Smoking as an independent predictor of radial spasm

Tabaquismo como predictor independiente de espasmo radial

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ABSTRACT

Objective. To determine the independent influence of smoking on the appearance of radial artery spasm in cardiac catheterization studies and study the association of different conditions with the development of radial artery spasm.

Material and method. Prospective, cross-sectional study. A 3-month follow-up of patients undergoing cardiac catheterization in 2 centers of the province of Córdoba, Argentina analyzed the influence of the procedural variables associated and clinical variables such as sex, age, and risk factors in the appearance of radial artery spasm (RAS).

Results. Patients undergoing cardiac catheterizations via radial artery access between September and December 2019 in 2 centers in the city of Cordoba, Argentina were analyzed. A population of 347 patients was finally studied. A total of 131 were women (37.8%) and 216 were men (62.2%). The incidence rate of radial artery spasm (RAS) in the study sample was 14.7% (n=51). A significant association between smoking and this event was finally confirmed. In all cases, the incidence rate of RAS was significantly higher in smokers (17.6%) compared to non-smokers (6.5%). Smoking was a variable significantly associated with radial artery spasm (P=.020).

Sex presented an OR associated with spasm (OR=8.2); the probability of women to present RAS would be 8 times greater compared to men. RAS occurred in almost a third of the women studied (29.0%) and in 6.0% of the males studied and was more commonly seen in smokers (33.3% of them suffered radial artery spasm). However, in non-smokers the incidence of spasm was also more common in women compared to men. Regarding procedural factors, it was observed that both the size of the catheter and the spasm kept a significant correlation (P=.021). Procedural time was significant (P=.022) with a higher risk of spasm associated with patients with procedural times > 20 min. (OR=2.6) and the type of study and occurrence of RAS (P=.014). The highest risk category was seen in the therapeutic study with an OR=3.1 (95%CI, 1.25-7.67).

Conclusions. The incidence rate of radial artery spasm was close to 15% in the study sample, which kept a positive correlation with female sex and smoking. Smoking was confirmed as an independent risk factor to predict the appearance of RAS in patients undergoing cardiac catheterization studies.

Key words: *radial spasm, smoking, cardiac catheterization.*Resumen

RESUMEN

Objetivo. Determinar la influencia independiente del tabaquismo en la aparición de espasmo de la arteria radial en estudios de cateterismo cardíaco y el análisis de la asociación de diferentes condiciones para el desarrollo del espasmo arterial radial.

Material y método. Estudio prospectivo, transversal. Seguimiento durante 3 meses de pacientes sometidos a cateterismo cardíaco en 2 centros de la provincia de Córdoba, analizando la influencia de variables asociadas al procedimiento y variables clínicas como sexo, edad y factores de riesgo en la aparición de espasmo arterial radial (EAR).

Resultado. Se analizó a los pacientes sometidos a cateterismo cardíaco por acceso arterial radial entre septiembre y diciembre de 2019 en 2 centros de la ciudad de Córdoba. Se obtuvo una población de 347 pacientes; 131 eran mujeres (37,8%) y 216, varones (62,2%). La ocurrencia de espasmo de arteria radial (EAR) en la muestra fue del 14,7% (n=51). Se verificó una asociación significativa entre tabaquismo y este evento. Todos los casos la proporción de EAR fue significativamente más elevada en fumadores (17,6%) en contraste con los no fumadores (6,5%). El tabaquismo fue una variable asociada significativamente al espasmo radial (p=0,020).

El sexo presentó un odds ratio (OR) asociado a espasmo de 8,2, la probabilidad de que las mujeres presenten EAR sería 8 veces mayor que la asociada a varones. El EAR ocurrió casi en un tercio de las mujeres estudiadas (29,0%) y en el 6,0% de los varones, y fue más observado en mujeres fumadoras (33,3% de ellas presentó espasmo), aunque también en no fumadores la incidencia de espasmo fue más frecuente en mujeres que en varones. En cuanto a los factores relacionados con el procedimiento, se observó que el tamaño del catéter y el espasmo se asociaba significativamente (p=0,021). El tiempo de procedimiento resultó significativo (p=0,022), con un mayor riesgo de espasmo asociado a pacientes con tiempos procedimentales superiores a 20 minutos (OR=2,6) y el tipo de estudio y ocurrencia de EAR (p=0,014), siendo la categoría de mayor riesgo el estudio terapéutico, con una OR=3.1 (intervalo de confianza del 95% [IC95%]: 1,25-7,67).

