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4-VESSELS ANGIOGRAPHY: A TINKERING TOOL IN MULTI-FACETED MANNER.

Neurosurgery

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ABSTRACT

Introduction: The global incidence of spontaneous intracranial vascular conditions such as: Spontaneous Subarachnoid hemorrhage (SAH); Non-aneurysmal subarachnoid hemorrhage (NASAH); and arterio-vascular malformation, which are low incidence conditions though lethal pathologies due to leakage of blood within the cranial cavity. Missed such conditions are mutual agony among healthcare providers. Management of these pathologies is imperative to an early diagnosis. Stimulatingly, despite the reiterated imaging studies that have been established for diagnosing intracranial vascular pathologies, 4-vessels angiography had ranked superior multidimensionally.

Thus, this study targets to address the diagnostic significance of angiography in spontaneous intracranial hemorrhages as the cardinal tool of management with reference point comparison of our findings with those reported in literature.

Methods: A retrospective chart review of patients presented with spontaneous intracranial hemorrhages over a period of 3-years from January 2014 till January 2017 at the neurosurgical department of King Hussein Medical Center was conducted. All patients had clinical features of sudden onset of severe headache, decrease level of consciousness of sudden neurological deficit, who were hospitalized within 72-hours after the bleeding onset. Clinical data, non-invasive radiological imaging studies confirmed the spontaneous intracranial hemorrhages presence. Patients underwent subsequent diagnostic workup. The results and complications of the Digital subtraction angiography (DSA) study were analyzed. Repeated DSA or computed tomography angiography (CTA) was performed 6-8 weeks later if initial angiographic result were negative.

Results: Of 141-patients who underwent cerebral angiography following spontaneous subarachnoid hemorrhage in the three-year time period, 81-females (57.47%), 60-males (42.55%), mean age 50.76 year. Fifty four examinations revealed aneurysms, another 26- small aneurysms were diagnosed in the angiogram negative cases on the follow-up studies. Eighteen patients had non-aneurysmal subarachnoid haemorrhage, fourteen-case showed arteriovenous malformation (AVM) and five-case showed dural fistula.

Sixty-seven percent of the patients classified their headache as being the worst headache of their life and approximately 54 % described maximum intensity of the pain within the first 2-hours. Sudden loss of consciousness (LOC) occurred in 42% of the patients due to increased intracranial pressure. LOC often is transitory; however, approximately 15 % of the patients remained comatosed for several days. Seizures during the acute phase occurred in 16-patients (11.35%).

Conclusion: Spontaneous intracranial hemorrhages is a devastating and multifarious disease which must be managed in well- established and dedicated centers. In our center, DSA following non-conclusive CT imaging of the brain was therefore a test of extremely high yield, utility, and also associated with decreased morbidity and mortality. Non-aneurysmal SAH cases have better neurological status compared with aneurysmalcases.

KEYWORDS

Sspontaneous intracranial hemorrhages; subarachnoid hemorrhages; angiography; ruptured aneurysm; arteriovenous malformation; digital subtraction angiography.

INTRODUCTION:

Spontaneous intracranial hemorrhages although uncommon, remain a significant source of a potentially high morbidity and mortality worldwide caused by leakage of blood within the intracranial spaces consequential to ruptured aneurysm; arteriovenous malformation (AVM) or bleeding tendency [1-4]. Spontaneous intracranial hemorrhages might lead to a devastating neurologic condition, diminished function, poor quality of life or death. Moreover, missed spontaneous intracranial hemorrhages are a mutual apprehension among healthcare providers [1, 2, and 5].

Effective management of these conditions from a neurosurgical perspective, and thus awareness of these conditions is imperative to an early diagnosis. Digital subtraction angiography (DSA) remains the paradigm as a fundamental tool in assessing both the brutality and the features of cerebrovascular pathology [6]. Thus, this study aims to address the diagnostic importance of angiography in spontaneous intracranial hemorrhages as the cardinal tool of management with baseline comparison of our findings with those reported in literature as supplementary work to our previous reviews.

Methods: We conducted retrospective chart review of patients presented with spontaneous intracranial hemorrhages over a period of 3-years from January 2014 till January 2017 at the neurosurgical department of King Hussein Medical Center. All patients had clinical features of sudden onset of severe headache, decrease level of consciousness of sudden neurological deficit, who were hospitalized within 72-hours after the bleeding onset. Clinical data, non-invasive radiological imaging studies (computed tomography (CT) or magnetic resonance (MR) angiography) confirmed the spontaneous intracranial hemorrhages presence. Patients went through a subsequent investigative workup. Digital angiography (DSA) implemented for all

patients at least once as primary investigation in our setup as diagnostic and therapeutic means. Regular angiographic views with/without complementary oblique views were obtained through both internal carotid, external carotid and vertebral arteries injections (Figure.1).

