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An Analysis of Complications of Coronary Angiography Correlation with Risk Factors in a Tertiary Care Hospital

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ABSTRACT

Coronary angiography and heart catheterization are invaluable tests for the detection and quantification of coronary artery disease and measurement of hemodynamic parameters. The risks and complications associated with these procedures relate to the patient's concomitant conditions and to the skill and judgment of the operator. In this review, we examine in detail the major complications. 50 consecutive patients subjected to coronary angiography in the cardiac catheterization laboratory in a tertiary care hospital formed the data base for this study. In present study, most of the angiography were done through femoral approach. Brachial approach was used in patients having peripheral vascular disease involving lower limbs. There were no local vascular complications. The complications occurred more frequently in males than females. All the patients who had complications had some risk factors. Common risk factors included were unstable angina, low ejection fraction and use of ionic contrast medium

Keywords: Cardiac catheterization, Angiography, Contrast material, Complication.

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INTRODUCTION

Coronary angiography (CAG) is the gold standard for detection of arterial narrowing related to atherosclerotic coronary artery disease (CAD). This procedure provides the most reliable information for determining the effectiveness of medical therapy as well as interventional procedures such as percutaneous coronary intervention (PCI) or coronary artery bypass graft (CABG) in patients with CAD.[1] Coronary angiography is performed through percutaneous approach to arteries; Therefore, selecting the best vascular access is one of the first decisions for any percutaneous cardiovascular procedure. For the first time this approach was applied in 1953,[2] and brachial artery was the first access to use.[3] Then cardiovascular interventionists began to use femoral access for CAG and PCI due to some complications of brachial access in 1967-4 However, this new access site has shown to have several complications as well.[5-9] During 1989 till 1999 percutaneous radial artery approach started to be applied by cardiology interventionists.[10] This procedure is associated with small but definite risk. Major complications are rare [Approx 1 in 1000] but do include death, Myocardial Infarction, Stroke, Aortic or Coronary Dissection, Cardiac rupture, Air Embolism, Cardiac Arrhythmias and peripheral vascular injury at the access site. Minor complications are relatively common and include haematoma at the site of arterial puncture, short lived episodes of angina pectoris, vasovagal reactions and allergies to contrast agents and drugs.

AIMS AND OBJECTIVES

1) To assess the incidence and severity of complications in patients undergoing coronary angiography. 2) To correlate the incidence and severity of these complications with I]The cardiac status: a)Acute coronary status b)Cardiac failure c) valvular heart disease d)extent of coronary occlusion. II]Other pre-existing risk factor -Age, Hypertension/Hypotension, Diabetes Mellitus, Renal insufficiency, Cerebrovascular/Peripheral vascular disease.