Conclusiones. La incidencia de EAR se ubicó cerca del 15% de la muestra estudiada, positivamente relacionada con el sexo femenino y el tabaquismo. Se observó que el tabaquismo es un factor de riesgo independiente para predecir la aparición de EAR en pacientes sometidos a estudios de cateterismo cardíaco.

Palabras claves: *espasmo radial, tabaquismo, cateterismo cardíaco.*

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INTRODUCTION

Radial access has been gaining traction over the last few years regarding percutaneous coronary interventions. To this date, it is one of the most commonly chosen access routes by interventional cardiologists worldwide when performing endovascular procedures (1-3). Evidence shows benefits for both patients and health centers with fewer vascular complications, more comfort and early mobilization, better results in high-risk patients, shorter hospital stays, and a significant reduction of hospital expenses (3,4,6).

Multiple randomized clinical trials such as the RIVAL (6,7) and the RIFLE-STEACS (8-10) confirm that the use of the radial access is associated with fewer adverse cardiovascular events in patients with ST-segment elevation myocardial infarction (STEMI). Based on the growing body of evidence, the most recent iteration of the clinical practice guidelines published by the European Society of Cardiology (ESC) (2017) regarding percutaneous coronary interventions (PCI) for the management of patients with STEMI changed the recommendation to a class I recommendation (level of evidence A) regarding the use of the radial artery as the access route (19).

Radial access is associated with lower rates of procedural success and a greater need for crossing to the femoral access when performing percutaneous coronary interventions (8,9), which is commonly associated with radial artery spasm (RAS) (6,7). The appearance of severe RAS requires changing the access site because RAS, a common complication, does not facilitate the proper advancement and manipulation of devices through this access route (11-13).

There are different concepts that can be used to define RAS. Maybe the most wide spread definition is the sudden, abrupt, and transient reduction of the arterial caliber clinically and/or angiographically diagnosed during the procedure (16), the presence of pain at the puncture site while advancing the guidewire, pain in the forearm when moving the catheters and/or pain and incapacity to manipulate the catheters (9-12); at times, pain is due to device displacement in the presence of factors like tortuous or spiral radial, brachial and/or subclavian arteries.

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TABLE 1. Model summary. From left to right: factor studied, category with higher chances of RAS; statistical significance (P); OR and 95%CI.

Explicative factor (predictor)	Category of highest risk of spasm	P	OR	95%IC for the OR	
				Lower limit	Upper limit
Sex	Women	<0,001	8,26	3,79	18,02
Ischemic heart disease	Yes	0,006	2,77	1,34	5,72
Smoking	Smokers	0,020	3,47	1,22	9,89
Catheter diameter (French)	6-Fr	0,021	2,91	1,18	7,19
Procedural time	≥ 20 min	0,022	2,63	1,15	6,02
MRS	Yes	0,046	3,53	1,02	12,22
Peripheral vascular disease	No	0,067	2,47	0,94	6,47
Treatment	Without treatment	0,122	1,96	0,83	4,59
Hypothyroidism	No	0,200	2,66	0,60	11,87
DLP	No	0,216	1,65	0,75	3,67
BMI	> 30	0,435	1,35	0,63	2,89
Interventional cardiologist	Experienced	0,455	1,33	0,63	2,79
Radial access (side)	-	0,535	1,39	0,49	3,88
Contrast agent	> 70 cc	0,618	1,25	0,52	2,97
AHT	-	0,638	1,13	0,42	3,02
DM	-	0,676	1,10	0,53	2,31
Age group	-	0,792	1,07	0,51	2,24
Absorbed dose rate (mGy/min)	-	0,804	1,03	0,93	1,13
Radioscopy time	-	0,854	1,00	1,00	1,00

RAS can have different degrees of severity and occur at any stage during the procedure resulting in a mismatch among the introducer sheath, the catheter, and the size of the artery; it is the most common cause of procedural failure when performing cardiac catheterizations (11,12,16).

