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RESEARCH ARTICLE

ROLE OF NON-CONTRAST MAGNETIC RESONANCE ANGIOGRAPHY IN THE DIAGNOSIS OF THE ATHEROSCLEROTIC LESIONS OF THE EXTRACRANIAL CAROTID ARTERIES

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Abstract

Formation of atherosclerotic plaque in the carotid arteries is the leading factor of hemodynamic disturbance in the cere-bral arteries. Visualization and characteristic of these plaques are most important factors from the viewpoint of preven-tive treatment- surgical or conservative. The goal of this study was to assess sensitivity and specificity of non-contrast MRA in evaluation and characteristics of atherosclerotic plaques in the extra-cranial carotid arteries. Our data was ob-tained from 130 patients: 38 were female (29.2%) and 92-male (70.8%). The middle age is 54.8 years (range 17-78 years). Patients were subjected to 3 diagnosis procedures, namely 85 patients were investigated by Doppler USG & 45 patients by MRA method. All patients underwent selective cerebral arterial angiography by DSA as a gold standard method. From 130 patients 27 patients had no atherosclerotic disease; 57 had bilateral atherosclerotic changes; 46 pa-tients had monolateral carotid ath-erosclerotic process. From 260 investigated carotid arteries 51 arteries were detected with complete occlusion (22 right and 21 left occlusion), in 4 patients (8 carotid arteries) bilateral occlusion was seen. 54 carotid arteries had severe degree of stenosis. From this stenosis 27 arteries were more than 90%.32 carotid arteries had moderate degree of stenosis. In 23 carotid arteries mild degree was seen, but in a 100 carotid arteries had complete pa-tency. We concluded that complex noninvasive methods- colored Doppler USG and non-contrast MRA distinguished good accuracy (90%) and may be used as an alternative to DSA.

Keywords: Magnetic resonance angiography (MRA), Ccarotid arteries, Digital Subtraction angiography (DS), Doppler Ultrasonography (USG).

Introduction:

Formation of atherosclerotic plaque in the carotid arteries is the leading factor of hemodynamic disturbance in the cerebral arteries. Visualization and characteristic of these plaques are most important factors from the viewpoint of preventive treatment particularly to choose the surgical intervention [1]. Today there is selection between differ-ent types of operations- angiographic endovascular and endarterectomy [2]. Some patients are not indicated for operations; they need conservative treatment. Magnetic Resonance Angiography (MRA) without intravenous contrast proved itself to be a very sensitive noninvasive method, especially at the site of common carotid artery bifurcation, shows high possibility in the evaluation of the degree of stenosis and morphological characteristic of the atherosclerotic plaque [3, 4, 5].

The modern digital subtraction angiography (DSA) is relatively used as the gold standard method to assess the condition of carotid arteries because it is difficult to make a conclusion about the depth of plaque invasion and cor-rect assessment of the plaque morphology [6]. Even it is not significantly but should be considered the risk of in-vasive character and the involvement of ionizing radia-tion along with the necessity of contrast injecting in this procedure.

Objective:

To assess sensitivity and specificity of non-enhanced MRA in evaluation and characteristics of atherosclerotic plaques localized in carotid arteries, to work out indications for selection of tactics for treatment on the basis of the results obtained from the MRA.

Material & Methods:

Material of this study is based on the analytical data obtained from 130 patients. Out of them 38 were female (formed 29.2%) and 92 (70.8% male) who underwent through examination and treatment at the City hospital #2, St. Petersburg, Russia.

From 130 patients, 32 cases were asymptomatic, not complained from any cerebrovascular symptoms. The middle age is 54.8 years (range 17-78 years).

Patients were subjected to 3 diagnosis procedures, namely 85 patients were investigated by help of Doppler Ultrasonography (USG); 45 patients by the method of MRA. All patients underwent selective cerebral arterial angiography by the help of Digital Subtraction angiography (DSA) as a relative gold standard method for all patients to assess the reliability of MRI with MRA and Duplex ultrasonography.

Degree of stenosis is classified into 5 categories:-

(I) Complete patency.

(II) Mild degree stenosis for less than 30%.

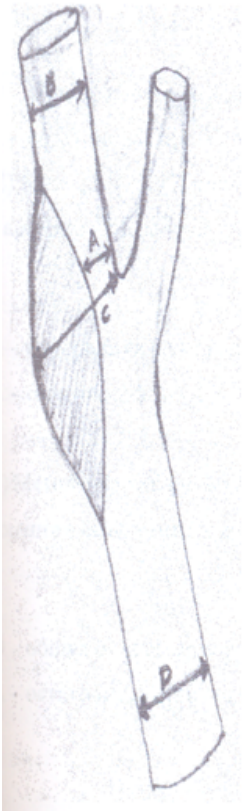
(III) Moderate degree stenosis (30-69%).

(IV) Sever degree stenosis (70-99%).

(V) Complete occlusion.

Table 1: Patients groups by age and gender Distribution (n=130)

Age	Sex		All	
	M	F	Amount	%
17-40	4	7	11	2548.7
41-60	63	21	84	64.6
>60	25	10	35	26.9
Total	**92**	**38**	**130**	**100**



There are three methods used to calculate the stenotic degree namely:-

1. NASCET method in the stenosis of distal in relation to carotid artery (28 patients).

Formulae- $\%\ \text{Stenosis} = 100 - \frac{A \times 100}{B}$

Or $\%\ \text{stenosis} = \frac{B-A}{B} \times 100$

B- Diameter of common carotid artery

A - Rest of the remaining open lumen.

2. Carotid Stenotic Index (CSI) for calculating stenosis in the bulb found in the bifurcation of Common carotid artery (done to 76 patients).