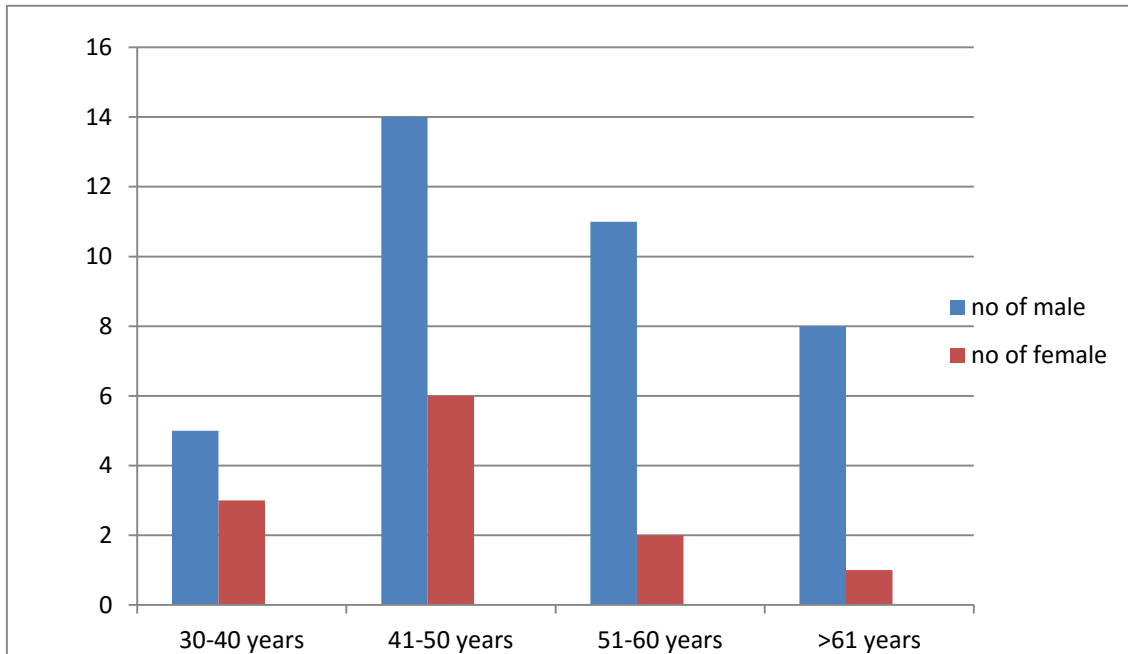
MATERIAL AND METHODS

Patients subjected to coronary angiography in the cardiac catheterization laboratory in a tertiary care hospital over a period of one year. 50 consecutive patients admitted in the medical ward and satisfying the above criteria were included in this study. Patients included in the study were evaluated as follows: A)Complete history B) Complete physical examination C)Pre-coronary angiography evaluation as - electrocardiogram, trans-thoracic 2Echocardiography, Chest X-ray, Blood sugar Level-fasting & post-prandial, serum Creatinine level D) post coronary angiography evaluation. All patients were observed and their cardiac rhythm was monitored in the intensive care unit for 24 hours after the procedure. Patients with suspected complications were observed long as required. Patients general condition, pulse rate, peripheral pulse and blood pressure was monitored immediately post angiography and after 4,6,12 and 24 hour after the procedure. Routine 12 Lead electrocardiogram was recorded at 6 and 24 hours post angiography. All patients were monitored for the following complication post-angiography as per the study protocol detailed below: Local haematoma, retroperitoneal haematoma, prolonged local bleeding, evidence of limb ischemia and distal emboli, local vascular dissection and rupture, cerebrovascular accident, vasovagal syncope, contrast reaction, contrast induced nephropathy, fresh onset coronary ischemia, acute myocardial infarction, left ventricular failure, local Cellulitis, septicemia and Air embolism.

OBERVATION

Table no 1: Age and sex distribution (n=50)

Age Group	Male	Female	Total	Percentage
30-40 years	5	3	8	16%
41-50 years	14	6	20	40%
51-60 years	11	2	13	26%
>60 years	8	1	9	18%
Total	38	12	50	100%



Graph-1 Age and sex distribution (n=50)

Majority of the patients were in between 41-50 years of the age{40%}
 Youngest - 34 years of age and Eldest – 70 years of age
 Male patients were 76% and Female patients were 24%