The incidence rate of RAS during a percutaneous coronary intervention is between 4% and 18% (8,9,12,14-16). Currently, it is well-known that the mechanism that causes RAS is associated with the existence of different factors that predispose to its appearance: clinical, anatomical, and procedural factors alike (9-11).

Female sex, age group between 20 and 40 years, low body mass index, and a past medical history of diabetes mellitus, smoking, ischemic heart disease are among the clinical factors that have been reported. The diameter of the radial artery, the presence of atherosclerotic lesions, arterial tortuosity, and radial artery anomalies and/or variants are some of the anatomical factors that have been reported. Successive failed attempts when trying to catheterize the radial artery, large-caliber devices, long procedural times, and the number of catheters used are some of the procedural factors reported too.

Today in Argentina there are very few studies correlating the patients' clinical predictors with the appearance of RAS. Instead, they are mostly focused on preventing this event by using drug therapy.

It is well-known that chronic smoking changes the endogenous mechanisms of pain and affects how pain is perceived and felt due to the chronic exposure to nicotine (15,16,18,20,24). Some epidemiological studies claim that smoking is a risk factor for chronic and acute pain (17,18) which is why smoking has been established as a predictor of intense pain, which may be associated with the state of radial artery hyperreactivity and induce spasm while performing percutaneous coronary interventions.

Given the scarce evidence available and the case reports presented by different cardiology societies since pharmacological prevention (11,12,14,15), and taking into consideration that we are dealing with complex, multifactorial events that lead to the occurrence of RAS, the objective of this study is to identify the presence of smoking as an independent predictor variable of RAS for a better understanding and prevention of radial artery spasm risk in patients with such a risk factor.

Objectives

To determine the impact of smoking on the appearance of RAS in cardiac catheterization studies and analyze the association of different conditions for the development of RAS.

MATERIALS AND METHODS

Analytical, prospective, and cross-sectional study. The target population included a total of 347 patients between 18 and 90 years-old studied over a 3-month follow-up period (from September through December 2019) in the *Clínica Privada Vélez Sarsfield* Interventional Cardiology Unit and the *Sanatorio Francés* Interventional Cardiology Unit, both in the City of Córdoba, Argentina.

TABLE 2. Relative and absolute frequencies of RAS occurrence based on smoking and category of different factors (the color scale is associated with percentages).

Factor	Category	Spasm in non-smokers		Spasm in smokers	
Sex	Feminine	11,5%	(3/26)	33,3%	(35/105)
	Masculine	4,5%	(3/66)	6,7%	(10/150)
Catheter diameter (French)	5-Fr	4,3%	(3/69)	14,0%	(25/178)
	6-Fr	13,0%	(3/23)	26,0%	(20/77)
Ischemic heart disease	Ischemic heart disease(no)	2,0%	(1/51)	13,3%	(20/150)
	Ischemic heart disease(yes)	12,2%	(5/41)	23,8%	(25/105)
Smoking	Non-smokers	6,5%	(6/92)		
	Smokers			17,6%	(45/255)
Procedural time	< 20	4,4%	(2/45)	11,2%	(13/116)
	≥ 20	8,5%	(4/47)	23,0%	(32/139)
MRS	No	6,6%	(6/91)	16,4%	(39/238)
	Yes	0,0%	(0/1)	35,3%	(6/17)
Study	Coronary computed tomography angiography	13,0%	(3/23)	21,6%	(16/74)
	Cine coronary angiography and others	4,3%	(3/69)	16,0%	(29/181)
Peripheral vascular disease	Peripheral vascular disease (no)	8,2%	(6/73)	21,5%	(37/172)
	Peripheral vascular disease (yes)	0,0%	(0/19)	9,6%	(8/83)
DLP (dyslipidemia)	DLP (no)	8,8%	(6/68)	21,6%	(27/125)
	DLP (yes)	0,0%	(0/24)	13,8%	(18/130)
Hypothyroidism	Hypothyroidism (no)	7,1%	(6/85)	17,9%	(42/235)
	Hypothyroidism (yes)	0,0%	(0/7)	15,0%	(3/20)
Treatment	Without treatment	0,0%	(0/4)	50,0%	(2/4)
	With treatment	6,8%	(6/88)	17,1%	(43/251)
BMI	BMI < 30	3,3%	(2/61)	18,1%	(30/166)
	BMI ≥ 30	12,9%	(4/31)	16,9%	(15/89)
Contrast agent	< 70 cc	4,5%	(2/44)	16,1%	(19/118)
	≥ 70 cc	8,3%	(4/48)	19,0%	(26/137)
AHT	AHT (no)	0,0%	(0/32)	14,8%	(8/54)
	AHT (yes)	10,0%	(6/60)	18,4%	(37/201)
DM	NO	9,8%	(5/51)	16,2%	(18/111)
	Yes	2,4%	(1/41)	18,8%	(27/144)
Interventional cardiologist	Not experienced	8,0%	(4/50)	15,8%	(24/152)
	Experienced	4,8%	(2/42)	20,4%	(21/103)
Age group	Up to 60 years	2,9%	(1/34)	17,0%	(17/100)
	Over 60 years	8,6%	(5/58)	18,1%	(28/155)

