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Investigation the Prevalence of Bacteremia after Coronary Artery Intervention in Patients Refereed to Afshar Hospital in Yazd, Iran

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Abstract: Percutaneus coronary artery intervention (PCI) is increasing in patients with cardiovascular disease. In this intervention some instruments enter into the vessels and it makes PCI as a risk factor for bacteremia and sepsis. bacteremia is rare, but is able to increase mortality rate. This study was designed to determine the prevalence of bacteremia after PCI in patients who were refereed to Afshar Hospital in Yazd, Iran. In an analytic cross-sectional study which was done among 300 patients refereed to Afshar Hospital in Yazd, Iran from April 2012 August 2012.exclusion criteria was history of infection and antibiotic consumption. Demographic data, number of vessels, type of stent, PCI duration and number of skin puncture were mentioned for everyone. For each one blood culture was done before procedure, immediately after procedure and eight hours after that. Data were analyzed by descriptive and analytic tests. 9 men and 5 women had positive blood culture in this study and fisher exact test showed that this difference is not significant. Comparing patients according to the type of PCI; emergent or elective, showed no significant difference. The average age was considerably significant between positive and negative blood culture groups (P-value=0.03). 2.8% of patients with one skin puncture had positive blood culture while it was positive in 15.95 of patients with two or more than two punctures and it was significant (P-value=0.002). There was no significant difference according to factors including type of stents, PCI duration and catheter type(used or new). There was significant difference between number of vessels (P-Value=0.04) and diabetes mellitus with septicemia (P-Value=0.04). According to our data, bacteremia after PCI was a rare side effect and it depended on number of skin punctures which was confirmed by similar studies.

Key words: Bacteremia · PCI · Skin Puncture · Blood Culture

INTRODUCTION

Coronary stent implantation is one of the most common medical procedures, with nearly 1 million patients in the United States undergoing this intervention annually [1]. The incidence of stent infection is unknown, but appears to be quite rare, given the limited number of cases reported since the introduction of intracoronary [2].

Coronary artery stent have been in use for more than 2 decades. It was initially reported in 1987. Stenting of the coronary arteries is now used in 40-60% of all interventional coronary artery procedures. The understanding of the pathophysiology of coronary artery disease is evolving. It has been suggested that atherosclerosis may be a complication of an infectious etiology. By using a stent to treat coronary artery disease, a foreign body is directly juxtaposed with an area of inflammation. The first reported case of an infected coronary artery stent was in 1993 [3].

Symptoms of stent infection present days to weeks after the initial coronary intervention. Early-onset infections are defined as those occurring less than 10 days after stent placement and late-onset infections, as those occurring 10 days or longer after stent placement. The designation of 10 days as the cut point between early-and late-onset infections is based on evaluation and treatment of foreign body in orthopedic surgery [4- 6].

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In the few cases reported in the literature, patients have presented within days to weeks of stent implantation with fever and the infection presumably was related to periprocedural bacteremia or direct septic stent implantation [7-10].

Dieter proposed criteria to determine the diagnosis of coronary stent infection. Definitive diagnosis was made by autopsy or by examination of surgical material. For possible diagnosis, 3 of the following must be present: placement of a coronary stent within the previous 4 weeks; multiple repeat procedures performed through the same arterial sheath; the presence of bacteremia, significant fever, or leukocytosis with no other cause; acute coronary syndrome, or positive cardiac imaging [3].

Although positive blood cultures are diagnostic of a serious infection, they do not necessarily identify the anatomic source of infection [3].

By considering that coronary stent implantation is one of the most common medical procedures, the evaluation of a patient with a potential stent infection has several goals. These include making a clinical, radiographic and microbiologic diagnosis, determining optimal therapy. Complex percutaneous coronary intervention (PCI) often requires introduction of numerous devices into and out of the arterial circulation and this may result in an increased risk of bacteremia or even septicemia. This study was undertaken to detect the frequency of bacteraemia that may be associated with such procedures and assess the characteristics of the patients, type of stent and PCI procedures in patients refereed to Afshar Hospital in Yazd, Iran.

MATERIALS AND METHODS

In a prescriptive analytic study, all patients who were undertaken PCI from April 2012 to August 2012 in Afshar hospital, Yazd, Iran, entered the study. The exclusion criteria were history of recent infection, recent antibiotic consumption and death after 24 hours of PCI. All the PCI, 299 patients (176 men and 123 female) were undertaken with unique professional team. The required data entered to the questionnaire. The questionnaire included demographic characteristics of patients, type of catheter (used or new), type of stent (drug-eluting stent, DES) or not-DES), number of artery under PCI, number of skin punctures, urgent or elective PCI, underlying disease such as diabetes mellitus, chronic renal failure and obesity and results of blood cultures.

