MR angiography of esophageal mural veins in portal hypertension: a correlation with endoscopic grades of esophageal varices

Portal hipertansiyonlu olgularda özofagus mural venlerinin MR anjiografik görünümü ile özofagus varislerinin endoskopik derecesi arasındaki korelasyon

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Background/aims: *The esophageal mural veins are important for providing blood to the esophageal submucosal varices. The purpose of this study was to investigate any correlation between the diameters of esophageal mural veins as observed on routine contrast-enhanced magnetic resonance angiography and the endoscopic grades of esophageal varices in patients with portal hypertension.* ***Methods:*** *The images of 57 patients with portal hypertension in whom magnetic resonance portography was performed were evaluated retrospectively. The correlation between the diameter of the esophageal mural veins and the endoscopic grade of the esophageal varices was investigated with Spearman's correlation test. This test was also used to assess the correlation between the grade of esophageal varices and the diameters of the paraesophageal veins. A p value less than 0.05 was considered to be statistically significant.* ***Results:*** *A positive correlation was determined between the diameter of mural veins and the endoscopic grade of the esophageal varices (p=0.022; r=0.363). There was no correlation, however, between the endoscopic grade of the esophageal varices and the diameter of the paraesophageal veins.* ***Conclusions:*** *A correlation exists between the diameters of the esophageal mural veins and the endoscopic grades of the esophageal varices. Magnetic resonance angiography may give information about the status of the esophageal varices in portal hypertensive patients.*

Key words: Portal hypertension, MR angiography, esophageal varices

Amaç: *Özofagusun mural venleri, özofagustaki submukozal varislerle bağlantılı olması bakımından önem taşır. Bu çalışmanın amacı, portal hipertansiyonlu hastalarda özofagus varislerinin endoskopik derecesi ile rutin kontrastlı (magnetik rezonans) anjiografide görülen özofagus mural venlerinin çapı arasında korelasyon olup olmadığını belirlemektir.* ***Metod:*** *Magnetik rezonans portografi yapılan portal hipertansiyonlu 57 hastanın görüntüleri retrospektif olarak değerlendirildi. Özofagusun mural venlerinin çapı ile submukozal varislerin endoskopik derecesi arasında uyumluluk olup olmadığı Spearman's korelasyon testiyle araştırıldı. Aynı test kullanılarak özofagus varislerinin derecesiyle paraözofagial venlerin çapı arasındaki korelasyon da değerlendirildi. p<0.05 değeri istatistiksel olarak anlamlı kabul edildi.* ***Bulgular:*** *Özofagus varis derecesiyle mural venlerin çapı arasında pozitif korelasyon bulundu (p=0.022; r=0.363). Özofagus varis derecesiyle paraözofagial venlerin çapı arasında korelasyon saptanmadı.* ***Sonuç:*** *Özofagus mural venlerinin çapıyla özofagustaki varislerin derecesi arasında korelasyon vardır. Portal hipertansiyonlu olgularda, özofagus varislerinin durumu hakkında magnetik rezonans anjiografi fikir verebilir.*

Anahtar kelimeler: Portal hipertansiyon, MR anjiograf, özofagus varisleri

INTRODUCTION

One of the most important clinical outcomes of portosystemic collateral formation is esophageal varices. Approximately half of the cirrhotic patients have esophageal varices at the time of diagnosis. Incidence of varices may increase to 90% in the long-term follow-up of the cases (1). Grade 3 and 4 varices have particular importance since they can cause life-threatening upper gastrointestinal hemorrhage. The gold standard method in the identification of esophageal varices is upper gastrointestinal endoscopy. However, this method is invasive. Although the noninvasive testing of portal hypertension (PHT) such as blood chemistry and sonographic assessment of splenic size

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can be used to identify patients with high risk for bleeding, the benefit that they provide is limited since these methods do not always give consistent results (2). In addition to these methods, upper gastrointestinal barium studies, endoscopic Doppler ultrasonography, magnetic resonance imaging (MRI), MR angiography, computed tomography (CT), and transesophageal MRI are the techniques that can be used in the diagnosis of esophageal varices (2-8).

In the last decade, contrast-enhanced MR angiography has been widely utilized in the evaluation of the portal venous system and the portosystemic collateral circulation in patients with chronic liver disease. The distal esophagus and esophagogastric junction can be clearly visualized during this procedure. In this study, we tried to determine whether the severity of the esophageal varices could be predicted by measuring the size of esophageal mural veins and paraesophageal veins on contrast-enhanced 3D (3-dimensional) MR angiography images. The aim of this study was to investigate any correlation between the diameter of esophageal mural veins observed on routine contrast-enhanced MR angiography and the endoscopic grade of esophageal varices in patients with PHT.

