ISSN: 0975-3583, 0976-2833 VOL14, ISSUE11, 2023

Original Research Article

Anxiety score as a predictor of radial artery spasm during transradial approach for percutaneous coronary intervention

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ABSTRACT:

Background: Transradial approach**(**TRA) is still not the dominant route used in for percutaneous coronary intervention(PCI). Radial artery spasm(RAS) is an important limitation of TRA failure and crossover to transfemoral approach(TFA). To enjoy the benefits of TRA, we need to predict the patients with high risk of spasm, to apply preventive measure in this specific subset of population.

Objectives: The aim of the study was to assess the anxiety score as a predictive score of RAS in patients undergoing transradial percutaneous coronary intervention (TRA-PCI)

Methods and material: The study population consisted of patients undergoing TRA-PCI by experienced TRA operators in our high volume radial center. Baseline characteristics, procedure details, and clinical outcomes were prospectively collected. preprocedural anxiety score was assessed and RAS was noted during procedure and post procedure. Logistic regression analysis was performed to determine independent predictors of RAS. ROC curve analysis was done to determine the cut-off value for anxiety score.

Results: A total of 360 consecutive patients undergoing TRA for PCI were included. The mean age of patients was 55.1 ±9.5 years, the majority (77.5%) were male. RAS was observed in 25.8%% patients. The rate of vasospasm was 19.4% for men and 48.1%% for women (P < .001). Mean anxiety score of the whole study population was 14.26±5.2. Anxiety score was 16.23±4.7 for women and 13.7+ 5.2 for men with statistical significance (P <0.01). Anxiety score was significantly increased in SPASM group (18.4±4.4) as compared to NO-SPASM group (12.8±4.6) (p<0.01) (odd's ratio[OR]:1.26;95%confidence interval[CI]:1.18-1.33). After logistic regression analysis, female gender, more than mild

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anxiety score,>1 puncture attempts and glycoprotein IIb/IIIa platelet receptor(Gp2b3a) antagonist use emerged as independent predictors for RAS. ROC curve analysis revealed 80.5% area under the curve ($p<0.01$) with 87.1% sensitivity and 61.4% specificity to predict RAS when anxiety score is 13.5.

Conclusion: Anxiety score can be used to predict RAS during PCI. Using this score one can identify the high-risk subgroup, where intensive spasm preventive measures can lead to reduction in frequency of RAS. Additionally, female gender,>1 puncture attempts and glycoprotein IIb/IIIa platelet receptor(Gp2b3a) antagonist use emerged as independent predictors for RAS. Although 25.8% RAS was noted in our study, TRA-PCI was successful in 99.1%.

Keywords: Radial artery spasm, Percutaneous coronary intervention, Transradial approach

1. Introduction:

The Transradial approach(TRA) for percutaneous coronary intervention(PCI) has been shown a considerable decrease in vascular complications compared with transfemoral approach(TFA) in terms of lower risk of access site bleeding and hematoma [1], early patient ambulation, shorter length of hospital stay, and lower hospital costs [2,3,4,5]. However, despite demonstrated benefits, TRA is employed only in a minority of patients undergoing PCI owning to longer learning curve, prolonged radiation exposure and radial artery spasm (RAS). RAS is the most frequent complication of TRA [6,7] with reported incidence varies from 6.8% to 30%. [6,8,9]. RAS may leave an unpleasant experience for both the operator and the patient and sometimes lead to crossover to femoral. [10] The radial artery is more vulnerable to vasospasm when compared to other vessels owning to thick smooth muscle wall [11,12], high alpha-1 receptors density [13,14,15,17] and small diameter [17,18]. Several factors have been identified as risk factors for RAS: female sex [19,20,], age [20], diabetes mellitus [21], unsuccessful first attempt, low flow mediated dilation [22], > 3 catheters used, small radial artery diameter [23,24], radial artery anomalies [6,25] and the number of interventions performed [12,26].