Formulae- $\%\ \text{Stenosis} = \frac{(D \times 1.2) - A \times 100}{D \times 1.2}$

D- Diameter of common carotid artery.
A- Rest of the remaining open lumen.
B-

3. Method of determining the coefficient factor of stenosis of the carotid artery which is below the bifurcation (4 patients).

Formulae- $\%\ \text{Stenosis} = \frac{D-A \times 100}{D}$

D- Diameter of common carotid artery.

A-Rest of the remaining open lumen.

1. DSA method

Intraarterial DSA studies were performed using an apparatus called Angiostar (Siemens –Germany) with a high resolution 1024x1024 pixel image matrix. For approach to this, Femoral artery was used as usual with a (5-French right Judkins) catheter for selective carotid angiography) or 5- French Pig-tail (for non-selective angiography). Intraarterial contrast was obtained by injecting 8 ml of Contrast medium in ratio 4ml/sec by the help of power automatic injector (Angiomat 6000, Liebel – Flarshklinn company- Germany) in an irremovable position of patient with 6 shot image per sec.

The main image was obtained in 3 projections: (postero-anterior, oblique, and lateral projections). Images processed were calculated by digital subtraction machine in order to visualize vessels more clearly.

2. Method of Doppler USG

This method was performed using probe with an operating frequency of 2.4 and 9 MHz to investigate blood flow in the brachiocephalic arteries (common carotid arteries, external and internal carotid arteries). Assessment of the vessels and blood-flow was produced in the following standard points: Bifurcation of the brachiocephalic trunk (medial margins of the sterno-clavicular junction); bifurcation of the common carotid arteries (along the medial margins of the sternocleidomastoid muscle).

The required application before doing Doppler scanning was to give satisfactory answers to the questions such as: degree of the atherosclerotic disease, localization and extension of atherosclerotic plaque and degree of arterial stenosis.

3. MRA method

MRA was performed by the help of 1.0 Tesla MR scanner "Magnetom Impact" (Siemens, Germany). In this method the patient lies in a supine position using receipting-transmitting head/neck coil. Before investigation of MRA, standard MRI is performed using the protocols: axial T2WI and sagittal T1-WI. Angiography by the help of MRI was obtained in axial plan using three dimensional time-of-flight MRA (3D TOF MRA) and pulse sequence FISP (Fast Imaging with Steady-State Precession) with the following sequence parameters: TR (time of repetition) =34; TE (time of Echo) 1oms; FA (flip angle) 20^0 and matrix size with minimal element of picture= 144x256; FOV (field of view) 150x200mm. To assess the blood flow by the intracranial internal carotid arteries ICA, axial 3D-TOF angiography of the cerebral arterial circle was performed. Parameters of pulse sequence FISP: TR =34; TE 1oms; FA 20^0; matrix size = 256x256; and FOV= 200x200mm.

Maximum intensity projection (MIP) reconstruction was made for all images.

Results:

DSA:

From 130 patients 27 patients had no atherosclerotic disease from either sides; 57 had bilateral atherosclerotic changes; 46 patients had monolateral carotid atherosclerotic pathological process. From 260 investigated carotid arteries 51 carotid arteries were detected with complete occlusion (22 right sided and 21 left sided occlusion), in 4 patients (with 8 carotid arteries bilateral occlusion was seen). 54 carotid arteries had severe degree of stenosis. From this stenosis 27 arteries were more than 90%.32 carotid arteries had moderate degree of stenosis. In 23 carotid arteries mild degree was noticed, but in a hundred carotid arteries had complete patency.

Table 2: Patient groups distributed by the degree of stenosis in the carotid arteries using the data of DSA.

No	Degree of stenosis	Gender		Total	%
		M	F		
1.	Complete patency	13	14	27	20.8
2.	Mild degree stenosis (<30%)	7	2	9	6.9
	*Bilateral	4	2	6	4.6
	*Monolateral	3	-	3	2.3
3.	Moderate degree stenosis (30-69%)	11	4	15	11.5
	*Bilateral	3	1	4	3.1
	*+<30%	1	-	1	0.8
	*Monolateral	7	3	10	7.6
4.	Hemodynamically significant stenosis (70-99%):	18	14	32	24.6
	-not complete occlusion:>90%	10	6	16	12.3
	*bilateral	2	-	2	1.5
	*+>70%	1	1	2	1.5
	*+30-69%	3	2	5	3.9
	*+<30%	-	1	1	0.8
	*Monolateral	4	2	6	4.6
	Stenosis (70-89%)-	8	8	16	12.3
	*Bilateral	3	1	4	3.1
	*+30-69%	2	-	2	1.5
	* +<30%	1	1	2	1.5
	*Monolateral	2	6	8	6.2
5.	Complete occlusion	43	4	47	36.2
	*Bilateral	3	1	4	3.1
	*with incomplete contralateral occlusion	9	-	9	6.9
	with severe contralateral stenosis *	5	-	5	3.9
	*with contralateral stenosis 30-69%	5	1	6	4.6
	*with contralateral stenosis <30%	4	-	4	3.1
	*Monolateral occlusion	17	2	19	14.6

Doppler USG:

