Original papers

Are patients suffering from stable angina receiving optimal medical treatment?

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Summary

There is good evidence for the use of antiplatelet, beta-blocker and lipid-lowering drugs in the treatment of ischaemic heart disease, but few data on how these medications are used in treating stable angina pectoris. We examined prescription profiles for a sample of patients aged ≥ 65 years with stable angina, to compare the profiles to local guidelines and to explore the determinants of these profiles, in a cross-sectional study. We identified 11 141 individuals from the Quebec provincial out-patient pharmaceutical database for the period 1 June 1996 to 31 May 1997, and examined the percentage of these patients with and without associated co-morbidities receiving antiplatelet, beta-blocker and lipid-lowering medications. We used hierarchical modelling to examine the role of patient and physician characteristics in explaining the variation in the use of these medications. Calcium-channel blockers were the class of anti-ischaemic drugs most prescribed (63%). Beta-blockers were prescribed in 52.1% of patients. Antiplatelet and lipid-lowering drugs were prescribed to 56.8% and 32.6%, respectively. Increasing age and female gender made patients less likely to be prescribed these treatments. General practitioners were less likely than cardiologists to prescribe beta-blockers and lipid-lowering drugs (OR 0.79, CI 95% 0.68–0.91 and OR 0.77, CI 95% 0.66–0.91, respectively). There is a general under-use of antiplatelet, beta-blocker and lipid-lowering medications in the treatment of stable angina pectoris patients, possibly leading to adverse patient outcomes.

Introduction

While the practice patterns surrounding myocardial infarction have been extensively studied, relatively little information is available concerning the treatment of stable angina pectoris. Due to the high prevalence of stable angina and the amount and quality of scientific knowledge on effective therapeutic interventions, several government agencies and learned societies have issued guidelines on its...
treatment.1–3 Past experience in the evaluation of myocardial infarction treatments has shown that the quality of information and the clarity of the guidelines do not guarantee the transfer of this knowledge to clinical practice.4–6 There is, however surprising lack of research on medical practice patterns in treating stable angina.

Studies of patients considered high-risk for coronary episodes showed that a large proportion of these patients were not receiving optimal medical treatment.7–9 It seems therefore reasonable to assume that there may be room for improvement in the treatment of patients suffering from stable angina. However, to the extent that we have limited data on the current state of medical practices, the dissemination of a strategy for the implementation of guidelines is problematic. In fact, given that the medical treatment of stable angina is based on several pharmacological interventions, an implementation strategy would be more effective if it targeted specific observed shortcomings, while supporting the maintenance of appropriate practices.

The goals of this study were to: (i) describe the prescription profile for a population of patients aged 65 and older being treated for stable angina; (ii) compare the profiles to local guidelines; and (iii) explore the determinants associated with the prescriptions of beta-blocker, antiplatelet and lipid-lowering therapies.

Methods
This was a cross-sectional study.

Definition of the study population
In Quebec, Canada, the government agency Régie de l’assurance maladie du Québec (RAMQ) covers the cost of the medical services and medications for the entire population, aged ≥65. All prescriptions are recorded in a provincial database. All citizens over age 65 and residing in Montreal, the South Shore (a major suburban area of Montreal), and the Laurentians (a more remote region located 200 km from Montreal) were included in this convenience sample, which was selected to represent different levels of availability of medical resources in the province. At the time of the study, 440,853 citizens aged 65 and over were registered in the RAMQ database.

The validity of the provincial databases relating to medication and medical services for the general population has been previously established.10 However, since the information on diagnoses in the databases has not been firmly validated, a clinical algorithm was developed to identify patients probably treated for stable angina. In Quebec, sub-lingual nitroglycerine can only be procured by medical prescription. The definition of a ‘presumed’ case of stable angina was as follows: any patient who filled a prescription for fast-acting sub-lingual nitroglycerine within the 12 months ending on 30/6/1997 and a prescription for one of the three classes of anti-ischaemic medication (beta-blockers, calcium channel blockers or long-acting nitrates) and who was neither seen in the emergency room nor hospitalized in the 3 months preceding the period of study. Patients receiving only short-acting nitroglycerine without any anti-ischaemic drug were excluded, since it is possible to be a ‘coronary’ patient and not suffer from angina and consequently not take any anti-ischaemic drugs—after effective revascularization, for example.

The database was then searched for a diagnosis of coronary artery disease (CAD). Patients for whom there was a perfect match between the diagnosis in the database and the clinical algorithm (80% of the entire sample) were considered to be suffering from stable angina.

