Are Calcium-Channel Blockers Mandatory Postoperatively with Radial Artery Grafting in CABG Patients

Original Article

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ABSTRACT

Background: Radial artery (RA) is one of the best conduit options for patients receiving coronary artery bypass grafting (CABG). One of RA's main supposed drawbacks as a graft conduit is its tendency for spasms, and possible subsequent affection of recurrent ischemia. Multiple efforts were done throughout the years for avoiding the spastic nature of RA, with one of those being perioperative use of calcium-channel blockers (CCBs). But so far, all the scientific evidence has been under debate and controversial.

Aim and Objectives: The aim of this work is to assess the quality of immediate postoperative convalescence and outcome of CABG patients who received radial artery conduit, with no perioperative use of calcium-channel blockers. Therefore, eliminating unnecessary postoperative medication.

Subjects and Methods: The study was a retrospective cohort study on one-hundred and forty patients, who had undergone CABG operation with radial artery conduit and no perioperative calcium-channel blocker use.

The study was done at the Cardiothoracic Surgery Department Ain Shams University and the Memorial Souad Kafafi University Hospital. By reviewing patient medical data from 1/1/2016 till 31/12/2023, after institutional consent.

Result: There was no necessity nor indication for calcium-channel blocker use perioperatively. As patients had an unremarkable immediate postoperative period up to at least one month, in regard to recurrence of cardiac ischemia.

Conclusion: The current study showed that the use of calcium-channel blockers (CCBs) isn't mandatory as anti-spastic measure with radial artery (RA) conduit in CABG. And so, should be avoided unless there's another medical indication based on each individual case. In order to help with postoperative patient compliance and avoiding unnecessary prescriptions.

Key Words: Coronary artery bypass grafting, calcium-channel blockers, radial artery.

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INTRODUCTION

In coronary artery bypass grafting (CABG), conventional practice is to use arterial conduit supplemented by venous, usually saphenous, grafts (SVG). The use of multiple arterial revascularization (MAR), or total arterial revascularization (TAR), however, has shown improved survival rates with fewer graft failures[1].

A main option for arterial conduit is radial artery (RA), after left and right internal thoracic mammaries (LIMA and RIMA). Despite that, RA use as arterial conduit in CABG remains rare in approximately 2-5% of CABG cases worldwide.

Extensive efforts into studying radial artery as conduit in CABG, aimed at managing its main disadvantage of being susceptible to severe spasms. Suggesting through the years, utilizing different tools whether pharmacological or surgical. But none of which has been standardized.

Calcium-channel blockers (CCBs) being the main pharmacological tool studied to combat the spastic downside of radial artery, and mainly Diltiazem, have been used in the perioperative period in patients undergoing CABG to prevent subsequent arterial graft spasm. However, there was no significant short-term nor long-term advantages over those who did not receive diltiazem[2].

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Such studies as conducted by ***Acar et al.*** reviewed 50 patients long-term postoperatively. Angiography after 5-7 years showed no differences regarding graft failure among patients on CCB treatment (*N*=27) compared to the ones who had not received CCB treatment (*N*=23)[3].

AIM OF THE WORK

The aim of this work is to see if calcium-channel blockers' perioperative use is mandatory with radial artery conduits in CABG patients. By assessing quality of immediate postoperative convalescence and outcome of CABG patients who received RA conduit, with no perioperative use of CCBs.

PATIENTS AND METHODS

In this study, one-hundred and forty patients who had undergone CABG operation with radial artery conduits were included. The study was done at the Cardiothoracic Surgery Department Ain Shams University and the Memorial Souad Kafafi University Hospital, retrospectively reviewing patient data from 1/1/2016 till 31/12/2023, after institutional consent and according to the following inclusion and exclusion criteria.

Inclusion criteria: Isolated coronary artery bypass grafting operation, whether on or off-pump, in which radial artery conduit was used. And no perioperative use of calcium-channel blockers.

Exclusion criteria: Concomitant cardiac procedure, history of previous cardiac procedure, chronic peripheral vascular disease, radial artery insufficiency, chronic left atrial dilatation, minimally-invasive surgical approaches, Ejection Fraction <30%.

