Role of b0 image obtained from Diffusion weighted sequence in detection of cerebral hemorrhage

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ABSTRACT

Background and Purpose: Gradient-echo (GRE) -weighted imaging (T2*WI) has higher sensitivity than do other MRI sequences used for detecting cerebral hemorrhage as it is sensitive to magnetic field inhomogeneity induced by the presence of the paramagnetic breakdown products of blood. Diffusion weighted (DWI) b0 image obtained with DWI imposes no additional time and could be used for detection of hemorrhage. An Echo-planner Imaging (EPI) is intrinsically sensitive to magnetic field inhomogeneity, paramagnetic blood breakdown products, it produces signal loss similar to that in T2*WI. The aim of this study is to evaluate the utility of b0 EPI image obtained from diffusion weighted sequence for detection of intracerebral hemorrhage. Subjects and Methods: The study included 26 patients from Ain-Shams specialized hospital with different stages of intracerebral hemorrhage (ICH). All patients had MRI examination including DWI including b0 image, T2*WI, T1WI, T2WI, Fluid attenuation inversion recovery sequence (FLAIR), and MRA. Radiologists reviewed the images of the examinations independently in a blinded fashion, followed by a final consensus reading. The sensitivity of hemorrhage detection, conspicuity of lesions, and diagnostic certainty were compared between the b0 EPI and GRE T2*WI sequences. Results: b0 image was 100% sensitive in detecting different stages of intracerebral hemorrhage in the study sample (acute, subacute and chronic). b0 image was as equal to T2*WI in detection of hemorrhage in 92.30 % of cases (24 cases out of 26), in one patient b0 detected hemorrhage more clearly than T2* WI, while in the remaining patient T2*WI detected hemorrhage more clearly than b0 image. Conclusion: b0 EPI is as sensitive as T2*WI in detecting different stages of intracerebral hemorrhage. (Egypt J. Neurol. Psychiat. Neurosurg., 2008, 45(2): 483-493)

INTRODUCTION

With the recent advances in neuro-imaging, there are more and more demands for rapid and accurate diagnosis for different neurological diseases. The acute neurological diseases are on the top of the list for rapid diagnosis and implementation of treatment. Most of acutely presented brain insults are associated with a degree of conscious level disturbance, irritability and/or psychiatric manifestations. This requires an ultrafast radiological examination to avoid deterioration of patient’s condition and motion artifacts.

DWI EPI technique is a fast sequence and is desirable for the assessment of confused and uncooperative patients presenting with acute strokes¹. DWI in addition to its superiority in detecting ischemia, it might also be used to detect the inhomogeneity of the magnetic field due to the presence of blood products.

The differentiation between hemorrhagic and ischemic lesions is critical in making acute treatment decisions, including patient eligibility for thrombolytic therapy². Diffuse signal loss (hypointensity) throughout the lesion could be identified on GRE images owing to their greater sensitivity to magnetic susceptibility³. This feature is exploited in susceptibility-weighted imaging sequences (T2*WI GRE and EPI sequences), which provide superior sensitivity in detecting hemorrhage as compared with spin-echo sequences ⁴.

In routine clinical DWI, four sets of spin-echo EPI images are acquired. Three DWI sets (obtained with orthogonally applied diffusion gradients) are combined to produce an isotropic DWI scan, and a
b0 set is acquired without diffusion gradients. Since EPI is intrinsically sensitive to magnetic field inhomogeneity, paramagnetic blood breakdown products produce signal loss similar to that in T2*WI GRE sequence. In theory, the b0 image may thus be helpful in identifying hemorrhage without the need for extra scanning time. The DWI b0 image obtained with DWI imposes no additional time and could be used for detection of hemorrhage.

If DWI with its b0 image is sensitive to the detection of blood products, it can substitute T2*WI GRE sequence for the exclusion of intracerebral bleeds, especially in acute settings. Therefore in patients with disturbed level of conscious, or with critical condition that stands against completion of the study DWI b0 image can be used independently for evaluation of the intracerebral hemorrhage.

