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Article

Impact of Nurse Practitioners on Guideline-Directed Medical Therapy at Discharge on Patients with Recent Acute Coronary Syndrome after Coronary Artery Bypass Graft Surgery

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Abstract

Background: Skills and knowledge of acute care nurse practitioners (ACNPs) are important resources within the healthcare team. Few studies have been conducted on their impact in terms of adherence to guideline-directed medical therapy (GDMT) at the time of discharge. **Methods**: A retrospective cohort study of 160 patients with a diagnosis of recent acute coronary syndrome (ACS) prior to coronary artery bypass graft surgery in Eastern Canada was conducted. Eighty randomly selected patients in each group were compared, one led by the physicians, and the other with the presence of ACNPs within the team. **Results**: In the physician-led group, adherence to GDMT at discharge was not reached in 47 patients versus six in the group with ACNPs (58.8% vs. 7.5%; χ^2 (1) = 45.58; p = 0.0001). Of the 47 non-adherent patients, 29 suffered a nonST segment elevation myocardial infarction. The main reason for non-adherence in both groups was the omission of dual antiplatelet therapy prescription. Mean length of stay in hours was longer in the physician-led group than in the group with ACNPs (148.1 vs. 127; F (1, 158) = 2.053; p = 0.154). At 30 days, returns to the emergency department (9 vs. 16; χ^2 (1) = 2.323, p = 0.127) and readmissions (4 vs. 8; χ^2 (1) = 1.441, p = 0.230) for cardiac surgery complications were not statistically different between both groups. **Conclusion**: On a cardiac surgery unit, the ACNP is a valuable addition with respect to adherence to GDMT at discharge in an ACS population post surgical revascularization.

Keywords

secondary prevention; nurse practitioners; guidelines

Introduction

The number of cardiac surgeries has been increasing steadily, with an annual range over 2000 in some Canadian centers [1]. The need for acute care nurse practitioners (ACNPs) on cardiac surgery wards has changed rapidly due to the decrease in numbers of surgical residents, pressure to reduce length of stay and increased patient acuity levels [2]. ACNPs are health professionals authorized to make diagnoses and prescribe appropriate treatments autonomously [3,4]. In Quebec, ACNPs require a master's degree in nursing science that combines knowledge in medicine and in nursing [5]. Nurse practitioner and physician co-management increases adherence to guideline-directed medical therapy (GDMT) and supports best practice in primary care settings [6].

However, to our knowledge, there is no study assessing the medical evidence-based practice by the integration of ACNPs on a postoperative cardiac surgery unit. At the McGill University Health Centre (MUHC), cardiac surgery residents were traditionally in charge of patient care and discharge plan, in collaboration with the cardiac surgeons. Since January 2017, ACNPs were integrated into the adult cardiac surgery team. This change offered an opportunity to evaluate added value of ACNPs on adherence to GDMT regarding cardiovascular secondary prevention at the time of discharge.

Objectives

The primary objective of this study is to evaluate the impact of the presence of ACNPs' care within a healthcare team compared to physician-led care on adherence to GDMT regarding secondary cardiovascular prevention at discharge in patients with acute coronary syndrome (ACS) within three months prior to coronary artery bypass graft (CABG) surgery.

The secondary objective was to explore the impact of the presence of ACNPs' care relative to physician-led care on length of stay, as well as emergency visits and readmission rates within 30 days post-discharge.

Materials and Methods

Primary End-Point

The authors have based adherence to GDMT on the 2014 AHA/ACC Guideline for the Management of Patients with Non-ST-Elevation Acute Coronary Syndromes' guideline [7]. Recommendations regarding medication to prescribe following an ACS event have not changed since 2014 [8]. Four classes of medication were considered to be adherent to GDMT: presence of dual antiplatelet therapy (DAPT), beta-blockers, angiotensin-converting enzyme inhibitor (ACEi)/angiotensin II receptor blockers (ARB) and an optimized dose of hydroxymethylglutaryl-CoA reductase inhibitors, also known as statins (see Table 1).

However, adherence to GDMT was granted for patients even if one of these therapies were not prescribed since there was a valid reason for omission, such as acute kidney injury, hypotension and post-operatively major bleeding complications (see Table 2).