MATERIALS AND METHODS

Patients

Between June 2000 and June 2005, 57 individuals (29 women, 28 men; mean age: 43.5±14.4; age range: 17-75 years) with PHT who underwent MR portography were enrolled into the study. Results of a study in the same patient group were reported in a recent article evaluating MR angiography of veins around the esophagus and the stomach in portal hypertensive gastropathy (9). Upper gastrointestinal endoscopy results of these patients were retrospectively analyzed. The diagnosis of PHT was made when splenomegaly, ascites or portosystemic collaterals were reported on ultrasonographic or CT examinations.

MR Angiography

The MR angiographic examination was performed on 1.0 T MRI system (Signa LX Horizon, General Electric Medical Systems) utilizing a phased-array torso coil. Following a bolus injection of contrast material (gadolinium chelate compound) via the antecubital vein, the scanning was carried out with 3D FSPGR (fast spoiled gradient recalled) pulse sequence in four consecutive phases. The imaging parameters were adjusted as: TR/TE/FA: 6 msec/1.2 msec/20°; receiver bandwidth: 31.2 or 62.5 kHz; image matrix: 256x128-160 and NEX: 1. Approximately 12 seconds were given to patients to respire between the phases of acquisition, each lasting about 15 seconds. After the conclusion of the data acquisition, the source images were processed with maximum intensity projection (MIP) technique to enhance the 3D nature of the vascular structures. For the purpose of this retrospective study, the images obtained in the early and late portal venous phases (approximately 45 and 60 seconds following contrast material injection) were evaluated.

Image Analysis

Diameters of the esophageal mural veins were measured on the magnified axial reformatted images at the work-station. Dot-like enhancements of the esophageal wall during the portal venous phase were considered as esophageal mural veins (Figure 1). The measurements were performed on the image in which the largest diameter of the mural vein was seen. The measurements were repeated three times for each vessel and the averages were used for the analysis. Since the mural veins can be mistaken for paraesophageal varices (dilated veins outside the wall of the esophagus), only contrast-enhanced nodularities having contact with the luminal surface of the esophagus were taken into account. Since a vessel outside the esophageal wall is not present in normal conditions, the vessels located around the esophagus were considered as paraesophageal collaterals (Figure 2).

All cases were also examined with upper gastrointestinal endoscopy and the severity of the esophageal varices were graded from 1-4 (10). The time interval between the MR angiography and upper gastrointestinal endoscopy was a maximum of one month.

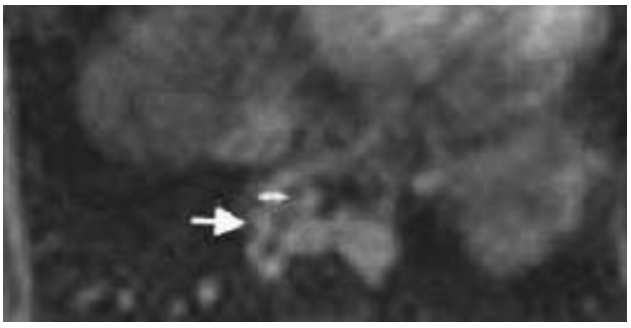

Figure 1. Reformatted MR angiographic image at axial plane shows esophageal mural veins (arrows).

Statistical Analysis

The correlation between the diameter of the esophageal mural veins and the endoscopic grade of the esophageal varices was investigated with Spearman's correlation test. This test was also used to assess the correlation between the grade of esophageal varices and the diameters of the paraesophageal veins (Figure 3). A p value of less than 0.05 was considered to be statistically significant.

RESULTS

Among the 57 patients with PHT, esophageal varices were detected with endoscopy in 44 patients (77%). Grade 1 varices were present in 8 patients, grade 2 in 12 patients, grade 3 in 15 patients, and grade 4 in 9 patients. On MR angiography, esophageal mural veins were detected in 26 of 57 patients (45.6%). Esophageal varices were present in 23 of these 26 patients (88.5%). Based on the presence of the esophageal mural veins on MR angiography, the sensitivity and specificity of the MR angiography for the detection of esophageal varices were 52.3% (95% confidence interval (CI): 0.379-0.663) and 76.9% (95% CI: 0.497–0.918), respectively. The mean mural vein diameter was 2.71±2.95 mm. A positive correlation was found between the diameter of the mural veins and the endoscopic grade of the esophageal varices (p=0.022; r=0.363).

On MR angiography, paraesophageal veins were observed in 20 of 57 patients (35%). The mean diameter of the paraesophageal veins was 7.49±3.64 mm. Esophageal varices were present on endoscopy in 75% (15/20) of cases in whom paraesophageal veins were seen on MR angiography, while paraesophageal veins were detected on MR angiography in 45% (20/44) of patients in whom varices were detected with endoscopy. Based on the presence of the paraesophageal veins on MR angiography, the sensitivity and specificity of the MR angiography for the detection of esophageal varices were 34.1% (95% CI: 0.219–0.489) and 61.5% (95% CI: 0.355-0.823), respectively. No correlation was found between the endoscopic grade of the esophageal varices and the diameter of the paraesophageal veins.

