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Analysis of 3.0 T1H-MRS Image Characteristics of Nasal Polyps

Li Yi[1] and Li Xuan[2]

[1]The 988rd Hospital of PLA
[2]The 988rd Hospital of PLA.

June 1, 2020

Abstract

Abstract Background: Nasal polyp is a common disease in otorhinolaryngology, and its clinical diagnosis often needs pathological examination. At present, 3.0T1H-MRS can analyze the spectrum of brain glioma and other diseases, get biochemical metabolism information with clinical diagnosis value, and correctly diagnose brain glioma. Therefore, we use 3.0T1H-MRS to analyze the spectrum of nasal mucosa polyp, in order to make a clear diagnosis of nasal mucosa polyp through 3.0T1H-MRS. Objective: To analyze and study the 3.0T1H-MRS characteristics of nasal polyps, and to explore the value of 3.0T1H-MRS in the diagnosis of nasal polyps. Methods: 50 patients with nasal polyps from January 2010 to June 2019 were randomly selected from our department for study. All patients were pathologically verified and 3.0T was performed MRI, 3.0T1H-MRS focus detection, and quantitative analysis were compared with the normal brain tissue in the same side of the forehead. The main study was acetic acid (Ace), lactic acid (Lac), n-acetylaspartic acid (NAA), choline (Cho), creatine (Cr) peak integral value and the ratio of each integral value: Cho / NAA, Cr / Lac, Cr / NAA, Cho / Cr,Lac / NAA and Lac / Ace. Results:The expression of 3.0T1H-MRS in nasal polyps was significantly different from that in normal brain tissues: NAA decreased, Cho increased,Lac increased, Ace increased and most obvious; Lac / NAA ratio increased; Cho / NAA ratio increased and more obvious; Lac / Ace ratio decreased and most obvious; The difference between the two groups was statistically significant ($P < 0.05$). Conclusions: The analysis of 3.0T1H-MRS can get the biochemical metabolism information of clinical value: Ace(11.43 $\pm$ 6.11), NAA (17.76 +- 6.20), Cho (23.19 +- 6.91), Lac (12.51 +- 3.42), Lac / Ace (1.09 +- 0.56); Cho / NAA (1.34 +- 1.10), Lac / NAA (0.70 +- 0.55). According to the different integral values of acetic acid, lactic acid, n-acetylaspartic acid, choline and creatine, it is helpful for the correct diagnosis of nasal mucosa polyp.

1 | Introduction

Nasal polyps are common in clinical practice. They are hyperplastic tissue masses on the surface of the nasal mucosa protruding from the nasal cavity or sinuses. The common symptoms are nasal obstruction or increased nasal secretions, which are more common in adults. They can be single or multiple. They are more common in maxillary sinus, ethmoid sinus, middle nasal meatus, middle turbinate, etc. At present, the location and range of polyps are often judged by imaging examination, and further pathological examination is often needed for clinical diagnosis. At present, 3.0T^{1}H-MRS can analyze the press sequence spectrum of brain gliomas [1-2] and prostate cancer [3] in the elderly, and can obtain biochemical metabolic information of clinical value, It can correctly diagnose and analyze brain glioma and prostate cancer in the elderly. In this way, we use 3.0T^{1}H-MRS to study nasal mucosa polyp. We find that the spectrum analysis plays an important role in the diagnosis of nasal mucosa polyp. The specific situation is as follows.

2 | Data and methods

2.1 | General information

From January 2010 to June 2019, 50 patients with nasal polyps were selected for the study. 22 of them were from maxillary sinus, 19 from ethmoid sinus, and 9 from middle turbinate. All the patients in this study

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were single nasal polyps. The age was 32-69 years, with an average of (47.12 ± 4.73) years. All the above cases were confirmed by pathology. All patients and their family members were interested in the study and signed the informed consent.

2.2 | Inspection method

In this study, SE (539 / 12ms) and FSE (4020 / 90ms) [4] were used to obtain T1 or T2 weighted and MR enhanced images. Based on the enhanced MRI images, the 3.0T^{1}H-MRS measurement area was located, and the region of interest was selected for the enhanced nodule and the ipsilateral normal frontal brain tissue, the size of which was $2.0 \times 2.0 \times 2.0$ cm^3. Contrast medium: 15 ml, 0.1 mmol / kg Gd-DTPA, high pressure syringe, injection speed of 3 ml / s were used. 3.0T^{1}H-MRS was detected by single voxel hydrogen proton spectrum detection technology. The fixed-point resolution spectrum sequence was used to compare the nasal mucosa polyp area and the normal brain tissue in the forehead. The shimming, water suppression and signal acquisition were automatically completed; the phase correction, baseline correction and measurement were used as the post-processing part, and the real part of the spectrum was taken for analysis. This paper mainly studies the integral values of the wave peaks of acetic acid (Ace), lactic acid (Lac), n-acetylaspartic acid (NAA), choline (Cho), creatine (Cr), and the ratio of the integral values: Cho / NAA, Cr / Lac, Cr / NAA, Cho / Cr, Lac / NAA and Lac / Ace.