The involvement of a cardiac surgery pharmacist in patient's discharge prescriptions was also identified by the authors. The pharmacists on the unit can give advice regarding medication at discharge. Nevertheless, the prescriber (the physician, resident or ACNP) remains the person that does and finalizes the discharge medication prescription.

Secondary End-Point

The length of stay is defined from the post-operative arrival of the patient on the cardiac surgery unit until the date of discharge. The time at the intensive care unit is excluded, because a different team is treating the patient. Cardiac surgery complications requiring visit to the emergency department or hospital readmission within 30 days of discharge are determined using the visit records in the patient computerized chart. Emergency visits and readmissions rates were collected from a single centre in both groups.

Table 1. Medication classifications recommended after an ACS.

DAPT
Beta-blockers
ACEi/ARBs
Optimized dose of hydroxymethylglutaryl-CoA reductase inhibitors (statins)

DAPT, dual antiplatelet therapy; ACEi, angiotensin-converting enzyme inhibitor; ARB, angiotensin II receptor blockers; ACS, acute coronary syndrome.

Definitions

The physician-led care group was selected from the 2016 patient registry (January 1st 2016–December 31st 2016) and the ACNP group from the 2022–2023 registry (May 16th 2022–May 15th 2023).

The physician-led care group is defined as the presence of a resident at the time of discharge. The cardiac surgery residents work in collaboration with the attending surgeons. In addition to working during weekdays, the residents take care of the patients during weekends and night shifts. In this group, there were no ACNPs.

The group with ACNPs within the healthcare team is defined by the presence of an ACNP at the time of discharge. ACNPs are responsible to write the hospitalisation summary and prescribe the discharge medication. The investigators decided to select patients operated between May 2022 and May 2023 to exclude the potential impact of COVID-19. ACNPs were reassigned during the pandemic providing less stability on the cardiac surgery ward. The years 2022 and 2023 are those with the most consistency in terms of numbers of ACNPs on the unit since their arrival in 2017.

In both groups, a cardiac surgery pharmacist was present on the unit. Pharmacist work during weekdays from 8 am to 4 pm. Their presence is not constant during the week, since they can be assigned to other units. The pharmacist, when available can make medication suggestions throughout the hospitalisation. At time of discharge, if needed, they can give advice on medication therapy.

Throughout this study, an ACS was defined, as per the 2014 AHA/ACC Guideline [7], as a non-ST segment elevation myocardial infarction (NSTEMI), ST elevation myocardial infarction (STEMI) or unstable angina (UA).

Study Design and Sample

This study is a retrospective cohort study that took place at the MUHC adult cardiac surgery ward. Approximately 270 patients annually underwent isolated CABG per year. All patients were grafted with conventional left internal mammary artery and/or saphenous vein as primary conduits. The study population was selected from the cardiac surgery department's registry of patients. Patients were identified using discharge summary sheets and progress notes. A data extraction sheet was created using an Excel spreadsheet. A third-year medical student acting as a research assistant and the principal investigator performed the data extraction. Adherence to GDMT at discharge was determined by the investigators.

Using the G*Power software (version 3.1.9.4, Program Written by Franz Faul, Universität Kiel, Germany),

Table 2. Valid reasons for omitting one or more therapy while remaining adherent to GDMT.

DAPT	– Patient taking direct-acting oral anticoagulant: No aspirin. (Adherent if on P2Y12 receptor antagonist + direct-acting oral anticoagulant) – Major bleeding complications – Pericardial effusion
Beta-blockers	– Pulse lower than 60 beats per minute – Systolic blood pressure lower than 110 – Intolerant to beta-blocker – If a non-dihydropyridine or dihydropyridine calcium channel blocker (e.g., diltiazem or amlodipine) is prescribed for a radial artery harvest – On an antiarrhythmic (sotalol, amiodarone)
ACEi/ARBs	– Estimated glomerular filtration rate lower than 30 – Serum potassium above 5.0 – Acute kidney injury – Systolic blood pressure lower than 110 – Intolerance to ACEi or ARBs – History of angioedema – Fluid overload requiring furosemide – Radial artery harvest
Statins	– Intolerant to statins defined by elevated markers of liver function or muscle function, as well as myopathy

GDMT, guideline-directed medical therapy.

we estimated a priori that a total sample size of 160 patients was necessary to detect a small to moderate effect size (w = 0.30), with a power of 0.95 and a probability of error of 0.05. A random sampling procedure was used to select the patients in each cohort. The web-based random number generator selected 80 different patients for each cohort. This allowed to have satisfactory statistical power based on a priori analysis in order to detect a significant difference between the cohorts with a moderate effect size.