DISCUSSION

The esophageal varices are dilated submucosal veins of the esophagus. They function as a collateral route between the portal venous system and the

Figure 2. Coronal source MR angiographic image shows dilated paraesophageal veins located outside the esophagus (arrow).

Figure 3. Portal venous phase coronal image obtained in a 32-year-old man with portal hypertension shows paraesophageal veins with very thin caliber (arrow). Grade 4 esophageal varices were detected on upper gastrointestinal examination in this patient.

superior vena cava. At present, 3D contrast-enhanced MR and CT angiography are the widely used methods throughout the world in the evaluation of portal venous abnormalities (11,12). From a diagnostic standpoint, the utility of these methods depends on their potential to visualize portal venous anatomy with all its tributaries in any imaging plane. These imaging techniques also permit visualization of the varicose veins in the esophageal wall without discomfort to the patient and without additional cost and complication risk (7).

Wall thickening of the esophagus, intraluminal protrusions and irregularities, as well as nodular enhancements inside the esophageal wall on the cross-sectional images are the findings suggesting the presence of esophageal varices. However, wall thickening and the intraluminal protrusions are not considered specific signs for the varices since similar appearances can be caused by esophageal peristalsis and redundant mucosal folds (4). In the study conducted by Matsuo et al. (6), the sensitivity and specificity of MRI in the detection of esophageal varices were found as 81% and 45%, respectively. In a study reported by Kim et al. (2), the sensitivity, specificity and accuracy of liver CT for varices with a threshold diameter of 3 mm were 92%, 85% and 85%, respectively. A significant positive correlation was found between the endoscopic grading and the vessel diameters on MR and CT examinations involving the distal esophagus (2, 6); however, it is also stated that these methods are not sufficient for omitting the necessity of endoscopy.

During the 3D contrast-enhanced MR angiography, it is important to be able to estimate esophageal varices while evaluating the portal venous system. In our study, a correlation was found between the diameter of the esophageal mural veins and the endoscopic grade of the esophageal varices. However, as this correlation was not very strong, predictions about the varice severity according to the mural vein diameter may not always be accurate. In this regard, MR angiography cannot replace endoscopic examination.

Collateral veins can be detected around the esophagus (paraesophageal veins) in 45% of patients with proven esophageal varices (4). In our study, we also found paraesophageal collaterals in 45% of patients in whom esophageal varices were seen in the endoscopic examination. It is reported that it would be reasonable to assume that esophageal varices are present in all patients with paraesophageal venous collaterals identified on CT images. Nevertheless, no correlation has been found between the endoscopic degree of the varices and the diameter of the paraesophageal venous collaterals. In the series of Balthazar et al. (4), very small varices were detected with endoscopy in a patient who had very large paraesophageal varices. Similar examples regarding the absence of such a correlation were available among our cases (Figure 3).

Irisawa et al. (13) established that the main role of the paraesophageal veins is reducing the portal venous pressure rather than supplying the esophageal varices. Both esophageal varices and paraesophageal veins, with respect to the direction of blood flow, are ascending collaterals developed for decreasing the portal pressure. Particularly, when the function of esophageal varices is interrupted, the paraesophageal collateral venous route becomes apparent. To the best of our knowledge, no data exist in the literature regarding the mean diameter of the paraesophageal veins. Studies on this topic are generally performed to establish the diameter changes after endoscopic treatment of the varices (14-16).

There are some limitations to the present study, the first of which concerns the drawback ascribed to correlating MR angiography results with those of endoscopy. Namely, the largest mural vein seen on the MR angiography was compared with the endoscopic grade. However, during routine endoscopy, a global observation is done and individual variceal diameter differences are not taken into consideration. This limitation is not only valid for the correlation studies with MR angiography but also for all cross-sectional imaging methods, including transesophageal MRI (8). Similarly, one-to-one matching of varices with endoscopic ultrasonography and conventional endoscopy is also not possible (17). In addition, the endoscopic grading is a subjective analysis that is prone to wide inter- and intraobserver variations (18-20). Despite these disadvantages, these diagnostic methods are important in determining bleeding risk (21). Although mural vein diameters on MR angiography may show a correlation with endoscopic grading and somewhat suggest the risk of bleeding, the diagnosis is usually based on the endoscopic findings. Endoscopy also has the potential to facilitate immediate performance of a therapeutic procedure.

In conclusion, MR angiography has a potential role in the assessment of varices in the esophageal

wall. MR angiographic evaluation of the esophageal mural veins may provide a clue about the status of the esophageal varices in PHT patients. We believe that this may have a role, particularly in patients in whom endoscopy could not be performed due to either contraindication or technical difficulties.

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