With wide incidence range we need some predictive score for RAS which can predict RAS in patients undergoing PCI and use this information to prevent it. Giannopoulos et al. showed that 5 weighted factors could be used to construct risk score for spasm: body-mass index, height, current smoking, hypertension and peripheral artery disease with a sensitivity of 84.5% and a specificity of 74.7% [51]. Patient undergoing any kind of operative procedure has some amount of anxiety. Anxiety may lead to increased circulating levels of catecholamines triggered by increased sympathetic tone, which may lead to RAS in conjunction with high adrenergic receptor density in radial artery [46,47,48]. Recently Ercan et al in a pilot study demonstrated that higher anxiety scores and female sex are the risk factors for radial artery vasospasm during percutaneous radial interventions correlating the cardiovascular disease, anxiety and RAS [27]. We evaluated the anxiety score as a pre-procedural predictor of RAS in large population.

2. Methods and materials:

Between January 2015 and June 2016, patients who were taken up for *ad hoc* PCI at our tertiary-care referral center were prospectively recruited in the study. Only patients who underwent successful TRA were included. Patients with negative Allen's test were excluded from the study. Patients not proceeding to PCI (mild/no coronary artery disease and patients

ISSN: 0975-3583, 0976-2833 VOL14, ISSUE11, 2023

advised for coronary artery bypass surgery) were excluded. All patients gave written informed consent and the authors conformed to institutional guidelines and those of the American Physiological Society. Approval of local ethics committee was obtained before starting the study. Data on demographics, medical history, and procedural characteristics were recorded for every patient. Routine hemogram, renal function test, and blood sugar levels were measured in all patients. Left ventricular ejection fraction (LVEF) was measured by echocardiography in all patients. Clinical radial artery patency was assessed by radial pulse examination. Allen's test was done in all patients. All procedures were performed by operators experienced with radial interventions. Operators were blinded to anxiety scores.

All patients were evaluated using the Hamilton Anxiety scale (HAM-A) on the day of the procedure to evaluate the severity of anxiety which consists of 14 questions examining both mental and physical signs. Every item has a score between 0 and 4, with a total between 0 and 56. Score from 0-17, 18-24, and >25 are labeled as mild, moderate and severe anxiety respectively [52].

The access site was anaesthetized with lidocaine and then arterial puncture was performed using a 6F puncture set (Terumo, radifocus introducer II, Japan). To prevent vasospasm and thromboembolic events, cocktail (nitroglycerine 100µg, verapamil 5 mg and xylocaine 100 µg) and 100 U/kg heparin were injected into the radial artery sheath for PCI. Hydrophilic radial sheath was not used. Specially designed radial guide catheters were used in PCI. We do not use sedative agents routinely and did not use these agents throughout the entire study. Glycoprotein IIb/IIIa platelet receptor antagonists were administered at the discretion of operating physician. Skilled operators with good experience of TRA PCI performed the procedure. Immediately after the procedure, the sheath was removed and TR band (Terumo, Japan) was placed. Hemostasis was achieved using patent hemostatic techniques.

Definition of RAS*:*

Operator-assessed RAS was based on 5 signs: persistent forearm pain, painful catheter manipulation, pain on sheath withdrawal, difficult catheter manipulation, and considerable resistance on withdrawal of the sheath. Patients who had at least 2 of these 5 signs or presence of just 1 when the operator considered it necessary to administer a second dose of spasmolytic agent were diagnosed as having clinical RAS [53][Table 5].

Procedural details like angiographic severity of coronary artery disease, number of vessels stented, and total number of stents used in each patient were noted. The complexity of lesions demanding prolonged radial cannulation time or use of multiple hardware (e.g., bifurcation lesions, chronic total occlusions, aorto-ostial lesions, lesions involving LAD, or LCX Ostia) was noted. Total fluoroscopy time and radiation dose were also noted for each patient.