Inclusion and Exclusion Criteria

Patients over the age of 18 years who were diagnosed with ACS within the three months-period preceding their CABG surgery and still requiring DAPT in the postoperative period were included in this study. Patients were excluded if they had a concomitant procedure with their CABG surgery.

Data Analysis

The primary endpoint was explored by comparing the percentage of patients whose prescribed medications at the time of discharge was adherent to GDMT regarding the 2014 AHA/ACC Guideline for the Management of Patients with Non-ST-Elevation Acute Coronary Syndromes. A chi-square statistic was computed to determine if the difference was statistically significant. Univariate analyses of variance were conducted in order to detect differences between the two cohorts on length of stay, the 30-day emergency visit, and the 30-day readmission at the MUHC for cardiac surgery complications. In order to verify the exactitude of the data entry, a random sample of 10 patients per group was independently coded by a member of the research team (HL). A perfect agreement was reached between the two coders (Cohen's kappa = 1).

A series of ANOVAs and chi-square analyses were conducted in order to detect any potential differences in provider adherence to GDMT based on the demographic characteristics within each cohort separately. Based on univariate analysis, there were no significant differences suggesting that patients' demographic characteristics were related to the adherence outcome. Therefore, no multivariate regression analysis was necessary.

Demographics, physical health characteristics, and medical history variables are described using descriptive statistics such as frequencies, percentages, means, and standard-deviations (see Table 3). Study variables are presented using frequencies and percentages (ordinal variables) and means and standard-deviations (continuous variables).

Table 3. Patient Demographics and Medical Information.

Variable	Physician-led group	Presence of ACNPs group	*p*-value
	N (%) or Mean	N (%) or Mean	
Age (years)			
Mean (SD)	66.2 (9.1)	67.1 (9.3)	$p = 0.519$
Sex			
Male (%)	73.8%	86.3%	$p = 0.015$
Weight (kg)	82 (17.95)	79.4 (16.44)	$p = 0.592$
BMI (kg/m^2)	32.9 (5.03)	31.7 (5.78)	$p = 0.019$
Smoking (%)			$p = 0.008$
Active	21.3%	15.0%	
Former	25%	6.3%	
ACS subtype (%)			$p = 0.255$
UA	23.8%	17.5%	
NSTEMI	61.3%	71.3%	
STEMI	15%	11.3%	
Hypertension (%)	85%	81.3%	$p = 0.828$
Dyslipidemia (%)	67.5%	80%	$p = 0.028$
Diabetes (%) (Type 2)	43.8%	30%	$p = 0.102$
CKD: eGFR (mL/min/1.73 m^2) <60 (%)	10%	16.3%	$p = 0.339$
EF pre-op (%)	49 (11.99)	50 (14.29)*	$p = 0.884$

*EF value was available for 61 patients. UA, unstable angina; NSTEMI, non-ST segment elevation myocardial infarction; STEMI, ST elevation myocardial infarction; ACNPs, acute care nurse practitioners; CKD, Chronic kidney disease.

Table 4. Adherence to GDMT results.

	Physician-led group	Presence of ACNPs group	*p*-value
	N (%)	N (%)	
Non-adherent	47 (58.8)	6 (7.5)	$p = 0.0001$
Non-adherence ACS subtype			
UA	12 (25.5)	5 (83.3)	
NSTEMI	29 (61.7)	1 (16.7)	
STEMI	6 (12.8)	0 (0)	
Reason for non-adherence			
No DAPT	34 (72.3)	5 (83.3)	
No ACEi/ARBs	4 (8.5)	1 (16.7)	
Statin not optimized	9 (19.1)	0 (0)	

Results

Demographics

In the physician-led group, 284 patients had a CABG procedure alone. Of this cohort, 132 patients had an ACS. In the group with ACNPs, 264 patients had a CABG procedure alone. Of this cohort, 142 patients had an ACS and were seen by an ACNP at discharge. Eighty patients were randomly selected in each group.

