Original Article

Diagnostic Cerebral Angiography in Spontaneous Intracranial Haemorrhage: A Guide for Developing Countries

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OBJECTIVE: Spontaneous intracranial haemorrhage constitutes 18–40% of all stroke cases. Indications for cerebral angiography to find underlying potentially treatable vascular abnormalities are not clear. This study determined which intracranial haemorrhage patients need cerebral angiography by correlating computed tomography (CT) findings, age and hypertension history with cerebral angiography findings.
METHODS: A total of 54 patients (8–79 years) with intracranial haemorrhage who underwent both CT examination and six-vessel cerebral angiography were studied over a 2-year period. Cerebral angiography was repeated within 6 weeks if the first angiogram was negative.
RESULTS: Angiography detected vascular lesions in 50% of cases (aneurysm 38.9% and arteriovenous malformation, AVM, 11.1%). In the aneurysm group, angiographic yield was 34.3% whereas in the AVM group, it was 37.9%. Subarachnoid haemorrhage (SAH) combined with other types of haemorrhage (such as intracerebral haemorrhage, ICH) was not significantly correlated with the likelihood of finding a vascular lesion, both aneurysm and AVM ($p = 0.157$). Age less than 50 years had significant correlation ($p = 0.021$) in the AVM group as well as in the aneurysm group ($p < 0.001$). A history of hypertension was associated with both aneurysm ($p = 0.039$) and AVM ($p = 0.008$). No patients with deep intracerebral haematoma had vascular lesions. The presence of an intraventricular haemorrhage (IVH) had significant correlation with aneurysm ($p = 0.008$) but not AVM. There was no significant difference in mean age between patients with and without a vascular lesion ($p = 0.134$).
CONCLUSION: Cerebral angiography is justified in patients with pure SAH ($p = 0.001$). Other factors associated with finding a vascular lesion were a history of hypertension and the presence of IVH. Diagnostic cerebral angiography is indicated for patients with ICH and SAH and IVH with a history of hypertension, regardless of age.
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Key Words: cerebral angiography, developing countries, hypertensive intracranial haemorrhage, indications, surgery

Introduction

Intracranial haemorrhage is named according to its anatomical distribution as intracerebral haemorrhage (ICH), subarachnoid haemorrhage (SAH), intraventricular haemorrhage (IVH), subdural haemorrhage or extradural haemorrhage. Spontaneous intracranial haemorrhage is a non-traumatic haemorrhage. It commonly occurs as ICH, SAH or IVH.[1] Subdural and

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extradural haemorrhages are commonly due to trauma.

In 1999, Fauziah studied 158 patients admitted to Hospital Universiti Sains Malaysia (HUSM) for symptoms of stroke and revealed that 32.9% were due to spontaneous ICH, 7.6% to SAH and 56.3% to infarction.[2] ICH accounts for 10–32% of all cerebrovascular strokes. A higher incidence of ICH has been noted in Chinese, Japanese and other Asian populations, and the incidence in ASEAN countries varies from 17.2% to 38.6%.[3]

Computed tomography (CT) is the primary investigation for ICH. Cerebral angiography is important if surgery is indicated. Most developing countries such as Malaysia have one cerebral angiogram facility for 4.5 million people. Finding the aetiology of the bleeding is essential in the management of intracranial haemorrhage, particularly for intracranial aneurysm and arteriovenous malformation (AVM), in which surgical or endovascular intervention significantly reduce the re-bleeding risk. Although previous studies have emphasized the safety of the angiography procedure,[4,5] it still carries a 0.07–0.3% risk of permanent stroke and an overall 1.8% risk of systemic complication. This raises the question of what factors determine the most suitable patients to be referred for angiography in developing countries where facilities are limited. The aim of this study was to find out which patients with intracranial haemorrhage need cerebral angiography by correlating CT findings with clinical data.

Methods

A cross-sectional study was conducted in patients with spontaneous intracranial haemorrhage admitted to HUSM between 1 October 1998 and 30 April 2001. Both CT and cerebral angiography were performed in all patients. Criteria for inclusion in the study were spontaneous intracranial haemorrhage, cranial CT and digital subtraction cerebral angiography. Patients who had negative angiography initially underwent repeat cerebral angiography within a 6-week period if intracerebral pathology was suspected. Patients were excluded if they had intracranial haemorrhage of traumatic origin, haemorrhage into a tumour diagnosed by CT or magnetic resonance imaging (MRI), unavailable CT scans or angiogram films, or haemorrhage attributed to coagulopathy or blood dyscrasia. All patients gave written informed consent for angiography.

Demographic data and medical history were collected, including age, sex, race and medical illnesses (hypertension, smoking and diabetes mellitus). Hypertension and diabetes mellitus were assumed to be present if the patients or their families had been informed of the diagnosis or if medical documentation indicated their presence. The Glasgow Coma Scale (GCS) was recorded on arrival in the accident and emergency department.

Plain cranial CT was performed using a non-helical CT Somatom HiQ-s (Siemens AG, Erlangen, Germany) or a Somatom Plus 4 (Siemens AG). Slice thickness was chosen according to international protocol format.

Cerebral angiography was performed according to standard protocols using an Advantx LAC/LCV+/LC+ (GE Medical Systems, Milwaukee, WI, USA). The procedures were performed under sedation and local anaesthesia or general anaesthesia. Cerebral vessels were usually cannulated using head-hunter 5F catheters. In all cases, a six-vessel cerebral angiogram was obtained using at least two projections of each of the vessels: anterior–posterior view and lateral view. Iohexol 300 mg/mL was used as the contrast medium.

Two blinded senior radiologists reviewed CT scans and cerebral angiography films. The presence of ICH, SAH, IVH or subdural haemorrhage was recorded from non-enhanced CT scans. ICH was defined by Laissy et al[6] and Steven et al,[7] SAH was defined according to Steven et al[7] and Hijdra et al,[8] IVH was defined according to Steven et al,[7] and subdural haemorrhage was defined according to Orrison and Lewine.[9]

The number and location of aneurysms and the arterial territory of AVMs were recorded from cerebral angiography.[10,11] A positive angiogram was defined as the identification of a vascular abnormality accounting for the haemorrhage. Angiographic yield was defined as the frequency of positive angiography (positive detection of vascular lesions) in a defined patient group.

Statistical analysis

Data were analysed using SPSS version 10 (SPSS Inc, Chicago, IL, USA). Sociodemographic and medical illness data were analysed using descriptive statistics for frequency, percentages for categorical data and mean, median and standard deviation for continuous data. The prevalences of aneurysm and AVM were also determined. McNemar's test was used for correlational statistics and the level of significance was set at 0.05.

Results

Only 18 cases per year were recruited into this study due to the strict CT scan criteria and also to patient reluctance for angiography that is common in developing countries such as Malaysia. Among the 54 patients with spontaneous intracra-