Statistical analysis:

All data were prospectively collected and entered. Dichotomous variables are reported as numbers and proportions. Continuous variables are presented as mean ± standard deviation. Student's t test was used to compare each continuous variable, whereas the chi square test was applied to the categorical values. Cut-off value for anxiety score was determined by ROC curve analysis. Potential risk factors for RAS were investigated first by univariate logistic regression analysis. A multivariate logistic regression model with all significant variables was established to estimate odds ratios (ORs) and inclusive 95% confidence bounds. All tests were performed as 2-sided at significance level of $P<0.05$. Statistical analyses were performed with SPSS version 20.0 (SPSS, Inc).

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3. Results:

Baseline characteristics.

A total of 900 consecutive patients undergoing PCI or *ad hoc* PCI were prospectively screened and 360 patients were included in the final analysis who qualified for PCI. Baseline characteristics of the subjects are presented in Table 1. The mean age of patients was 55.1 ±9.5 years, the majority (77.5%) were male, mean body mass index (BMI) was 25.7±3.1 kg/m2, and mean body surface area (BSA) was 1.74 ± 0.173 m2. About one-third of patients were diabetic (33.1%) and about one-half were hypertensive (45%). About one third of our patients had stable angina, while the rest had acute coronary syndrome. About one fifth of our patients had double or triple vessel disease. The majority (92.5%) had relatively preserved ejection fraction (LVEF >40%). All patients received aspirin, clopidogrel/prasugrel/ticagrelor, and a statin. Most of our patients received beta-blocker and angiotensin-converting enzyme inhibitor/angiotensin-receptor blocker's/o Prior artery cannulation was present in one fifth cases.

Procedural characteristics.

Procedural characteristics are presented in Table 2. A 6 Fr radial sheath size was used in all patients. Most patients underwent single-vessel angioplasty. Complex PCI was done in about one-third of the patients. Glycoprotein inhibitors were used in nearly 40% of the patients. Mean fluoroscopy time was 15.3±7.9 minutes. Mean radiation dose was 2.5±1.3 Gy. Procedural success was noted in 99.1% subjects. TRA was unsuccessful in 3 patients due to severe radial vasospasm. About one fifth patients had undergone more than 1 puncture attempts and catheter exchange > 3 times was noted in nearly 10% patients.

Anxiety score:

Mean anxiety score of the whole study population was 14.26±5.2. The anxiety score was 16.23±4.7 for women and 13.7+ 5.2 for men (P <0.01). Anxiety score was significantly increased in SPASM group (18.4±4.4) as compared to NO-SPASM group (12.8±4.6) (p<0.01) with odd's ratio of 1.26(1.18-1.33). Nearly one third of subjects were having more than mild anxiety score. Patients with increasing grade of anxiety were significantly associated with RAS (Fig 1). 3 patients with severe anxiety resulted in TRA failure. ROC curve analysis (fig 2) revealed 80.5% area under the curve (p<0.01) with 87.1% sensitivity and 61.4% specificity to predict RAS when anxiety score was 13.5.

Radial artery spasm and its predictors:

RAS was observed in 25.8%% of the population. The rate of vasospasm was 19.4% for men and 48.1%% for women (P < .001). In patients with RAS average no of stents per patients was 1.57±0.6 as compared to 1.38±0.6 in patients without spasm (P=0.016). Smoking, peripheral arterial disease, hypertension and dyslipidemia was more common in patients with RAS but did not meet significance. The univariate analysis of predictors of RAS is presented in Table 3. Female gender, low body weight, more than mild anxiety score,>1 puncture attempts, acute coronary syndrome presentation, GP2b3a inhibitor use and more than one vessel stenting were the significant predictors of RAS. Interestingly, Prior radial artery cannulation, complex PCI, catheter exchange > 3times and fluoroscopic time were not predictors of RAS. On multivariate logistic regression analysis, female gender, more than mild anxiety score,>1 puncture attempts and gp2b3a inhibiter use emerged as independent predictors for RAS (Table 4).

