one was the posterior cerebellar (% 3.33) and one was olfactory groove (3.33%).

Interobserver reliability was excellent in all comparisons. The ICC values of comparisons, ranging between 0,974 and 0,997. The results are given in table 2.

## DISCUSSION

In this study, excellent reliability was detected between CE T1W and TSE T2W tumor size measurements for each observer. The differences between the tumors in terms of the volume measurements were quite small. The inter-observer agreement in terms of each sequence was found to be quite high. We compared the results of our study with the results of the studies conducted on schwannomas due to the lack of these kinds of studies about meningiomas in the literature and the similarity in appearance. In 2011, Bayraktaroğlu et al. compared the measurements of the CE T1W series and CISS sequences with 2 observers in vestibular schwannoma cases (13). In this study, there was no statistically significant difference between the intersequential measurements of both observers. The correlation of the sequences between the observers was calculated as 0.945 for the first observer and 0.922 for the second observer. Although researchers have not demonstrated intratumoral hemorrhage or necrotic changes, they have reported that a contrast-free sequence, such as CISS, may be an alternative in the follow-up of vestibular Schwannoma's dimensional progression. In our study, we also found that the measurements of both observers between the sequences were higher in terms of volumes (0.995 and 0.997). Abele et al. evaluated internal auditory canal lesions smaller than 10 mm by using unenhanced axial CISS

Table 1. Sequences parameters

|                        | TR   | TE   | Slice Thickness | FOV   | NEX | ETL |
|------------------------|------|------|-----------------|-------|-----|-----|
| <b>TSE T2 Sagittal</b> | 3360 | 75   | 3,5             | 23x25 | 1   | 18  |
| <b>TSE T2 Coronal</b>  | 3520 | 74   | 4,0             | 17x22 | 1   | 18  |
| <b>TSE T2 Axial</b>    | 3540 | 101  | 3,0             | 17x22 | 1   | 15  |
| <b>T1 Axial</b>        | 263  | 2,64 | 3,0             | 17x22 | 1   | 1   |
| <b>FLAIR</b>           | 7500 | 85   | 3,0             | 17x22 | 1   | 16  |
| <b>CE T1 Axial</b>     | 250  | 2,49 | 3,0             | 17x22 | 1   | 1   |
| <b>CE T1 Sagittal</b>  | 240  | 2,46 | 3,5             | 23x25 | 1   | 1   |

TR: Time repetition, TE: Echo time, FOV: Field of view, NEX: Number of excitation, ETL: Echo train length, TSE. Turbo spin echo, FLAIR: Fluid attenuated inversion recovery  
CE: Contrast enhanced

Table 2. Intraclass correlations

|        |           | ICC   | 95% confidence interval | P    |
|--------|-----------|-------|-------------------------|------|
| O1     | T1-T2 vol | 0,997 | 0,993-0,998             | 0,01 |
| O2     | T1-T2 vol | 0,995 | 0,989-0,997             | 0,01 |
| T1 vol | O1-O2     | 0,974 | 0,946-0,988             | 0,01 |
| T2 vol | O1-O2     | 0,996 | 0,992-0,998             | 0,01 |

ICC: Intraclass correlation coefficient O1: Observer 1, O2: Observer 2,  
T1 vol: Contrast enhanced T1 volume, T2 vol: TSE T2 volume

and coronal T2W sequences (14). In this study using double observers, both observers found the sensitivity and specificity of the CISS+T2W sequence combination as 100% and 96-98%, respectively.

CT and MRI are used in the follow-up of meningiomas. The contrast-enhanced TSE T1A sequence is important in the detection and follow-up of tumors. The administration of contrast agent facilitates the detection of meningiomas as well as provides information on the internal structure of a tumor. The necrotic/cystic changes of tumors may be more significantly demonstrated in contrast-enhanced examinations. However, the cystic changes and necrosis are rare findings in meningiomas (15). Unlike the CISS sequence, the necrotic and cystic changes can be recognized in TSE T2W images. The administration of the contrast agent is not useful in detecting intratumoral or subarachnoid haemorrhages. The susceptibility weighted imaging (SWI), also an unenhanced examination used today, is more useful to investigate hemorrhages (16). There are studies evaluating the growth of tumors volumetrically or planimetrically. In the literature, there are publications about the fact that volumetric growth is faster than the planimetric growth (12).

In this study, the condition during follow-ups was not evaluated. Therefore, the progression rates of the CET1W and TSE T2W sequences were not compared. In the study of Bayraktaroğlu et al. they made a kappa analysis to investigate progression agreement of two observers and found a very good agreement for the CISS sequence with 0.902. The same measurement was calculated as 0.706 (good agreement) in the contrast-enhanced examination (13). Secondly, since most of the cases in this study did not undergo any surgical procedure, the exact size of the lesion was unknown and only the agreement between the contrast-enhanced and unenhanced sequences was investigated. In cases who underwent surgery and whose exact size of the tumor is known, whether the contrast-enhanced sequence or the unenhanced sequence has a more accurate measurement result can be investigated.

This study demonstrated that unenhanced follow-ups may be an alternative in meningioma cases planned to be followed up if borderline or impaired renal functions are present and if there is concern about the use of contrast substance even if the renal functions are normal, or if it is desired to avoid the side effects of the multiple contrast substance use.

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