The one-hundred and forty patients' reviewed data included the following:

Preoperative parameters:

History taking, Clinical examination, Investigation: routine laboratory investigations, electrocardiogram (ECG): 12- lead electrocardiogram was done to record the basic rhythm of the patient whether sinus rhythm or A.F, radiological examination of the chest and echocardiography: M-mode, two dimensional and doppler echocardiography for each patient. Evaluation included assessment of the left ventricular end-diastolic diameter (EDD), left ventricular end-systolic diameter (ESD), ejection fraction (EF), left ventricular wall motion, any valvular pathology and morphology, Coronary Angiography, Modified Allen's test, and upper limb doppler if needed.

Operative Parameters: The following data were reviewed for statistical analysis:

Cardiopulmonary bypass (CPB) time: duration in minutes from initiation of CPB and until successful patient weaning.

Cross-clamp time: duration in minutes from applying the aortic clamp until removal of the clamp.

Weaning off-bypass: whether eventless or complicated.

Use of inotropic support after weaning from cardiopulmonary bypass.

Postoperative Parameters: All patients were reviewed for the following data:

Postoperative ECG, and continuous monitoring for any signs of ischemic changes or compromised cardiac output.

Postoperative rhythm, whether sinus or atrial fibrillation (AF).

Total intensive care unit stay.

Duration of inotropic infusions.

Total hospital stay.

Morbidity or mortality during admission, chest or other complications.

Readmission within one month after discharge, due to cardiac reasons.

Statistical Analysis: data were analyzed using Statistics Package for Social Science (SPSS) version 25. Qualitative data were expressed as frequency and percentage. Continuous quantitative data were expressed as mean ± standard deviation (SD).

Mean (average): the central value of a discrete set of numbers, specifically the sum of values divided by the number of values.

Standard deviation (SD): is the measure of dispersion of a set of values. A low SD indicates that the values tend to be close to the mean of the set, while a high SD indicate that the values are spread out over a wider range.

RESULTS

Table 1: Description of medical history in all studied patients.

Medical history		All patients (*n*= 140)	
DM	Yes	67	47.9%
	No	73	52.1%
HTN	Yes	80	57.1%
	No	60	42.9%
AF	Yes	21	15.0%
	No	119	85.0%
RHD	Yes	0	0.0%
	No	140	100.0%

DM=Diabetes Mellitus, HTN=Hypertension, AF=Atrial Fibrillation, RHD=Rheumatic Heart Disease.

Table 2: Description of pre-operative laboratory data in all studied patients.

Laboratory Data		All patients (n= 140)	
CBC	Normal	140	100.0%
	Abnormal	0	0.0%
INR	Normal	140	100.0%
	Abnormal	0	0.0%
LFTs	Normal	139	99.3%
	Abnormal	1	0.7%
KFTs	Normal	139	99.3%
	Abnormal	1	0.7%

CBC=Complete Blood Count, INR=International Normalised Ratio, LFTs=Liver Function Tests, KFTs=Kidney Function Tests

Table 3: Description of pre-operative HR rhythm in ECG for all studied patients.

ECG		All patients (*n*= 140)	
HR	Sinus Rhythm	119	85.0%
	AF	21	15.0%

ECG=Electrocardiogram, HR=Heart Rate, AF=Atrial Fibrillation

Table 4: Description of pre-operative chest imaging findings in all studied patients.

		All patients (*n*= 140)	
Chest Imaging	Normal	131	93.5%
	Abnormal	9	6.4%
Abnormal Chest Imaging Findings (*n*= 9)			
Hyper inflated lung		1	11.1%
Mild Pericardial effusion		5	55.5%
Mild Pleural effusion		3	33.3%

Table 5: Description of pre-operative EF in echo in all studied patients.

		All patients (*n*= 140)
EF (%)	Mean ± SD	52.1 ± 11.6
	Min – max	32 – 68

EF=Ejection Fraction

Table 6: Description of operative data in all studied patients.

Operative data		All patients (*n*= 140)
CPBT (minutes)	Mean ± SD	100.9 ± 13.1
	Min – max	80 – 130
CCT (minutes)	Mean ± SD	70.1 ± 9.6
	Min – max	50 – 95
Total operation time (minutes)	Mean ± SD	221.1 ± 22.6
	Min – max	180 – 275

CPBT=Cardiopulmonary Bypass Time, CCT=Cross-clamp Time

Table 7: Description of post-operative data in all studied patients:

