Results of cerebral CTA in subarachnoid hemorrhage

Resultados de la ATC cerebral en la hemorragia subaracnoidea

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Abstract

Background: subarachnoid hemorrhage is bleeding within the subarachnoid space around the brain. It is a life threatening condition with incidence of 6-8 cases in 100,000 per year. Rupture of cerebral aneurysm is a common cause. Objective: to study the causes of subarachnoid hemorrhage that can be seen in cerebral CTA. Patients and methods: Data from 64 patients with subarachnoid hemorrhage were collected, when they were admitted to neurological ward. Data included gender, age, clinical presentations, presence of hypertension and diabetes, history of smoking and results of cerebral CT angiography. Result: Female gender was slightly higher than males. Mean age was approximately 50 years. Aneurysms were found in half of those who underwent CTA. All of detected aneurysms were in the anterior cerebral circulation. Discussion and conclusion: SAH is a life intimidating disorder with case death rate of 50%. Female gender is slightly higher with high incidence of aneurysmal SAH. Hypertension and smoking are risk factors for aneurysmal rupture. In those who underwent cerebral CTA, aneurysms were the most common pathology detected. All of them were in the anterior cerebral circulation. Early and easier collaboration between radiological, neurological and neurosurgical department are needed to facilitate patient management and decrease the mortality and morbidity.

Keywords: subarachnoid hemorrhage, CTA, aneurysm, arteriovenous malformation.

Resumen

Antecedentes: la hemorragia subaracnoidea es un sangrado dentro del espacio subaracnoideo alrededor del cerebro. Es una afección potencialmente mortal con una incidencia de 6-8 casos por cada 100.000 por año. La rotura de un aneurisma cerebral es una causa común. Objetivo: estudiar las causas de hemorragia subaracnoidea que se pueden observar en la ATC cerebral. Pacientes y métodos: Se recogieron datos de 64 pacientes con hemorragia subaracnoidea cuando ingresaron en la sala de neurología. Los datos incluyeron sexo, edad, presentaciones clínicas, presencia de hipertensión y diabetes, antecedentes de tabaquismo y resultados de la angiografía por TC cerebral. Resultado: el sexo femenino fue ligeramente más alto que el masculino. La edad media fue de aproximadamente 50 años. Se encontraron aneurismas en la mitad de los que se sometieron a ATC. Todos los aneurismas detectados estaban en la circulación cerebral anterior. Discusión y conclusión: La HSA es un trastorno que intimida la vida con una tasa de muerte del 50%. El sexo femenino es ligeramente más alto con una alta incidencia de HSA por aneurisma. La hipertensión y el tabaquismo son factores de riesgo de rotura aneurismática. En los que se sometieron a ATC cerebral, los aneurismas fueron la patología más común detectada. Todos ellos estaban en la circulación cerebral anterior. Se necesita una colaboración temprana y más fácil entre los departamentos de radiología, neurología y neurocirugía para facilitar el manejo del paciente y reducir la mortalidad y la morbilidad.

Palabras clave: hemorragia subaracnoidea, ATC, aneurisma, malformación arteriovenosa.

Introduction

Subarachnoid Hemorrhage (SAH) is defined as bleeding in the Cerebrospinal Fluid (CSF) within the subarachnoid space that is present between dura and pia of the meninges [1]. Approximately 5-10% of all stroke are due to SAH [2-4]. It constitutes about half of non-traumatic (spontaneous) intracranial hemorrhage[1]. SAH incidence in most populations is 6-8 cases in 100,000 per year [5]. The average age is 50-55 years [6]. SAH is 1.6 times more in women than in men [5]. Hypertension, smoking, and excess alcohol intake are modifiable risk factors that individually double the risk of SAH[7]. Spontaneous SAH is caused by rupture of intracranial aneurysm in 80% of cases, others are caused by vascular malformation, arterial dissections, vasculitis and use of anticoagulation [2,8]. 1 to 2% of the people have intracranial aneurysms. They naturally occur at branch point's lengthways-intracranial arteries [9]. Aneurysms are learnt lesions linked to hemodynamic pressure on the arterial walls at bifurcation points and bends. Saccular or berry aneurysms are exact to the intracranial arteries due to their walls absence an outside elastic lamina and have exact thin adventitia causes that may dispose to the creation of aneurysms. An extra characterizes is that they lie uncorroborated in the subarachnoid space [10]. Causes linked with high danger of aneurysm break include black race, Hispanic group, high blood pressure, present smoking, abuse of alcohol, usage of sympathomimetic medicines (cocaine), plus an aneurysm greater than 7 mm [11]. Approximately 5% of aneurysms are associated with connective tissue disorders, the most important being Ehlers–Danlos syndrome (type IV), neurofibromatosis type 1, and autosomal dominant polycystic kidney disease. Prevalence of familial aneurysms, defined as ≥2 first-degree relatives affected, ranges between 7% and 20%[12]. The use of CT angiography, MRA, and subtraction conventional angiography had increased the rate of detection of intracranial aneurysms [3]. The majority of intracranial aneurysms arise from the anterior cerebral circulation; mostly at the anterior communicating/ anterior cerebral artery junction, posterior communicating artery and middle cerebral artery bifurcation. Less than 10% arise from the vertebrobasilar circulation. About 20% of patients have multiple cerebral aneurysms, many at mirror sites bilaterally [13].

