Comparison between Nonvisualized Finding of 3d-Tof Mrv Cerebral and Cerebral Angiograpgy result

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Comparision between Nonvisualized Finding of 3D-Tof Mrv Cerebral and Cerebral Angiography Result

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Abstract

Background: Magnetic Resonance Venography (MRV) is a non-invasive method that evaluates the venous system without exposure to the radiation in the procedure compared to cerebral angiography and CT Venography. Nowadays, the use of MRV cerebral started to increase even though there are still many non-visualized (not visualized vein image) on MRV led to divergent interpretations or noncompliance to the findings of cerebral angiography, which is the gold standard to evaluate venous system. There has been few research comparing MRV findings with cerebral angiography so far.

Objective: The aim of this study is to evaluate the findings of non-visualized on MRV compare to cerebral angiography as the gold standard in helping the interpretation of examinations to avoid misdiagnosis.

Methods: Observational retrospective analytic study was used in this study that conducted at Husada Utama Surabaya Hospital from October 2013 to February 2014. 39 out of 49 patients selected as samples for fulfilling the inclusion criteria. The observation on the results of MRV and cerebral angiography procedures performed by two specialists of radiology, then the data were analyzed using SPSS.

Results: Based on the findings of abnormalities location from 39 samples, we found 35.45% abnormalities in the transverse sinus, 32.91% in the sigmoid sinus, 27.84% in the jugular vein, 2.53% in the straight sinus, and 1.27% in the superior sagittal sinus.The results of comparison between MRV test and cerebral angiography showed compliance at 21% hypoplasia with 88.9% of thrombus. MRV test results with the cause of hypoplasia have100% sensitivity, 67.4% specificity, and 70% accuracy.Meanwhile, we found that 41% sensitivity, 82% specificity, and 50% accuracy because of thrombus.

Conclusion: There was significant compliance between 3D-TOF MRV cerebral findings along with cerebral angiography, especially at thrombus.

Keywords: *Magnetic Resonance Venography, Cerebral Angiography, Thrombus, Nonvisualized*

Introduction

The use of Magnetic Resonance Venography (MRV) cerebral as a non-invasive method in the diagnosis of intracranial venous system abnormalities start to increase. MRI combined with MR Venography (MRV) has largely replaced the conventional invasive modalities such as angiography and CT [1]. MRV could be done without the use of contrast agents but by using of Time-of-Flight (TOF) technique. However, based on the previous studies, flow and artifacts could interfere in the evaluation of venous structures [2].

MRV has been widely used because not only it is non-invasive but also it does not give radiation exposure like cerebral angiography and CT Venography procedure. Therefore, the non-visualized (vein image not visualized) findings on MRV often led to diverse interpretations [3]. Some previous studies also found many images that show MRV pitfall or inconsistency in findings compared with cerebral angiography as the

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gold standard: R.H. Ayanzen et al. (31%) , Sharma UK (47%), E. Widjaja (51%) [4].

There has been few research findings comparing MRV with cerebral angiography so far. The aim of this study is to evaluate the findings of non-visualized on MRV compared to cerebral angiography as the gold standard to help the interpretation of the examinations to avoid misdiagnosis.

Method

Observational retrospective analytic study was used in this study that conducted at Husada Utama Surabaya Hospital from October 2013 to February 2014. The data obtained from observing the medical records of patients that examined with MRV cerebral and angiography cerebral [5]. There were 49 patients that examined with MRV cerebral and angiography cerebral. However, we only used 39 samples which their medical records were completed and accessible. Interpretation of the results of MRV and cerebral angiography performed by two specialists in radiology meanwhile,the data were analyzed using SPSS [6].

Results

Most of the research samples were chronic CVA patients (35.89%) while, patients with a ruptured aneurysm (2.56%) were the fewest sample. The data distribution of patients based on clinical diagnosis could be seen in Table 1. Meanwhile, table 2 shows the location of abnormalities with the highest percentage was in the transverse sinus (35.45%), and the lowest percentage was in the superior sagittal sinus (1.27%).

The examination of 39 samples using MRV found 50 findings. Detailed MRV examination results could be seen in Table 3. MRV examination results show the highest readings was hypoplasia in 19 people (38%), while the thrombus and non-visualized respectively were 18 people (36%) and 13 patients (26%).