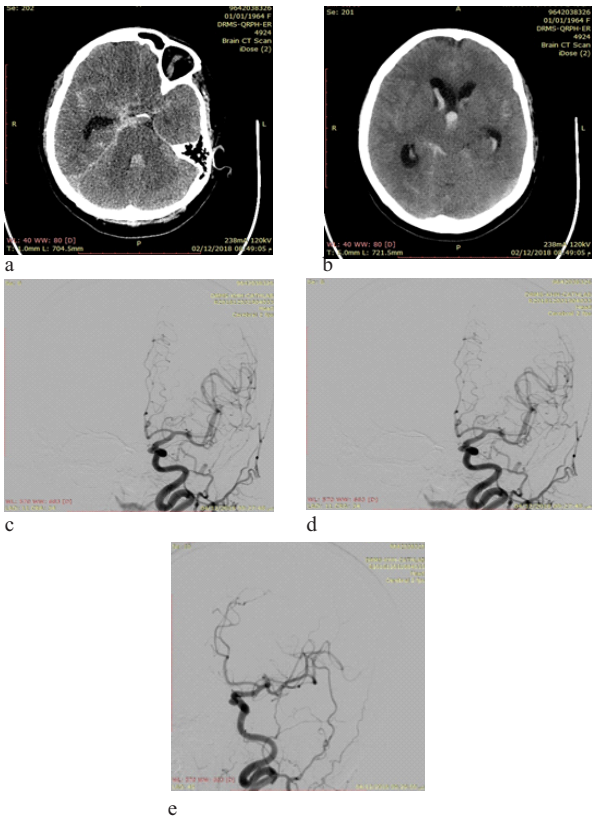


Fig. I: A 55 year old female patient presented with severe headache. Non attenuation CT scan (a) and (b) shows subarachnoid and interventricular bleeding, DSA (c) towne, (d) lateral and (e) oblique project views show left para-ophthalmic left ICA aneurysm.

Rotational angiography and three-dimensional reconstruction were conducted for the clear identification of suspected hemorrhagic sources. The results and complications of the DSA study were analyzed. Repeated DSA or computed tomography angiography (CTA) was performed 6-8 weeks later if initial angiographic result were negative to detect tiny aneurysms effaced by the hematoma, then according to the diagnosed pathology a management and follow-up was maintained.

Results: Of 141-patients who underwent cerebral angiography following spontaneous subarachnoid hemorrhage in the three-year time period, additional 13-charts were excluded based on missing data: five because the neurologic examination was not documented, four because radiological attending interpretation of the initial imaging study was not documented, two because no attending interventional radiologist interpretation for the angiograms was documented, and two because of death of the patients prior to the follow-up angiogram following a negative initial angiogram. Of the final study cohort.

A total of 141- patients: 81-females (57.47%), 60-males (42.55%), mean age 50.76 (range between 19–77 years) underwent Digital subtraction angiography. Fifty four examinations revealed aneurysms, seventeen patients had more than one aneurysm, one of which had two aneurysms mirroring in both middle cerebral arteries, whereby both were treated at the separate session. Another 26- small aneurysms were diagnosed in the angiogram negative cases on the follow-up studies. Eighteen patients had non-aneurysmal subarachnoid haemorrhage, fourteen-case showed arteriovenous malformation (AVM) and five-case showed dural fistula, while on 50-studies no definite cause of bleeding could be identified.

The majority of aneurysms were wide neck saccular aneurysms (69.4%). Six fusiform aneurysms were identified. Four aneurysms (7.41%) were localized in the posterior circulation. Complications encountered at the rate of 7.8% without any mortality.

Sixty-seven percent of the patients classified their headache as being the worst headache of their life and approximately 54 % described maximum intensity of the pain within the first 2-hours. Sudden loss of consciousness (LOC) occurred in 42% of the patients due to increased intracranial pressure. LOC often is transitory; however, approximately 15 % of the patients remained comatosed for several days. Seizures during the acute phase occurred in 16-patients (11.35%).

DISCUSSION:

Spontaneous intracranial hemorrhages are infrequent and severe subtype of bleeding in the intracranial spaces affecting patients at a mean age of 55-years, leading to severe disability [5].

