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SWI IN HEADACHE– RELATIONSHIP WITH VENOUS ENGORGEMENT

Original Artıcle

SWI SEKANSI İLE BAŞAĞRISI-VENÖZ ENGORJMAN İLİŞKİSİ

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ÖZET

Amaç

Atipik ya da şiddetli başağrısı ile başvuran olgularda, son birkaç yıla kadar, subaraknoid kanama (SAK) ekartasyonu için bilgisayarlı tomografi (BT) ile inceleme zorunluluğu sözkonusu idi. Ancak yeni geliştirilen manyetik rezonans görüntüleme (MRG) sekansları ile; kanama, kalsifikasyon ile ilgili BT'den daha ayrıntılı bilgi alınabileceğini gösteren çalışmalar mevcuttur. Bu çalışmada, akut başağrısı ile başvuran ve MRG inceleme gereği duyulmuş olguların protokolüne SWI (Susceptibility Weighted Imaging-duyarlılık ağırlıklı görüntüleme) sekansı ilave ettik. Bu özel sekansda, akut başağrısı ile başvuran olguların hemisferik kortikal venöz ağında asimetrik yoğunluk, yani engorjman bulunup bulunmadığını tespit etmeyi amaçladık.

Materyal ve metod

Son bir yıl içinde, başağrısı nedeni ile akut olarak acil servise başvurmuş, migren tanısı almış 27 olgu, migren dışı (sinüzit, nonspesifik) başağrısı tanısı almış 23 olgu ile, sağlıklı 19 olgu çalışmaya dahil edildi. Bu olgularda, standart bir kesitden, aynı okuyucu tarafından farklı zamanlarda değerlendirilerek subjektif olarak sağ ya da sol dominant veya simetrik şeklinde nitelendirilen hemisferik kortikal venöz sinyal kayıp yoğunlukları karşılaştırıldı.

Bulgular

Okuyucunun, üç ayrı ölçüm bulguları arasında istatistiki olarak anlamlı bir farklılık tespit edilmemişti. Üç ölçüm ortalaması değerleri dikkate alınarak değerlendirildiğinde, migren grubunda, sadece %19.75 olguda; her iki hemisferik venöz sistem simetrik iken, %44.45 oranında sağ; %35.80 oranında ise sol hemisferik venöz engorjmandan bahsedilmişti. Bu değerler sırası ile migren tanısı almayan başağrısı grubunda ise %85.50, %13.00, %1.50 ölçülmüş ve başağrısı olmayan kontrol grubunda ise

yine sırası ile %75.50, %3.50, %21.00 olarak tespit edilmişti.

Sonuç

Başağrısı ile acil kranial MRG çekimi yapılan olgularda, migren ile uyumlu kliniği olanlarda, hemisferik kortikal venöz ağda, kontrol grubu ya da migren olmaksızın başağrısı şikayeti olan gruba göre sağ ya da sol tarafda asimetrik, engorjman lehine yorumladığımız yoğunluk artışı sözkonusudur. Bu sekansın akut başağrısı ile başvuran olguların protokolüne eklenmesi ile, başağrısı tipinin tahmin edilmesi şu an için mümkün görünmektedir.

Anahtar Kelimeler: *Duyarlılık ağırlıklı görüntüleme-SWI;başağrısı; migren.*

SUMMARY

Purpose

Computerized tomographic (CT) examination of patients presenting with atypical or severe headache has been essential until the last couple of years in order to rule out subarachnoid hemorrhage (SAH). However, there are studies suggesting that recently developed magnetic resonance imaging (MRI) sequences can provide more detailed information about hemorrhage and calcification compared to CT. In this study, we included SWI (Susceptibility Weighted Imaging) sequences in imaging protocol of patients in whom MRI examination was thought to be essential after presenting with acute headache. Our purpose was to determine if there is asymmetric increased signal intensity in hemispheric cortical venous network, in other words venous engorgement, in patients presenting with acute headache.

Material and method

27 cases, who were admitted to the emergency department due to headache within the last one year and subsequently diagnosed with migraine, 23 cases, who were diagnosed with non-migraine headache (sinusitis, non-specific) and 19 healthy subjects were included in this study. Standard sequences of the cases were evaluated by a single reader in different time periods and hemispheric cortical venous signal intensities were compared that were defined subjectively as right or left dominant or symmetric.