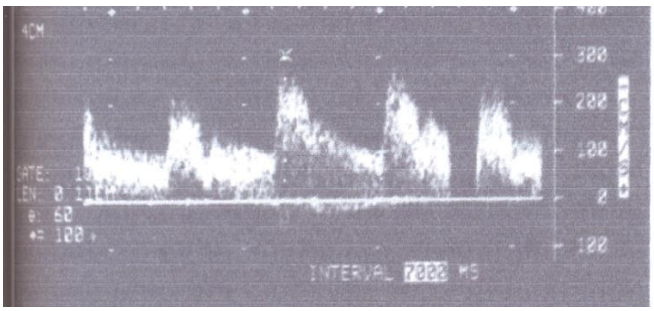
Analysis of the result in 170 carotid arteries (85patients) in this method showed combination of the result with result of DSA in 138 vessels (81%). Discoordination was in 32 vessels which is 19%, in this 14 vessels were overestimated and 18 vessels were underestimated (table 3). Data inspector of maximal peak systolic velocity (PSV) graded as:- PSV< 100-125 cm/sec which shows mild blood flow disturbance (<30% stenosis), PSV125-225cm/sec shows moderate disturbance in blood flow (30-69% stenosis), PSV>225cm/sec shows severe blood flow disturbance(>70-99% stenosis), absence of PSV (0) happens in complete occlusion.

Doppler USG allows visualization of rough surface of the plaque in 83% vessels and smooth in 17% vessels. 21 Carotid artery were filled with hyperechogenic plaque in bifurcation of common carotid artery which leads to gradual block as a result of entire complex pathological disturbance associated with atherosclerosis obstruction so plaque appears heterogeneously and consist of at least hard elements as well as calcification.4 arteries were bulged by thrombus which were very hypoechogenic and even could be visualized, if the direction of the colored blood stream doesn't change the direction near the point of occlusion formation. Duplex scanning allows detection of minimum bulging of internal membranes and plaque in the common carotid artery also in the bulb and in the beginning of the internal carotid artery in 11 vessels assessed as stenosis less than 30%.

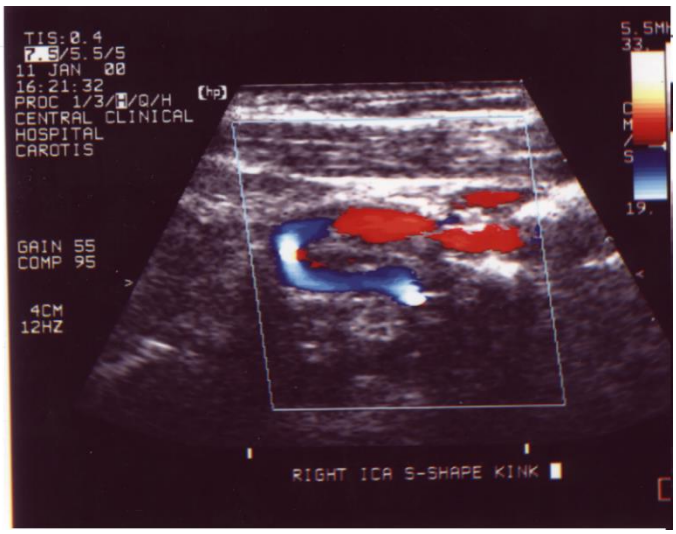
Table 3: Comparison between Doppler USG and DSA in all degrees of stenosis in 170 arteries.

Degree of stenosis by Doppler USG	Degree of stenosis by DSA				
	0	<30%	30-69%	70-99%	Occlusion
0	54	1	7	2	-
<30%	3	10	2	1	-
30-69%	4	-	9	3	-
70-99%	2	1	2	32	2
Occlusion	-	-	-	2	33
Total	**63**	**12**	**20**	**40**	**35**

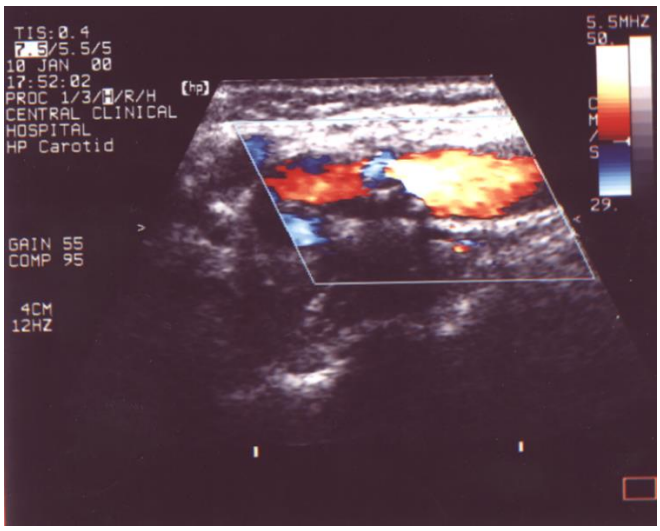
The results from the table show visualization in Doppler USG to be sensitivity 82%, specificity 79% and general accuracy 81%.



Peak systolic velocity in the left carotid artery 308 cm/sec - 80% stenosis)



A calcified atherosclerotic plaque is visualized in the RT carotid bifurcation, extended to the ostium and proximal part of internal carotid artery caused 30% stenosis. Marked S-shape Kink of proximal part of internal carotid artery.



A heterogeneous plaque is detected in the carotid bifurcation with dominant hard component -calcified atherosclerotic plaque caused 60% stenosis of the vessel lumen.

MRA:

In table 4 demonstrated results of investigation of 45 patients (90 carotid arteries) by the help of MRA method

Table 4: Comparison between MRA and DSA in all degrees of stenosis in 90 arteries.