In our study, we investigated the ability of b0 image to detect intracerebral bleeds taking T2*WI as a reference for detecting intracerebral hemorrhage due to its high sensitivity in detecting blood products.

SUBJECTS AND METHODS

A retrospective study for 400 patients recruited from Ain-Shams Specialized Hospital who underwent brain MRI studies during years 2007 and 2008, out of them we included 26 patients with intracerebral hemorrhage due to different causes excluding patients with non-hemorrhagic brain lesions, traumatic brain hemorrhage, extracerebral hemorrhage and bad image quality.

The following were recorded for each patient; age, risk factors including hypertension, Diabetes Mellitus, and cardiac disorders, the neurological status including conscious level and the neurological deficits and treatment by anticoagulant and/or antiplatelet. The conscious level of patients was classified into fully conscious, sleepy (tendency to fall asleep), drowsy (response to sustained verbal stimuli), stuprous (unresponsiveness from which the subject can be aroused only by vigorous and repeated stimuli), and comatose (unarousable and unresponsiveness).

MRI protocol:

All patients were subjected to MRI studies performed at MRI unit, Ain Shams Specialized University Hospital. MR studies were performed using a 1.5 Tesla General Electric Superconducting Magnet System, Signa Prospeed LX. The protocol includes the following sequences; Axial single-shot DWI using an echo-planar sequence, the echo time is 1000s/mm2, TR/TE: 9999/106 FE; matrix size 128X128/1.00 NEX; FOV: 24X24, slice thickness: 5 mm, interslice gap: 0. A separate image was acquired without diffusion gradients (the b0 image). Axial GRE T2*WI: a GR/20, TR/TE: 500/15 msec and matrix size: 265X192. Slide thickness is 5 mm and the intersection gap is 2 mm, FOV: 24X18. Axial FLAIR; TR 8000/TE 147/EF msec; matrix size: 256X128/1 NEX, slice thickness: 5 mm, interslice gap: 2 mm, FOV: 24X24 mm, inversion time: 2000 msec. Axial T1WI; TR/TE 500-600/9Fr and axial T2WI; TR/TE; 6000/90-110/EF mesc. 3D TOF MRA; 37/6.9/fr (TR/TE), 20˚ flip angle, 22 × 16 mm FOV, 256 × 160/1 NEX matrix, 800 sections with a 1.4 mm effective thickness and 0 spacing.

Image analysis:

Radiologists reviewed the images of the examinations independently in a blinded fashion, followed by a final consensus reading. Data interpretation was based on the examination of the entire set of MR images, specifically targeting the presence of cerebral hemorrhage on axial images. The sensitivity of hemorrhage detection, conspicuity of lesions, and diagnostic certainty were compared between the b0 EPI and T2*WI GRE sequences. The presence or absence of hemorrhage was classified as negative or positive. The appearance of hemorrhage in both b0 image and T2*WI was low signal intensity (black signal). Conspicuity of lesions in b0 and its relationship to T2*WI was classified into (EPI+ve/GRE- ve) indicates seen only on EPI, (EPI>GRE) indicates seen better on EPI, (EPI=GRE) indicates seen equally well on both sequences, (EPI<GRE) indicates seen worse on EPI and (EPI- ve/GRE+ve) indicates seen only in GRE.

Hemorrhage is detected as hypointense signal in both GRE and b0 images. In the current study, the shape of hemorrhage was divided into two categories. Petechial hemorrhage was a small discrete homogeneous rounded focus or foci of abnormal hypointensity observed in both GRE and b0 images. Parenchymal hemorrhage was considered when both GRE and b0 images showed large,
convoluted hypointense signal in the brain parenchyma.