Post-Operative Data		All patients (*n*= 140)	
HR rhythm	Sinus Rhythm	119	85.0%
	AF	21	15.0%
ECG changes	Elevated ST segment	28	20.0%
	No changes	112	80.0%
Low COP	Yes	0	0.0%
	No	140	100.0%
ICU Stay (days)	Mean ± SD	2.4 ± 0.6	
	Min – max	1.5 – 4	
Total Hospital Stay (days)	Mean ± SD	6.4 ± 0.6	
	Min – max	5.5 – 8	
Inotropic infusion (days)	Mean ± SD	1.4 ± 0.6	
	Min – max	0.5 – 3	
Chest complications	Yes	2	1.4%
	No	138	98.6%
Other complications	Elevated KFTs	2	1.4%
	No	138	98.6%
Morbidity and Mortality	Yes	0	0.0%
	No	140	100.0%
Readmission Due to Cardiac Reasons (within 1 month of discharge)	Yes	0	0.0%
	No	140	100.0%

HR=Heart Rate, ECG=Electrocardiogram, COP=Cardiac Output, ICU=Intensive Care Unit, AF=Atrial Fibrillation, KFTs=Kidney Function Tests

DISCUSSION

Although in recent years, the use of the RA has been very limited among the surgical community, the publication of the results of the primary analysis of RADIAL and the consequent Class I indication in the 2018 ESC/EACTS guidelines are likely to elicit renewed interest for the artery and the issues related to its use for CABG[4].

In regard to the thick muscular wall of the RA and concerns of graft spasm, CCB is traditionally prescribed postoperatively for CABG-RA patients[5]. However, just few studies have evaluated the effect of CCB on the angiographic and clinical outcome of RA grafts relating to adverse cardiac events[6] and repeat revascularization, and in most studies, the results have been neutral[7] Therefore, the evaluation of CCB efficacy in patients with RA grafts is of major relevance for the patients and the cardiovascular community.

One of the studies cited to support CCB use with RA grafts, is the one done by ***Gaudino et al.***, in which they correlated CCB use with reduced postoperative complications, such as a shorter ICU stay and reduced need for prolonged inotropic support[8] Which are some of the parameters used in our study for evaluation of immediate postoperative patient convalescence.

In our study, the mean age of the study group was 58.2 (±12.2) years with range of (21 – 82). As regard sex, there were 94 males (67.1%) and 46 females (32.9%) in all studied patients. As regard smoking, there were 74 smokers (52.9%) and 66 non-smokers (47.1%) in all studied patients.

In the study group, 47.9% of patients had a history of diabetes mellitus (DM), 57.1% had hypertension (HTN), and 15% had atrial fibrillation (AF), while 85% maintained sinus rhythm, and none had a history of rheumatic heart disease (RHD).

Preoperative laboratory workup was normal in all patients (100%), with exception of LFTs and KFTs, which were normal in one patient each (0.7%).

There was preoperative sinus rhythm in 119 patients (85%) and AF in 21 patients (15%). Preoperative chest imaging revealed normal findings in 131 patients (93.5%), with only 9 patients (6.4%) demonstrating nonsignificant abnormalities.

The preoperative mean EF was 52.1 (±11.6)% with a range from 32% to 68%.

As regard operative data, the mean CPBT was (100.9 ± 13.1) min. with range of (80 – 130) min. in all studied patients. The mean CCT was (70.1 ± 9.6) min. with range of (50 – 95) min. in all studied patients. The mean total operation time was (221.1 ± 22.6) min. with range of (180 – 275) min. in all studied patients.

Preoperative patient data was comparable to those included in similar major studies conducted by ***Gaudino et al.***[9], and ***Deboard et al.***[10], on CABG with RA patients.

Postoperatively, 85% of patients maintained sinus rhythm while 15% exhibited controlled atrial fibrillation, and ECG changes were minimal with only 20% showing mild ST-segment elevation (the remaining 80% had no changes). Low cardiac output was absent in all patients. The mean ICU stay was 2.4 ± 0.6 days (range, 1.5–4 days), and the total hospital stay averaged 6.4 ± 0.6 days (range, 5.5–8 days), with inotropic support required for an average of 1.4 ± 0.6 days (range, 0.5–3 days). Additionally, postoperative chest complications and other complications were rare (each occurring in only 1.4% of patients), with no peripheral ischemia reported, and there were no instances of morbidity, mortality, or readmission due to cardiac reasons within one month of discharge.

Which are consistent with desired outcome for CABG patients generally, and comparable to findings in studies assessing patients after CABG with RA.

