Original Research Article

Complications of intra-arterial digital subtraction angiography in patients investigated for cerebral vascular disease in Tertiary Care Hospital

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Abstract

Background: Cerebral DSA is mainly performed as a diagnostic procedure but at times used for intervention. Usually DSA is safe procedure but rarely could it be associated with complications such as nausea, vomiting, transient hypotension, anaphylaxis, and groin hematoma, neurological complications secondary to thromboembolism which occurs secondary to thrombus formation within catheters or device-induced micro-dissections. The purpose of this study was to determine the complications of intra-arterial digital subtraction angiography in patients investigated for cerebral vascular disease. **Methods:** Present study was prospective in nature conducted on 100 dengue patients. All patients fulfilling inclusion criteria and exclusion criteria were taken up for the study. Study was carried from August to October 2021. **Results:** Majority of the patients was in the age group of 40-60 years and most of them were male. Complications of the DSA procedure were neurological & non-neurological. Most of the non-neurological complications were local like pain at the puncture site, puncture site hematoma, femoral artery dissection & few were systemic as nausea, vomiting, contrast dye allergy. Neurological complications were transient ischemic attack of motor type, transient ischemic attack of sensory type & stroke of sensory type. Incidence of neurological complications in our study was 4.83%. **Conclusion:** DSA is a safe procedure with rare incidence of neurological complications.

Key words: DSA, neurological complications.

Introduction

Noninvasive vascular imaging techniques like ultrasound, MRI, CT have replaced invasive vascular imaging techniques such as digital subtraction angiography (DSA), still DSA is gold standard because it is having higher accuracy, superiority & quality[1-6]. It has the advantage of looking at all three blood flow phases, i.e. arterial, capillary, and venous & maintains a standardized pattern. However due to non-availability many centers use other alternatives like trans-cranial Doppler or CT angiography[5,6]. Cerebral DSA is mainly performed as a diagnostic procedure but at times used for intervention. Usually DSA is safe procedure but rarely could it be associated with complications[7,8] such as nausea, vomiting, transient hypotension, anaphylaxis, and groin hematoma, neurological complications secondary to thromboembolism which occurs secondary to thrombus formation within catheters or device-induced micro-dissections[9,10] & there is paucity of studies to confirm this hypothesis, hence we have undertaken this study.

Objectives

To determine the complications of intra-arterial digital subtraction angiography in patients investigated for cerebral vascular disease.

Materials and Methods

The protocol of this longitudinal follow up study was approved by the Institutional Ethical committee of the medical college. Written informed consent was taken from all study subjects.

All patients fulfilling inclusion criteria and exclusion criteria admitted in general medicine ward of Dr. PDMMC and tertiary care hospital were taken up for the study until fulfilling the required sample size.

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Study was carried out over a period of three months from August to October 2021.

Inclusion criteria include CVA patients who underwent cerebral digital subtraction angiography & giving consent to participate in the study. Exclusion criteria include patients with history of renal insufficiency, any history of a severe anaphylactic reaction to the contrast medium or a coagulopathy with an increased risk of delayed hemostasis. Thorough systemic & clinical evaluation carried out and then patients followed up for development of any complications. Primary outcome was complications associated with DSA. Complications were categorized into neurological and non-neurological. Events that occurred within 24 hours of angiography were considered to be complications of the procedure.

Sample size was calculated with $n = [DEFF*Np(1-p)]/ [(d^2/Z^2_{1-\alpha/2}*(N-1)+p*(1-p)]$ using OPENEPI software version 3.

Ball JB et al[11] in their study of Complications of Intravenous Digital Subtraction Angiography, found prevalence of complications was 20%. Considering this prevalence, with 95% confidence interval and absolute precision of 10%, sample size came out to be 62.

Method of assessment

Pre-validated, pretested, semi structured questionnaire was used as data collection tool. Thorough systemic and general examination was done for clinical evaluation.

A neurologic complication was defined as any new neurologic sign or symptom or worsening of a preexisting neurologic deficit that occurred during the procedure or within 24 hours. A non-neurologic complication was defined as any sign or symptom occurring either locally at the puncture site or systemically within 24 hours of the procedure. It was classified as transient if last for <24 hours; reversible if last >24 hours to less than 7 days & permanent if last >7 days.

Procedures as a part of Pre DSA work up included 1. Blood investigations: Serum urea, creatinine, serum electrolytes, blood hemogram including BT/CT 2. Overnight fasting 3. Part preparation.

DSA procedure

It was performed with or without sedation, sometimes general anesthesia. Materials used were 18/19 G single puncture needle; 4F/5F femoral sheath; 4F/5F vertebral diagnostic catheter; 032 or 035 Terumo J-tipped guiding wire;3-way connector, Luer lock syringes, continuous heparinized saline flush (1000 U in 500 ml saline) through the femoral sheath. Bolus Heparin injection given after femoral artery puncture- 75-100 U/kg body weight. Injection Protamine was given at the end of the procedure to reverse heparinization. Hemostasis was achieved at the puncture site by manual compression. Data was entered in Microsoft Excel and analyzed using SPSS Software.

