

PREDICTIVE VALIDITY OF EUROSORE RISK SCORING SYSTEM IN PATIENTS UNDERGOING CORONARY ARTERY BYPASS GRAFT SURGERY IN AZADI HEART CENTER -DUHOK, KURDISTAN REGION, IRAQ

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ABSTRACT

Background: EuroScore (ES) models have been used over the last twenty years for risk assessment before coronary artery bypass graft surgery (CABG) with variation in their ability to assess the overall complications after surgery, the intensive care unit (ICU) stay and heart performance after revascularization in different areas over the world.

Objective: To assess the performance of the EuroSCORE in prediction of post-CABG complications at Azadi Heart Center (AHC).

Patients and Methods: This correlation study was conducted at AHC, Duhok, Kurdistan Region (Iraq). The study participants were 50 patients (38 males and 12 females) who underwent CABG surgery; informed consent was obtained from all of them for participation in this study. EuroScore II (ES II) model has been assessed before and after CABG, and its correlations with short-term (up to one month) post-operative outcomes were studied.

Results: Patients were grouped into low, moderate and high-risk groups each with frequency of 26, 21 and 3, respectively. There was significant correlation between the pre-operative ES II and the post-operative ejection fraction (EF%) in the high-risk group, while there were non-significant correlations with the short-term overall complications and the ICU stay post-operatively.

Conclusions: ES II can be used in AHC to predict post-operative EF%, the higher the ES II, the lower post-operative EF%. However, ES II is not valuable to predict other short-term post-operative complications following CABG surgery.

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Keywords: EuroScore II, Coronary Artery Bypass Graft Surgery, Correlation Study.

The risk scoring system most commonly used is the European Score system which was developed in Europe and promoted there in three stages: European Score Additive (ESA) in 1999, European Score Logistic (ESL) in 2003 and the last form European Score II (ESII) which is the best in use because it is resulted from a huge European project focus¹. EuroScore systems depend on 17 factors and assess 30-days mortality among cardiac surgery patients and it is widely used everywhere, although they have some limitations because they involve several pieces of data to calculate

the score that might be difficult in some centers and can predict mortality and complications. Nowadays, both ESL and ES II are used worldwide as risk predictors for cardiac surgeries but it is unknown if they effectively predict Intensive Care Unit (ICU) stay or not². The ES system has been used in Japan and North America^{3,4}. It is not accepted in Thailand and Southeast of Asia⁵, while in Netherland, ES II and ESL are overestimating mortality rate⁶. Because EuroScore(ES) systems were started approximately twenty years ago and a wonderful advance happened in surgical methods, anesthesia,

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and the intensive care quality post-CABG; all of that improve outcomes, while ES still overestimates mortality which affect its validity in mortality risk prediction⁷.

The first human CABG was done in 1961⁸. The main goal of CABG is to do reperfusion to the myocardium, different approaches assist this reperfusion whether on-pump (CPB) or off-pump (OPCAB)⁹. Left Internal Mammary Artery (LIMA) is the first artery to use in grafting, Saphenous vein grafts (SVGs) are used also in CABG. There are other arterial grafts like radial artery, gastroepiploic artery and inferior epigastric¹⁰.

A lot of complications may occur post-CABG, whether cardiac (graft thrombosis, cardiac tamponade, MI post-operative, arrhythmia or heart failure) or non-cardiac (wound infection, pleural effusion, bleeding, renal impairment, cerebrovascular accident, etc.). ES for risk assessment in CABG surgery is not applicable for all countries; it needs more research to find a local risk scoring system for each area in the world depending on their demography⁷.

Studies for the use of ES in risk assessment for CABG surgery have shown different results regarding outcomes prediction in different areas over the world^{3,4,5,6}.

In Azadi Heart Center (AHC)-Duhok City, studies of outcomes of CABG surgery are not available, moreover, studies covering the use or implication of ES II in CABG outcomes are scarce in Kurdistan Region and Iraq.

We aimed to investigate if preoperative EuroScore is associated with postoperative adverse outcomes in patients undergoing isolated coronary artery bypass grafting (CABG).