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Table 1: Baseline patient's characteristics	
Characteristics	**(n=360)**
Age (years)	55.1 ±9.5
Women, n (%)	81(22.5%)
Weight (kg)	67.7±10.8
Height(cm)	162 ±8.2
BMI(kg/m2)	25.7±3.1
BSA(m2)	1.74 ± 0.173
Diabetes, n (%)	119(33.1%)
Hypertension, n (%)	162(45%)
Smoking, n (%)	124(34.4%)
Clinical presentation n (%) Stable angina Acute coronary syndromes	 109(30.3%) 251(69.7%)
Dyslipidemia n (%)	93(25.8%)
Peripheral artery disease n (%)	28(7.8%)
More than mild renal dysfunction n (%)	82(22.8(%)
S creatinine(mg/dl)	1.0±0.2
LVEF, n (%) >40% <40%	 333(92.5%) 27(7.5%)
Medications, n (%) Aspirin Clopidogrel Prasugrel Ticagrelor Statin ACE-I/ARB Beta blocker	 360(100%) 342(95%) 7(1.9%) 11(3.1%) 345(95.8%) 330(91.6%) 334(92.7%)
Anxiety score	14.26±5.2
Anxiety score, n (%) Mild Moderate severe	 236(65.6%) 112(31.1%) 12(3.3%)
Prior radial artery cannulation, n (%)	65(18.1)
No of vessels stented, n (%) SVD DVD/TVD	 286(79.4%) 74(20.6%)
Data presented as mean ± standard deviation or number (percentage). BMI=body mass index; BSA=body surface area; LVEF=left ventricular ejection fraction; ACEI=angiotensin-converting enzyme inhibitor; ARB=angiotensin-receptor antagonist; SVD=single vessel disease; DVD=double vessel disease; TVD=triple vessel disease	

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Table 2: Transradial coronary angioplasty procedural characteristics.

Characteristics (n=360)	
PCI, n (%) Simple Bifurcation LM CTO LAD/LCX ostial	 239(66.4%) 38(10.6%) 7(1.9%) 25(6.9%) 51(14.2%)
Average Number of stents /patient	1.43±0.6
Procedural success (%)	357(99.1%)
Puncture attempts, n (%) 1 >1	 280(77.8%) 80(22.2%)
GpIIb/IIIa antagonist use, n (%)	142(39.4%)
Flouro time(min)	15.3±7.9
Radiation dose(Gy)	2.5±1.3
Catheter exchange, n (%) <3 >3	 327(90.8%) 33(9.2%)

Data presented as mean ± standard deviation or number (percentage).
PCI=percutaneous coronary intervention; LM=left main; CTO=chronic total occlusion; LAD=left anterior descending artery; LCX=left circumflex artery; GpIIb/IIIa=glycoprotein IIb/IIIa platelet receptor

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Table 3: Univariate analysis for factors influencing radial artery spasm(n=360)

	Odds Ratio(95%CI)	P-value
Age	0.98 (0.9-1.0)	0.29
Women	3.86 (2.2-6.5)	0.01
Weight	0.97 (0.95-0.99)	0.01
Height	0.97 (0.9-1.0)	0.12
BMI	0.93(0.86-1.002)	0.06
BSA	0.9(0.23-3.5)	0.891
Diabetes	0.83 (0.5-1.3)	0.48
Hypertension	1.13(0.7-1.8)	0.603
Smoking	1.13 (0.6-1.8)	0.618
Clinical presentation Stable angina Acute coronary syndromes	 0.56(0.34-0.9)	 0.02
Dyslipidemia	1.4(0.8-2.4)	0.10
Peripheral artery disease	1.67(0.74-3.7)	0.214
More than mild renal dysfunction	1.5(0.92-2.6)	0.09
S creatinine	0.10 (0.02-0.35)	<0.01
LVEF >40 <40	 2.96 (0.8-10.0)	 0.06
Prior radial artery cannulation	0.83 (0.4-1.5)	0.575
No of vessels stented SVD DVD/TVD	 2.07(1.2-3.57)	 <0.01
PCI Simple Bifurcation LM CTO LAD/LCX ostial	 1.28(0.6-2.7%) 2(0.4-9.6%) 1.3(0.5-3.1) 0.9(0.1-1.0)	 0.502 0.34 0.54 0.06
Anxiety score Mild Moderate severe	 4.183(2.5-6.9) 7.5(2.2-25)	 <0.01 <0.01
Puncture attempts 1 >1	 5.76(3.36-9.86)	 <0.01
GpIIb/IIIa antagonist use	0.5(0.38-0.87)	<0.01
Flouro time	0.99(0.96-1.02)	0.58
Fluoroscopy (radiation dose)	0.93(0.78-1.1)	0.46
Catheter exchange <3 >3	 1.08(0.48-2.4)	 0.84
CI=confidence interval		