The clinical age of intra cerebral hemorrhage (ICH) was based on the period between MR imaging examination and the start of bleeding, which was considered to be on the day of the onset of symptoms or on the day of the last relevant clinical event. ICHs were classified as hyperacute (age <24 hours), acute (between 24 hours and up to 3 days), early subacute (3–7 days), late subacute (between 8 days and 1 month), or chronic (>1 month) according to Bradley and Parizel et al.

Statistical methods:
Statistical analysis was done by a computer package using SPSS (version 13.0) software. Data were collected, checked, coded and entered. Statistical methods included descriptive analysis, and cross tabulation using chi-square test.

**RESULTS**

Our study included 26 patients; 50% (13 patients) of them were women and 50% (13 patients) were men ranging in age from 26-89 years with mean age 60 years.

In our study we had fifteen patients (57.7%) presented with hemorrhagic arterial infarction, 2 patients (7.7%) with venous infarction, 3 patients (11.5%) with primary parenchymal hemorrhage (Figs. 2 and 3), 3 patients (11.5%) with parenchymal hemorrhage in space occupying lesions (SOL) (Fig. 4), one patient (3.8%) with parenchymal hemorrhage in arteriovenous malformation (AVM), one patient (3.8%) with parenchymal hemorrhage in ruptured aneurysm, and the remaining patient (3.8%) had parenchymal hemorrhage in surgical bed (post operative).

Fourteen patients (53.9%) were ≥61 years, 75% (11 patients) of them had hemorrhagic arterial infarction which constitute 73.3 % (11 patients out of 15) of patients with hemorrhagic arterial infarction. Eighteen patients (69.2%) out of 26 had hypertension while 8 patients (30.8%) were non hypertensive. 14 out of 15 patients (93.3%) with hemorrhagic arterial infarction were hypertensive, one patient out of the two presented with venous infarction had hypertension, two patients out of the 3 presented with primary parenchymal hemorrhage (66.7%) had hypertension, no patients with parenchymal hemorrhage inside SOL were hypertensive. The patients with hemorrhage on top of AVM and patients with parenchymal hemorrhage inside postoperative surgical bed were both hypertensive.

Intracerebral hemorrhage was petechial hemorrhage (Fig. 1) in 38.5% (10 patients) and parenchymal hemorrhage in 61.5% (16 patients). In the 10 patients with petechial hemorrhage, 50% of them were fully conscious while the other 50% were sleepy. In the 16 patients with parenchymal hemorrhage; 75% had disturbed conscious level ranging from sleepy (18.75%), drowsy (18.75%), and stuporous (37.5%).

We had 17 patients with both arterial and venous hemorrhagic infarcts. Eight patients (47.05%) were on both low molecular weight heparin (LMWH) and antiplatelet. Four patients (23.52%) were on LMWH, two patients (11.76%) were on antiplatelet, one patient (5.88%) was neither on LMWH nor antiplatelet, and two patients (11.76%) were outpatients and the treatment plan wasn’t available. Patients with the other types of hemorrhage were neither on anticoagulant nor antiplatelet.

Most patients were scanned in the subacute stage of hemorrhage (19 patients), 5 patients in the acute stage of hemorrhage, and 2 patients with chronic hemorrhage. The association between type of hemorrhage, shape of hemorrhage and stage of hemorrhage is shown in table (1).

In our patients we classified the lesion conspicuity and diagnostic certainty with b0 EPI versus GRE T2*WI into (EPI+ve/GRE-ve) which indicates seen only on EPI, (EPI>GRE) indicates seen better on EPI, (EPI=GRE) indicates seen equally well on both sequences, (EPI<GRE) indicates seen worse on EPI and (EPI-ve/GRE+ve) indicates seen only in GRE. Table (2) shows the Lesion conspicuity and diagnostic certainty with EPI versus GRE T2*WI in our patients.