Table 3 presents patient demographics and medical information. There were more former smokers or current smokers in the physician-led care group ($p = 0.008$). NSTEMI was the main indication for CABG in both groups.

Primary End-Point

Among patients considered adherent to GDMT at discharge despite omitting one or more therapies for a valid reason, the physician-led group had 14 patients, compared with 43 in the group with ACNPs (χ^2 (1) = 2.5552, p = 0.1333).

In the physician-led group, 47 patients did not meet adherence to GDMT at discharge versus six in the group with ACNPs (58.8% vs. 7.5%; χ^2 (1) = 45.58; $p = 0.0001$). Of the 47 patients in the physician-led group, 29 patients suffered a NSTEMI. As for the group with ACNPs, the non-adherence to GDMT was mostly seen with the presentation of UA (n = 5). The main reason for non-adherence to GDMT was the omission of DAPT's prescription in both groups (See Table 4).

Table 5. Secondary End-Point results.

	Physician-led group	Presence of ACNPs group	*p*-value
Mean length of stay (in hours)	148.1	127	$p = 0.154$
Returns to the emergency department at 30 days	N = 9	N = 16	$p = 0.127$
Readmissions at 30 days	N = 4	N = 8	$p = 0.230$

No difference was found with regard to the involvement of the pharmacist and adherence to GDMT for the physician-led group (χ^2 (1) = 1.950, p = 0.163), nor the group with ACNPs (χ^2 (1) = 0.191, p = 0.662).

Secondary End-Point

Mean length of stay (in hours) was longer in the physician-led group versus the group with ACNPs, but the difference was not statistically significant (148.1 vs. 127; F (1, 158) = 2.053; p = 0.154). Return to the emergency department at 30 days (9 vs. 16; χ^2 (1) = 2.323, p = 0.127) and readmission at 30 days (4 vs. 8; χ^2 (1) = 1.441, p = 0.230) for cardiac surgery complications were also not statistically different between both groups (see Table 5).

Discussion

Adherence to GDMT

Long-term graft patency, which is translated to freedom of ischemia and potential left ventricle function preservation, is the main objective of CABG [9]. However, graft failure may occur in a substantial proportion of CABG conduits. Multiple non technical mechanisms can be associated with graft failure, such as thrombosis, endothelial dysfunction, vasospasm, and oxidative stress [9]. Pharmacological prevention is associated with long-term benefits of revascularization, such as reduced morbidity and mortality [10]. In addition, secondary prevention after CABG has been shown to slow the progression of atherosclerosis in both native and grafted vessels, as well as prevent atherothrombotic complications [9–11].

Role of ACNPs

The earlier study addressing the impact of ACNP within a healthcare team was conducted in Alberta in 2004 [12]. The goal was to assess health care providers' perceptions regarding the impact of the novel ACNP role on a cardiothoracic intensive care unit. The results suggested ACNPs enhanced the continuity of care, communication within the team, and improved the planning of treatment goals in line with the patient's wishes.

Another study conducted in 2012 examined the effectiveness of ACNP-led care relative to hospitalist-led care in a post-operative cardiac surgery unit [2]. No significant differences were found regarding the length of stay, rate of readmissions, number of post-operative complications, or patient attendance at scheduled cardiology follow-up appointments. However, the group of patients cared for by an ACNP had higher satisfaction scores related to teaching, answering questions, listening skills, and pain management.

To the best of our knowledge, this study seems to be one of the first to compare physician-led care to the addition of ACNP care focusing on adherence to GDMT in ACS patients who have undergone successful surgical revascularisation.

This study found that adherence to GDMT at discharge was significantly higher in the group with ACNPs compared to the physician-led group. Similar adherence rates to GDMT among teams with ACNPs have also been reported in primary care and in the intensive care unit [6,13].