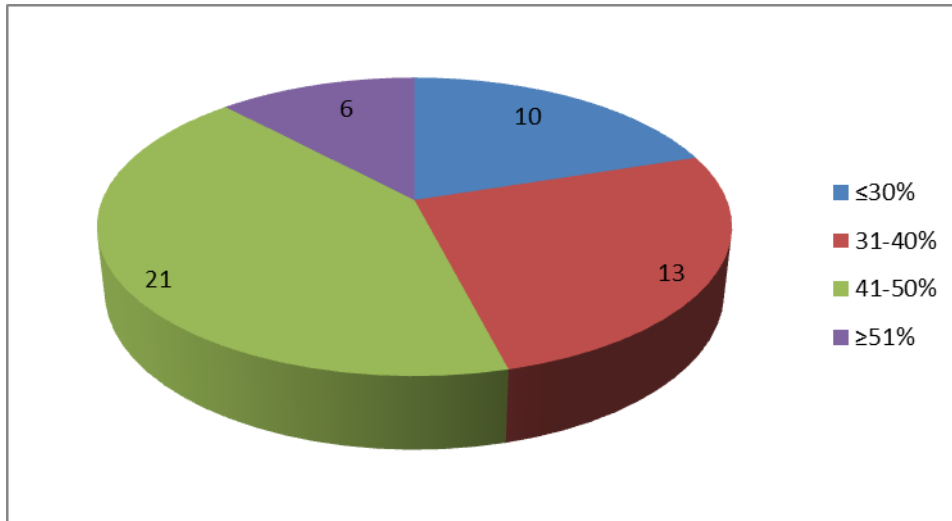
Table 2 Site of myocardial infarction

SITES OF INFARCTION	NO OF PATIENTS
Anterior / Anteroseptal	5/0
Anterolateral	11/17
Transanterior	1/0
Inferior	5
Inferior with RV	2
Inferior + Lateral	5
Lateral	6
Inferior+ Lateral	6

The most common site of infarction of was the Anterior wall of myocardium.

Table 3: Left ventricular dysfunction [n=50]

LV EJECTION FRACTION	NO OF PATIENTS	PERCENTAGE
≤30%	10	20%
31-40%	13	26%
41-50%	21	42%
>50%	6	12%

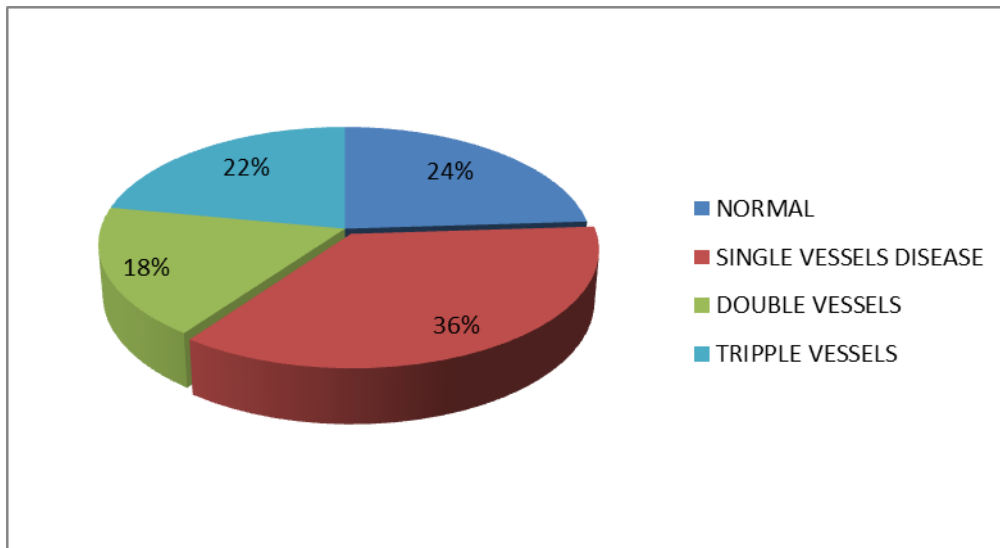


Graph 2 : Left ventricular dysfunction [n=50]

Majority of the patients had ejection fraction between 41-50% [42%]. Only 20% patients had EF ≤30%

Tables 4: Numbers of vessels involved [n=50]

VESSELS INVOLVED		NO OF PATIENTS	PERCENTAGE
NORMAL		12	24%
SINGLE VESSELS DISEASE	LAD	11	22%
	RCA	2	4%
	Circumflex	2	4%
	LEFT MAIN	3	6%
DOUBLE VESSELS	LAD + RCA	5	10%
	LAD + Circ	2	4%
	RCA + Circ	2	4%
TRIPPLE VESSELS	LAD + RCA + Circ	11	22%



Graph 3 : Numbers of vessels involved [n=50]

Out of 50 patients, 18 patients[36%] had single vessel disease, 9 patients [18%] had double vessel disease and 11 patients [22%] had triple vessel disease. Among patients who had single vessel disease, LAD was the major culprit vessel.