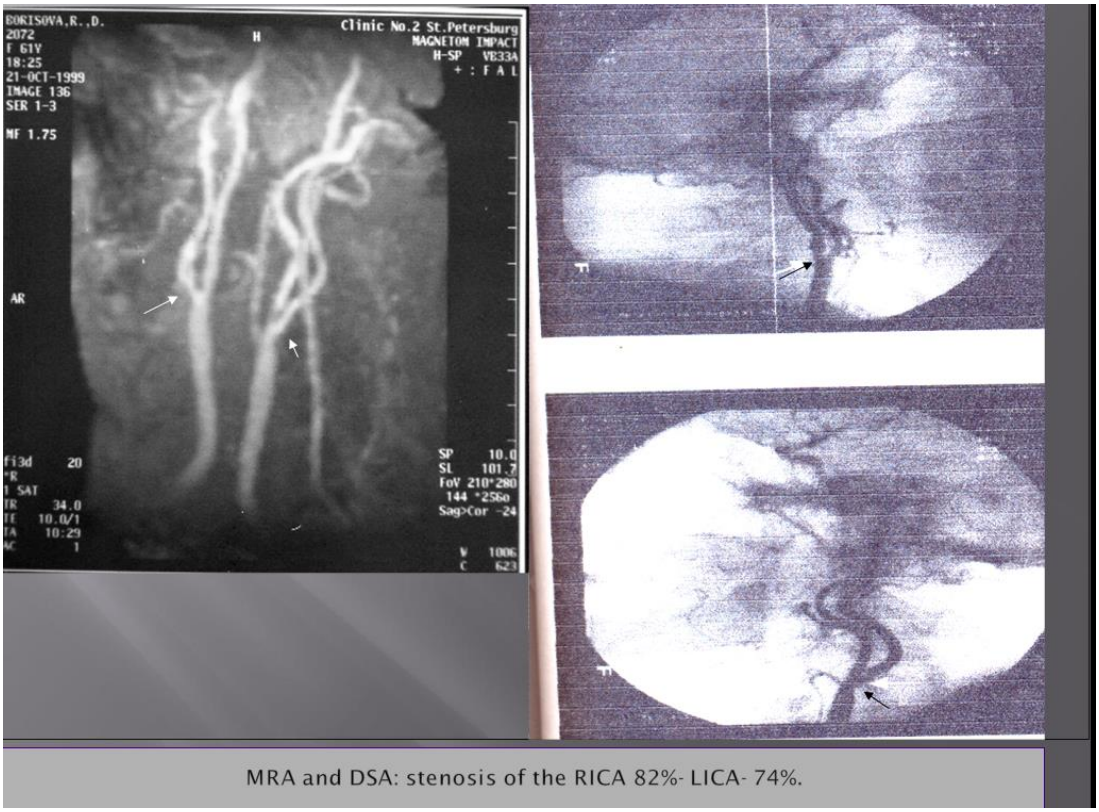
Degree of stenosis by MRA	Degree of stenosis by DSA				
	0	<30%	30-69%	70-99%	Occlusion
0	37	1	-	-	-
<30%	-	2	-	-	-
30-69%	-	-	8	-	-
70-99%	-	-	-	21	-
Occlusion	-	-	-	-	21
Total	**37**	**3**	**8**	**21**	**21**

Severe stenosis and conditions near to occlusion (string signs) were detected in 100%.

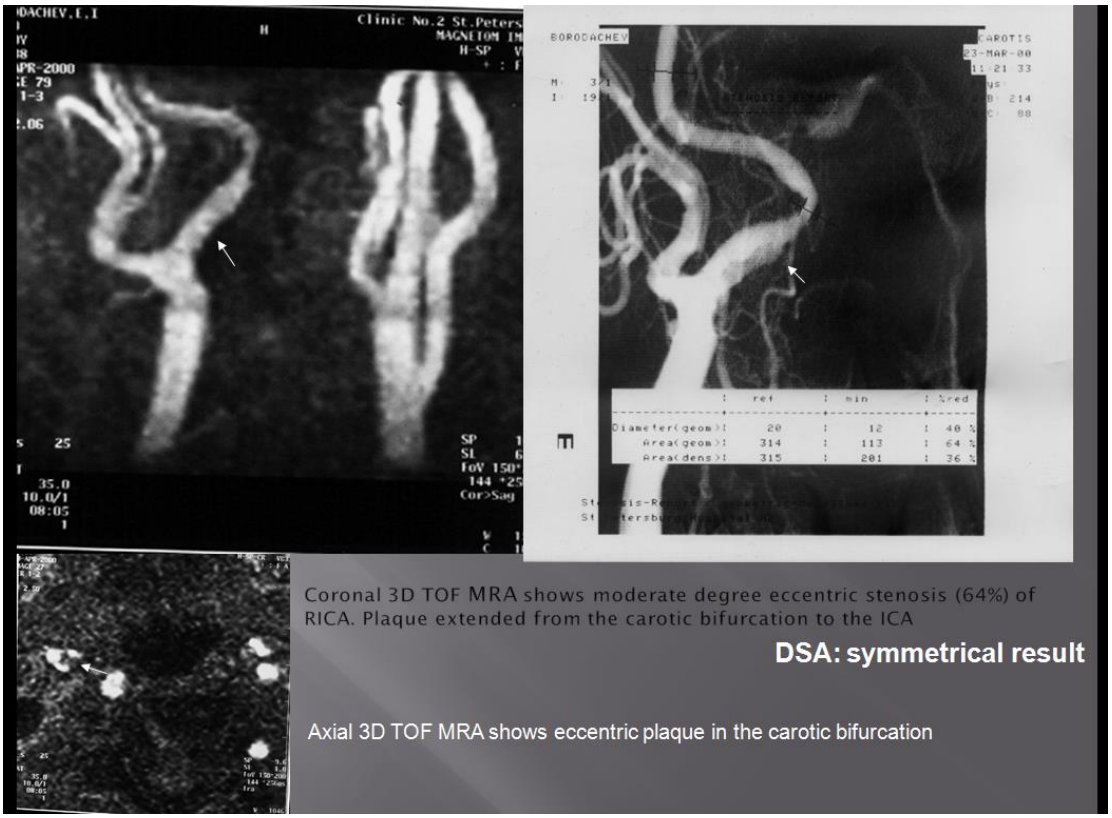
All cases with occlusion also were detected in 100%.All pathological disturbances evaluate by MRA (table 4) were subjected by DSA method except for 1 case with mild degree stenosis <30%, which was not correctly interpretated by MRA and gave complete patency of the vessel (Norma). This way MRA didn't give false positive result and only gave 1 false negative result. Sensitivity of MRA method formed 98%, specificity 100% and accuracy 99%/.