Patients eligible for diagnostic and/or therapeutic left cardiac catheterization via radial artery access were included. Patients who met any of the following criteria were excluded:

- Allergy to drugs used as prophylactic therapy to prevent radial artery spasm.
- Hemodynamically unstable patients: severe hypotension requiring vasoactive drugs.
- Negative Allen's test: it is used to measure the state of circulation of the palmar arch cubital collateral artery to avoid any possible ischemic complications associated with palmar capillary refill. It consists of asking the patient to close his hand—which compresses the cubital and radial arteries—which turns the palm of the hand into white color due to blood flow interruption. Then, the cubital artery pressure is released and the time is takes for the skin to go back to normal color is measured.

Different variables were analyzed in each patient and then categorized into clinical and procedural variables. Some of the clinical variables reported were the age of the patients measured in years, feminine/masculine sex, and the presence of previous comorbidities like diabetes mellitus (DM), arterial hypertension (AHT), dyslipidemia (DLP), chronic kidney disease (CKD), body mass index (BMI) < or > 30, ischemic heart disease, previous myocardial revascularization surgery (MRS), and smoking.

Procedural variables reported were the type of interventional cardiologist who performed the procedure (experienced

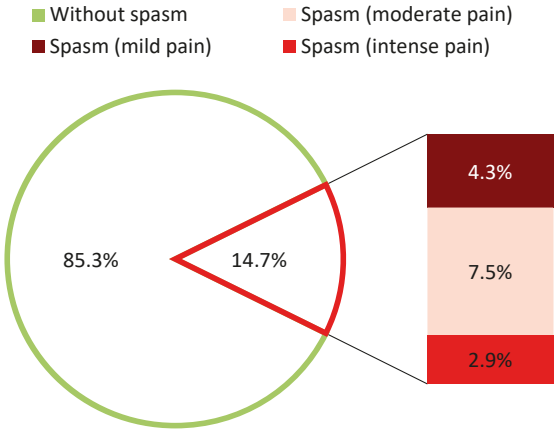

Figure 1. *Percentage of cases based on the incidence rate of spasm and pain intensity perceived associated with the spasm.*