The b0 sequence was 100% sensitive in detection of intracerebral hemorrhage, b0 was as equal to T2* GRE in detection of hemorrhage in 92.30 % of cases (24 cases out of 26), in one patient b0 detected hemorrhage more clearly than T2*GRE, while in the remaining patient T2*WI GRE
detected hemorrhage more clearly than b0 EPI image. b0 image didn’t miss any acute, subacute or chronic case. The association of lesion conspicuity and diagnostic certainty of b0 in relation to T2*WI and stage, type and shape of hemorrhage is demonstrated in tables (3), (4) and (5).

**Table 1.** Association between type, shape and stage of hemorrhage.

<table>
<thead>
<tr>
<th>Hemorrhage Staging</th>
<th>Total</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Acute</td>
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<tr>
<td>Type of hemorrhage</td>
<td></td>
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<tr>
<td>Hemorrhagic Infarction</td>
<td>2</td>
</tr>
<tr>
<td>venous Infarction</td>
<td>3</td>
</tr>
<tr>
<td>Parenchymal hemorrhage</td>
<td>2</td>
</tr>
<tr>
<td>Parenchymal hemorrhage within SOL</td>
<td>3</td>
</tr>
<tr>
<td>Parenchymal hemorrhage in AVM</td>
<td>1</td>
</tr>
<tr>
<td>Parenchymal hemorrhage in rupture aneurysm</td>
<td>1</td>
</tr>
<tr>
<td>Parenchymal hemorrhage in surgical bed (post operative)</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>5</td>
</tr>
</tbody>
</table>

**Table 2.** Lesion conspicuity and diagnostic certainty with b0 EPI versus GRE T2*WI in our patients.

<table>
<thead>
<tr>
<th>Lesion conspicuity and diagnostic certainty with EPI versus GRE T2*WI</th>
<th>No of patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>EPI+ / GRE-</td>
<td>0</td>
</tr>
<tr>
<td>EPI&gt; GRE</td>
<td>1</td>
</tr>
<tr>
<td>EPI= GRE</td>
<td>24</td>
</tr>
<tr>
<td>EPI&lt;GRE</td>
<td>1</td>
</tr>
<tr>
<td>EPI- / GRE+</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>26</td>
</tr>
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</table>

**Table 3.** Lesion conspicuity and diagnostic certainty of b0 EPI in relation to T2*WI GRE and type and shape of hemorrhage in cases with acute stage of cerebral hemorrhage.

<table>
<thead>
<tr>
<th>Hemorrhage Stage</th>
<th>Type of hemorrhage</th>
<th>Shape of hemorrhage</th>
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<tbody>
<tr>
<td>Acute</td>
<td>Hemorrhagic Infarction</td>
<td>Parenchymal hemorrhage</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Peticheal hemorrhage</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td></td>
</tr>
</tbody>
</table>

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Table 4. Lesion conspicuity and diagnostic certainty of b0 EPI in relation to T2*WI GRE and type and shape of hemorrhage in cases with subacute stage of cerebral hemorrhage.

<table>
<thead>
<tr>
<th>Hemorrhage Stage</th>
<th>Type of hemorrhage</th>
<th>Shape of hemorrhage</th>
<th>EPI= GRE</th>
<th>EPI&lt; GRE</th>
<th>EPI&gt; GRE</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subacute</td>
<td>Hemorrhagic Infarction</td>
<td>Parenchymal hemorrhage</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Peticheal</td>
<td>7</td>
<td></td>
<td></td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Parenchymal Hemorrhage</td>
<td>Parenchymal hemorrhage</td>
<td>2</td>
<td>2</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>venous Infarction</td>
<td>Parenchymal hemorrhage</td>
<td>2</td>
<td>2</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Parenchymal hemorrhage within SOL</td>
<td>Parenchymal hemorrhage</td>
<td>3</td>
<td>3</td>
<td></td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Parenchymal hemorrhage in AVM</td>
<td>Parenchymal hemorrhage</td>
<td>1</td>
<td>1</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Parenchymal hemorrhage in surgical bed (post operative)</td>
<td>Parenchymal hemorrhage</td>
<td>1</td>
<td>1</td>
<td></td>
<td>2</td>
</tr>
</tbody>
</table>

18 1 19

Table 5. Lesion conspicuity and diagnostic certainty of b0 EPI in relation to T2*WI GRE and type and shape of hemorrhage in cases with chronic stage of cerebral hemorrhage.