The blood culture sent before PCI was started and 2 other blood cultures sent after finishing of PCI with the interval of 8 hours. The volume of each sample should be 2ml. Positive blood culture was considered as bacteremia in our study.

In all patients with positive blood culture we followed them for four weeks for systemic symptoms of sepsis and septic shock.

Paired sample T-test, Z-test and chi-square were used in statistical analysis. Value of $p<0.05$ in Z and T test and values of $p<0.01$ in chi-square were considered significant.

RESULTS

In our study 14 blood cultures were positive (4.6%). The blood cultures were positive in 9 men (5.1%) and 5 female (4.1%). There was no significant association between gender and bacteremia (P-value=0.78) (Table 1).

As mentioned 14 patients had positive blood cultures with the average age of 63.50±12.40 and average age of patients with negative blood culture were 57.39 ±11.2. The average age was considerably significant between 2 groups (P-value=0.03) (Table 2).

The pathogen organism was identified in 13 patients was *staph aureus* and in 1 patient the β-hemolytic staph. aureus was the pathogen.

Underlying disease was also assessed. Diabetes mellitus (DM) were present in 102 patients and chronic renal failure (CRF) and obesity were present in 22 and 71 patients respectively. One blood culture was positive among patients with DM, which was significant in our study (P-value=0.04) (Table 3).

31 PCI were done in urgent condition. 2 blood cultures of 31 urgent PCI were positive and 12 from 268 elective PCI had positive blood culture. According to the results of the study, being urgent or elective was not significant risk factor in bacteremia. (P-value=0.64) (Table 4).

The number of skin puncture was also assessed. When it was only 1, one of the blood culture from 7 was positive (2.8%). 44 patients had 2 or more punctures and 7 blood cultures were positive (15.9%). According to the result of the study, multiple skin punctures had significant association with positive blood culture (P-value=0.002).

The results of the blood culture were also assessed according to the types of the catheter if it was new or used. 2 blood cultures out of 127 used catheters were

Table 1: Blood culture results according to gender

Gender	Culture result				
	Positive culture		Negative culture	Total	p-value (Fisher Extract)
Male	Number(s)	9	167	176	0.78
	Percent(%)	5.1%	94.9%	100%	
Female	Number(s)	5	118	123	
	Percent(%)	4.1%	95.9%	100%	

Table 2: The blood culture results according to patients' age

Culture result	Age			
	Number	Average age	Standard deviation	p-value (Mann-Whitney)
Positive culture	14	63.50	12.40	0.03
Negative culture	285	57.39	11.20	
Total	299	57.67	11.31	

Table 3: Blood culture results according to underlying disease

Disease	Culture result				
	Positive culture		Negative culture	Total	p-value (Fisher Extract)
DM	Number(s)	1	101	102	0.04
	Percent(%)	1%	995	100%	
CRF	Number(s)	2	20	22	0.27
	Percent(%)	9.1%	90.9%	100%	
Obesity	Number(s)	4	67	71	0.74
	Percent(%)	5.6%	94.4%	100%	

Table 4: Blood culture results according to urgent or elective PCI

Procedure	Culture result				
	Positive culture		Negative culture	Total	p-value (Fisher Extract)
Elective	Number(s)	12	256	268	0.64
	Percent (%)	5.1%	94.9%	100%	
Urgent	Number(s)	2	29	31	
	Percent(%)	6.5%	93.5%	100%	

Table 5: Blood culture results according to number of punctures

Puncture number(s)	Culture result				
	Positive culture		Negative culture	Total	p-value (Fisher Extract)
1 puncture	Number(s)	7	246	253	0.002
	Percent(%)	2.8%	97.2%	100%	
2 or more punctures	Number(s)	7	37	44	
	Percent(%)	15.9%	84.1%	100%	

Table 6: Blood culture results according to type of catheter (used or new)

Catheter Type	Culture result				
	Positive culture		Negative culture	Total	p-value (Fisher Extract)
Used	Number(s)	6	121	127	1
	Percent(%)	4.7%	95.3%	100%	
New	Number(s)	8	164	172	
	Percent(%)	4.7%	95.3%	100%	