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Table 4: Multivariate analysis of factors influencing radial artery spasm(n=320)

	Odds Ratio(95%CI)	P-value
Sex (female)	2.85(1.5-5.4)	0.001
Anxiety score Mod severe	 4.3(2.3-7.8) 10.08(2.6-38.5)	 <0.001 0.001
Puncture attempt >1	5.7(3.0-10.6)	<0.001
GpIIb/IIIa antagonist use	1.92(1.08-3.4)	0.026

Table 5. Signs of radial artery spasm
1.Persistent forearm pain 2.Painful catheter manipulation, 3.Pain on sheath withdrawal, 4.Difficult catheter manipulation, 5.Considerable resistance on withdrawal of the sheath.
Patients who had at least 2 of these 5 signs or presence of just 1 when the operator considered it necessary to administer a second dose of spasmolytic agent were diagnosed as having clinical RAS

Fig 1: Radial artery spasm relation with grades of anxiety score

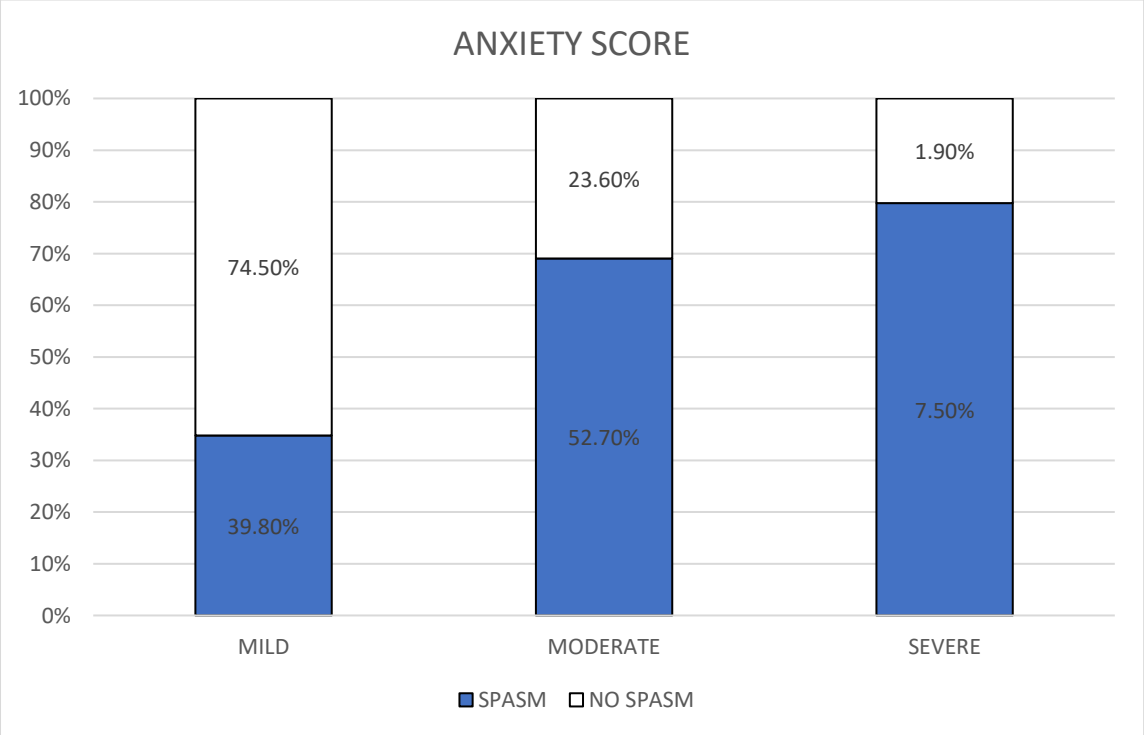

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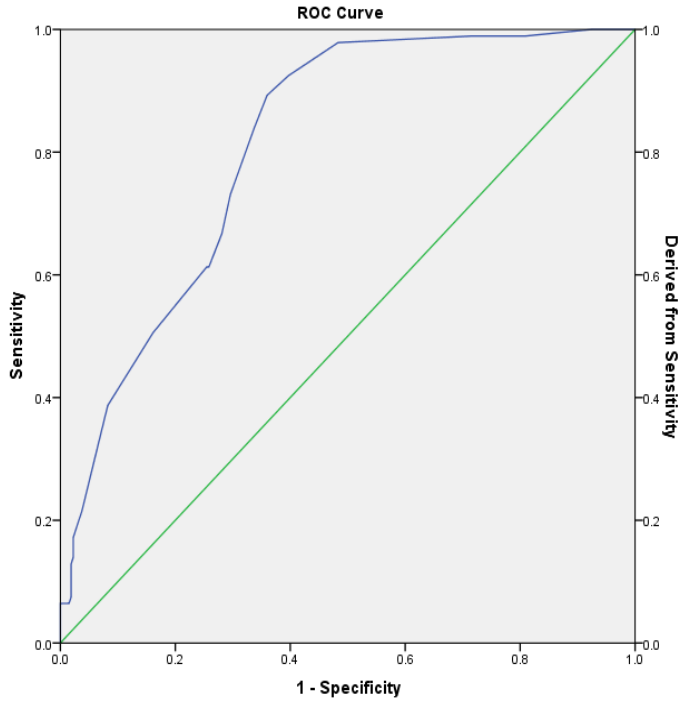
Fig 2: ROC curve: Receiver's operating characteristic curve for prediction of spasm by the anxiety score



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Hamilton Anxiety Rating Scale (HAM-A)

Below is a list of phrases that describe certain feeling that people have. Rate the patients by finding the answer which best describes the extent to which he/she has these conditions. Select one of the five responses for each of the fourteen questions.

0 = Not present, 1 = Mild, 2 = Moderate, 3 = Severe, 4 = Very severe.

