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RESEARCH ARTICLE

IMPACT OF DIABETES ON EARLY AND MIDTERM OUTCOME OF CORONARY ARTERY BYPASS GRAFT SURGERY IN PATIENTS WITH LEFT VENTRICULAR DYSFUNCTION.

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Abstract

Background and aim of the study: diabetes mellitus (dm) is an independant cardiovascular risk factor. It increases both the severity and the risk of coronary artery disease.

The present study investigated patient characteristics, early postoperative outcome, and mid-term survival in dm and non-dm patients with left ventricular dysfunction after isolated coronary artery bypass grafting.

Methods: we performed a retrospective study that included 112 patients (61 without m and 51 with) with low left ventricular ejection fraction ($\leq 45\%$) undergoing coronary artery bypass graft surgery (CABG) from 1994 to 2012 with a mean follow-up time of 48 ± 8 months.

Results: dm patients differed from those without dm in terms of previous history of htn, mi and stroke. Diabetics were at higher risk for immediate postoperative sternal wound infection, and renal failure.

30 days operative mortality after CABG was 6.5% in non diabetic patients versus 5,8% in diabetic patients. However, 4 year mortality was 26,4% and 23,3% respectively.

Conclusion: dm is associated with increased early postoperative (renal failure and sternal infection) but doesn't impact operative mortality and midterm survival after coronary artery bypass graft surgery among patients with left ventricular dysfunction

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Introduction:-

Diabetes is an independent cardiovascular risk factor that increases both the risk of occurrence and the severity of coronary heart disease.

In Morocco, the prevalence of diabetes is 6.6%, which constitutes a public health problem [1]

The aim of this study is to describe the characteristics of the patients, to evaluate the early post-operative follow-up and the medium-term survival in both diabetic and non-diabetic patients with LV dysfunction who have undergone coronary artery bypass surgery.

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Materials and methods:-

1. This is a retrospective study of a series of 112 patients (including 51 diabetics and 61 non-diabetics) with an ejection fraction $\leq 45\%$ and who had benefited from a CABG between 1994 and 2012 with an average follow-up of $48. \pm 8$ months.
2. Patient characteristics, considering socio-demographic and medical data, were presented as follows:
3. For quantitative variables: the median and the interquartile range have been calculated.
4. For qualitative variables: the size and percentage have been specified.
5. These characteristics were compared in both types of patients using the Mann-Whitney U test and the Fisher exact test.
6. Then, we conducted a univariate analysis looking for an association between diabetes and post-operative complications as well as early and late mortality, the comparison of the groups was done by non-parametric Mann-Whitney tests.
7. The statistical significance of all analyzes was calculated bilaterally, a value of $p < 0.05$ was considered statistically significant.
8. The data entry was done using Microsoft Excel 2013, and the descriptive study as well as the statistical analysis was conducted using the SPSS (Statistical Package for the Social Sciences) version 24 for Mac, in collaboration with the laboratory team of Epidemiology and Clinical Research (ECR) of the Faculty of Medicine and Pharmacy in Rabat.

Results:-

1. There is a clear male predominance in our series in both groups of patients.
2. Diabetic patients differ from non-diabetic ones; they often have a history of hypertension, myocardial infarction and stroke.
3. They are more likely to have tri-truncular coronary lesions of left main coronary artery (LMCA) (Table 1).
4. They are also at higher risk of developing postoperative sternal wound infections and kidney failure.
5. Mortality during the 30 days after bypass is 6% for nondiabetic patients versus 5.8% for diabetic ones. Between 30 days and 4 years postoperatively, it is 26.4% and 24.3% respectively (Table 2).

Tables 1 and 2 summarize the clinical and angiographic data, and the postoperative complications of our series.