PATIENTS AND METHODS

As a correlation study between pre-operative EuroScore and short-term (within one month) adverse outcomes after isolated coronary artery bypass graft (CABG) surgery, 50 patients (38 males and 12 females, their mean age was 59 years \pm 1.5 year) who underwent isolated CABG surgery during the period from May to December, 2018, were included. Any patient with renal and/or valvular heart disease had been excluded from this study. The study was approved by the Scientific and Ethical Committees of Duhok University/Medical College. The idea of the research was explained for all patients and informed written consents were taken. A questionnaire was prepared and filled for each patient. Pre-operative data include: Demographic information (age, sex, body mass index-(BMI) and risk factors: diabetes mellitus, hypertension and any other chronic disease if present), clinical parameters such as: (blood pressure-BP, pulse rate-PR, SpO₂ and heart arrhythmia), laboratory tests (renal function test-RFT, liver function test-LFT), EuroScore risk scoring assessment, Echocardiography (ejection fraction-EF and left ventricular end-diastolic diameter-LVEDD) and carotid Doppler. EuroScore risk scoring assessment was reported using European Score II (ES II)¹. Operative notes include: duration of surgery, bypass time, cross clamp time, number of grafts and any event that happened during the surgery. Post-operative notes include: clinical state (vital signs), duration of intubation, follow up laboratory tests, duration of intensive care unit (ICU) admission and any event if happened. Follow up of patients post-operatively was done in the first day for vital signs and general condition. The follow up had been

continued till 30 days (short-term follow-up) for both cardiac and non-cardiac complications like cardiac tamponade, bleeding, atrial fibrillation, ventricular arrhythmia, myocardial infarction, pneumothorax, renal impairment, cerebrovascular accident (CVA), wound infection, etc. When the patient had been seen after 30 days, the follow up includes: vital signs (blood pressure, pulse rate and SpO₂), electrocardiography (ECG), Fast Echocardiography assessment (ejection fraction-EF, left ventricular end diastolic diameter-LVEDD) and drugs being used. Statistical analysis had been done by the Statistical Package of Social Science (SPSS) version 24. Pearson correlation (r) and spearman correlation (rs) have been used to study the relation between EuroScore II (ESII) and New York Heart Association (NYHA) classification, EF% (before and after CABG surgery), duration of surgery, bypass time, duration of ICU-stay and post-operative complications till one month. ANOVA formula have been used to show difference between two or more components. Chi square test was used to test association among categorical variables and t-test was used to test differences between means of numerical variables. The level of statistical significance (P value) had been set as less than 0.05.

RESULTS

Table 1 shows the mean age of patients involved in the study and general operative notes. Table 2 shows that the most frequent risk factors were hyperlipidemia (78%), male gender (76%), hypertension (68%), smoking (66%), history of ischemic heart disease (IHD) (58%) and Diabetes mellitus (DM) (46%), respectively.

As shown in Table 3 and Figure 1, Spearman correlation showed non-significant correlations between ES II with NYHA class while Pearson correlation showed non-significant relation between ES II and pre-operative ejection fraction % (EF%). However, there was a statistically significant negative correlation between ES II and post-operative EF% like in Figure 2. Moreover, according to ES II and as shown in Table 4, Pearson correlation showed that ES II was significantly correlated with post-operative EF% in the high risk group (P= 0.026).

Table 5 illustrate the correlation between ES II and duration of ICU stay (in days) was statistically not significant (P=0.523). In Figure 3, there was non-significant correlation between pre-operative EF% with overall complications after surgery.

Also there were non-significant correlations between number of grafts with post-operative EF% and duration of surgery with post-operative EF%.

Results showed that only 4 out of 50 patients developed complications within 1 month after surgery and were equally distributed between low and moderate risk groups according to ES II classification.

Table 1: Mean age and operative notes among patients involved in the study (n=50)

Variables	Mean	SD
Age in years	59.04	10.351
Number of grafts	3.60	0.926
Bypass time (minutes)	111.66	26.77
Duration of surgery (hours)	5.33	0.91
Drainage 24-hour post-operative (ml)	631.80	343.20
ICU stay (days)	2.30	1.46

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Table 2: Distribution of risk factors among patients involved in this study and underwent coronary artery bypass graft surgery (CABG) (n=50)

Variable		Percent
Gender	Male	76 %
	Female	24 %
HTN	Yes	68 %
	No	32 %
DM	Yes	46 %
	No	54 %
Hyperlipidemia	Yes	78 %
	No	22 %
Smoking	Yes	66 %
	No	34 %
IHD history	Yes	58 %
	No	42 %

Table 3: Pearson Correlation of EuroScore II with multiple variables.

EuroScore With:	r	P
NYHA class	0.007*	0.961
Pre-operative EF %	-0.129	0.373
Post-operative EF %	-0.331	0.019
Duration of surgery	-0.071	0.622
Bypass Time	-0.070	0.629
Duration of ICU-stay	0.094	0.518
Duration of Ward-stay	0.103	0.478
Drainage24hrs	0.021	0.887
Pre-LVEDD	0.177	0.220
Post-LVEDD	0.193	0.179

* Spearman Correlation

Table 4: Variations in EuroScore II groups and Ejection Fraction between patients involved in this study.