Definition of study variables
The study variables were extracted from the following RAMQ files: (i) the medication file which includes all information of the prescription served to the patient (dosage, number of repeats, costs, name of the prescribing physician, etc.); (ii) the medical services file which includes all information on visits and acts performed (type of visit, location of the visits, costs, physician responsible and diagnosis); (iii) the patient files and the physician files (sociodemographic variables, year of graduation, speciality, etc.). These files were linked through the use of unique encoded identification numbers for each patient and each physician. We were able to link 100% of the sample successfully.

The following classes of medications were considered relevant to the treatment of stable angina: anti-ischaemics (beta-blockers, calcium channel inhibitors, long-acting nitrates), anti-platelet agents, and lipid-lowering drugs.

Three indicators of co-morbidity examined the use of additional medications. These were (i) diabetes (defined by the use of oral hypoglycemics including acarbose and/or insulin); (ii) chronic obstructive pulmonary disease (defined by the use of theophylline and/or beta₂ agonist, steroid or ipratropium inhalers); and (iii) heart failure (defined by the use of two of the following three medications: angiotensin-converting-enzyme inhibitor (ACEI), furosemide or digoxin).
A physician was considered the principal prescribing physician for a patient if responsible for over 50% of the prescriptions specific to the treatment of stable angina over the 12-month period. Co-treatment between a general practitioner and a cardiologist or internist was deemed to exist if there was concomitant billing during the year for a complete major medical examination by a different category of physician than the principal prescriber.

Since our objective was to study the physicians’ characteristics associated with the prescription profiles, we excluded 1637 patients for whom no principal prescribing physician could be identified (of the 12 778 patients who fulfilled our definition of stable angina). There were no statistical differences in the distribution of outcome variables between those two samples.

**Analysis**

Simple univariate analyses used Student’s t test and Pearson’s χ² for continuous and categorical variables, respectively. Multi-level logistic regression was used to take into account the hierarchical structure of the data, i.e. prescription profiles for 11 141 patients treated by 3293 physicians. This approach allows for studying the impact of certain predictors at both the patient and physician level, while taking into account the co-variance introduced between observations sharing the same hierarchical structure. We used the formula proposed by Snijders and Bosker,¹¹ which produces intraclass correlation coefficients as measures of the variation of the logit of the dependent variable between physicians. We applied a forward search fitting strategy for the three outcome measures of interest: prescription of beta-blockers, of antiplatelet drugs and of lipid-lowering agents. The ML-Win software package, version 1.0, was used.¹²

**Results**

**Populations studied**

Table 1 shows the characteristics of the patient and physician populations studied. There was an equal distribution of men and women, and almost 50% were aged >75 years. General practitioners constituted 86.5% of the physicians, although on average they treated fewer patients than did the cardiologists. Co-treatment between a generalist and a cardiologist/internist occurred in 66.3% of patients. However, for 59.8%, the CAD treatment drugs were prescribed by only one physician, suggesting that co-treatment, defined by the presence of a consultation with the physician in a given year, does not necessarily lead to co-prescription.

The principal prescribing physician was solely responsible for all of the medication concerning the treatment of angina in 70.7% of patients. When the principal prescribing physician was a general practitioner, they were the sole prescriber of medication for 74.7% of the patients, compared to 65.9% when the principal prescriber was a cardiologist, and 61% when another type of specialist.

**General prescription profile (all patients)**

As many as 37.2% of the patients were on two anti-ischaemic drugs, and 10% were on a triple-therapy regimen. Only 12% (n = 1331) had filled a prescription for an anti-ischaemic drug, an antiplatelet drug and a lipid-lowering drug.

Figure 1 shows the breakdown of prescriptions for the medications under study. Fast-acting nitrates were prescribed in the spray-pump format in 74.5% of the cases and in tablet form for the remainder. Calcium-channel blockers were the class of anti-ischaemic prescribed most often (n = 7018; 63%), with diltiazem being the most prescribed drug (n = 3955; 35.5%). Beta-blockers and nitrates were prescribed in 52.1% (n = 5793) and 45.7% (n = 5091) of cases, respectively. As for concomitant medication, 56.2% (n = 6261) of patients had an active prescription for aspirin in their record and 32.6% (n = 3631) had a prescription for a lipid-lowering drug. Lastly, 3.4% women were receiving hormone-replacement therapy. Even excluding the 3014 patients with potential contraindications, as assessed by three co-morbidities (diabetes, COPD and heart failure), beta-blockers remain under-prescribed (54.9% of the 8127 patients with none of the three co-morbidities).