1 **Anxious mood** [0] [1] [2] [3] [4] Worries, anticipation of the worst, fearful anticipation, irritability.	8 **Somatic (sensory)** [0] [1] [2] [3] [4] Tinnitus, blurring of vision, hot and cold flushes, feelings of weakness, pricking sensation.
2 **Tension** [0] [1] [2] [3] [4] Feelings of tension, fatigability, startle response, moved to tears easily, trembling, feelings of restlessness, inability to relax.	9 **Cardiovascular symptoms** [0] [1] [2] [3] [4] Tachycardia, palpitations, pain in chest, throbbing of vessels, fainting feelings, missing beat.
3 **Fears** [0] [1] [2] [3] [4] Of dark, of strangers, of being left alone, of animals, of traffic, of crowds.	10 **Respiratory symptoms** [0] [1] [2] [3] [4] Pressure or constriction in chest, choking feelings, sighing, dyspnea.
4 **Insomnia** [0] [1] [2] [3] [4] Difficulty in falling asleep, broken sleep, unsatisfying sleep and fatigue on waking, dreams, nightmares, night terrors.	11 **Gastrointestinal symptoms** [0] [1] [2] [3] [4] Difficulty in swallowing, wind abdominal pain, burning sensations, abdominal fullness, nausea, vomiting, borborygmi, looseness of bowels, loss of weight, constipation.
5 **Intellectual** [0] [1] [2] [3] [4] Difficulty in concentration, poor memory.	12 **Genitourinary symptoms** [0] [1] [2] [3] [4] Frequency of micturition, urgency of micturition, amenorrhea, menorrhagia, development of frigidity, premature ejaculation, loss of libido, impotence.
6 **Depressed mood** [0] [1] [2] [3] [4] Loss of interest, lack of pleasure in hobbies, depression, early waking, diurnal swing.	13 **Autonomic symptoms** [0] [1] [2] [3] [4] Dry mouth, flushing, pallor, tendency to sweat, giddiness, tension headache, raising of hair.
7 **Somatic (muscular)** [0] [1] [2] [3] [4] Pains and aches, twitching, stiffness, myoclonic jerks, grinding of teeth, unsteady voice, increased muscular tone.	14 **Behavior at interview** [0] [1] [2] [3] [4] Fidgeting, restlessness or pacing, tremor of hands, furrowed brow, strained face, sighing or rapid respiration, facial pallor, swallowing, etc.

Each item is scored on a scale of 0 (not present) to 4 (severe), with a total score range of 0–56, where <17 indicates mild severity, 18–24 mild to moderate severity and 25–30 moderate to severe.

4. Discussion:

TRA is well established technique for PCI with several studies documenting the advantages of TRA over TFA in terms of fewer local complications, major bleedings, ischemic events, early ambulation, major adverse events and similar procedural success rates. However prolonged learning curve, prolonged radiation exposure [28,29], RAS and lack of experience with use of specially designed radial catheters via TRA are some disadvantages. RAS is a specific complication that can occur at any phase of intervention and is very unpleasant for both patient and operator. Dehghani et al reported that RAS is the most common cause of TRA PCI failure in 34% patients [30]. Also, Rathore et al observed a high incidence of radial occlusion in patients with documented RAS [31].

RAS incidence ranges from 6.8% to 30% [6,8,9,] depending upon the subjective spasm criteria, premedication use, sheath size, sheath coating [32,33,34] and experience of the operator. When subjective spasm criteria are combined with objective confirmation, then various trials reported the incidences between 4 -20.2% [35,36,37,38,39,40]. Finally, when only angiographic definition was used, various trials reported extremely high incidences ranging from 51.3% to almost 100%. The mean incidence of RAS is 14.7% when relevant studies were included [50]. In our study, the incidence of RAS was 25.8% which was higher

ISSN: 0975-3583, 0976-2833 VOL14, ISSUE11, 2023

than the previously reported incidences from randomized controlled trial except the one from Rathore et al, who reported the incidence of 29.4% [31]. Increased incidence in our study may resulted partly because of universal use of 6F radial sheath irrespective of patient height as we did not measure the preprocedural radial artery diameter and partly due to fact that all patients underwent PCI which resulted in increased duration of procedure, contrast volume and number of catheters used which are significantly associated with RAS as reported by Deftereos et al [22].

Mood and anxiety disorders have been linked to heart disease, with research showing that those displaying symptoms of anxiety or depression are at higher risk for cardiovascular-related morbidity and mortality [41,42]. Those with the highest levels of anxiety have as much as a three-fold increase in risk for fatal coronary heart disease [42]. Various biobehavioral mechanisms have been proposed to explain this association, including behavioral risk factors (e.g. smoking, heavy alcohol use, physical inactivity), poor treatment compliance, elevated levels of proinflammatory cytokines, platelet activation, disturbances in the autonomic nervous system (reduced heart rate variability), hypothalamic pituitary adrenal (HPA) axis dysfunction, and the stressfulness of heart disease related events such as AMI [43,44,45]. Anxiety leads to increased circulating levels of catecholamines triggered by increased sympathetic tone, which may lead to RAS in conjunction with high adrenergic receptor density in radial artery [46,47,48]. This might explain the finding of increased anxiety scores and occurrence of RAS in our patients presented with ACS than stable angina. Our study suggested that patients with high anxiety scores in patients can predict the RAS and steps can take to prevent RAS in these patients as in earlier studies from Kiemeneij et al and Rathore et al reported that, use of antispam medications and hydrophilic sheaths respectively could significantly decreases the incidence of RAS [31,32,33,34].