One of the main findings of the present study consists of the frequent omission of DAPT for NSTEMI in the physician-led group. Aggressive antiplatelet therapy may risk higher incidence of bleeding complications [14]. Yet, studies have shown that DAPT was not associated with an increased risk of bleeding while compared with aspirin alone in a CABG population [15,16]. On the other hand, the benefits of increasing the durability of bypass grafts were well documented and have recommended to continue DAPT at least for a year after CABG [7,8].

Length of Stay, Emergency Visits and Readmissions

This study observed a trend towards a shorter length of stay by approximately 24 hours in the group with ACNPs. The difference could be partially explained by the possibility of a closer follow-up with an ACNP in the post-operative clinic. The reasons for ACNP's follow-up are broad, ranging from surgical wound and blood tests monitoring to medication optimization. This clinic was not present in 2016. Previous studies in a trauma unit and chest pain unit were consistent with this trend and obtained similar reductions in length of stay [17,18]. In Quebec, ACNPs cannot admit or discharge patients [19]. Although ACNPs can give their opinion on the adequate time of discharge, the decision remains that of the admitting or treating physician. More research is needed to better to explore the influence of ACNPs on length of stay.

This study showed an increase in emergency visits and readmissions for cardiac surgery complications within 30 days in the group with ACNPs. However, the difference was not significant. Emergency visits and readmis-

sions were only collected from one healthcare centre in both groups. Visits to other hospitals could not be accounted for. Therefore, minor reasons for emergency visits could have been missed. Patients with major cardiac surgery complications that might require surgical re-intervention were usually transferred back to the original hospital where the index surgery was performed.

Strengths and Limitations

The study was conducted in an academic university teaching hospital, which performed cardiac surgery in one out of six teaching hospitals in the province of Quebec.

A kappa of 1 was reached when verifying concordance of data entry. To limit selection bias, patients were randomly selected for both groups.

As for the limits, this was a single centered retrospective study, which could limit its generalizability. Furthermore, the sample size was small. However, it was sufficient to have a statistically significant difference between the two groups. In addition, the investigators were not blinded to which cohort the patient belonged when determining the adherence to GDMT and other outcomes.

Another limitation is the inability to completely isolate the impact of ACNPs on adherence to GDMT, as patient care is ultimately a team effort. In addition, it is difficult to predict that the medication could not have been started by another healthcare professional. The authors therefore focused on discharge to assess whether the ACNP had ensured that the required medications were properly prescribed.

Finally, the study was conducted at two different timelines. The results could have been due to other differences in practice that occurred between 2016 and 2022–2023. Nevertheless, the guidelines for ACS patients who have undergone surgical revascularisation has not changed during this study period. The integration of ACNPs in the surgical care team was the most significant change that occurred during that period. The selection of the period 2016 for physician-led group was to maximize avoiding potential contamination of data by not having ACNP on the unit.

The period of 2022–2023 represented the year when the integration of ACNPs on the unit in terms of number and coverage were most consistent, as well as the closest to current era of practice without the influence of COVID-19.

Conclusion

This study seems to be one of the first to support the added value of ACNPs in a post-operative cardiac surgery setting in terms of adherence to GDMT regarding cardiovascular secondary prevention at the time of discharge for an ACS population. Larger prospective studies exploring provider adherence outcomes led mainly by ACNPs, as well as length of stay and re-admission rate will be required.

Availability of Data and Materials

All data points generated or analyzed during this study are included in this published article.

Author Contributions

AG, HL, GL and AB designed the research study. AG and HL performed the research. GL analyzed the data. FAD, LEB, AN, RS, MF and DST have interpreted the data and reviewed the manuscript critically. All authors contributed to editorial changes in the manuscript. All authors read and approved the final manuscript. All authors have participated sufficiently in the work and agreed to be accountable for all aspects of the work.

Ethics Approval and Consent to Participate

This study was approved by the MUHC Research Ethics Board (2022-7688) The study was conducted following the Good Clinical Practice and Standard Operating Procedures as well as in accordance with the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans (2018). This study was carried out in accordance with the guidelines of the Declaration of Helsinki. Because this study is retrospective, informed consent from patients is not required.

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Conflict of Interest

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