CONCLUSION

Patients undergoing coronary artery bypass grafting (CABG) surgery with use of radial artery (RA) conduit without perioperative use of calcium channel blockers (CCBs), have shown favorable immediate post-operative results, with no need for additional pharmacological or surgical intervention relating to RA graft.

Regarding ICU and hospital length of stay, dependency on inotropic infusions, as well as no debilitating postoperative ECG changes, which would be indicative of ischemia resulting from spastic coronary graft.

Meaning that use of perioperative CCBs with RA conduits in CABG as a form of antispastic measure, isn't mandatory.

And so, supporting the use of RA conduit in myocardial revascularization, without unnecessary use of CCBs.

AUTHORS' CONTRIBUTION

Topic was chosen by main author, Prof. Dr. Gamal Sami Sayed.

Data collection, writing & review done by collaborative work of all participating authors.

CONFLICT OF INTEREST

None of the participating authors has any conflicts of interest with subject matter and process, whether financial or any other.

ETHICAL CONSIDERATIONS

Study protocol was reviewed by the Research Ethics Committee (REC) at the Faculty of Medicine, Ain Shams University. And approved with no ethical concerns. [FMASU MS 686/2024].

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هل حاصرات قنوات الكالسيوم إلزامية بعد جراحة القلب المستخدم بها الشريان الكعبري لدى مرضى ترقيع الشريان التاجي؟

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المقدمة: يُعد الشريان الكعبري (RA) أحد أفضل خيارات التوصيلات الشريانية للمرضى الذين يخضعون لجراحة مجازة الشريان التاجي (CABG). ولكن يعتبر من أهم عيوبه المزعومة كوصلة شريانية هو ميله للتعرض للتشنجات بسهولة، واحتمالية حدوث نقص تروية دموية متكررة لاحقًا. وقد بُذلت جهود متعددة على مر السنين لتجنب الطبيعة التشنجية للشريان الكعبري، وكان من بينها استخدام حاصرات قنوات الكالسيوم (CCBs) أثناء وبعد الجراحة. ولكن حتى الآن، لا تزال جميع الأدلة العلمية موضع نقاش وجدل.

الهدف: يهدف هذا العمل إلى تقييم جودة فترة النقاهة بعد الجراحة مباشرةً ونتائج مرضى جراحة مجازة الشريان التاجي والمستخدم بها الشريان الكعبري كأحد الوصلات الشريانية، دون استخدام حاصرات قنوات الكالسيوم أثناء الجراحة أو في فترة ما بعد الجراحة. وبالتالي، يتم الاستغناء عن الأدوية غير الضرورية ما بعد الجراحة.

المواد والطرق: أجريت هذه الدراسة بأثر رجعي على مائة وأربعين مريضًا خضعوا لجراحة مجازة الشريان التاجي (CABG) باستخدام الشريان الكعبري (RA) كأحد الوصلات الشريانية، ودون استخدام حاصرات قنوات الكالسيوم (CCBs) أثناء أو بعد الجراحة.

أُجريت الدراسة في قسم جراحة القلب والصدر بجامعة عين شمس ومستشفى سعاد كفافي الجامعي. بمراجعة البيانات الطبية للمرضى من ٢٠١٦/١/١ حتى ٢٠٢٣/١٢/٣١، بعد الحصول على الموافقات المؤسسية.

النتيجة: لم تكن هناك ضرورة أو مؤشر لاستخدام حاصرات قنوات الكالسيوم (CCB) أثناء أو بعد الجراحة. حيث أن فترة ما بعد الجراحة مباشرة كانت سلسة ولم تشمل على حدوث أي مؤشرات تدل على وجود قصور بالشريان الكعبري كوصلة شريانية على الشرايين التاجية. حيث كانت مؤشرات المرضى ضمن المعدل الطبيعي المقبول ما بعد الجراحة، مع عدم حدوث أي مضاعفات قلبية أو وجود داع لإعادة الحجز بالمستشفى على مدار شهر ما بعد الجراحة.

الاستنتاج: أظهرت الدراسة الحالية أن استخدام حاصرات قنوات الكالسيوم (CCBs) ليس إلزاميًا كإجراء مضاد للتشنج مع الشريان الكعبري (RA) في جراحة مجازة الشريان التاجي. وبالتالي، يجب تجنبها ما لم يكن هناك مؤشر طبي آخر بناءً على كل حالة على حدة. وذلك للمساعدة في التزام المريض بالعلاج بعد الجراحة وتجنب الوصفات الطبية غير الضرورية.