Ejection Fraction (EF%)	EuroScore System Groups	Number of Patients	Minimum of EF %	Maximum of EF %	P
PreEF	Low risk	26	35	65	0.855
	Moderate risk	21	38	60	
	High risk	3	43	55	
	Total	50	35	65	
PostEF	Low risk	26	38	65	0.026*
	Moderate risk	21	35	65	
	High risk	3	40	48	
	Total	50	35	65	

* The high risk group is significantly different from the low and moderate risk groups.

The duration of ICU stay ranged from 2-4 days in low and high risk groups, while in the moderate risk group the range of ICU-stay was 2-12 days.

Table 5: Variations in EuroScore II groups and ICU stay (days) among the patients involved in the study.

EURO score	Number of patients	Mean of ICU-stay	Standard deviation	Standard error	Minimum days of ICU-stay	Maximum days of ICU-stay
Low risk	26	2.08	0.39	0.08	2	4
Moderate risk	21	2.57	2.20	0.48	2	12
High risk	3	2.33	0.58	0.33	2	3
Total	50	2.30	1.46	0.21	2	12

P = 0.523

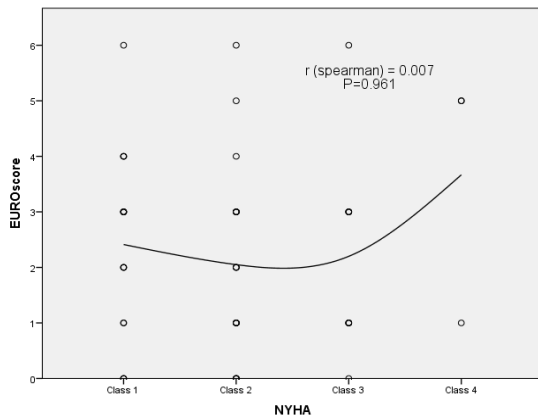


Figure 1: Spearman correlation between EuroScore II and New York Heart Association (NYHA) class (r=0.007, P=0.961).

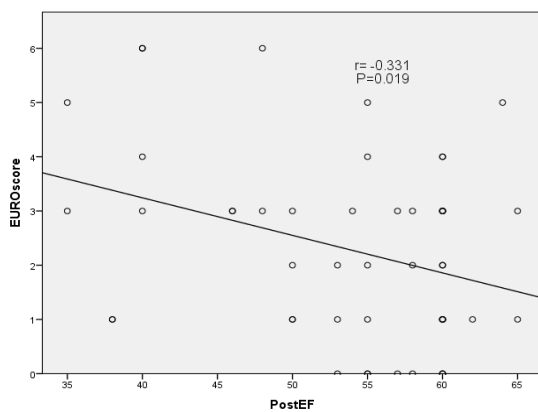


Figure 2: Pearson Correlation between EuroScore II (ESII) and Post-operative Ejection Fraction (EF%) (r=-0.331 and P=0.019).

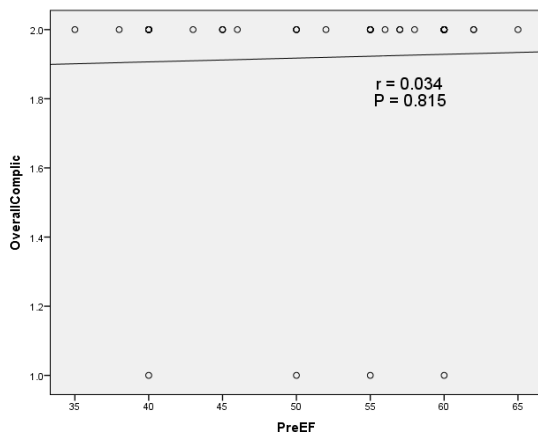


Figure 3: Pearson correlation between pre-operative ejection fraction% and overall complications after surgery (r=0.034 and P=0.815).

DISCUSSION

EuroSCORE (ES) is one of the most successful adult cardiac surgery risk scoring system, without any doubt, contributed to improve the quality of clinical research and patients’ care. Recently, its ability to stratify the operative risk has been criticized as it has been shown to overestimate the patient risk which may severely affect any assessment of clinical results and may lead to a false sense of risk prediction, underperformance may go undetected, and patient may be compromised¹¹. This study showed the non-significant correlation between EuroScore II (ES II) and New York Heart Association (NYHA), also there was non-significant relation between the pre-operative ejection fraction (EF%) and the ES II, (the EF% range of patients included in this study was 35-65%, there was no severe left ventricular dysfunction), the lower the pre-operative EF% would be the higher ES II which means higher risk for surgery but this relation statistically was non-significant. As far as we are aware of data concerning the correlation of ES II with NYHA classification and pre-operative EF are not available.