Table 7: Blood culture results according to stent type

	Culture result				
Stent type	Positive culture		Negative culture	Total	p-value (Fisher Extract)
DES	Number(s)	11	231	242	0.73
	Percent(%)	4.5%	95.5%	100%	
Not DES	Number(s)	3	54	57	
	Percent(%)	5.3%	94.7%	100%	

Table 8: Blood culture results according to time of sending blood culture

	Culture result				
Time	Positive culture		Negative culture	Total	p-value (Fisher Extract)
Less than 30 min	Number(s)	3	87	90	0.56
	Percent(%)	3.3%	96.7%	100%	
more than 30 min	Number(s)	11	198	209	
	Percent(%)	5.3%	94.7%	100%	

Table 9: blood culture results according to number of artery under the PCI

	Culture result				
Number of artery	Positive culture		Negative culture	Total	p-value (chi-square)
1 artery	Number(s)	9	241	250	0.04
	Percent(%)	3.6%	96.4%	100%	
2 arteries	Number(s)	5	35	40	
	Percent(%)	12.5%	87.5%	100%	
3 or more than	Number(s)	0	7	7	
	Percent(%)	0	100%	100%	

positive and the blood cultures were positive in 8 out of 172 new catheter. Type of catheter, if it was new or use was not significant in our study (Table 6).

In 242 patients, drug-eluting stents (DES) were used and 11(4.5%) blood cultures were positive. In 57 patients the DES were not used and 3 (5.3%) blood cultures were positive. There was no significant differences between types of stent with bacteremia (P-value=0.073) (Table 7).

90 blood cultures sent in PCI duration less than 30 minutes, among them 3 (3.3%) were positive and when the blood culture sent in PCI duration less than 30 minutes, 11 (5.3%) had positive blood cultures. (P-value=0.56) (Table8).

The number of artery under PCI was another factor that assessed in our study. In 250 cases only 1 artery was under PCI and 9 (3.6%) blood cultures were positive among them. Among 40 patients with 2 arteries under PCI, 5 (12.5%) had positive blood cultures. No positive blood cultures were observed among 9 patients with 3 arteries under PCI. According to the results of the study, number of artery under PCI was significant factor in predisposing stent infection (P-value=0.04) (Table9).

In all patients with positive blood cultures we followed them for four weeks for systemic symptoms of sepsis and septic. There were no systemic symptoms in any of them.

DISCUSSION

Percutaneous coronary stent implantation is a widely employed procedure, with an estimated 1.4 million stents implanted annually in the United States [1]. The development of stent infection is exceedingly rare, but represents a very severe complication with an associated mortality of 50% [3].

The pathogenic organisms were identified in all patients. Staphylococcus epidermis was the most common organism found in 13 patients. In 1 case streptococcus non β-hemolytic was positive in blood culture. The results were consistent with the results of literature search of 17 patients. Staph epidermis was found in 14 patients, all of whom had positive blood culture. In 2 patients, pseudomonas auroginosa was isolated from blood culture and in 1, coagulate negative staphylococci were isolated from infected tissue [11-21].

299 patients (176 men and 123 female) who were undertaken PCI from April 2012 August 2012in afshar hospital, Yazd, Iran, entered the study. The exclusion criteria were history of recent infection, recent antibiotic consumption and patients death after 24 hours of PCI. The blood cultures were positive in 9 men (5.1%) and 5 female (4.1%). There was no significant association between gender and bacteremia (P-value=0.78) (Table1).

Like our study. Fortunately, there is a low occurrence of clinically significant bacteremia during nonsurgical cardiology procedures and this likely limits the incidence of coronary stent infection. In a prospective study assessing the incidence of bacteremia among 960 cardiac catheterization procedures, the incidence of clinically significant procedure-related bacteremia was zero.15 of interest was the development of positive blood cultures in 5.8% of all cultures taken. Only 0.16% of these were concluded to be clinically significant and all were due to an IV line and none to the actual cardiac procedure. Risk factors for the development of clinically non significant bacteremia from cardiac catheterization included procedure duration, multiple skin punctures, use of multiple balloons and obesity. Preventive measures during cardiac catheterization may limit the development of bacteremia and the potential risk of coronary stent infection [22].

As mentioned 14 patients had positive blood cultures with the average age of 63.50±12.40 and average age of patients with negative blood culture were 57.39 ±11.2. The average age was considerably significant between 2 groups (P-value=0.03) (Table 2).