We found 50 findings in 39 patients using angiography. The results of angiography could be seen in Table 4 that was showed the highest result in the examination is thrombus in 39 samples (78%). Table 5 shows the results of cross tabulation between MRV examination results with the results of angiography examination. 20 samples (40%) from the results of MRV examination are found match with the results of angiography. MRV examination results with hypoplasia were 19 samples, while the results of angiography were only 4 samples (21%).The remaining 11 samples were thrombus and four other samples were normal. MRV examination results showed 18 samples of thrombus while,16 samples (88.9%) of thrombus were found in the results of angiography. Then, the remaining two samples were normal. MRV examination results showed 13 samples of non-visualized which examined with angiography showed 12 samples (92.3%) of thrombus and the other one sample was normal.

Table 5 shows the results of MRV sensitivity of hypoplasia were 100% with a specificity of 67.4% and accuracy of 70%, whereas the results of MRV sensitivity of the thrombus were 41% with a specificity of 82% and accuracy of 50%. Both MRV and cerebral angiography readings in this study were observed by the two senior radiology specialists (dr. ADS experts of neuroradiology and dr. LM who works in interventional radiology section). If there is a difference in the interpretation of MRV and cerebral angiography, then decisions are taken by consensus (agreement). However, before consensus, each observer of MRV and cerebral angiography were tested their interpretation reliability by calculating the interobserver variation for each parameter characteristic image of MRV and cerebral angiography that were observed. The interobserver reliability showed good results, with a kappa coefficient (k) above 0.9 with $p < 0.05$ for all parameters examined in the interpretation on the readings of MRV and cerebral angiography. It could be said that the examiners have good reliability interobserver.

Table 1. Data Distribution Based on Clinical Diagnosis

Diagnosis	Frequency	Percentage (%)
Vertigo	7	17.95
Cephalgia	2	5.13
Chronic CVA	14	35.89
Acute CVA	10	25.64
Sub-acute CVA	3	7.69
TIA	2	5.13
Ruptured aneurysm	1	2.56
Total	39	100%

Table 2. Distribution of Data Based on Location Abnormalities

Abnormalities location	Frequency	Percentage (%)
Superior sagittal sinus	1	1,27
Straight sinus	2	2,53
Sigmoid sinus	26	32,91
Transversus sinus	28	35,45
Jugular vein	22	27,84
Total	79	100

Table 3. Data Distribution Based on Inspection Results MRV

Result of MRV examination	Frequency	Percentage (%)
Hipoplasia	19	38
Trombus	18	36
Non visualized	13	26
Total	50	100

Table 4. Data Distribution Based on Inspection Results Angiography

Result of Angiography	Frequency	Percentage (%)
Hipoplasia	4	8
Trombus	39	78
Normal	7	14
Total	50	100

Table 5. Cross-Tabulation Results of MRV with Angiography

Hipoplasia Trombus			Angiography			Total
			Normal			
MRV	Hipoplasia	Amount	4	11	4	19
		% within MRV	21.1%	57.9%	21.1%	100.0%
		% within Angiography	100.0%	28.2%	57.1%	38.0%
		% from Total	8.0%	22.2%	8.0%	38.0%
	Trombus	Amount	0	16	2	18
		% within MRV	0%	88.9%	11.1%	100.0%
		% within Angiography	.0%	41.0%	28.6%	36.0%
		% from Total	.0%	32.0%	4.0%	36.0%
	Non-visualized	Amount	0	12	1	13
		% within MRV	.0%	92.3%	7.7%	100.0%
		% within Angiography	.0%	30.8%	14.3%	26.0%
		% from Total	.0%	24.0%	2.0%	26.0%
Total		Amount	4	39	7	50
		% within MRV	8.0%	78.0%	14.0%	100.0%
		% within Angiography	100.0%	100.0%	100.0%	100.0%
		% from Total	8.0%	78.0%	14.0%	100.0%

Discussion

Based on the data, the distribution pattern of sample by the highest amount of clinical diagnosis are chronic CVA 14 people (35.89%), vertigo 7 people (17.95%), cephalgia 2 people (5.13%), acute CVA 10 people (25.64%), sub-acute CVA 3 people (7.69%), TIA 2 (5.13%). The findings are consistent with the previous studies that have reported CVT could be found in about 10-20% of stroke patients. The distribution based on the

highest percentage abnormality located on the first place were; transverse sinus abnormalities 35.45%, sigmoid sinus 32.91%, jugular venous 27.84%, straight sinus 2.53%, and superior sagittal sinus 1.27%.

Location prediction is matching with previous research that showed 31% of abnormalities found in sinus transversus and 90% of thrombus have been reported in transverse sinus and sigmoid sinus, while 15% to 30% of non-visualized patients have partial or complete absence on one of the transverse sinus. Images related the loss signal of blood vessels mostly appearedat the use of 3D-TOF MRV that occurs in sinus transverse non-dominant. If it appeared on the sinus transverse dominant, it could be estimated that there are venous obstruction which resulting in the appearance of venous hypertension intracranial. Variant of normal venous anatomy may resemble sinus thrombosis [7]. MRV artifacts could resemble cerebral venous thrombosis in the absence of normal signal flow in venous or sinus [8].