<table>
<thead>
<tr>
<th>Hemorrhage Staging</th>
<th>Type of hemorrhage</th>
<th>Shape of hemorrhage</th>
<th>EPI= GRE</th>
<th>EPI&lt; GRE</th>
<th>EPI&gt; GRE</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chronic</td>
<td>Parenchymal hemorrhage</td>
<td>Parenchymal hemorrhage</td>
<td>1</td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Parenchymal hemorrhage in rupture aneurysm</td>
<td>Parenchymal hemorrhage</td>
<td>1</td>
<td></td>
<td></td>
<td>1</td>
</tr>
</tbody>
</table>

2 2
Fig. (1): A-C, T1WI (A), T2*WI (B) and b0 EPI (C) Subacute petechial hemorrhage at the right cerebellum that shows hyperintense signal in T1WI, hypointense signal in both T2*WI and b0 EPI (arrow heads).

Fig. (2): A-F, DWI b1000 (A,B) T2*WI (C,D) and b0 EPI (E,F) hemorrhagic infarction at the left MCA that shows bright signal in DWI b1000 with central area of hypo intense signal suggesting hemorrhage that is more clearly detected in both T2*WI and b0 EPI as hypointense signal.
Fig. (3): A-D, T2*WI (A,B) and b0 EPI (C,D) Subacute hemorrhagic infarction at the left MCA that shows hypointense signal in both T2*WI and b0 EPI.

Fig. (4): A-D, T2*WI (A,B) and b0 EPI (C,D) Multiple lesions that exhibit hypointense signal in both T2*WI and b0 EPI that suggest hemorrhagic metastasis seen at right cerebellum and left parietal (arrow heads).
DISCUSSION

The detection of acute hemorrhage on MR images has been the subject of controversy. Initially, it was believed that MR imaging was less sensitive than CT in the detection of acute hemorrhage. With increased clinical experience and advances in MR technology, the detection of acute hemorrhage has been facilitated. Over the past several years, a number of clinical human and experimental animal studies have documented that the sensitivity of MR imaging in the detection of intracranial hemorrhage is equal or superior to that of CT. Moreover, T2*WI GRE MR sequences are the most sensitive for the detection of intracranial hemorrhage as compared with other MR sequences11-13.

As the therapeutic ischemic stroke intervention relies on exclusion of hemorrhage, the need for an accurate radiological evaluation is a must. Thrombolytic therapy is one of the most effective treatments for the management of cerebral infarction. The effectiveness of the treatment is critically dependent on the accurate identification of the area of acute infarction at an early stage. The major risk of thrombolysis is hemorrhage. However, the risk can be reduced if thrombolysis can be performed as quickly as possible after the onset of symptoms. Excluding recent hemorrhage is also important because intracerebral hemorrhage is one contradiction for thrombolytic therapy and antithrombotic agents14.

Un-enhanced CT provides a quick and accurate assessment of hemorrhage, but it is insensitive to ischemic changes in the first few hours after ictus so it can be used in combination with MRI yet this combination is time consuming and expensive especially in uncooperative confused and medically unstable patients12.

T2*WI GRE is able to detect acute intraparenchymal hemorrhage as it is sensitive to magnetic field inhomogeneity induced by the presence of the paramagnetic breakdown products of blood. Schellinger et al.14 concluded that multimodal stroke MRI protocol (T1WI, T2WI, FLAIR, T2*WI, DWI, PWI and MRA) was reliable as CT in the assessment of hyperacute intracranial hemorrhage, therefore additional CT is no longer necessary to rule out intracranial hemorrhage in hyperacute stroke and that the use of MRI alone in the diagnostic workup saves time and costs while rendering all the critical information needed to initiate an optimal treatment14.