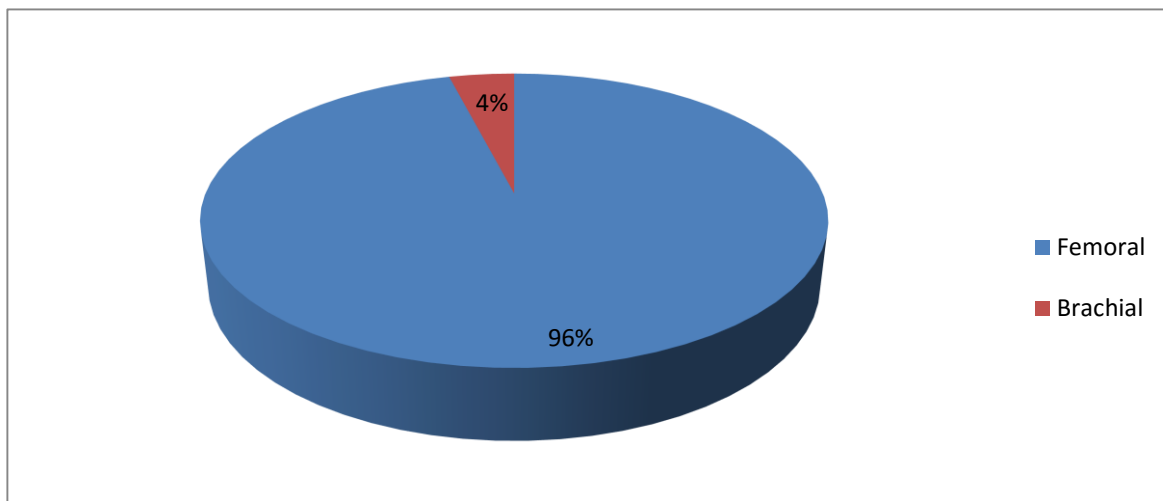
Tables 5: Factors and number of vessels involved [n=50]

RISK FACTORS	SINGLE VESSEL DISEASE [n=18]		MULTIPLE VESSEL DISEASE [n=20]	
	NUMBER	PERCENTAGE	NUMBER	PERCENTAGE
Age > 60 years	40	22%	4	20%
Diabetes mellitus	3	16.5%	4	20%
Hypertension	1	5.5%	9	45%
LVEF ≤30%	0	0%	10	50%
Unstable angina	7	38.5%	10	50%
Peripheral vascular disease	1	5.5%	0	0%
Congestive cardiac failure	0	0%	2	10%

Hypertension and diabetes were the risk factor for multiple vessel disease. Patients with multiple vessel disease have increased risk of having left ventricular dysfunction[50% and unstable Angina [50%].

Table : 6 Approach for coronary angiography [n=50]

APPROACH	NO. OF PATIENTS	PERCENTAGE
FEMORAL	48	96%
BRACHIAL	2	4%



Graph- 4 Approach for coronary angiography [n=50]

Most of the angiography were done by femoral approach.