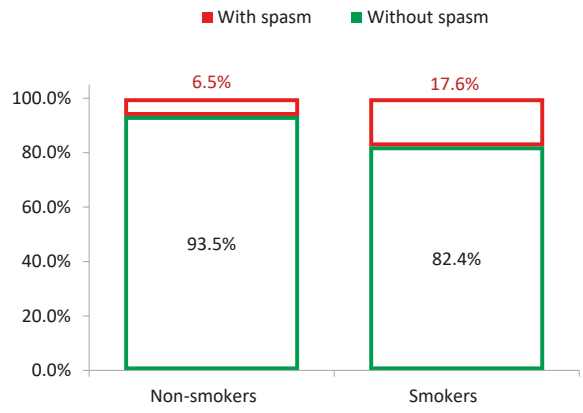

Figure 2. *Relative frequencies of spasm based on smoking.*

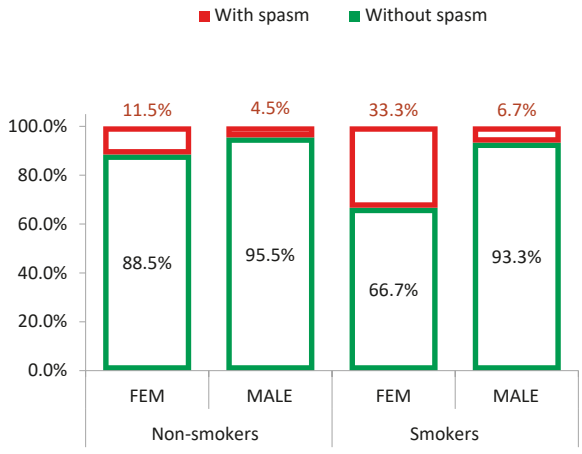

Figure 3. *Relative frequencies of radial spasm based on sex and smoking.*

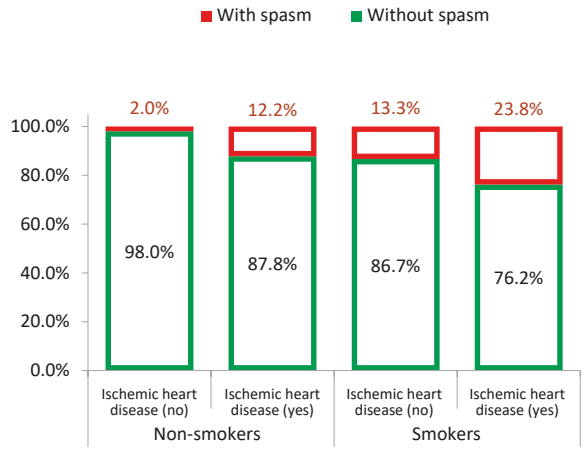

Figure 4. *Relative frequencies of radial spasm based on ischemic heart disease and smoking.*

or non-experienced). Experienced interventional cardiologists were those who had performed over 150 percutaneous coronary interventions as lead operator and 450+ coronary diagnostic catheterizations; procedural variables were also the number of radial access punctures (more or less than 1); the catheter French size (5-Fr, 6-Fr), the number of catheters used, and the procedural time measured in minutes counting from the puncture until the introducer sheath was retrieved via radial access (> 20 min or < 20 min).

The presence of RAS was defined as the difficulty and/or tamponade and/or severe pain when trying to move the catheter or introducer sheath that literally stops the procedure in its tracks. The degree of pain was assessed using an intensity index (score from 1 to 10) that was subjectively measured by the patient. Scores of up to 3 were indicative of mild pain, between 4 and 6 were indicative of moderate pain, and scores > 7 were indicative of intense pain and/or incapacity to move the catheter, and/or need for a difference access route.

First, a descriptive analysis was conducted of all the variables based on the measuring scales used: percentage of occurrence was used to express the qualitative variables, while central tendency and variability measures were used to express the continuous variables. The inter-groups differences were established regarding sex and age. The association between risk factors and dependent variables was estimated too as categorized data were used to measure the odds ratio (OR) with a 95% confidence interval (IC95%).

To assess the degree of association of the different factors involved with radial artery spasms a binary logistics regression model was used. This regression analysis was completed with a stratified descriptive analysis that associated the 2 most relevant study variables (spasm and smoking) with different study factors. The variable of the type of procedure performed, whether diagnostic and/or therapeutic, was also used to study its possible association with RAS.

Ethical considerations

All data were gathered from the patients' clinical histories upon admission to the cath lab following their authorization to use these data with statistical purposes only. If they would not give their authorization, they were removed from the study. All data were analyzed in full compliance with ethical, confidential, privacy, and anonymity requirements making the patients' identification virtually impossible.