Hemorrhagic transformation is a common evolution of ischemic lesions, particularly of cardioembolic origin15, which sometimes is enhanced by the use of combination of anticoagulant and antiplatelet therapy. In this study, we had 30.76% of all patients were on a combination therapy of LMWH and antiplatelet.

A decreased level of consciousness is considered the earliest neurologic abnormality and the most common initial physical finding in patients with parenchymal intracerebral hemorrhage (PIH)16. In this study, 75% of patients with PIH had disturbed level of consciousness. This is the most limiting factor in performing MRI study for such patients.

Our current stroke MRI protocol is used to detect the presence of hemorrhage, infarction’s site, size, date, zone of penumbra and state of intra cranial vessels taking into consideration the least acquisition time for patient’s condition, comfort and the best image quality. The protocol starts by DWI, which is a functional ultrafast MR sequence very sensitive to hyperacute ischemic lesions17. The DWI b0 image comes with DWI; therefore, it imposes no additional time and may serve as both T2 weighted and susceptibility-weighted images. So, b0 image could be used for staging of infarction and presence or absence of hemorrhage.

Recently, more ultrafast sequences have been developed and applied clinically because of their remarkable time savings and minimization of motion artifacts, especially in uncooperative medically unstable patients. It was found that b0 EPI is comparable to GRE T2*WI in the supratentorial compartments but less sensitive for lesions near skull base4. Yet in our study, we had three cases with infratentorial ICH. ICH could be detected in the cerebellum of two of them; and in the midbrain of the third one. In all the 3 cases, b0 EPI was as sensitive as T2*WI in detecting the ICH.

In a clinical situation, the mean concern when patients with ischemic stroke, SOL, and hemorrhagic stroke neurologically deteriorate is to exclude hemorrhage or to follow up the dynamic changes in the hematoma especially for those on antithrombotic therapy. Another value for radiological evaluation is to rule out the occurrence of recurrent ischemic insults. The question remains
either to continue or to stop the antithrombotic agents for patient with ischemic stroke who develope acute deterioration of conscious level.

In a trial to investigate other radiological sequences for detection of ICH, they found that both b0 EPI and T2*WI GRE sequences are sensitive to the susceptibility effects of magnetic field inhomogeneity because they use gradient refocusing pulses. They depict hemorrhages as foci of hypointense signal secondary to proton dephasing. Both sequences have been shown to be superior to fast spin echo sequences, in which the susceptibility effect is minimized by multiple refocusing pulses. This results goes with the results of our study as we found that both b0 and T2*WI were 100% sensitive different stages of intracerebral hemorrhage in the study sample (acute, subacute and chronic). b0 image was as equal as T2* GRE in detection of hemorrhage in 92.30% of cases (24 cases out of 26), in one patient b0 detected hemorrhage more clearly than T2* GRE, while in the remaining patient T2*WI GRE detected hemorrhage more clearly than b0 image. b0 image and T2*WI didn’t miss any case of acute, subacute or chronic hemorrhage in our study. Chia-Ying Lu, et al. found no significant difference in the sensitivity between T2*WI GRE and b0 EPI for acute hemorrhage detection. However Lin et al. found that GRE sequencing is more sensitive than b0 EPI for identifying acute hemorrhage at 1.5T, partly due to the lower spatial resolution in b0 EPI (b0 EPI matrix is 128x128; GRE matrix is 256x256), which is not the case in our study in spite of using 1.5 tesla equipment with nearly the same matrix in both b0 EPI (128x128) and T2*WI GRE (265x192).