Also there was non-significant correlation between the pre-EF% and the overall complications post-operatively which was not consistent with a study that was done in 2010 which showed that pre-EF% was statistically significant predictor for higher rates of early and late mortality after CABG surgery¹², another study showed that the lower the pre-EF%, the more adverse outcomes to be expected¹³.

Only 4 out of 50 patients developed complications in short-term follow up, those 4 patients who suffered post-

operative complication had low and moderate risk in ES II scores, while the ES II high risk group which were 3 out of 50 patients, their operation passed smoothly without any complications. This result was non-consistent with a study in 2012 showed that ES II was a good predictor for immediate and short-term complications especially in high risk group¹⁴. However, results of the current study are consistent with another large cohort study in 2006 showed that ES models were not a good predictor for adverse outcomes post-operatively¹⁵. On the other hand, a study showed that ES II provides the clinicians and the patients with a good estimate of prognosis after surgery¹⁶. The duration of intensive care unit (ICU) stay post-operatively ranged between 2-12 days, mostly 2-4 days (which was a routine in AHC) in low and high risk groups and up to 12 days in moderate risk group according to ES II. The correlation between the ES II and the ICU stay was non-significant. This result was non consistent with a study that revealed a high pre-operative predictive value of ES II with ICU stay and its cost post-operatively¹⁷.

There was significant negative correlation between ES II (the high risk group) and the post-operative EF%. This indicates that patients with pre-operative high ES II are liable to low post-operative EF%, This interesting finding must be taken into consideration in high risk group patient as far as they are more prone to post-operative left ventricular failure.

There was no relation between the ES II and the duration of surgery statistically; the higher ES II didn't lead to longer surgery time; in this study the highest ES

II was 6 which were 3 out of 50 patients and their duration of surgery was ranging between 4 and 5 hours not reaching 7 hours which occur in more than 10 patients from the 50 patients who were involved in the study (distributed between the low and moderate risk groups).

There was non-significant correlation between ES II and bypass time because the bypass time depend on the number of grafts that are needed, on the surgeon's hand and any event that happened during surgery. Because data concerning the correlation of ES II with duration of surgery and bypass time are not available, it was not possible to compare current results with other studies.

In conclusion, ES II can be used in AHC to predict post-operative EF%, the higher the ES II, the lower post-operative EF%. However, ES II is not valuable to predict other short-term post-operative complications following CABG surgery.

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پوخته

دروستیا پیشبینیکرنا پولینکرنا مه ترسیا ئه وری بو نه خوشین دگه فنه بهر نشته ریا چاندنا خوینبه را ل بنگه هی ئازادی یی نشته ریا دلی / دهوکی / هه ریما کوردستانی / عیراق

پیشه کی: دببست سالی ن بوریدا گه له ک جورین مه ترسیا ئه وری هاتنه بکارئینان بو هه لسه نگاندا ریژا مه ترسیا پیشبینیکری بهری نشته ریا چاندنا خوینبه را دگه ل جیاوازا شیانین وی د هه لسه نگاندا ل سهرانسهری جیهانی ژلایی دووژانگین پیشبینیکری پشتی نشته ریی زیده باری ده می مانئ ل یه که یا چاقدیریا چر و پیرابوونا دلی پشتی چاندنا خوینبه ران.

ئارمانج: بو هه لسه نگاندا پیرابوونا پولینکرنا مه ترسیا ئه وری د فنه دیتنا دووژانگین پیشبینیکری پشتی کریارا نشته ریا چاندنا خوینبه ران ل بنگه هی ئازادی یی نشته ریا دلی.

بابه ت و ریکین فه کولینی: فه کولینا فی هه فبه ندیی ل بنگه هی ئازادی بو نشته ریا دلی ل دهوکی / هه ریما کوردستانی عیراق هاته کرن. ئه فی فه کولینی 50 نه خوش (38 نیرو 12 می) بخوشه گرتن و که تنه بهر نشته ریا چاندنا خوینبه ران. بهری وی چه ندی رزامه ندی ژه می نه خوشان هاته وه گرتن بو پیشکداریکرن دفی فه کولینیدا. نه خوش هاتنه هه لسه نگاندا ب ریکا پولینکرنا مه ترسیا ئه وری یا دووی بهری نشته ریی و پاشی ب وان دووژانگانه هاته گریدان کو پشتی نشته ریی رویدان ل ده می دیفچوونه کا کورت د ماوی هه یفه کیدا.