Diagnosis:

1. CT is mandatory in those with suspected SAH, Modern generation CT will demonstrate the presence of blood in 95% of patients scanned within 48 hours [14].

2. If clinical thought is solid and the CT is usual, lumbar puncture preferably by skilled worker done supposing there are no contraindications. Xanthochromia of the supernatant, which is optimistic in nearly all patients with SAH between 12 hours and 2 weeks, is diagnostic. This must be resolute by spectrophotometry reasonably than optical checkup [14].

3. Conventional MRI is not subtle to acute bleeding as there is moreover little methaemoglobin for hemorrhage to be simply distinguished from CSF. MRI is excellent for representing subacute and earlier SAH, when the diagnostic produce from CT falls [14].

4. Digital subtraction angiography (DSA) considered the golden investigation till just, but non-invasive replacements, including CT and MR angiography, are ahead acceptance [14].

5. CT Angiography

Current developments in 3 dimensional CT angiography have intended that it today has a sensitivity and specificity future that of percutaneous catheter angiography (sensitivity 77–97% and specificity 87–100%). Imaging time is significantly reduced, allowing acquisition of the entire CT volume in 30–45 seconds during the first arterial pass of an intravenous contrast injection, with slight patient effort artifact. Its non-invasive nature may escape the need for cerebral angiography with its specific risks, at least as early line checkup [14]. Digital deduction cerebral angiography has standard for the discovery of cerebral aneurysms, multi pointer CT angiography (MD-CTA) of the intracranial vessels is today frequently complete, united into the imaging and management procedure of patients with acute subarachnoid bleeding in numerous centers in the England as well as Europe [15].

<u>Intracranial arteriovenous malformation</u>

Arteriovenous malformations (AVM) progress when blood flows straight from the arterial system to the venous system with no capillary system passing. AVMs are reflected inherited lesions and are have feature of failure of the embryonic vascular plexus to completely distinguish and grow to complete capillary bed in the affected zone [1].

The response to shunting of arterial blood into veins is "arterialization" of veins due to proliferation of smooth muscle in the vessels wall [16].

The high pressure vascular circuit of cerebral AVM causes local arterial hypotension and venous hypertension, challenging the local cerebrovascularphysiology and autoregulation [16].

The most common clinical presentations of intracranial AVM:

1- Intracranial hemorrhage(ICH)
2- Headaches
3- Seizures
4- Focal neurological deficits [1]

AVMs most commonly present with ICH in 40-70%. They are the most common cause of intracerebral hemorrhage in young adults [17, 18].

Hemorrhage is more likely to be caused by small lesion. The annual risk of intracranial hemorrhages associated with AVMs is 2-3% [1].

Cerebral angiography provides definitive diagnosis for AVMs [1].

Methods

This study included 64 patients whom were diagnosed with subarachnoid hemorrhage(SAH) based on clinical, radiological and CSF findings, they were admitted to the neurology ward at Marjan teaching hospital in Babil governorate\ Iraq during the period between 2014 to 2018.Data extracted from patients' clinical records and during follow- up. Variables included: age, gender, clinical presentation, presence of hypertension, diabetes, history of smoking and cerebral CT angiography (CTA) findings.

Results

Total number of patients was sixty-four (64), thirty-five (35) of them were females (54.68%) and twenty-nine (29) males (45.32%).

Female to male ratio F: M ratio 1:0.8

Mean age was 48.86

Median 45.5. as show in table 1.

CTA finding

It was done in 48 patients (75%). It was not done in 16 patients (25%) because of their critical clinical condition that made their transfer to CTA department difficult. (CTA department lies outside the hospital). Aneurysms were found in 24 patients from the 48 who underwent CTA (50%). Anterior circulation aneurysm found in all of patients who had aneurysms. As show in table 2.

Table 1: Regarding age distribution.

RANGE AGE	No. of patients
25-35	**9**
36-45	**23**
46-55	**16**
56-65	**10**
>65	**6**

Table 2: CT finding distribution.