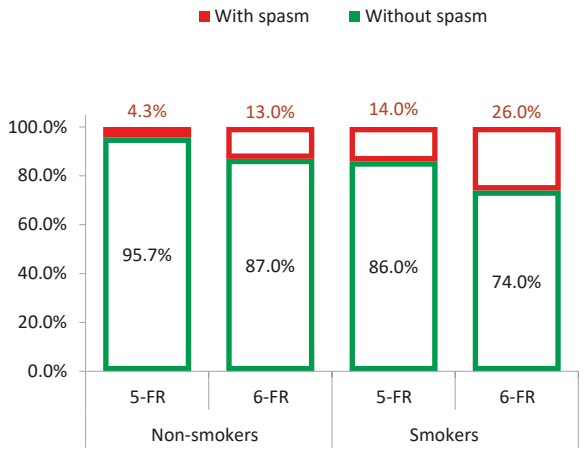

Figure 5. *Relative frequencies of radial spasm based on Fr and smoking.*

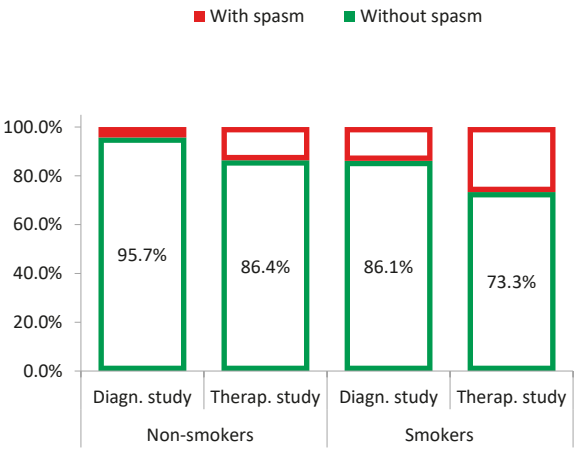

Figure 6. *Relative frequencies of radial spasm based on type of study and smoking.*

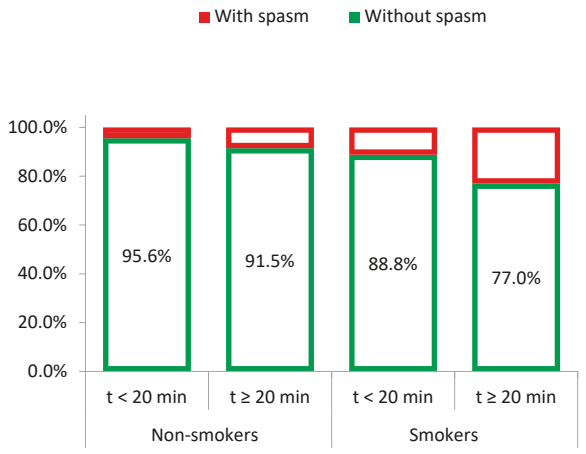

Figure 7. *Incidence rate of radial spasm based on smoking and procedural time.*

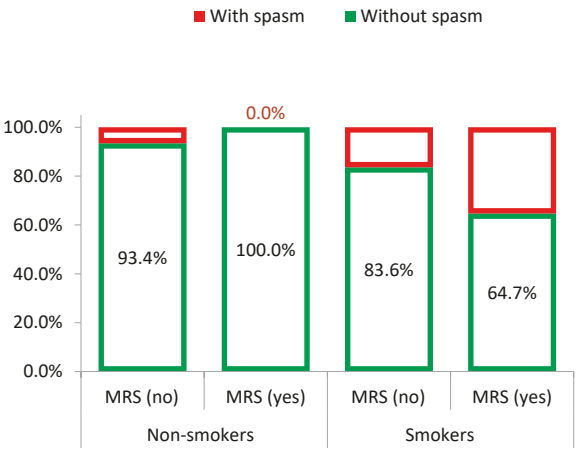

Figure 8. *Relative frequencies of radial spasm based on MRS and smoking.*

RESULTS

This analysis was generated from a sample of 347 patients of an age group between 37 and 93 years old with a mean age of 64.1 years; 131 were women (37.8%) and 216 were men (62.2%). Procedural complications were reported in zero patients. The occurrence of RAS in the study sample was 14.7% (n = 51). **Figure 1** shows the information reported.

Table 1 shows the factors introduced in the logistics regression model and arranged in descending order based on their statistical significance indicating in each case, the strength of the association with the RAS through its OR and 95%CI.

Table 2 shows the relative frequencies of the RAS event based on the categories of each factor. This descriptive analysis included both the factors considered significant in the logistics regression analysis and those considered significant enough for this study. Within the non-smokers group, the rate of spasm exceeds the values obtained for the overall rate [that was 14.7% (n = 59)]. In all the cases, the rate of spasms reported was higher among smokers.

Regarding smoking, the rate of RAS was significantly higher in smokers (17.6%) compared to non-smokers (6.5%). As **Figure 1** shows, smoking was the variable most significantly associated with the occurrence of radial spasms (P =. 020) as smokers had a higher risk of having spasms compared to non-smokers.