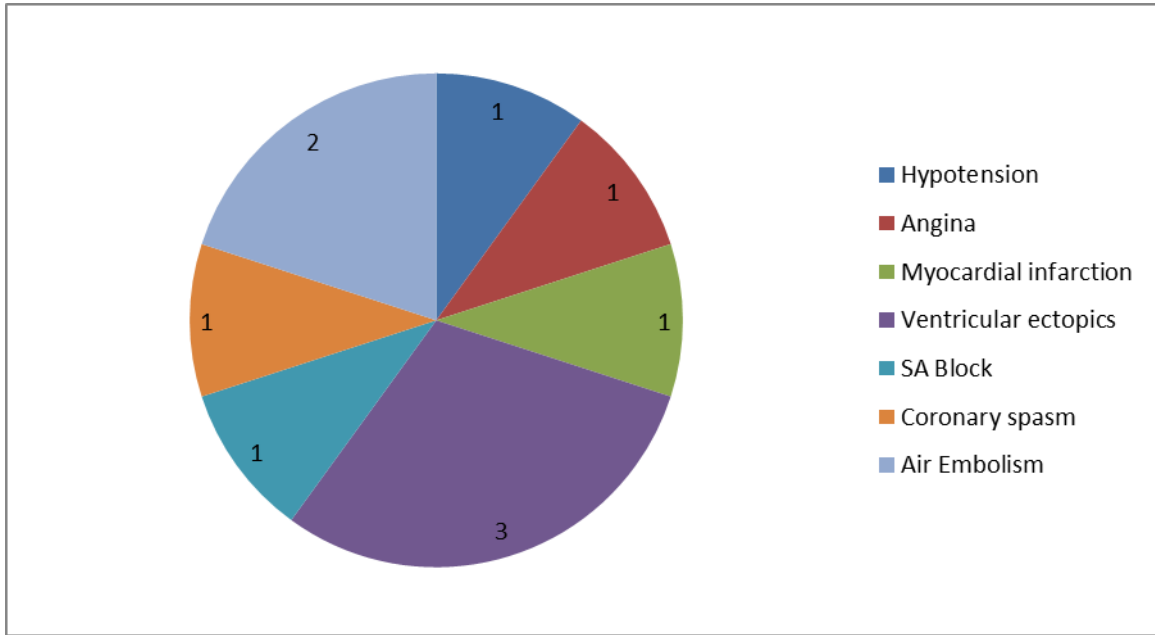
Table: 7 Contrast agents [n=50]

TYPE OF CONTRAST	NO. OF PATIENTS	PERCENTAGE
IONIC	46	92%
NON-IONIC	4	8%

In most of the patients [92%] ionic contrast agent were used.

Table: 8 Complications

TYPE	NO. OF PATIENTS
Hypotension	1
Angina	1
Myocardial infarction	1
Ventricular ectopics	3
SA Block	1
Coronary spasm	1
Air Embolism	2
TOTAL	10

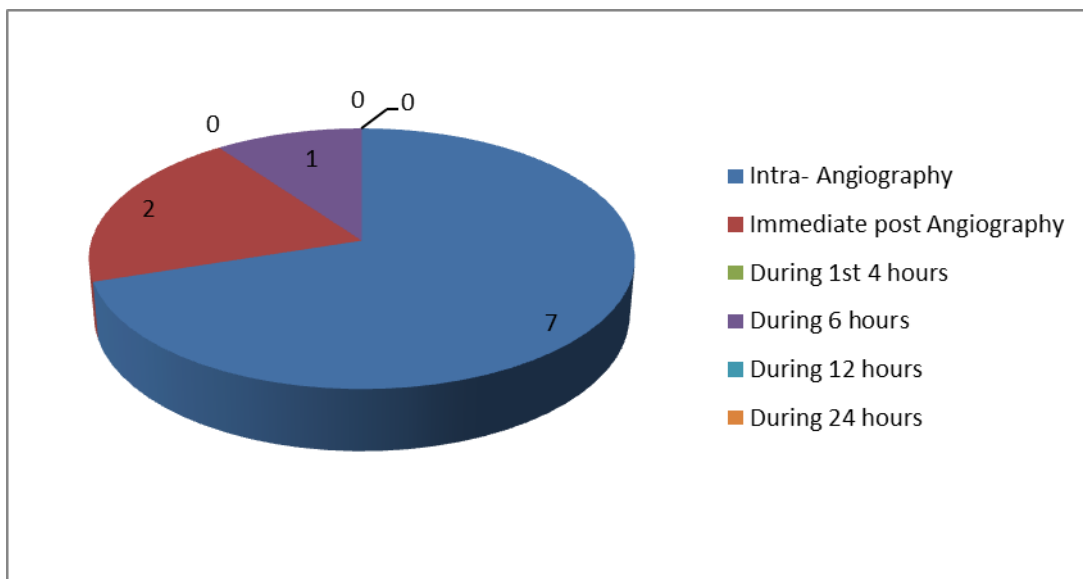


Graph- 5 Complications.

Out of 50 patients, 10 patients [20%] had complications of coronary angiography.