Results

No statistically significant difference was found between the three different reading findings. When the average of three measurements are taken into consideration, venous system of both hemispheres in migraine group was symmetric in 19.75% of the cases whereas there was right hemispheric venous engorgement in 44.45% and left hemispheric venous engorgement in 35.80% of the cases. The measured values in non-migraine headache group were 85.50%, 13.00% and 1.50%; and in the control group without headache the measured values were 75.50%, 3.50% and 21.00%, respectively.

Conclusion

Compared to the control group and non-migraine headache group, there was increased signal intensity in hemispheric cortical venous network that was interpreted as right or left-sided asymmetric venous engorgement in patients who underwent emergency cranial MRI due to headache and in whom clinical findings were consistent with the migraine headache. It seems currently feasible to estimate the type of headache with the addition of this sequence into the imaging protocol of patients presenting with acute headache.

Keywords: *Susceptibility weighted imaging-SWI; headache; migraine.*

INTRODUCTION

Until recent years, computerized tomographic (CT) examination of patients presenting with atypical or severe headache has been considered to be essential in order to rule out subarachnoid hemorrhage (SAH). Although CT remains superior in detecting bone structures and calcifications, studies suggest that FLAIR sequences can be as accurate as CT in detecting subarachnoid hemorrhage. These data have increased the use of MRI in headaches. We added SWI (susceptibility weighted imaging) sequences into the imaging protocol of patients presenting with headache and in whom MRI examination was thought to be necessary. With this study, our purpose was to determine, if there was different cortical venous signal intensity in patients presenting with headache and undergoing emergency cranial MRI compared to normal population.

MATERIAL AND METHOD

27 cases, who were admitted to the emergency department due to headache within the last one year and subsequently diagnosed with and treated for migraine, 23 cases diagnosed with non-migraine headache (sinusitis, non-specific) and 19 healthy subjects were included in this study. Maximum intensity projection images reconstructed from axial SWIs in which internal cerebral veins join to form Galen vein were interpreted three times by a single investigator one week intervals. In these examinations, presence (R or L) or absence (E) of asymmetric increase in venous signal intensity of the right-left hemispheres was investigated and recorded. In cases with asymmetric appearance, venous engorgement was considered positive in the presence of clearly traceable 5 or more enlarged veins more than 2 mm in diameter. Those patients were excluded who had widespread microangiopathic signal loss, microhemorrhage associated with amyloid angiopathy or cranial vascular malformation. All data collected were statistically analyzed and compared.

RESULTS

There was no statistically significant difference in symptom distribution between the groups (Fisher's Exact Test, $P=0.586>0.05$). No statistically significant difference was found between three readings of the interpreter and all values were consistent with each other. When the average of the three measurements is taken into consideration; hemispheric venous system was symmetric in only 19.75% of the cases whereas there was right hemispheric venous engorgement in 44.45% and left hemispheric venous engorgement in 35.80% of the cases in migraine group. The side with engorgement was in the same side that headache started or the headache was worse except 1 case in the right and 2 cases in the left side **(Table I).**

NO	Symptom	Engorgement-SWI R, L or Equal FIRST measurement	Engorgement-SWI R, L or Equal SECOND measurement	Engorgement-SWI R, L or Equal THIRD measurement
1	R	R	R	R
2	R	E	E	R
3	R	R	R	R
4	R	R	R	R
5	L	L	L	L
6	L	E	E	L
7	R	R	R	R
8	L	L	L	L
9	R	R	R	R
10	L	L	L	L
11	L	L	L	E
12	R	E	E	E
13	R	R	E	R
14	R	R	R	R
15	L	L	L	L
16	L	R	E	L
17	L	L	L	L
18	R	R	R	R

19	R	R	R	R
20	R	R	R	E
21	R	R	R	R
22	L	E	L	E
23	L	L	L	L
24	L	L	L	L
25	R	E	E	E
26	L	L	L	L
27	R	R	R	R

Table I. *Readings in three different time frames to detect engorgement in patients in migraine headache group.*

The measured values in non-migraine headache group were 85.50% symmetric, 13.00% right dominant and 1.50% left dominant **(Table II).**

NO	Symptom	Engorgement-SWI R, L or Equal FIRST measurement	Engorgement-SWI R, L or Equal SECOND measurement	Engorgement-SWI R, L or Equal THIRD measurement
1	R	R	R	R
2	R	E	E	R
3	R	E	E	E
4	L	E	E	E
5	L	E	E	E
6	R	E	E	E
7	L	E	E	E
8	R	E	E	E
9	L	E	E	E
10	L	L	E	E
11	L	E	E	E
12	R	R	R	R
13	R	E	E	E
14	L	E	E	E
15	L	E	E	E
16	R	E	E	E
17	L	E	E	E
18	R	E	E	E
19	R	E	E	E
20	R	E	E	E
21	L	E	E	E
22	R	R	R	R
23	R	E	E	E