Test results of MRV with hypoplasia were 19 samples, but the results of angiography with hypoplastic were only 4 samples (21%), while the remaining 11 samples thrombus and four other samples were normal. That happened may be due to changes in the dynamics of blood flow in hypoplasia or aplasia venous sinus resulting in loss of flow marks on 3D-TOF MR Venography which able to resemble thrombosis. MRV pitfall in the diagnosis is related to flow and refocusing of the slow flow [9], thatcould resemble intraluminal thrombus or blood products paramagnetic (intracellular deoxyhemoglobin or methemoglobin) as a normal signal. Low T2 signal intensity in the early stages could be interpreted as a flow-void [10]. This variant could be further divided into veins anatomical variants that resemble occlusion (sinus atresia or hypoplasia), asymmetric or sinus drainage variant (occipital sinus, sinus duplication), and normal sinus filling defects (arachnoid granulation, intrasinus septa). Usually, when there is a low signal into a vein, it is associated with flow void and signs of venous patency [11]. However, there are intracellular deoxyhemoglobin, which is dark on T2 and resembles a flow void at some stages of thrombus. Hypoplasia and aplasia transverse sinus on the right or left side is a common finding that could be considered as sinus thrombosisbecause on the MRA showed one of the transverse sinuses was not visible. If hypoplasia still suspected on the transverse sinus, the size of the jugular foramen must be observed [12].

MRV test results showed 18 samples of thrombus, from 18 samples to 16 samples (88.9%) of thrombus and the other two samples were normal on cerebral angiography examination. Results of previous studies showed that MRV hasasensitivity of 100% and a specificity of 78.6% for detectingthe presence of thrombus. High sensitivity of MRV to see a thrombus in the thrombus imagesis due to dural sinus or vein is pathognomonic. Signals of thrombus within the dural sinus or cortical veins vary. However, most patient's thrombus image showing of hyper-intense signal in both the T1 and T2 images. Abnormal T2 signal replaces the normal signal of sinus thrombosis as a definite sign of the existence of a very slow blood flow that could sometimes create a high signal on spin echo T1WI. Findings on the examination of two samples using MRV were read as thrombus but in cerebral angiography read as normal, this may occurs because MRV artifacts may resemble cerebral venous thrombosis in the absence of signals in normal flow or venous sinuses.Most of the loss of artifactual on vascular signal could be seen with the use of 3D-TOF MRV [13].

MRV test results showed 13 samples of non-visualized, from those 13 samples the angiography obtained 12 samples (92.3%) of thrombus, while the remaining sample was normal. Findings nonvisualized on MRV showed 92.3% of thrombus on its angiography cerebral could be due to the 3D-TOF flow gap occurs as a result of intravascular slow blood flow as blood flow patterns are complex and varied features [14]. This diversity illustrates the pathophysiological changes seen after venous occlusion. There are two main processes; the first process is the presence of local edema and venous infarction that usually seen after a cortical vein occlusion, while the second process is the presence of intracranial hypertension, both processes often occur together [15]. These results indicate that the sensitivity of hypoplasia using MRV of 100% with a specificity of 67.4% and accuracy of 70%, whereas the sensitivity of the thrombus using MRV is 41% with a specificity of 82% and accuracy of 50%.

Conclusions

MRV test's results have compatibility with cerebral angiography examination's results by 40%. The examination results MRV suitability with the results of angiography showed 21% hypoplasia, 88.9% thrombus. Meanwhile, MRV test results that showed nonvisualized obtained 92.3% of thrombus while the remaining 7.7%

were normal in the results of angiography.

MRV test results with the cause of hypoplasia have a sensitivity of 100% and a specificity of 67.4% and an accuracy of 70%. The examination results of MRV with the cause of thrombus have a sensitivity of 41% with a specificity of 82% and an accuracy of 50%. MRV examination without contrast has a diagnostic value that could be considered as non-invasive imaging methods that are useful in cerebral venous disorders.

Ethical Clearance: This research involves participants in the survey using sampling method that was accordant with the ethical research principle based on the regulation of research ethic committee. The present study was carried out in accordance with the research principles. This study implemented the basic principle ethics of respect, beneficence, nonmaleficence, and justice.

Conflict of Interest: The authors report that there is no conflict of interest related with this paper.

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Authors' Contribution: Arif Shidiq do the laboratory research while Anggraini Dwi Sensusiati writes the laboratory result into this paper.

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