Tables : 10 Period of complications

PERIOD OF COMPLICATION	NO. OF COMPLICATIONS	PERCENTAGE
Intra- Angiography	7	70%
Immediate post Angiography	2	20%
During 1 st 4 hours	0	0%
During 6 hours	1	10%
During 12 hours	0	0%
During 24 hours	0	0%



Graph- 6 Period of complications

Most of the complications occurred during angiography [70%].

Table: 11 Co-relation of the complications occurred with risk factors.

COMPLICATION	AGE/SEX	DM	HTn	CCF	EF	SVD	DVD	TVD	UNSTABLE ANGINA	CONTRAST AGENT
Hypotension	56/M	+	+	+	25%	-	-	+	+	Ionic
Angina	55/M	-	-	-	40%	-	+	-	+	Ionic
Subendocardial infarct	42/M	-	-	-	55%	+	-	-	+	Ionic
Ventricular ectopics										
i)	62/M	-	-	-	60%	-	-	-	+	Ionic
ii)	70/M	-	+	-	30%	-	-	+	+	Ionic
iii)	42/M	-	-	-	25%	-	-	+	+	Ionic
SA Block	45/M	+	+	-	30%	-	-	+	+	Ionic
Spasm	46/M	-	-	-	40%	+	-	-	+	Ionic
Air Embolus	40/F	-	+	-	50%	-	-	-	-	Ionic
Air Embolus	45/M	+	-	-	45%	+	-	-	-	Ionic

DISCUSSION

The present study deals with analysis of the complication of coronary angiography and to co-relation of their incidence and severity with certain risk factors.

Age and sex distribution: in the present study, majority [40%] of the patients were of the age group of 41-50 years of age. In previous studies, Bourassa et al 1976 observed those patients with age more than 60 years had increased risk of mortality.[1]1 According to Steinberg et al 1992 and Mathai et al 1993, patients with age more than 60 years are at increased risk of contrast reactions.[12,13] In present study, 18% patients were in age group of more than 60 years out of these 2 patients had Ventricular ectopics during coronary angiography. In present study out of 50 patients 36 patients[76%] were males and 21patients[24%] were females . **Left Ventricular Dysfunction:** In present study, 21 patients[42%] out of 50 had LVEF between 41-50%. Out of 50, 10 patients [20%] had LVEF<30%. In a study by Kathryn et al, 1979 patients with LVEF <30% had a 9 fold increased risk of mortality either due to sudden cardiac death, Pulmonary edema or Cardiogenic Shock.[14] Latter in a study by Lozner et al 1984-87, SCAI registry in which death related to coronary angiography were analysed , he found that patients with LVEF <30% had several fold increased risk of procedural mortality particularly if the pulmonary Wedge pressure >25mm of Hg and systolic Arterial pressure <100 mm of Hg.[15] out of 10 patients who had EF< 30%, 4 patients [40%] had complications. The complications observed in patients with ejection fractions <30% were hypotension, SA block and Ventricular ectopics. **Number of Vessels involved** In present study, 36% patients had Single vessel disease, 18% patients had Double vessel disease. 22% patients had Triple vessel disease and 24% normal coronaries. In patients with left main coronary artery disease mortality is 10 times greater than for patients with single vessel disease.[16] According to previous studies, the mortality in patients with left main coronary disease was as follows,

	YEAR	MORTALITY	REFERENCES
Cohen et al	1972	15%	19
Lavin et al	1972	10%	48
Adam & Abrams	1975	46%	1
Bourassa et al	1976	6%	11
Kathryn et al	1979	0.76%	41
Hillis & Collegues	1992	2.8%	35
Kennedy et al	1982	0.86%	42