Underlying disease was also assessed. Diabetes mellitus (DM) were present in 102 patients and chronic renal failure (CRF) and obesity were present in 22 and 71 patients respectively. One blood culture was positive among patients with DM, which was significant in our study (P-value=0.04) (Table 3). The results of our study to some extent were consistent with the literature search of 17 patients with coronary stent infection in which hypertension, DM and hyperlipidemia had no significant association in predisposing stent infection [4]. 31 PCI were done in urgent condition. 2 blood cultures of 31 urgent PCI were positive and 12 from 268 elective PCI had positive blood culture. According to the results of the study, being urgent or elective was not significant risk factor in bacteremia. (P-value=0.64) (Table 4).

The number of skin puncture was also assessed. When it was only, one blood culture from 7 was positive (2.8%). 44 patients had 2 or more punctures and 7 blood cultures were positive (15.9%). According to the result of the study, multiple skin punctures had significant association with positive blood culture (P-value=0.002) (Table5).

The results of the blood culture were also assessed according to the types of the catheter if it was new or used. 2 blood cultures out of 127 used catheters were positive and the blood cultures were positive in 8 out of 172 new catheter. Type of catheter, if it was new or use was not significant in our study.

The use of drug-eluting stents (DES) during coronary interventions has exploded in recent years because of their dramatic ability to inhibit neointimal proliferation. However, DES may affect the normal healing process of the vessel wall after vascular injury, resulting in delayed endothelization [23].

The utilization of drug-eluting stents (DES) may have a higher theoretical risk of infection due to their local immunosuppressant effect. Theoretically, drug-eluting stents (DES) may present an increased risk of infection due to the localized immunosuppressant effect, the impairment of local host defense mechanisms and delayed stent endothelialization [24].

In 242 patients, drug-eluting stents (DES) were used in our study and 11(4.5%) blood cultures were positive. In 57 patients the DES were not used and 3 (5.3%) blood cultures were positive. There was no significant differences between types of stent in bacteremia (P-value=0.073). The results of our study were not consistent with the fact that DES has higher risk of infection.

90 blood cultures sent less than 30 minutes after completing PCI, among them 3 (3.3%) were positive and when the blood culture sent 30 minutes after finishing PCI, 11 (5.3%) had positive blood cultures. (P-value=0.56). These results were similar to previous studies. Benai and colleagues [25] found an incidence of 7.3% immediately after diagnostic catheterization and 4.6% immediately after PCI. 4 hours later, positive blood culture occurred in 3.9% after diagnostic catheterization and in 4.1% after PCI. In ramsdale *et al.* study [26], 147 patients undergoing complex PCI had blood culture tests immediately after and 12 hours after the procedure of 147 patients, 26 (17.7%) had detectable bacteraemia immediately after PCI. Coagulase-negative staphylococcus was isolated most commonly. An additional 12% of patients yielded positive blood cultures in the next 12 hours with femoral sheaths still in-situ. There were no associated clinical sequelae like our study. The results of this study are consistent with Ramsdale study [26].

The number of artery under PCI was another factor assessed in our study. In 250 cases only 1 artery was under PCI and 9 (3.6%) blood cultures were positive among them. Among 40 patients with 2 arteries under PCI, 5 (12.5%) had positive blood cultures. No positive blood culture was observed among 9 patients with 3 arteries under PCI. According to the results of the study, number of artery under PCI was significant factor in predisposing stent infection (P-value=0.04).

The exact incidence of coronary stent infection is unknown. However, the low number of published case reports suggests that coronary stent infection represent a rather uncommon complication of PCI. Our study was undertaken to assess the prevalence of bacteremia after PCI [27, 28].

In all patients with positive blood cultures we followed them for four weeks for systemic symptoms of sepsis and septic shock. There were no systemic symptoms in any of them.

According to the results of our study, the number of skin puncture during PCI and the number of artery under PCI were the considerably significant factors in predisposing stent infection. Because uncomplicated bacteraemia is not uncommon as a result of complex PCI procedures, although there are usually no clinical sequelae, these findings are important for those patients who are considered to be at moderate or high risk of infection. This paper emphasizes the need for maximum sterility during PCI procedures so infective complications and stent infection are to be avoided. According to results by decreasing the number of skin punctures during PCI, the risk of stent infection may be lower significantly. Decreasing the artery under PCI was other significant risk factors.

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