In our study, Anxiety score emerged as a strongest predictor of RAS with odds ratio of 4.3 and 10 in moderate anxiety and severe anxiety subgroups respectively. Several predictors of RAS have been reported in different studies. But to best of our knowledge only four studies confirmed them by logistic regression analysis trials i.e. post dilation RA diameter, RA flow mediated dilation lower than 2.95%, number of catheter exchange, unsuccessful first attempt of cannulation, painful cannulation, diabetes, female sex [19,20], RA anomalies, younger age [23,24]. Identification of RAS predictors, despite proposed vasodilators and different available sheaths and catheters, is an important issue in patient selection and avoidance of complications, including RAS. In our study after multivariate logistic regression analysis, female gender, more than mild anxiety score, more than one puncture attempts and gp2b3a inhibiter use emerged as independent predictors for RAS which were in accordance with previous studies except Gp2b3a inhibitor use which can explained by the fact that in our study nearly 70% of patients presented with ACS and concomitant usage of Gp2b3a in these patients (39.4%) ,who might have increased catecholamines levels due to high anxiety and recent ACS, resulted in RAS. Female sex was identified as independent predictor of RAS which is consistent with previous studies. Even though we did not measure the radial artery diameter, females have been reported to have small radial artery diameter which in conjunction with higher anxiety in these resulted in RAS. Multiple punctures are associated with higher incidence of RAS mostly due to muscular nature of radial artery. Young age, lower Height, lower weight which although common in spasm group, did not meet significance. Smoking history, PAD, HTN and diabetes were not independent predictors of RAS in contrast to previous studies. Smoking, PAD, HTN and DM leads to endothelial dysfunction an increased incidence of RAS.

Limitation:

ISSN: 0975-3583, 0976-2833 VOL14, ISSUE11, 2023

Firstly, there is lack of clear universal definition of RAS during catheterization. Only one objective definition was provided by Kiemeneij et al [49] using automated pullback device which was not applicable in our setting as we usually employ shorter radial introducers. Therefore, we used subjective nature of RAS definition. Secondly our study operators were not fully blinded. Thirdly, the length of the procedure is not taken in to account which might resulted in increased RAS incidence. Fourthly, radial artery anomalies were not noted which might had accounted for spasm in some patients. But these factors did not affect our study as this study was dedicated to find predictors of RAS. Fifthly, the angiographic evaluation of RAS was not done in our study. Angiographic confirmation is important as sometimes pain in the arm may not be caused by spasm but by other factors like tortuosity or loops which make the catheter movement difficult and cause pain to the patient. And finally-procedural radial artery diameter was not measured and all patients were catheterized with 6F sheath. It has been reported that the larger sheath in radial arteries having a small diameter provokes greater vascular injury [17] which may have resulted in increased incidence of RAS in our study.

5. Conclusion:

Although incidence of RAS in our study was 25.8%, TRA-PCI was successful in 99.1%. High anxiety score can predict the occurrence of RAS during PCI. Using this score one can identify the high-risk subgroup, where intensive spasm preventive measures can lead to reduction in frequency of RAS. Additionally, female gender,>1 puncture attempts and glycoprotein IIb/IIIa platelet receptor(Gp2b3a) antagonist use emerged as independent predictors for RAS. Further studies are needed to know the predictive power of this score and its clinical relevance.

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