In present study, None of them had mortality or any other complications. Patients who had subendocardial infarct had LAD 100% block and patients who had angina had double vessel diseases with LAD 100% block and RCA 80% stenosed. **Approch for coronary angiography:** In present study, out of 50 patients, 48 patients [96%] underwent coronary angiography through femoral approach while 2 patients [4%] had a Brachial approach. According to Donald et al, Brachial approach tends to have more thrombotic complications while femoral approach has more more hemorrhagic complications.[17] **Contrast Agent:** In present study, in 92% patients ionic contrast agent were used. Whereas only 8% patients used non-ionic agent. Among 46

patients, Receiving Ionic contrast agent 8 patients [17%] had Complications. Non of the patients receiving non ionic contrast had any complications. Period of Complications: in the present study, most of the complications occurred during angiography[70%]. 20% occurred immediate post angiography and 10% occurred after 6 hour of angiography. In previous study by Kathryn et al, who studied complications at 0-24 hours & 24-48 hours, most of the complications occurred on the day of the procedure.[0-24 hours][14] correlation of the complications occurred with the risk factors: 1] Hypotension: patients who had hypotension had multiple risk factors. The patients had diabetes mellitus, hypertension, CCF, EF<30%, Triple vessel Disease, Unstable angina and use of Ionic contrast agent. Likely cause of hypotension may be antihypertensive drugs, reduced cardiac output, Contrast induced or hypovolemia due to inadequate prehydration. The patient was treated with Dopamin. 2] Angina Pectoris: patients who had angina pectoris was a 55 years male with double vessel disease & unstable angina. Likely cause of this complication in this patient included unstable angina or Contrast induced.ECG showed no significant changes. 3] Subendocardial Infarction: patients who had Subendocardial Infarction history of unstable angina. These complication occurred 6 hours after the procedure. Angiogram of these patients revealed LAD 100% block. So likely cause could be Unstable Angina.² 4] Ventricular Ectopics:there were 3 patients who developed ventricular Ectopics during the procedure. Ventricular Ectopics in these patients may be due to use of ionic contrast agent or electrolyte imbalance. 5]SA Block: patients who had SA Block during the procedure had Diabetes, Hypertension, triple vessel disease, Unstable Angina and use of Ionic contrast agent. Likely Reasons for this patients could be either due to injection of high osmolar ionic contrast agent in to the right coronary artery. Incidence could be minimized by using non ionic contrast agent in such patients. 6]Spasm: patients who had Right coronary artery spasm had 50% stenosis of the same artery due to atherosclerotic plaque. Spasm was readily reversed by injections. Arterial spasm near the puncture site occurs when arterial size is too small for the sheath. The transradial approach for coronary angiography or angioplasty is increasingly being used as an alternative to femoral access due to its low rate of local complications. Arterial spasm is the most common complication of this technique especially in female patients. Use of hydrophilic coated sheath, but not long sheath, reduces the incidence of radial artery spasm during transradial coronary procedures.[19] Intra-arterial or subcutaneous infusion of nitroglycerin reduces arterial spasm and facilitates introduction of catheters.[20] intracoronary nitroglycerin. 7] Air Embolism: in the both cases, the likely cause of air embolism is Air bubbler trapped either in syringe, 3 way adapter or the catheter. This can be avoided by taking meticulous precautions during the procedure.

CONCLUSION

1)Patients of all the age groups had complications.2)The complications occurred more frequently in males than females.3)Risk factors seen in patients included in this study were unstable angina, hypertension, diabetes, rheumatic valvular heart disease, congestive cardiac failure and peripheral vascular disease. Among these history of unstable angina was present in 50% patients. Next being hypertension and diabetes.4)In the present study, patients had Ejection Fraction less than 30% out of which 4 patients 5)Patients with multiple vessel disease have increased risk of having ventricular dysfunction and unstable angina.6)In present study, most of the angiography were done through femoral approach. Brachial approach was used in patients having peripheral vascular disease involving lower limbs. There were no local vascular complications.7) Ionic contrast agent was used in most of the patients[92%]. All the complications occurred in patients receiving ionic contrast medium. No complication were seen with non-ionic agents.8)Complications seen during this study were hypotension, angina, Myocardial infarction, Ventricular ectopics, SA block, Coronary spasm and Air Embolism. Complications in present study of 50 patients in 20%. 9)In present study, the complications occurred during the procedure and within 6 hours of the procedures.10)All the patients who had complications had some risk factors. Common risk factors included were unstable angina, low ejection fraction and use of ionic contrast medium.

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