On the other hand, sex was the most explicative factor of the RAS event in the logistics regression model used (P <. 001), the OR associated with the RAS was 8.2, and the chances that women had RAS were 8 times higher compared to men. RAS occurred in almost a third of the women studied (29.0%) compared to 6.0% of the men. These results are shown on **Figure 3** and adjusted to smoking. The RAS event was most commonly seen among female smokers (33.3% of them had spasms), although among non-smokers, the rate of spasm was more common in women compared to men.

Regarding pre-existing conditions, as shown on **Figure 4**, patients with previous ischemic heart disease had more chances of developing radial artery spasm compared to patients with index episodes. The degree of association between this factor and the spasm was significant (P =. 006).

Regarding procedural factors, the size of the catheter used, measured in French units, and the spasm were significantly associated (*P* =. 021). The largest caliber catheter (6-Fr) was more commonly associated with the appearance of RAS compared to the smallest caliber catheter (5-Fr) as shown on **Figure 5**.

We should mention that in 100% of the therapeutic studies conducted (n = 97) 6-Fr catheters were used while in the diagnostic studies conducted only 5-Fr catheters were used (98.8%). Therefore, the results obtained for the size of the catheters are also valid for the type of study conducted. As a matter of fact, when the catheter size was changed by type of study conducted in the logistics regression analysis, very similar values to those reported on **Table 2** were obtained. Therefore, a significant strength of association was seen between the type of study conducted and the occurrence of RAS (*P* =. 014) being the therapeutic study the category of the highest risk [OR = 3.1 (95%CI, 1.257.67)] as already seen (**Figure 6**).

Procedural time was confirmed as a significant factor (*P* =. 022) with a higher risk of spasm associated with patients with procedural times > 20 min (OR = 2.6). In both smoking categories, the occurrence of radial artery spasm was more common in the group of patients with procedural times > 20 min, and a significantly higher risk of RAS was confirmed when both factors were present (**Figure 7**).

Regarding the clinical variable of previous MRS, a significant association was seen among smokers with a past medical history of MRS compared to non-smokers with a past medical history of MRS (*P* =. 046), indicative of a higher risk of RAS associated with patients with MRS, particularly in current or former smokers (**Figure 8**).

Regarding DM, age, body mass index, and PVD, no significant differences were seen with the occurrence of RAS. There was a higher, though statistically insignificant, occurrence of this event in patients over 60. The same thing happened with radioscopy time inside procedural variables.

DISCUSSION

Despite the widespread use of this technique, to this day, very few studies have focused on the association of risk factors with the occurrence of RAS in diagnostic and/or therapeutic cardiac catheterizations. On this regard we found no scientific articles on smoking while conducting our bibliographic search. However, the results show that this habit clearly predisposes to the occurrence of the study primary endpoint.

In the scientific literature, the incidence rate of RAS varies based on the definition used and type of study conducted (10-13). In our study, the overall incidence rate of radial artery spasm was 14.7% and kept a positive correlation with feminine sex, previous ischemic heart disease, previous MRS, and smoking. Consistent with multiple studies, Ruiz-Salmerón RJ et al. studied a population of 637 patients. They found that in 127 patients (20.2%), radial artery spasm occurred during the procedure. In 25 patients (3.9%) another access route had to be used (in 13 cases due to radial artery spasm, 2% of the total) (31-33).

Experienced centers on this approach reported that radial artery spasm occurred in 15% to 30% of all the procedures. The SPASM and the SPASM-3 clinical trials (15,16) showed a significant increase in the incidence rate of RAS (from 3% to 73%) depending on the criterion used to define radial spasm, use of vasodilators prior to the procedure, and also associated with the study population (1219 patients). In a Latin American bibliographic review, more journals like the *Cuban Journal of Cardiology and Cardiovascular Surgery(*1,3,20,27) reported fewer cases with an incidence rate of radial spams starting at around 10%. The same incidence rate was reported in the study conducted by Goldsmit et al. and published on *RACI* (16): access spasms occur in approximately 10% of the patients, which makes the procedure tougher and longer to perform, sometimes even having to cross to the femoral access route. Goldberg et al. (30,31) studied an early series of patients on whom the radial artery was used by interventional cardiologists not experienced in the use of the arm as an access site to perform percutaneous coronary interventions. Clinical success was achieved through the radial artery in 87% of 32 lesions treated and in 84% of 27 patients. The main characteristic that limited success through the arm was radial/brachial artery spasm, which occurred in 30% of the cases (clinical success: 50% with spasm vs 95% without it, *P* <. 05). Spasm was more common in patients with peripheral vascular disease and in hypertensive patients too. In their study, they showed that prevention is probably more effective than the treatment of spasms, which is why it is so important to know the predictive factors of this event (33,34).