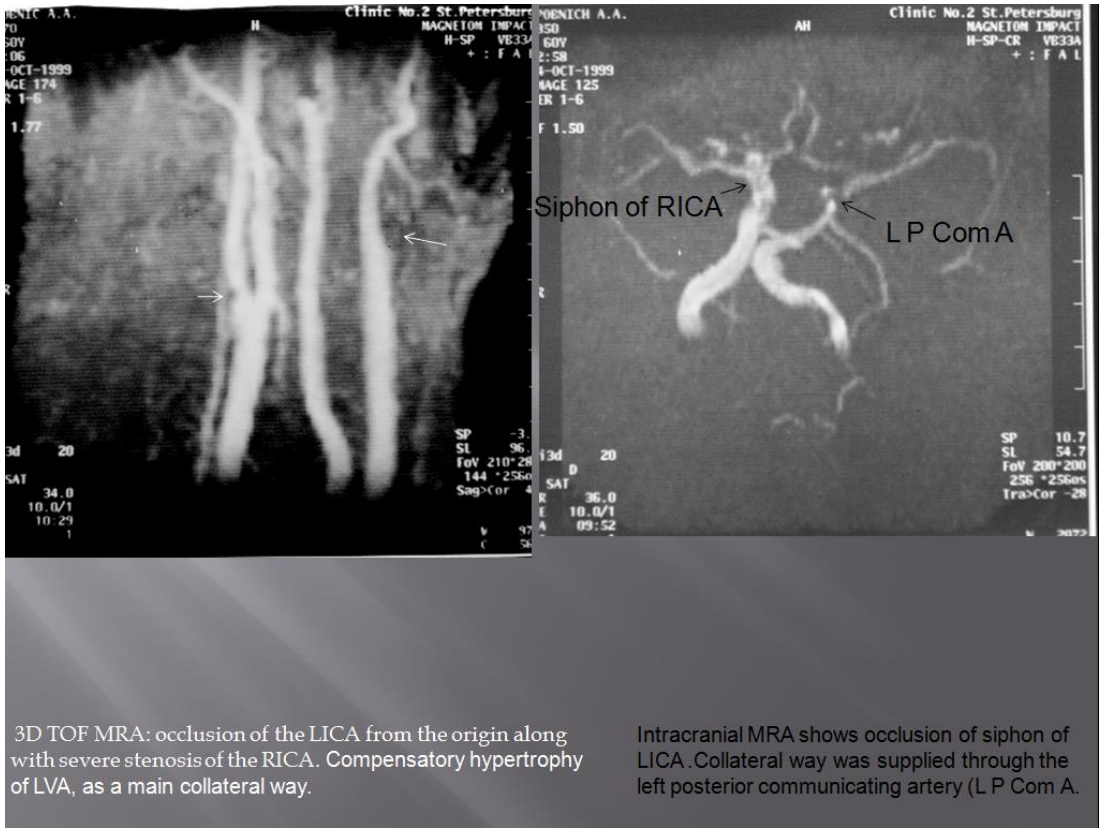
For hemodynamic assessment of the collaterals through arterial circle of the brain MRA results were accepted.6 cases in which MRA couldn't assess the value contribution of anterior communicant artery, in patient with bilateral occlusion of ICA (3 cases of bilateral thrombosis and 3 cases monolateral thrombosis with contralateral sub-occlusion),when blood was supplied into the brain by the basilar and external carotid artery. For ophthalmic collateral tract MRA relatively not sensitive, though in some cases increased diameter of artery took place, what indirectly showed variability of activisation of ophthalmic collateral tract. Ischemic zones detected in MRI obviously demonstrated correlation with lack of cerebral blood flow as a result of occlusion or severe stenosis of main vessels , what was seen in MRI.