2.3 | Spectrum analysis

After randomly numbering the spectrum data of all cases, the phase and baseline were corrected by the software of the machine itself, and the integral value of each peak was calculated; the integral value of each peak corresponding to each compound was determined according to the chemical displacement, and the integral value ratio was obtained by comparing its integral value: Cho / Cr, Cho / NAA, Cr / NAA, etc.

2.4 | Statistical analysis

SPSS 26.0 statistical software was used to calculate the mean and standard deviation of the data. The data was expressed by X ± S. comparing the data of nasal mucosa polyp with that of frontal normal brain tissue, the results were tested by t-test. The test level was $\alpha = 0.05$, with $P < 0.05$ as the difference.

3 | Results

This study shows that the expression of 3.0T^{1}H-MRS in nasal polyps is significantly different from that in normal brain tissue, and there is a significant difference between the two (see Table 1, spectrum analysis Figure 1-2). The expression of Ace in nasal polyps was the highest (11.43 ± 6.11), NAA decreased significantly (17.76 ± 6.20), Cho increased (23.19 ± 6.91), Lac increased (12.51 ± 3.42), Lac / Ace ratio decreased most significantly (1.09 ± 0.56); Cho / NAA ratio increased significantly (1.34 ± 1.10); Lac / NAA ratio increased most significantly (0.70 ± 0.55); compared with the data of normal brain tissue in the same side, t-test had statistical significance.

4 | Discuss

4.1 | Spectrum analysis

The results of t -test showed that there was a significant difference between nasal polyps and normal brain tissue in the same side. The analysis of 3.0T1H-MRS can get the biochemical metabolism information of clinical value: Ace(11.43 +- 6.11), NAA (17.76 +- 6.20), Cho (23.19 +- 6.91), Lac (12.51 +- 3.42), Lac / Ace (1.09 +- 0.56); Cho / NAA (1.34 +- 1.10), Lac / NAA (0.70 +- 0.55).The results showed that Ace increased and was the most obvious, Cho increased, lac increased and NAA decreased, Lac / Ace ratio decreased the most obvious, Cho / NAA ratio increased and was more obvious, Lac / NAA ratio increased. This explains. Nasal polyps have their own biochemical characteristics. If we grasp the biochemical characteristics of nasal polyps in clinical practice, we can carry out the differential diagnosis of nasal polyps by doing 3.0T^{1}H-MRS, which lays a good foundation for non-invasive non-pathological diagnosis of nasal polyps. 3.0T^{1}H-MRS has obvious advantages in imaging compared with the conventional low field MR spectrum. It can not only collect the single voxel during imaging, but also collect the multi voxel, and

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effectively control the accuracy and stability of the spectral baseline. 3.0T^{1}H-MRS can effectively analyze the change characteristics of metabolites from both qualitative and quantitative perspectives, so as to analyze and judge the patient's condition[1-5]. MRS uses magnetic resonance phenomenon and chemical shift to define the molecular composition, which is noninvasive and can show the metabolite composition in brain tissue[6].

