Comparison of Diagnostic Value of MRI and MRV with MRI/MRV Combination in Cerebral Venous Thrombosis

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Abstract

Introduction: Cerebral venous sinus thrombosis (CVST) is not so common, but it could be lethal if the diagnosis is delayed. Magnetic resonance imaging (MRI), magnetic resonance venography (MRV) and a combination of MRI and MRV have been suggested in such patients, but a direct comparison between the three imaging techniques is missing.

Methods: In this study a total of 10 patients with definite subacute CVST and 10 controls underwent MRI and MRV.

Results: Sensitivity and specificity of the three mentioned techniques were calculated. The sensitivity and specificity of MRI alone were 93.2% and 89.5%. The corresponding values were 77.4% and 96.9% for MRV alone, and 90.3% and 97.3% for a combination of MRI and MRV, respectively.

Conclusions: According to these findings, a combination of MRI and MRV is superior to MRI or MRV alone in detecting subacute CVST.

INTRODUCTION

Development of thrombosis inside the cerebral venous sinuses is called cerebral venous sinus thrombosis (CVST). The disease is not common, but is clinically important that may cause morbidity and mortality if the diagnosis is delayed [1]. The diagnostic method of choice is a combination of magnetic resonance imaging (MRI) and magnetic resonance venography (MRV) [2-4]. MRI can detect both direct and indirect signs of CVST, whereas MRV localize the disease inside the vascular system [2, 5]. Although the combination of MRI and MRV is widely accepted as the standard imaging technique in suspects with CVST, interestingly there is not any study on comparing the diagnostic performance of MRI alone, MRV alone, and their combination in this regard. Therefore, this study aims, for the first time in the literature, to do this comparison in a group of patients with CVST.

METHODS

A total of 10 patients with CVST and 10 controls were studied in this retrospective study in Tabriz Imam Reza Teaching Hospital from January 2014 to March 2015. The diagnosis of CVST was confirmed with the use of venography. The ethics committee of our university approved this study. MRI and MRV were performed in all patients by using a 1.5 tesla MRI machine (Avanto, Siemens). MR images included sagittal, coronal and axial T1 and T2 weighted sequences. MRV images were 2-dimentional TOF sequences with a thickness of 3 mm. Two experienced radiologists reviewed all images independently and a final consensus was reached. The study variables were demographic data, locations of CVST, and the diagnostic accuracy of the imaging methods. Statistics: Sensitivity and specificity of the diagnostic methods were calculated using an Excel-based software (Dag_Stat).

RESULTS

The case group included 6 females (60%) and 4 males (40%) with a mean age of 48.23 ± 12.12 years (range, 27-69). The location of CVST was the transverse sinus in 6 cases (6%) and the sigmoid sinus in 4 cases (40%). All the studied cases had subacute CVST. The controls were 5 males (50%) and 5 females (50%) with a mean age of 46.43 ± 10.87 years (range, 25-71). Sensitivity and specificity of the three imaging methods in detecting CVST are summarized in Table 1. According-ly, MRI was the most sensitive method in detecting CVST, whereas its specificity was the lowest. MRV was the least sensitive method with a high specificity. MRV plus MRV technique was both sensitive and specific in this regard.
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ARDS in patients with subacute CVST [6, 7]. In addition, intracellular

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Diagnostic Accuracy of the Three Imaging Techniques in Detecting CVST

Table 1:

<table>
<thead>
<tr>
<th>Imaging Method</th>
<th>Sensitivity</th>
<th>Specificity</th>
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<tbody>
<tr>
<td>MRI</td>
<td>93.2 (85.4-98.2)</td>
<td>89.5 (83.4-92.0)</td>
</tr>
<tr>
<td>MRV</td>
<td>77.4 (63.4-83.4)</td>
<td>96.9 (91.3-99.2)</td>
</tr>
<tr>
<td>MRI Plus MRV</td>
<td>90.3 (84.4-95.7)</td>
<td>97.3 (92.3-99.9)</td>
</tr>
</tbody>
</table>

Abbreviations: MRI, magnetic resonance imaging; MRV, magnetic resonance venography.

Data in parenthesis indicate 95% confidence interval.

DISCUSSION

In the present study we showed that while MRI alone was

very sensitive in detecting CVST, its specificity was low.

MRV alone, in contrast was very specific but the least sensitive technique. A combination of MRI and MRV, on the

other hand, was both sensitive and specific in the diagnosis of subacute CVST.

The phase of thrombosis is a critical factor in the appearance of CVST on MR images. In subacute stages the thrombosis is

composed of methemoglobin, so it is hyperintense on both T1 and T2 weighted images [6-8]. During subacute phase, signal intensity of the involved sinus is clearly different from a normal flow [2]. This is probably why MRI alone is very sensitive in detecting subacute CVST in the present study.

It has been shown the flow-related enhancement of blood flow is a major source of false positive findings by MRI alone in patients with subacute CVST [6, 7]. In addition, intracellular deoxyhemoglobin and methemoglobin may cause further artifacts in detecting CVST by MRI [9].

Because of such shortcoming of MRI, MRV has been used as a complementary imaging technique in patients with possible CVST [7]. But as shown in the present work, MRV alone is not a sensitive technique in adequate imaging of subacute CVST. This is mainly due to the shine-through effect, in which the thrombosis may seem like a flow in the sinuses [2]. In addition to this effect, intravascular signal loss may also compromise the accuracy of MRV alone in detecting CVST [10]. Other previous studies, in conformity with our finding, have also been reported a low sensitivity of MRV in CVST cases [10, 11].

Finally, as we found a combination of MRI and MRV the most accurate method in detecting CVST, in other studies the high sensitivity and specificity of this technique has been emphasized [12, 13]. But as mentioned earlier, the present work is the only one in the literature that compares the diagnostic performance of MRI alone, MRV alone and MRI plus MRV in detecting subacute CVST.

Not including acute and chronic CVST cases and small sample size should be acknowledged as the major limitations of the present study. Considering these limitations, further studies are recommended for more definite conclusion. In cases with suspected subacute CVST a combination of MRI and MRV is more accurate than MRI or MRV alone.

ACKNOWLEDGEMENTS

None declared.

CONFLICTS OF INTEREST

There is no conflict of interest.

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