Discussion:-

1. Diabetes is a major risk factor for atherosclerosis and cardiovascular death.
2. Coronary lesions are more diffuse in diabetic patients due to specific abnormalities of lipid profile and silent ischemia is more frequent by alteration of the autonomic nervous system [2].
3. The risk of coronary occlusion is higher in diabetic patients due to increased platelet aggregation and fibrinogen, as well as impaired fibrinolytic activity.
4. Long-term mortality after coronary revascularization is two to three times higher in diabetic patients than in non-diabetic patients
5. Hence, the importance of preventing the progression of lesions on native network or bypass graft, that requires the correction of all risk factors, and in particular glycemia.[3]
6. The diffuse and multi-truncal nature of coronary artery disease in diabetic patients is confirmed in our series since 78% of our patients were truncal triplicates with proximal IVA involvement in 90%, this goes hand in hand with the data from the literature. [4]
7. The current question regarding the therapeutic management of coronary artery disease in this particular context of diabetes is the choice between transluminal coronary angioplasty (TCA) and surgery. Admittedly, TCA has a proven track record in the management of coronary heart disease, but CABG surgery remains the gold standard of treatment, especially in the presence of complex and diffuse lesions that are common in diabetic patients. The superiority of surgery on angioplasty could be explained by a more complete revascularization in the surgical group and by the frequency of restenosis after angioplasty in diabetic patients; moreover deleterious as the myocardial ischemia is often painless, may be infarction or ventricular rhythm disorder. In fact, the FREEDOM study demonstrated that, in diabetic patients with coronary disease affecting at least two coronary arteries, offering bypass rather than coronary angioplasty with active stents significantly reduces the risk of death, IDM and stroke of 5 years. At 5 years, the incidence of these events was 26.6% in patients treated with angioplasty and only 18.7% in patients treated by bypass. [5]

8. The role of CABG in treating patients with both coronary and heart failure has not been clearly established; various studies have shown that the two modalities TCA and CABG are almost similar in terms of short-term efficiency with a slight increase in morbidity and mortality to the detriment of the CABG in immediate post-procedure. The medium and long-term results are in favor of the CABG in terms of survival, angina recurrence, need for revascularization, cardiovascular events and progression to heart failure.
9. This may be explained by the completeness of the surgical myocardial revascularization compared to TCA, where it can only rarely be complete and the evolution of the intra-stent lesions despite all the recent medical therapy made available which has certainly decreased progression of intra-stent lesions without stopping it completely.
10. The STICH trial (surgical treatment for ischemic heart failure) compared medical treatment alone with medical treatment associated with CABG in patients with coronary artery disease and left ventricular dysfunction. There was no significant difference between the two study groups in relation to the primary endpoint of death by any cause. Rates of death from cardiovascular causes and deaths from another cause or hospitalization for cardiac causes were lower in patients with CABG than in those who received medical treatment. [6]
11. Another study has shown that patients with ischemic heart disease with severe LV dysfunction can benefit from CABG in the long term by improving LV contractility and increasing the ejection fraction. Successful bypass is associated with an actual survival rate of 59% at 5 years. Immediate and long-term mortality rates are better for elective cases than for emergency cases. Although the morbidity rate of this population is slightly higher than that of patients with better left ventricular systolic function, long-term benefit justifies risk-taking. [7]
12. Diabetes is known to be predisposing to infections, coronary surgery is no exception to this general rule. Even more, the long duration of intervention, the extracorporeal circulation with its proven impact on immunity predisposes even more to infection, especially when the diabetic patient is often obese.
13. The main complication feared by all surgeons is the mediastinitis in which the removal of both internal mammary artery (IMA) occurred. This is a serious complication with a mortality rate of 14-40% [8]. This requires close postoperative monitoring of the scar and the general signs of infection to treat them as early as possible.
14. In the majority of studies that treat the subject of mediastinitis coronary surgery, diabetes is noted as a risk determinant even more in case of non-skeletal sampling of IMA.
15. To reduce the risk of infection, some measures can be taken like weight reduction in the obese patients, perfect glycemic balance and finally the cessation of smoking [8]. In our series, the mediastinitis rate is 3.8%, which is consistent with the data from some series [9]. This rate increases to 0.9% in the case of skeletonized sampling of IMAs.
16. Although less severe but more common than mediastinitis, stomach infection can occur in diabetic patient with an impact on glycemic control and on hospital sejour and total cost [10,11,12]. In our series, it is 8% in agreement with some studies [13, 14, 15] and in disagreement with others [16].
17. Diabetes therefore appears as an independent predictor of wall infection after CABG, despite the preventive measures [17, 18].
18. However, tight glycemic control improves perioperative outcomes, increases survival, and decreases the incidence of ischemic events and wound complications [19].
19. Other predictors include prolonged preoperative hospitalization, obesity, smoking, female sex, number of CABG, use of both IMAs, and duration of extracorporeal circulation [18].
20. In our study, predictors of infection were duration of extracorporeal circulation, smoking, and obesity.
21. The other non-infectious complications:
 - Early mortality during CABG under extracorporeal circulation is generally around 1.5-3% in the world's largest series. In our work it was 2%; it is an acceptable rate considering the data of the literature [20, 21].
 - The risk of postoperative myocardial infarction (MI) is perfectly real and is apparent in the majority of studies. In our series, it is 1.9% concordant with the literature. The rate of IDM after CABG varies from 0.1% to more than 10% depending on the studies, with an average of 2.4% -3.4% [22]. As for mortality in hospital, it goes from 3% in the group without elevation of the troponin to 7% in the group where it raises without passing the bar of 1,5ng / ml and reaches 22% in case of postoperative MI [23, 24]. In our series, the low number of perioperative MIs partly explains the low mortality at 30 days.
 - Neurological complications are diverse, ranging from minor psychic disorders to stroke; they are more frequent in diabetic patients with 24.3% versus 16.9% in non-diabetics [25]. In our series, we have 0.9% stroke and 11.7% transient mental disorders.