The incidence of subarachnoid hemorrhage (SAH) is around 6 cases per 100 000 patient years [6]. The rupture of an intracranial aneurysm is the underlining cause in 85% of cases [7, 8] (Figure.2).

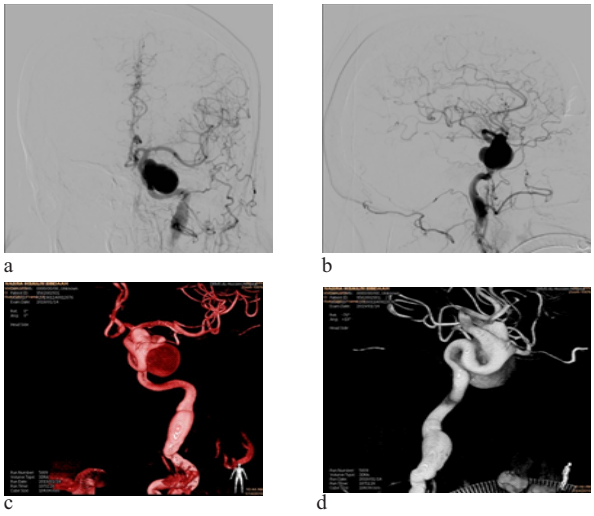


Fig. II: (A) DSA image of selective catheterization left ICA Towne view s and (B) lateral view shows large para-ophthalmic aneurysm (c) and (D) is 3D images of the same patient

Survival from aneurysmal subarachnoid hemorrhage has increased by 17% in the past few decades, possibly because of better diagnosis and advanced intensive care support [9]. The communal clinical presentation is most often in the form of a thunderclap headache, characteristically defined as maximal at onset and worst of life, subtle presentations are still missed [10,11]. However, the cause of SAH in up to 15% of patients show no source of bleeding. The majority of patients with non-aneurysmal SAH are in good general clinical condition at presentation. Non-aneurysmal and especially perimesencephalic SAH is often associated with favorable outcome [12-16]. Intracranial arteriovenous malformation (AVM) is an exceptionally detrimental intimidating clinical condition (Figure.3). Almost greater than 50% of AVM patients demonstrate intracranial hemorrhage and 20% to 25% have focal or generalized lifelong seizures that become more severe with age [17].

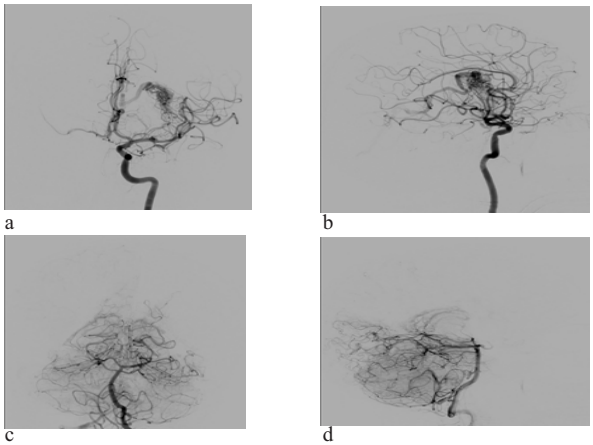


Fig. III: Digital subtraction images selective catheterization of the left internal carotid artery (a) towne view shows arterio-venous malformation in the left thalamic area which supplies from branches of the left middle cerebral artery (b) is a lateral view shows the AVM drainage into deep vein (c) and (D) are selective left vertebral artery angiogram for same Patient and appear normal