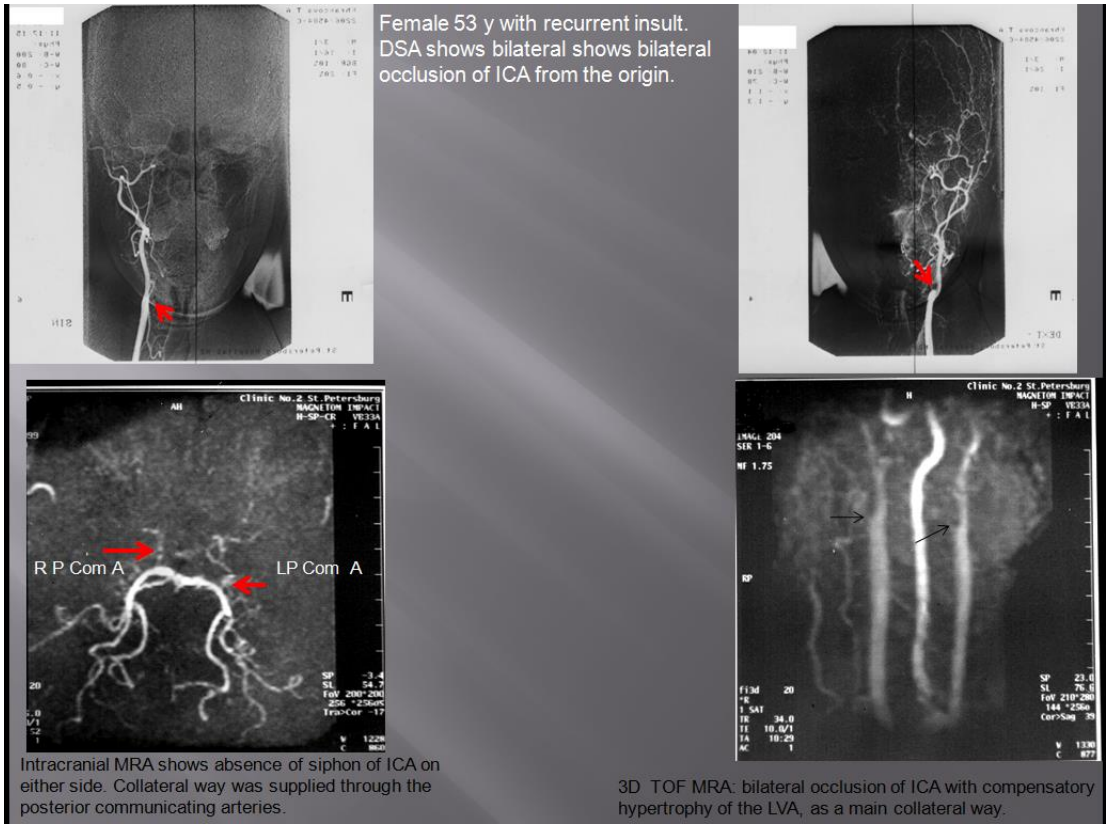
3D MRA optimally can visualizes the common carotid artery from the aortic arch to bifurcation



MRA and DSA: stenosis of the RICA 82%- LICA- 74%.


Coronal 3D TOF MRA shows moderate degree eccentric stenosis (64%) of RICA. Plaque extended from the carotic bifurcation to the ICA
DSA: symmetrical result
Axial 3D TOF MRA shows eccentric plaque in the carotic bifurcation


Siphon of RICA
L P Com A
3D TOF MRA: occlusion of the LICA from the origin along with severe stenosis of the RICA. Compensatory hypertrophy of LVA, as a main collateral way.
Intracranial MRA shows occlusion of siphon of LICA .Collateral way was supplied through the left posterior communicating artery (L P Com A.



Same patient with MRA

Discussion:

Carotid artery stenosis is a high risk factor for ischemic stroke. Stroke is one of most common causes of death in the worldwide [7, 8]. Imaging of the extracranial carotid vessels is of great importance in screening, evaluating therapeutic indications and for the follow-up of these patients. In patients with surgical stenosis, there is selection between different types of operations- angiographic endovascular or endarterectomy.

As a gold standard method, in the imaging of the carotid arteries, the DSA is still considered as an invasive diagnostic method using high dose of contrast media along with ionizing radiation. Moreover, by DSA it is difficult to make a conclusion about the depth of plaque invasion and plaque morphology. Another disadvantage of DSA, particularly not exact quantity assessment of stenosis, based on a two dimensioned (2D) image, what specially affects the assessment of eccentric plaque.

This study was aimed to provide comparison of data obtained by the help of noninvasive methods, with DSA data and also determines whether these methods can differentiate surgical from non-surgical degree of stenosis in the carotid artery with same accuracy to avoid the use of DSA.

In cases when severe stenosis took place there was no any difference of results between Doppler USG method and MRA. The presence of carotid plaque with high pulse wave velocity was associated with a high risk of cardiovascular disease events and ischemic stroke. Moreover, the combination of carotid artery ultrasonography with pulse wave velocity measurement could predict the risk for cardiovascular disease ability more accurately than a single measurement alone. Also, screening individuals for carotid plaque might help improve risk stratification and identify individuals in need of interventions to reduce cardiovascular disease risk, especially cerebral ischemic stroke [9]. Doppler USG may detect the plaque without or with smaller stenosis degree. USG allows the making of the correct diagnosis "acute thrombus of carotid artery" even if the lumen of the artery is seen and proves information about the probability of risks of embolism and prognosis of the end product of the diagnosed lesions. This data demonstrated in high degree of interrelation between pathological diseases of carotid arteries and cerebrovascular ischemia.

More difference in Doppler USG as compared with DSA methods in the assessment of stenosis showed ultrasound is not adequate for assessment before operation. In providing these investigations almost all errors took place by the following reasons:-

1- Anatomic disturbances, as looping or calcified plaques, this made the vessels not clearly visualized for this we came to uncertainty in the assessment of degree of stenosis in this zone. Followed DSA showed that calculation of stenosis by this method not always carried out in the site of maximal stenosis.

2- Mistakes could take place as a result of not fully qualified operator in this cases stenosis will not correctly be determined.

The analysis of carotid artery stenosis showed that DSA was same with the result of non-enhanced 3D TOF MRA [10, 11, 12]. About the assessment of plaque structure in cases of serious stenosis, the signal from plaque was clearly detected by the help of 3D TOF MRA method in the axial projection in thin slices (<1mm). If soft plaque were detected it means the signal will be of relatively high intensity, but hard plaque the signal will be of low intensity. The first corresponded the plaque in the type of thrombus with fibred plaque in the images maintained by Doppler USG method , but heterogeneous calcified plaque were detected in MRA in type of separated elements with low intensive signal (black zone) [13, 14].