ئه حجام: نه خوش هاتنه پولینکرنا بو پیچه ک، نافنجی و گه له ک مه ترسیدار ب هژمارا 26 - 21 - 3 لدویف ئیک. په یوه ندیه کا کارتیکه ره پیدابوو دناقبه را پولینکرنا مه ترسیا ئه وری یا دووی بهری نشته ریی دگه ل ریژه یا شکه ستنا هاقیژه ر یا دلی ل نک نه خوشین خودان مه ترسیه کا گه له ک لدویف پولینکرنا ئه وری. لی په یوه ندیه کا هه فبه ندیی نه بوو دناقبه را مه ترسیا ئه وری یا دووی و دووژانگین په یدابووین د هه یفه کیدا پشتی نشته ریی و نه دگه ل ده می مانئ ژئ ل یه که یا چاقدیریا چر پشتی نشته ریی.

ده ره نه حجام: ل بنگه هی ئازادی یی نشته ریا دلی، چیدبیت پشت به ستن بهیته کرن ل سهر پولینکرنا مه ترسیا ئه وری یا دووی د بیشینکرنا ریژه یا شکه ستنا هاقیژه ر یا دلی پشتی نشته ریا چاندنا خوینبه ران (یا بلندتر ب پولینکرنا مه ترسیا ئه وری یا دووی بهری نشته ریی کو کیتر به ره م دئینیت ب ریژه یا شکه ستنا هاقیژه ر یا دلی پشتی نشته ریی). دگه ل وی چه ند پشت به ستن ل سهر پولینکرنا مه ترسیا ئه وری یا دووی ناهیه ته کرن د پیشبینیکرنا په یدابوونا دووژانگان د هه یفا ئیکیدا پشتی نشته ریی.

الخلاصة

صحة تنبؤ تصنيف الخطورة الاوربي للمرضى الخاضعين لعملية زراعة الشرايين التاجية في مركز ازادي لجراحة القلب/ دهوك/ إقليم كردستان العراق

الخلفية: خلال العشرين سنة الماضية تستخدم انواع من تصنيف الخطورة الاوربي لتقييم نسبة الخطورة المتوقعة قبل اجراء عملية زراعة الشرايين التاجية مع اختلاف قابليته في التقييم في مختلف انحاء العالم من ناحية المضاعفات المتوقعة بعد العملية بالاضافة لمدة البقاء في وحدة العناية المركزة و اداء القلب بعد زراعة الشرايين.

الاهداف: لتقييم اداء تصنيف الخطورة الاوربي في كشف المضاعفات المتوقعة بعد اجراء عملية زراعة الشرايين التاجية في مركز ازادي لجراحة القلب.

المواضيع وطرق البحث: دراسة الارتباط هذه اقيمت في مركز ازادي لجراحة القلب في دهوك/اقليم كردستان/عراق، شملت هذه الدراسة 50 مريض (38 ذكر و12 انثى) خضعوا لعملية زرع الشرايين التاجية، اخذت الموافقة المسبقة من جميع المرضى للمشاركة في هذه الدراسة. تم تقييم المرضى بواسطه تصنيف الخطورة الاوربي الثاني قبل العملية ومن ثم ربطه بالمضاعفات التي حدثت بعد العملية بفترة المتابعة القصيرة البالغة شهر واحد.

النتائج: تم تصنيف المرضى الى قليل، متوسط وعالي الخطورة باعداد 26 - 21 - 3 على التوالي. وجدت علاقة مؤثرة بين تصنيف الخطورة الاوربي الثاني قبل العملية مع نسبة الكسر القذفي للقلب في المرضى ذوي الخطورة العالية حسب التصنيف الاوربي. ولم توجد هناك علاقة ارتباط بين تصنيف الخطورة الاوربي الثاني و المضاعفات الحاصلة خلال شهر واحد بعد العملية ولا مع طول فترة البقاء في وحدة العناية المركزة بعد العملية.

الاستنتاجات: في مركز ازادي لجراحة القلب من الممكن الاعتماد على تصنيف الخطورة الاوربي الثاني في توقع نسبة الكسر القذفي للقلب بعد عملية زرع الشرايين (الاعلى بتصنيف الخطورة الاوربي الثاني قبل العملية ينتج الاقل بنسبة الكسر القذفي للقلب بعد العملية). مع ذلك لا يمكن الاعتماد على تصنيف الخطورة الاوربي الثاني في توقع حدوث المضاعفات خلال الشهر الاول بعد العملية.