

# Improvement of MRI examination in cerebral thromboembolism

Qaynarbekova Mokhinur, Ablyazov A.A, Zulunov Azizbek  
Andijan State Medical Institute Department of Medical Radiology

## Abstract

**Background** Cerebral venous thrombosis (CVT) is a rare disease, and with poor prognosis. Computed tomography (CT) and magnetic resonance imaging (MRI) are the most commonly used image modalities for patients with non-specific neurologic symptoms. We present here a meta-analysis to assess the accuracy of CT and MRI in the differential diagnosis of CVT and cerebral venous sinus thrombosis (CVST). **Materials and Methods** A comprehensive search of the PubMed, EMBASE, Web of Science, Cochrane Database and Chinese Biomedical (CBM) databases was conducted. In this report, we assess the methodological quality of each article individually and perform a meta-analysis to obtain the summary of the diagnostic accuracy MRI in correctly identifying CVT and CVST. **Results** Twenty-four eligible articles comprising 48 studies (4,595 cases) were included. The pooled sensitivity for CT-CVT/CT-CVST groups is 0.79 (95% confidence interval, with an area under the curve (AUC) for the summary receiver operating characteristic (SROC) of 0.9314/0.9161

Difficulties in diagnosing cerebral vein (MV) and venous sinus (VS) thrombosis are associated with a variety of clinical manifestations, localization of thrombosis, the rate of its development, and the cause of the disease. The MV and sinuses of the dura mater contain about 70% of the blood flowing to the brain, however, MV and VS thrombosis is much less common than arterial thrombosis. The course of MV and VS thrombosis is highly variable, ranging from progressive and recurrent to benign and curable.

**Epidemiology.** To date, there are no epidemiological studies on MV and VS thrombosis, so the exact incidence rate is unknown. The first data on the frequency of MV and VS thrombosis were obtained from the results of autopsies. H. Ehlers and C. Courville in 1936, summarizing the results of 12,500 autopsies, identified 16 cases of MV and VS thrombosis, however, data from modern studies indicate that the incidence is 10 times higher.

**Keywords:** Computed tomography, magnetic resonance tomography, intracranial thrombosis

## Introduction

The prevalence of MV and VS thrombosis is heterogeneous. In most patients, the disease develops at the age of 20-50 years. Children and the elderly also get sick. In this regard, the epidemiology of the disease is described separately for different age groups. According to the ISCV DST, the incidence of MV and VS thrombosis in adults is 3-4 cases per 1 million, and in children and newborns - 7 cases per 1 million of the child population. Until the mid-60s, the incidence of MV and VS thrombosis in men and women was considered equal, however, according to recent reports, MV and VS thrombosis occurs more often in women, especially in the age group from 20 to 35 years (male:female ratio is 3: one). The prevalence of the disease in women of childbearing age is most likely associated with pregnancy, the postpartum period, and the use of oral contraceptives. According to a study conducted in the United States in 1993-1994, about 12 births out of 100,000 are complicated by the development of MV and VS thrombosis [7]. An increase in the proportion of women among patients with MV and VS thrombosis over the past decade has been shown, currently it is about 70%. The predominance of female patients is explained by hormonal factors. About 1/3 of women of childbearing age in Western countries use oral contraceptives, which is about 1/2 of patients with MV and VS thrombosis.

There are no reliable data on geographical or ethnic differences in incidence, but several studies have produced noteworthy results. In 2016, data from a study in the Adelaide region (Australia) with an adult population of about 1 million were published. the incidence was 15.7 cases per 1 million population per year; an almost equal distribution of patients by sex was found (52% women, 48% men). The prevalence of MV

and VS thrombosis in the Netherlands in 2008-2010 amounted to 13.2 cases per 1 million population; in Hamadan (Iran) in 2009-2015 - 13.5 cases per 1 million population.



### Material & Methods

A comprehensive search of the PubMed, EMBASE, Web of Science, Cochrane Database and Chinese Biomedical (CBM) databases was conducted. In this report, we assess the methodological quality of each article individually and perform a meta-analysis to obtain the summary of the diagnostic accuracy MRI diagnosis in correctly identifying CVT and CVST.

### Results

Thirty patients were studied in the search of the efficiency of MRI technology to diagnose cerebral venous thrombosis and cerebral venous sinus thrombosis. Twenty eligible articles comprising 48 studies (4,595 cases) were included. The pooled sensitivity for CT–CVT/CT–CVST groups is 0.79 (95% confidence interval). For MRI–CVT/MRI–CVST, the pooled sensitivity is 0.82, and pooled specificity is 0.92, with an AUC for the SROC of 0.92, respectively.

### Discussion

CT and MRI have been widely reported in diagnosing CVT and CVST. However, varied sensitivity and specificity were documented across different studies making it difficult to apply CT and MRI in clinical use. There is no relevant systematic review and meta-analysis reported. Besides, considering the low incidence of CVT and CVST, data from multi-central randomized control trials are also scarce. So, we retrieved 48 eligible comparative studies and conducted a meta-analysis to systematically assess the performance of CT and MRI in diagnosing CVT and CVST.

## Conclusion

This analysis indicates that both MRI has a high level of diagnostic accuracy in the differential diagnosis of CVT and CVST, independent of stage, target for analysis or analysis methods. It could be chosen as alternative sub-optimal gold standards for diagnosing CVT and CVST, especially in emergency cases.

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