With development progress in methods MRA dramatic improvements took place in the non invasive assessment of stenosis of carotid artery [15, 16]. Method allowed realization of multiplanner visualization of vessels, giving a chance to select the angle of projection and realizing reconstruction for optimal visualization of vessels. This work was directed to determine the abilities of MRA methods giving a value for stenosis of carotid artery as compared with DSA when required to answer questions about the selection between surgical and non surgical degree of stenosis. Data compared using DSA and MRA in our work showed that 3D TOF MRA certainly assisted the percent of stenosis without statically valuable difference as compared with DSA. It was possible to obtain image for all carotid artery from arch of aorta to the arterial circle of the brain, in which vascular image was illustrated from different visual angles. MRA of vessels in arterial circle of the brain important in evaluation of collateral tracts. In addition to MRA, MRI was carried out to detect brain infarct [17].

Both methods MRA and Doppler USG showed excellent correlation, helped to assess the pathological changes in the intra- and extracranial carotid arteries. Information obtained from these non invasive methods allowed exception of requirements in contrast with angiography and its not risky and more effective in provision of endarterectomy, in conditions where results of these methods are correlated.

Conclusion

1- As screening method allowing to make a plan for the next investigation of carotid artery adequetly color Duplex ultrasound is used which directly allows excluding or detecting mild degree of stenosis of carotid arteries during diagnosis.

2- Till now DSA remains as golden standard method in the assessment of degree of stenosis. But complex application of non invasive methods- colored Duplex scanning and MRI distinguished good accuracy (90% of the cases by our data) and may be used as an alternative to DSA

3- The main reason of deco-ordination in MRA and Duplex in the assessment of degree of stenosis (10%) cases related with calcification of plaque and manual practice of the operator.

4- DSA is not adequately in the assessment of character of the atheoschlerotic lesions because it doesn't give complete information of the structure of plaque, which its considered as one of the main factor to select patients for enderterectomy, angioplastic or stent.

5- DSA indicated in cases where MRA is unable (metallic paramagnetic implants artificial pace maker of cardiac pulse) and not lost its importance in provision of Roentgen-endovascular operations.

References

[1] Jan Menke. "Diagnostic accuracy of contrast-enhanced MR angiography in severe carotid stenosis: meta-analysis with metaregression of different technique". European Radiology J. vol. 19, no. 9: 22004-16; Sep. 2009.

[2] Michel Henry, MD, Max Amor, MD, Christos Klonaris, MD, Isabelle Henry, MD, Isabelle Masson, MD, Zukai Chati, MD, Edmond Leborgne, MD, and Michèle Hugel, RN. "Angioplasty and Stenting of the Extracranial Carotid Arteries". Texas Heart Inst J. 150-158; vol. 27, no. 2, 2000.

[3] Ulrike Cornelia Isabel Hoyer, Simon Lennartz, Nuran Abdullayev, Florian Fichter, Stephanie T. Jünger, Lukas Goertz, Kai Roman Laukamp, Roman Johannes Gertz, Jan-Peter Grunz, Christopher Hohmann, David Maintz, Thorsten Persigehl, Christoph Kabbasch, Jan Borggrefe, Kilian Weiss, and Lenhard Pennig. Imaging of the extracranial internal carotid artery in acute ischemic stroke: assessment of stenosis, plaques, and image quality using relaxation-enhanced angiography without contrast and triggering (REACT). Quant Imaging in Medicine and Surgery J. 3640–3654; 12(7); July 2022.

[4] M B Johnson , I D Wilkinson, J Wattam, G S Venables, P D Griffiths. Comparison of Doppler ultrasound, magnetic resonance angiographic techniques and catheter angiography in evaluation of carotid stenosis. Clinical Radiology J. 912-20; 55(12); 2000 Dec.

[5] S. William. I. Kerwin. Carotid Artery Disease and Stroke: Assessing Risk with Vessel Wall MRI. International Scholarly Research Network (ISRN) Cardiology, Volume 2012 | Article ID 180710; 2012

[6] M. DAVID. PELZ, M.D., J. ALLAN. FOX, M.D. AND FERNANDO VINUELA, M.D. Digital Subtraction Angiography: Current Clinical Applications. Stroke J. 528–536; 16 (3). 1985

[7] Li Feng MD, Qin Fang MD, Wei Wang MD, Jingjing Peng MD, De-yu Qin MD, Xue-feng Wang MD, Guang-wei Liu MD. Research on the cause of death for severe stroke patients. JCN. 2017 July.

[8] H.A. Patricia. Halkes, MD; Jan van Gijn, MD, FRCP, FRCPE; L. Jaap Kappelle, MD; J. Peter. Koudstaal, MD; Ale Algra, MD, FAHA. Classification of Cause of Death After Stroke in Clinical Research. Stroke J. 1521-1524; 37. 2006 June

[9] Li Wen, Yan Wang, Shuohua Chen, Jianqiu Zhao3, Qi Su, Fanl Yanfeng, Wu Shouling, Li Jun and Jiang Hong. Evaluation of Carotid Artery Atherosclerosis and Arterial Stiffness in Cardiovascular Disease Risk: Angion Prospective Study From the Kailuan Cohort. Frontiers in Cardiovascular Medicine. Volume 9; 2022 May.