Variable	Number of patients and percentages 100%
Total No.	**64**
Female Male	**35 (54.68%)** **29(45.32%)**
Mean age	**48.86**
CTA Done Not done	 **48 (75%)** **16(25%)**
ANEURYSMS Sites: Anterior circulation: *ACA* *ICA-MCA* *Acom* *Pcom* **AVM** **NORMAL** **NOT DONE**	 **24 of 48(50%)** **24(50%)** **4(8.33%)** **2(4.1%)** **10(20.83%)** **8(16.66%)** **6(12.5%)** **18(37.5%)** **16(25%)**
Clinical association and aneurysm site: Seizure *-Acom+seizure* *Pcom+seizure-* *- Normal CTA +seizure* - CTA *Not done* Loss of consciousness -Acom -ACA -Pcom -Normal -Not done vasospasm ACA- Acom- -ICA-MCA Rebleeding -Acom - Died	 **19(29.68%)** **4(21%)** **4(21%)** **7(36.84%)** **4(21%)** **22(34.375%)** **5(22.7%)** **2(9.09%)** **1(4.54%)** **2(9.09)** **12(54.54%)** **8(12.5%)** **2(25%)** **2(25%)** **2(25%)** **8(12.5%)** **4(50%)** **15(23.437%)**
Hypertension Diabetes Smoking Hypertensive and smoker **Hypertension and site of aneurysm:** Acom AcA Pcom ICA-MCA AVM Normal CTA Not done **Smoking and site of aneurysm:** Acom Pcom AVM Normal CTA Not done **Aneurysm site in those both hypertensive and smokers** Acom Normal Not done	**41(64.06%)** **5(7.812%)** **22(34.375%)** **15(23.43%)** **6(14.63%)** **2(4.87%)** **5(12.2%)** **2(4.87%)** **2(4.87%)** **10(24.4%)** **14(34.14%)** **4(18.18%)** **1(4.54%)** **2(9.1%)** **7(31.81%)** **8(36.36%)** **2(13.33%)** **5(33.33%)** **8(53.33%)**
Perimecencephalic SAH	**3(4.7%)**

Acom=anterior communicating artery, Pcom= posterior communicating artery, ACA=anterior cerebral artery, ICA-MCA= internal carotid artery-middle cerebral artery, AVM=arteriovenous malformation, CTA=cerebral CT angiography, SAH=subarachnoid hemorrhage.

CTA findings according to gender:

Females: Aneurysms were found in 13 out of 26 females whom undergone CTA

AVM found in 2 comprising 5.7 (14%) of female patients in the studied population.

Males: Aneurysms were found in 11 out of 22 males underwent CTA

AVM found in 4 males making a percentage of 13.8%

Regarding clinical presentation and complications, seizures were most presented in anterior and posterior communicating artery aneurysms, vasospasm in equal percentages in anterior circulation aneurysms. In those who developed loss of consciousness unfortunately, CTA was not done for them.

Limitations

Absence of integrated neurological center in our region with full neurosurgical and radiological facilities made it difficult for easy patient transfer, early intervention and follow up.

Discussion

Studies regarding epidemiology, clinical presentation and radiological findings in SAH in Iraq are limited in the past decades, however taking in consideration that radiological and neurosurgical facilities are now available in the country; we hope further studies being performed in the near future.

SAH is a distressing disorder with a total mortality rate of 50% (counting pre-hospital losses), with 30% of stayers being leftward reliant on [14], with main neurological discrepancy. International statistics show a higher incidence in United States, Finland and Japan and a low incidence in Middle East [1].

This study showed a slightly higher female proportion than males in accordance to international statistics. It also shows higher incidence of aneurysmal SAH in older age groups [1,14].

Most patients were hypertensive and a significant proportion were smokers. the importance of such finding lies in the fact that Hypertension besides smoking are danger causes for aneurysmal rupture although the study didn't measure pack year for smokers as smoking is a dose-dependent risk factor for rupture. It seems that hypertension and smoking act as synergistic risk factors. The risk of SAH in hypertensive smokers is nearly 15 times that in the non-smoking non-hypertensive population [12,19,20,21].

Studies showed that smoking was more associated with basilar artery aneurysm, multiple aneurysms and a larger aneurysm size. Unfortunately most hypertensive and smokers in this study did not undergo CTA to study any association between site and size of aneurysms and hypertension and smoking [22,23].

CTA findings among the study population detected a pathology in 62.5% of the studied population. Most of them were aneurysms followed by AVMs, all of the aneurysm detected were in the anterior circulation, anterior and posterior communication artery aneurysms made the largest proportion goes with other international statistics [24].

Perimecencephalic SAH was detected in 4.7% of patients a percentage lower than international statistics probably due to small sample size [14].

Conclusions

Subarachnoid hemorrhage is slightly higher in females than males. It is more common in older age groups. Smoking and hypertension are the most common associated risk factors. CTA detected a cause in more than

two thirds of patients. Most were aneurysms followed by AVMs. All aneurysms detected were anterior circulation.

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