Results

In the present prospective study there was no lost to follow up and we have analyzed 62 patients at the end, so the response rate was 100%. Majority i.e. 36 (58.06%) of the patients were in the younger age group of 40-60 years followed by 15 (24.19%) from the age group of >60 years and least 11 (17.74%) from the age group <40 years. Most i.e. 35 (56.45%) of the patients were male. 27 (43.55%) gave history of addiction to alcohol & 31 (50%) were addicted to smoking. Out of total 62 patients, 13 (20.97%) had CHD, 9 (14.52%) DM, 16 (25.81%) HTN & 7 (11.29%) had DM + HTN as a risk factor for the DSA procedure. (Table 1)

Table 1. Distribution of CVA patients according to baseline characteristics

Sr. No.	Baseline characteristic		Frequency (no.)	Percentage (%)
1	Age groups	<40	11	17.74
		40-60	36	58.06
		>60	15	24.19
2	Gender	Male	35	56.45
		Female	27	43.55
3	Addiction	Alcohol	27	43.55
		Smoking	31	50
4	Risk factors	CHD*	13	20.97
		DM$	09	14.52
		HTN#	16	25.81
		DM + HTN	07	11.29

*Coronary heart disease; $ Diiabetes mellitus; # Hypertension.

Complications following DSA have been divided into neurological & non-neurological. Most common non-neurological complication was pain at the puncture site in 24 (38.70%) patients followed by puncture site hematoma in 18 (29.03%), nausea in 16 (25.81%), vomiting in 12 (19.35%), femoral artery dissection in 8 (12.90%) & contrast dye allergy in 1 (1.61%) patient. Neurological complications were transient ischemic attack of motor type, transient ischemic attack of sensory type & stroke of sensory type, each in 1 (1.61%) patient. (Table 2)

Table 2. Complications of cerebral digital subtraction angiography

Complication	Frequency (no.)	Percentage (%)
Neurological		
TIA motor	01	1.61
TIA cognition	01	1.61
Stroke sensory	01	1.61
Non-neurological		
Pain at puncture site	24	38.70
Puncture site hematoma	18	29.03
Nausea	16	25.81
Vomiting	12	19.35
Femoral artery dissection	08	12.90
Contrast allergy	01	1.61

In our study, neurological complications did not have significant association with baseline characteristics like age, gender, history of smoking or alcohol and risk factors (p>0.05). (Table 3)

Table 3. Association between baseline characteristic of patients & neurological complications of cerebral digital subtraction angiography

Sr. No.	Baseline characteristic		Complication No. (%)	P value
1	Age groups	<40 (n=11)	00 (00)	0.7
		40-60 (n=36)	02 (5.55)	
		>60 (n=15)	01 (6.67)	
2	Gender	Male (n=35)	02 (5.71)	0.7
		Female (n=27)	01 (3.70)	
3	Addiction	Alcohol (n=27)	01 (3.70)	0.6
		Smoking (n=31)	02 (6.45)	
4	Risk factors	CHD (n=13)	01 (7.69)	0.5
		DM (n=9)	01 (11.11)	
		HTN (n=16)	00 (00)	
		DM + HTN (n=7)	01 (14.29)	

Discussion

In the current prospective study on CVA patients with mean age of 56.8 years majority of them were males. High proportions (around 50%) of patients were addicted in our study & around 25% had comorbidity as a risk factor. Consistent mean age of the patients was reported by Yoon-Hee Choo et al[12] but they had female majority in their study. Qasim Bashir et al[13] also reported consistent mean age & male majority in their study.

Complications of the DSA procedure were neurological & non-neurological. Most of the non-neurological complications were local like pain at the puncture site (38.70%), puncture site hematoma (29.03%), femoral artery dissection & few were systemic as nausea,

vomiting, contrast dye allergy. Neurological complications were transient ischemic attack of motor type, transient ischemic attack of sensory type & stroke of sensory type. Incidence of neurological complications in our study was 4.83%. Similar incidence (5%) was reported by Yoon-Hee Choo et al[12]. Burger et al[14] found (0.4%) low rate of complications among children. Qasim Bashir et al[13] also reported low rate (0.3%) of complications. Similar complications following DSA also noted by Jie Shen et al[15].

In our study, neurological complications were not associated with baseline characteristics like age, gender, history of smoking or alcohol and risk factors ($p>0.05$).

Conclusion

Incidence of serious neurological complications following cerebral digital subtraction angiography was very less i.e. 4.83% & these were not associated with particular age, gender, addiction or comorbidity, so DSA is a safe procedure with rare incidence of neurological complications.

Declaration

There was no source of funding in our study and there were no any conflict of interest.

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