[10] M. Sarah; BA Debrey; Yu Hua, MD; K. John Lynch, DO, MPH; Karl-Olof Lo¨vblad, MD; L. Violet. Wright, RN; Sok-Ja D. Janket, MD, MPH; E. Alison Baird, FRACP, PhD. Diagnostic Accuracy of Magnetic Resonance Angiography for Internal Carotid Artery Disease A Systematic Review and Meta-Analysis. Stroke J . Papers-2237-2248. Volume 39. 2008. Augest.

[11] Nicoletta Anzalone, Francesco Scomazzoni, Renata Castellano, Laura Strada, Claudio Righi, Letterio S. Politi, Miles A. Kirchin, Roberto Chiesa, Giuseppe Scotti. Carotid Artery Stenosis: Intraindividual Correlations of 3D Time-of-Flight MR Angiography, Contrast-enhanced MR Angiography, Conventional DSA, and Rotational Angiography for Detection and Grading. RSNA J. Volume 236. No.1. July 2005.

[12] Jeffrey S. DI Rossi, A. Skye Buckner Petty, Waleed Brinjikji, M. Joseph. ID Hoxworth , T. Vance Lehman , H. Erik. Middlebrooks , C. Ameet. ID Patel, P. Christopher Wood. Multiple reader comparison of 2D TOF, 3D TOF, and CEMRA in screening of the carotid bifurcations: Time to reconsider routine contrast use?. Plos one J. Published: 15 (9). 2020.

[13] N. Yamada, M. Higashi, R. Otsubo, T. Sakuma, N. Oyama, R. Tanaka, K. Iihara, H. Naritomi, K. Minematsu, and H. Naito. Association between Signal Hyperintensity on T1-Weighted MR Imaging of Carotid Plaques and Ipsilateral Ischemic Events. AJNR. 287–292; 28(2). 2007 Feb.

[14] D. Bernard. Coombs, MBChB, PhD; H. Joseph Rapp, MD; C. Phillip Ursell, MD; M. Linda Reilly, MD; David Saloner, PhD. Structure of Plaque at Carotid Bifurcation High-Resolution MRI With Histological Correlation. Stroke J. 2516–2521; 32 (11). 2001.

[15] J. Stephen Riederer, G. Eric Stinson and T. Paul Weavers· Technical Aspects of Contrast-enhanced MR Angiography: Current Status and New Applications. Magn Reson Med Sci.; 3–12; 17(1). 2018/

[16] Ryusuke Irei, Shiori Amemiya, Tsuyoshi Ueyama, Yuichi Suzuki, Kouhei Kamiya, Hidemasa Takao, Harushi Mori & Osama Abe. Accelerated acquisition of carotid MR angiography using 3D gradient-echo imaging with two-point Dixon. Neuroradiology J.; pages 1345-1349; volume 62. 2020.

[17] S. Peters; M. Huhndrof, U. Jensen-Kondering, N. Larsen, I. Koktzoglou, R.R. Edelman, J. Graessner, M. Both, O. Jansen and M. Salehi Ravesh. Non-contrast-enhanced Carotid MRA: clinical Evaluation of Novel Ungated Radial Quiescent –Interval Slice-Selective MRA at 1.5 T AJNR, 1529-1537; 40(9). 2019 September.

مقالة بحثية

دور الرنين المغناطيسي في تصوير آفات تصلب جدار الشرايين في للأوعية السباتيه خارج المخ - (بدون صبغه)

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المُلخّص

تكوين اللويحات التصلبيه في الشرايين السباتيه هو العامل الرئيسي للاضطراب الديناميكي الدموي في الشرايين الدماغية. تصوير وتمييز هذه اللويحات في جدار الشرايين يعد من العوامل المهمة لاختيار التدخل الجراحي او العلاج الوقائي. وقد هدفت هذه الدراسة لتقييم الحساسية والنوعية للرنين المغناطيسي للأوعية الدموية في كشف وتقييم خصائص اللويحات التصلبيه في جدار الشرايين السباتية العنقية. اجريت الدراسة على 130 مريضً: 92 ذكور (70.8%) و 38 اناث (29.2%). حيث خضع المرضى إلى 3 وسائل تشخيصية: 85 مريضًا بمساعدة التصوير بالموجات فوق الصوتيه- الدوبلر. 45 مريضا تم تصويرهم بالرنين المغناطيسي للأوعية الدموية. جميع المرضى خضعوا للتصوير الرقمي الانتقائي للأوعية الدموية الدماغية كطريقه تشخيصيه اساسيه. اظهرت النتائج بأن 27 مريضا من 130 ليس لديهم تصلب شرياتي. 57 لديهم تصلب شرياني بالجانبين. 46 لدبهم تصلب شرياني بجانب واحد. من 260 شريان سباتي تبين ان 51 شريان مصاب بانسداد كامل (22 باليمين و 12 بالشمال). في 4 مرضى (8 شرايين) كان الأنسداد من الجانبين. في 54 شريان سباتي كان التضيق شديد -منهم 27 شريان كانت درجة التضيق بهم أكثر من 90%. 32 شريان سباتي كانت درجة التضيق متوسطة. في 23 شريان سباتي لوحظ درجة خفيفة من التضيق ومئة شريان سباتي مفتوح بالكامل. خاصت الدراسة الى ان التطبيق المشترك المركب للطرق غير التداخلية -المسح المزدوج بالدوبلر الملون والتصوير بالرنين المغناطيسي للأوعية الدموية يتميز بدقة ممتازة حسب بياناتنا ويمكن استخدامهم كبديل للتصوير الرقمي للأوعية الدموية.

الكلمات المفتاحية: الرنين المغناطيسي للأوعية الدموية، الشرايين السباتيه، للتصوير الرقمي للأوعية الدموية، دوبلر، موجات فوق الصوتية.

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