In this study, feminine sex was the most significant variable for the occurrence of RAS [(*P*<.01), OR=8.24], and the rate of RAS was 8 times higher in women compared to men. Consistent with the scientific literature available, the RIVAL clinical trial confirmed feminine sex as one of the 4 predictive factors independently associated with the appearance of RAS: feminine sex, first failed attempt trying to access the radial artery, emergency procedure, and use of diltiazem. In their study of patients operated via radial access, Dehghani et al. (29,36), confirmed that 17% of the patients were women, which proves that sex is associated with higher rates of procedural failure.

Recently, Gorgulu et al. studied 1722 patients and reported that feminine sex was the only independent predictor of RAS at the beginning of the procedure. However, our study identified additional factors such as smoking (45,46).

In this study, smoking was an independent risk factor to explain the increasing occurrence of RAS, that is, the presence of this factor increased the probabilities of RAS occurrence [OR=3.46 (95%CI: 1.22-9.89)]. Therefore, current smokers have almost 3.5 times more chances of suffering from RAS as a procedural complication.

Women who also happen to be smokers have a 33.3% incidence rate of RAS. Therefore, these two variables combined can help predict, before performing any diagnostic and therapeutic cardiac catheterizations, the occurrence of RAS and any possible associated complications. These results were not found anywhere else.

In their comparative study of 200 patients in whom 6-Fr introducer sheaths were used, Gul et al. revealed a risk sub-analysis that suggests that patients with a history of smoking probably have lower chances of procedural success regardless of the type of introducer sheath used. In this RAS registry, dyslipidemia—added to feminine sex—was a strong predictor of moderate-to-severe radial artery spasm (47,48,50).

However, Gorgulu et al. reported a RAS incidence rate of 10.3%, and feminine sex as the only independent predic-

tor of risk; surprisingly, smoking was less common in patients with spasms (17% vs 29%, P <. 001).45,46
Giannopoulos et al. presented 3 different cohorts of patients who underwent elective PCIs via transradial access where 5 weighed factors could be used to build up a risk score for developing spasm: body mass index, height, current smoking status, hypertension, and PVD. Feminine sex was considered the main predictor in all the groups, while the occurrence of RAS in smokers was also relevant in the different subgroups (P <. 01), yet not statistically significant.20,22
Although the effect of smoking on coronary artery disease is well-known as a preventable factor, its role in the development of the pathological process triggered by this condition or in procedural complications is still unknown.
According to this logistics regression model, the probability of experiencing radial artery spasms based on the contribution of different risk factors can be estimated. For example, patients with the following clinical parameters: women over 60 years old, current smoker, previous ischemic heart disease, hypertension, cardiac catheterization with a 6-Fr catheter, and a long procedural time would have, on average, 76% chances of having a spasm based on the predictive model proposed. For this reason, the analysis of the factors associated with RAS was presented independently from smoking to predict the occurrence of RAS.

However, being aware of the existence of certain risk factors associated with complications of this type of procedure like serious pre-existing conditions, age or sex facilitate the identification of patients at a higher risk of RAS so the necessary preventive measures can be implemented to reduce the appearance of this event and improve the results of percutaneous coronary interventions.
We should mention that the study sample was not large enough; however, as stated in this article, prospective studies are needed to come up with preventive measures to stop RAS from happening while taking into consideration the particular characteristics of the population and the results seen. This may facilitate the converstion of the information obtained into clinical practice protocols to facilitate a comprehensive approach to this event to prevent its appearance and improve the results of interventional procedures.

CONCLUSIONS

The incidence rate of RAS was close to 15% in the study sample and was positively associated with feminine sex, previous acute myocardial infarction, and smoking.
This study proved that smoking is an independent risk factor that predicts the appearance of RAS in patients eligible for cardiac catheterization.

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