In our study we had fifteen patients (57.7%) presented with hemorrhagic arterial infarction and 2 patients (7.7%) with venous infarction, constituting 65.4% of our all patients. In this group of patients, 60% had disturbed conscious level which was the alarming sign for referring patients for MRI examination. Among the group of patients with hemorrhagic arterial infarction, 53.3% of them were on both LMWH and antiplatelet raising the possibility of hemorrhagic transformation in ischemic stroke patients on combined anticoagulant and antiplatelet therapy. A single MRI sequence which is sensitive to acute ischemic insults as well as different stages and shapes of hemorrhage will be the ideal radiological tool for such group of patients.

In this study, b0 was 100% sensitive in detecting different stages of ICH as compared with T2*WI GRE and because it added no acquisition time as it is obtained from the DWI sequence. So, DWI b1000 with its accompanying b0 image can answer most of the questions about acute ischemic insults from detecting hyperacute infarction associated also with the ability to detect hemorrhage in its various stages.

Hypertension is the single most important modifiable risk factor for ischemic stroke. The efficacy of antihypertensive treatment for reduction of stroke has been well established in clinical trials. In the studied group, 18 patients (69.2%) were hypertensive, 14 patients presented with hemorrhagic arterial infarction and 2 patients with primary parenchymal hemorrhage. These results coincide with previous results of Sacco et al.

Aref et al. found that T2*WI is sensitive in detecting petechial hemorrhage. In this study, we took T2*WI as a reference for detection of cerebral hemorrhage and we found that b0 image is as sensitive as T2*WI in detecting petechial hemorrhage. Evidence of associated modifiable risk factors (most notably, uncontrolled hypertension) should be sought in all patients with microhemorrhage.

In conclusion, b0 EPI image obtained with DWI is as sensitive as T2*WI in detecting different stages of intracerebral hemorrhage. The DWI b0 image as it comes with DWI and as it imposes no additional time. So it could serve as both T2 weighted and susceptibility-weighted images. So, b0 image could be used for staging of infarction and presence or absence of hemorrhage. In patients with disturbed level of consciousness or with critical condition that stands against completion of the study DWI b0 image can be used independently for evaluation of the intra cerebral hemorrhage, whatever the stage of hemorrhage and regardless it is primary or secondary hemorrhage with a significant degree of certainty.

REFERENCES


تقييم دور صورة b0 المصاحبة للرنين المغناطيسي بواسطة خاصية الانتشار DWI في تقييم حالات النزيف الدمخي

الغرض من البحث:
تقييم دقة القصص باستخدام صورة b0 المصاحبة للرنين المغناطيسي بواسطة خاصية الانتشار DWI في حالات النزيف الدمخي.

طريقة البحث:
قد تم تطبيق الدراسة على 26 مريضاً مصابين بالنزيف الدمخي، وقد تم تقييم جميع المرضى عن طريق الكشف الإكلينيكي والرنين المغناطيسي للمخ وشرعين الدم. وقد تم قصص الدم باستخدام الرنين المغناطيسي باستخدام كل من Echo-Planar (DWI) و T2*WI, (T1WI) و (T2WI) و (Flair) و MRA. وتتم مقارنة نتائج الرنين المغناطيسي باستخدام صورة b0 المصاحبة للرنين DWI - T2*WI GRE - المغناطيسي بواسطة خاصية الانتشار في حالات النزيف الدمخي.

النتائج:
قد استخلصنا من هذا البحث بأن b0 المصاحبة للرنين المغناطيسي بواسطة خاصية الانتشار لتوحده حساسية* Echo-Planar T2 DWI في تشخيص حالات النزيف الدمخي. حيث أنه يمكن الحصول عليها مع القصص بواسطة خاصية الانتشار DWI بدون إضافة أي وقت آخر للقصص يمكن استغلالها على الأقل في الحالات الحرجة أو الحالات التي لم يكتمل فيها استكشاف الفص بسوا حالة المريض في تشخيص النزيف الدمخي في جميع مراحله.