Table II. *Readings in three different time frames to detect engorgement in patients in non-migraine headache group.*

The measured values for venous engorgement in the control group without headache were 75.50% symmetric, 3.50% right dominant and 21.00% left dominant **(Table III).**

NO	Engorgement-SWI R, L or Equal FIRST measurement	Engorgement-SWI R, L or Equal SECOND measurement	Engorgement-SWI R, L or Equal THIRD measurement
1	E	E	E
2	E	E	L
3	E	E	E
4	R	E	R
5	E	E	E
6	E	E	E
7	E	E	E
8	E	E	E
9	L	L	L
10	L	L	E
11	E	E	E
12	L	L	L
13	E	E	E
14	E	E	E
15	E	E	E
16	E	E	E
17	L	L	L
18	E	E	E
19	E	E	E

Table III. *Readings in three different time frames to detect engorgement in healthy patients with no headache.*

Right or left dominance was more pronounced in migraine group and this was statistically significant (Fisher's Exact Test, P =0.0001 < 0.05). Right dominance in the non-migraine headache group and minimal asymmetric left dominance in the control group was not found to be statistically significant when compared with marked lateralizing dominance in migraine group (P > 0.05) (**Figure 1**).

Figure 1. *SWI axial sections of the same patients;* ***a)*** *At the acute phase, asymmetric appearance in hemispheric venous configuration. Left hemispheric venous system shows engorgement (crowded and dilated surface veins).* ***b)*** *There is no marked asymmetric appearance between the left and right hemispheric venous plains, both hemispheres were considered symmetric on the section obtained a day after the acute headache attack.*

DISCUSSION

In cranial hemorrhages, oxyhemoglobin found in the blood and blood products that leak into the tissue parenchyma lose oxygen and it is converted to deoxyhemoglobin. Oxyhemoglobin is a diamagnetic molecule whereas deoxyhemoglobin is a paramagnetic molecule (1).

The amount of deoxyaemoglobin within the tissues increases gradually and appears hypointense on MRI. Therefore, it has become possible to display venous pool by evaluating patients with SWI that has high sensitivity in detecting increased deoxyhemoglobin in cerebral venous system although not as high as in detecting hemorrhagic products (2-4).

This method is not actually a simple gradient echo weighted imaging but has also been subject to research in recent studies on chronic cerebrospinal venous insufficiency which has been suggested to play a role in the etiology of multiple sclerosis (4, 5).

This imaging sequence has been used for the last couple of years and it is highly sensitive to decreased blood flow and hemorrhagic products; it allows quantitative evaluation of deoxyhemoglobin the amount of which increases in poorly perfused areas or in capillaries and veins that drain the affected area. Thus, hypoperfused areas can perhaps be indirectly visualized. In certain pathologies (i.e. migraine), this imaging sequence adds to the information gathered from conventional MRI and in cases with the suspicion of encephalitis, supplementing conventional imaging methods by this imaging sequence would aid in establishing the diagnosis by detecting the pathology at an earlier time and would allow early initiation of the therapy; this would, thereby, avoid overlooking this rapidly progressive entity (6). It is known that more demonstrative changes appear at an earlier period in SWI sequences of neural parenchyma in acute ischemic conditions and other isoechoic pathologies (7).

CONCLUSION

Compared to the control group and non-migraine headache group, there was right or left-sided asymmetric venous engorgement in patients who underwent emergency cranial MRI due to headache and in whom clinical findings were consistent with the migraine headache. This imaging sequence can also detect intracranial hemorrhage and micro-hemorrhages, and indicate the affected area as venous engorgement in some pathologies such as migraine or encephalitis. Thus, this imaging sequence can provide simple and semi-quantitative method in distinguishing migrainous and nonspecific headaches. As mentioned in the literature, SWI would have contribution in revealing the etiology of acute headaches such as isoechoic hemorrhage, hyperacute ischemia or subarachnoid hemorrhage but it would also direct the treatment by discriminating migrainous and non-migrainous headaches. This imaging sequence should be therefore included in MRI examination of patients presenting to the emergency room, inpatient or outpatient clinics with headache.

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