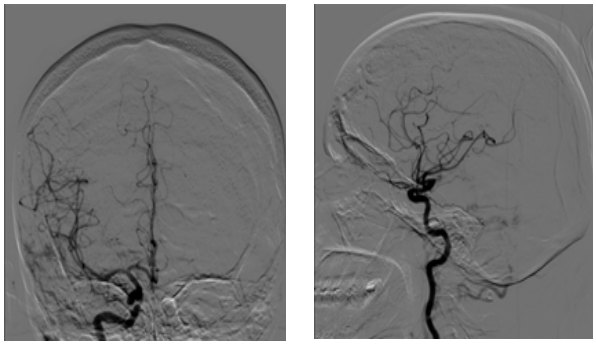
The diagnostic approach of spontaneous intracranial hemorrhage cases depends usually on a high threshold of clinical suspicion combined with radiologic verification via urgent non-enhanced computed tomography (CT) scan. Conventionally, a negative CT scan is followed by further work-up. Nevertheless, non-contrast CT followed by CT angiography (CTA) of the brain can rule out spontaneous intracranial hemorrhage with greater than 99% sensitivity [18]. After the verification of spontaneous intracranial hemorrhage, supplementary imaging should be implemented to illustrate the source of the hemorrhage. This determination can include standard angiography, CT angiography, and magnetic resonance (MR) angiography. A full four-vessel cerebral angiography is a two-dimensional representation of the vessel lumen, permits accurate estimation of both extracranial and intracranial, carotid, and vertebral arteries. Undoubtedly, DSA is the primary method to elucidate the cause of spontaneous intracranial hemorrhage and is considered superior to noninvasive imaging techniques [19]. It allows high resolution assessment of the entire cerebrovascular circulation. A comprehensive carotid and vertebral diagnostic angiography is a necessary procedure to provide anatomic details for stage-managing the interventional approach and for anticipating potential challenges Many reports have revealed that female gender is a recognized risk factor for the occurrence of aneurysmal SAH [19-25]. The female-to-male ratio was approximately 1.35:1 in our study, there was also a gender difference between aneurysmal and non-aneurysmal SAH patients. The percentage of females was less in non-aneurysmal SAH patients. This demographic dissimilarity proposes that the fundamental physiologic or anatomic processes of gender influence may be exceptionally susceptible to either aneurysmal SAH or non-aneurysmal SAH.

Topographically, anterior and posterior communicating arteries were the most common sites in aneurysmal SAH patients in this study. Middle cerebral artery bifurcation was another prime site. The explanation for these highest locations susceptible to intracranial aneurysm is due to the morphologic vulnerability and blood flow feature in the Willis circle, or because of arterial bifurcation [19]. These results are in line with previous reports [26, 27].

Our data showed a favorable outcome in non-aneurysmal SAH patients compared with aneurysmal SAH patients. Former studies reported that the majority of patients with non-aneurysmal SAH had favorable clinical condition on admission [28-30].

The etiology of non-aneurysmal SAH varies. In our series, unknown sources of SAH account for approximately 12.76 % of patients. In this review the positive percentage of repeated angiography was 52%, our results were consistent with those reports previously reported [31].

In the current study, 45.4% of non-aneurysmal SAH cases had positive initial angiographic findings, (AVM) or arteriovenous fistula (AVF) are the major sources of bleeding among them (Figure.4). As described in previous studies, rupture of superficial arteriovenous malformation could consequence in SAH, especially if there is an associated aneurysm in the nidus [32, 33].



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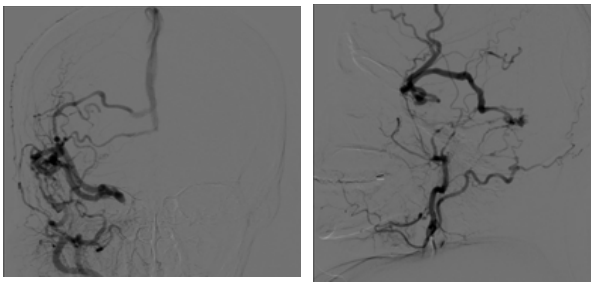

C d

Fig.IV: DSA of 18year old male patient presented with headache (a) towne and (b) lateral projestion shows right internal carotid artery injection (c) and (d) towne and lateral external carotid artery injections confirm a dural arterio-venous fistula (Borden type 3) with arterial supply from right occipital artery

The complication rate related to the technique of DSA encountered in the acute stage of spontaneous intracranial hemorrhage in our review was limited to a reasonable level of (7.8%) without any mortality; nevertheless, it appears to be marginally higher compared with previous reports [34-36]. Also naturally, vasospasm was the primary consequence of emergent DSA, as the angiography process was implemented in the highly distressed cerebral arteries during the acute stages of spontaneous intracranial hemorrhage or the vasospasm was just the pathological course of spontaneous intracranial hemorrhage itself [37-39].

Conclusion: spontaneous intracranial hemorrhage is a severe and multifarious disease which must be handled in dedicated centers by professionals with sufficient experience in relevant diagnostic and therapeutic procedures. In our setting, DSA following non-conclusive CT imaging of the brain was therefore a test of extremely high yield, utility, and also associated with decreased morbidity and mortality. The majority of the ruptured aneurysms are detected in the AComA, PComA, and MCA. Non-aneurysmal SAH; AVM and dural fistula cases showed favorable neurological condition compared with aneurysmal cases. Repeated angiography revealed high percentage of hidden aneurysms effaced at first examination.

Limitations: This study has major limitations. First, this is a descriptive retrospective study, deficient information on pathology-specified treatment and resultant outcomes. Second, the small number included in this study.

Conflicts of interest: There are no conflicts of interest.

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