4.2 | Spectrum characteristics

NAA showed the highest peak in 3.0T^{1}H-MRS detection of normal brain tissue, which could reflect the functional activity and density of neurons [1]. Because NAA was only stored in neurons, and the content of neurons in nasal polyps was significantly reduced, the peak value of NAA decreased significantly. Cho plays an important role in the evaluation of tumor cell metabolism. Due to the abnormal proliferation of nasal polyp cells, the cell metabolism level is high and the material exchange is strong, so the Cho summit appears to increase. Cho is a choline complex. These complex peaks include phosphatidylcholine, glycerophosphingobiline and other substances. Through these complex peaks, the specific condition of patients can be directly reflected[2-3]; Ace stands for acetate, the dissociated form of acetic acid, Because the pka of fatty acid carboxyl group is about 4.8, usually the pH value of plasma is 7.4, and the pH value of intracellular fluid is 7.0, so almost all the fatty acid molecules in body fluid (99.9%) are in dissociation state, that is, acetic acid exists in body fluid in the form of anion[4], because of the rapid growth and obvious hyperplasia of nasal mucosa polyp, the content in polyp tissue increases significantly (this can be considered as nasal mucus) The most typical characteristic of the spectrum of membranous polyps); ace can also be produced by bacteria, It is also an important marker of anaerobe infection. Therefore, in the long-term growth process of nasal polyps, due to blocking the ostium of the sinuses or preventing the outflow of secretions from the ostium, it is easy to lead to the degeneration, necrosis or liquefaction of the inside of the sinuses or the polyps themselves due to bacterial infection, and finally form a purulent or mucopurulent abscess like substance. The creatine complex (Cr) contains creatine and phosphoric acid When the energy metabolism of creatine decreases, Cr increases, and the higher the peak value of Cr, the worse the metabolism of brain tissue; Lac is stored in the extracellular and intracellular space, mainly composed of two resonance peaks, which are also called double lines in medical circles; when TE is 288, the double peaks are upward, when TE is 144, the double peaks are downward[1-7]. In the healthy state, cells are mainly aerobic metabolism, Lac peak is trace or none; the growth block of nasal polyp tissue has an inhibitory effect on cell aerobic respiration, and glycolysis will be strengthened, so Lac peak is increased[6-10]. The degree of necrosis and degeneration of nasal polyps was in direct proportion to the decrease of NAA and the increase of Cho. Ace, Cho, Lac, NAA are highly specific in the diagnosis of nasal polyps. The peak of Ace is significantly higher (which can be considered as the most typical feature of the spectrum of nasal polyps), Cho is higher, Lac is higher, Lac / Ace ratio is significantly lower, Cho / NAA ratio is significantly higher, Lac / NAA ratio is higher, which provides an objective basis for the diagnosis of nasal polyps.

In a word, on the basis of other imaging examination, the spectrum analysis of 3.0T^{1}H-MRS can get the biochemical metabolism information of clinical value of nasal mucosa polyp.

The value of Ace in nasal polyps was"11.43 +- 6.11", NAA (17.76 +- 6.20), Cho (23.19 +- 6.91), Lac (12.51 +- 3.42), Lac / Ace (1.09 +- 0.56); Cho / NAA (1.34 +- 1.10), Lac / NAA (0.70 +- 0.55). According to the different characteristics of Cho, Cr, Lac, Ace peak integral value and the ratio of each integral value, it is helpful for the correct diagnosis of nasal mucosa polyp.

ACKNOWLEDGEMENT

The authors thank the probands and their family members who participated in this study.

CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

ETHICS STATEMENT

This study abides by the Declaration of Helsinki. No ethical approval required.

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DATA AVAILABILITY STATEMENT

The data supporting the results of this study are obtained from magnetic resonance spectroscopy, and the data are reliable.

References

1.Hao Jun-chao, Yang Hai-ye. Analysis of MRI features of different pathological types of intracranial cystic lesions [J]. World's latest medical information abstract, 2019, (65): 190-192.

2.Zong Ran, Li Xiao-hu, Zhang Yu-jiao, et al. MRI features of cerebellar cystic tumor [J]. Anhui Medical Science, 2017,38 (5): 556-559.

3.Zhai Yong-wen. Application of MRI in the differential diagnosis of prostate cancer and benign prostatic hyperplasia in the elderly [J]. Journal of integrated traditional Chinese and Western medicine and cardiovascular disease (Electronic Edition), 2018,6 (22): 103-104.

4.Li Yi, Wei Rui-li.Application of proton magnetic resonance spectroscopy in orbital hemangioma, new progress in ophthalmology [J]. 2005,25 (2): 153-155.

5.GasparettoEL,AlvesleonS,DominguesFS.Neurocysticercosis,familial cerebral cavernomas and intracranial calcifications:differential diagnosis for adequate management[J]. Arquivosde neuropsiquiatria,2016,74(6):495- 500.

6.Hong Jin-ling, Yao Ye, sun Yun-feng, et al.Ultrasound diagnosis of neonatal intraventricular and periventricular cystic lesions and its relationship with gestational age [J]. Journal of Harbin Medical University, 2017,51 (4): 356-359.

7.SunL,WuQ,PeiY.Prenatal diagnosis and genetic discoveries of an intracranial mixed neuronal-glial tumor:Acaser eport and literature review[J]. Medicine, 2016,95(45):5378.

8.Zhang song, Tang xu-qun, Wu Han-feng, et al.The clinical application of stereotactic puncture and Ommaya cyst implantation in intracranial cystic lesions [J]. Chinese Journal of neurotrauma surgery, 2016,2 (1): 34-36.

9.Li Li, Qian Wei-jun, Wang Ya-jun, et al. Study on the risk of rupture of intracranial single cystic aneurysm based on 64 row CTA technology [J]. Chinese Journal of practical neurology, 2017,20 (7): 38-40.

10.Wang Yang,Yang Bo-wen.Progress in the application of NMR spectroscopy in cancer diagnosis and treatment [J].Imaging research and medical application, 2019, 3 (24): 6-7.

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