Conclusion:-

Diabetes is associated with an increase in postoperative complications, but it does not affect short-and mid-term postoperative mortality in patients with left ventricular dysfunction.

The results of our study show relatively low hospital mortality and morbidity rates, with satisfactory short- and medium-term results compared to those reported in the literature. This seems to justify surgical treatment for this group of high-risk patients.

What is known on the subject:-

Some studies have shown that diabetes increases both morbidity and mortality after coronary artery bypass grafting in patients with left ventricular dysfunction, while in other studies it increases morbidity without increasing mortality.

Takeaways:-

Diabetes does not influence mortality after coronary artery bypass in patients with VG dysfunction Benefit of perioperative glycemic balance

Table 1:-Clinical and Angiographic Data

Variables	Total	DM -	DM +	P-Value
	n=112	n=61 (54%)	n=51 (46%)	
Demographic data				
old, years	58 (48; 70)	59 (49; 70)	57 (48; 65)	
sex male, %	93%	52	41	0,155
cardiovascular risk factors and comorbidities				
Hypertension, %	35	16	19	0,134
Dyslipidemia, %	25	13	12	0,913
smoking, %	66	38	28	0,043
Myocardial infarction, %	32	12	20	0,089
stroke, %	3	0	3	
renal failure	8	2	6	0,043
Anemia	10	2	8	0,011
Obesity, BMI \geq 30, %	11	4	7	
COPD	19	8	11	0,639
clinical data				
NYHA \geq III, %	48	25	22	0,876
Angina class I-II, %	63	30	33	

Angina \geq class III, %	37	24	12	0,042
mitral regurgitation \geq class II	11	5	6	0,706
angiographic data				
Monotroncular coronary lesion	10	8	2	0,006
Bitroncular coronary lesion	25	17	8	0,0016
Tritroncular coronary lesion	65	29	35	0,02
Left main coronary artery lesion	15	5	10	0,085

Table 2:-Postoperative complications

	DM-	DM+	p Value
early mortality<30 days	3,5	4	0,883
Late mortality	20	19	
Coronary artery disease	11	9	0,577
Renal failure	4	8	<0,001
reoperation	2	3	0,799
Infection of the lining	4	8	<0,001
Blood transfusion		1	
stroke per/ post operation	2	1	
Use of drugs inotrop > 24 hours %	16	18	0,385
Mechanical ventilation > 48 hours	7	8	0,789

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