**Variables associated with the prescription of medication specific to stable angina: results of the multi-level analysis**

Table 2 summarizes the results of the multi-level analysis. Only significant results are reported. Patient age, sex, region of residence, and the number of prescribing physicians per patient were often statistically associated with the three classes of medication. Patients on medications for COPD and heart failure were less likely to be exposed to beta-blockers and, to a lesser extent, to antiplatelet and lipid-lowering drugs. General practitioners were less likely to prescribe beta-blockers and lipid-lowering drugs than were cardiologists. Physicians
with over 20 years of experience tended to prescribe anti-platelet agents significantly less. Finally, high-volume physicians tended to prescribe more antiplatelet drugs.

The percentage of variations of the prescription profiles attributable to the physician level, as estimated by the intraclass correlation coefficients, were, respectively, 7.9% for the beta-blockers; 4.4% for antiplatelet agents and 9.5% for lipid-lowering drugs.

### Discussion

Only 54.9% of our sample without indicators of co-morbidity had filled a prescription for a beta-blocker, suggesting that patients aged ≥65 years who are suffering from stable angina are under-exposed to beta-blockers, the recommended first choice anti-ischaemic medication. They are also underexposed to lipid-lowering drugs, and to a lesser extent, to antiplatelet agents. These patients cannot hope to derive the maximum morbidity and mortality benefit from currently recommended treatments. Our results suggest that the very elderly are even less likely to receive optimal therapy, a finding reported also in the US.13

Antiplatelet14 and lipid-lowering15,16 drugs consistently decrease mortality and morbidity in this patient group. Beta-blockers decrease mortality in coronary patients who have suffered a myocardial infarction.3 The economic impact of those gains in mortality and morbidity has been well established.15

We are among the first to report information on prescription profiles for a patient population treated for stable angina. Under-exposure to beta-blockers has been well documented in post-infarction populations, in the range of 30–38%.8,17,18 In the light of those studies, our results can be seen as encouraging. It is not surprising to find that men and older patients are less likely to receive beta-blockers, as the side-effects of this class of medications may be accentuated in these sub-groups.

The under-exposure to lipid-lowering drugs is also not surprising, since it has been documented to be some 20–25% in populations of patients at risk for coronary disease.7,19 It is, however, cause for grave concern, given the demonstrated effectiveness of this class of medication for those suffering from prior myocardial infarction as well
Figure 1. Breakdown of prescriptions for patients aged 65 and over with at least one prescription for anti-ischaemics (n = 11,141).

As stable angina. On the other hand, it is reassuring to note that diabetic patients run less of a risk of being under-exposed to optimal treatment.

It is difficult to explain the association of better prescription profiles with a particular region. This best performing region is, however, the furthest away from the major urban centres, and is served almost exclusively by two regional hospitals. It is possible that these conditions favour a more homogenous dissemination of the practice guidelines.

In the multi-level analysis, characteristics associated with physicians had a limited impact on the prescription profiles. However, the variation taken at the physician’s level (level 2 of the multi-level analysis) is proportionally greater for the two agents with better evidence of benefit: beta-blockers and lipid-lowering therapy. That the addition of variables linked to them does not modify the variance explained by the second level of analysis means that these differences are due to factors other than those that we measured, probably relating to knowledge and/or attitudes.

For beta-blockers and lipid-lowering therapy, we observed variations linked to physicians’ speciality. We are not the first to have observed that patients followed by general practitioners are at a somewhat higher risk for receiving sub-optimal treatment than those followed by cardiologists. Differences in knowledge and the perception of the risks associated with risk factors for coronary disease have been shown, and cited at least partially explain these differences. There may also be a relationship between patient volume and severity profiles, as is often seen, particularly in cardiovascular
Table 2  Summary of multilevel logistic regression models predicting prescription of selected cardiovascular medications (estimates expressed as OR of receiving a prescription)

<table>
<thead>
<tr>
<th>Drug type …</th>
<th>Beta-blockers OR (95%CI)</th>
<th>Antiplatelet OR (95%CI)</th>
<th>Lipid-lowering OR (95%CI)</th>
</tr>
</thead>
</table>

**Patient characteristics**

**Sex**
- Female
  - OR: 1.00
  - CI: 1.00
- Male
  - OR: 1.15 (1.06–1.25)
  - CI: 1.43 (1.32–1.55)

**Age**
- 65–69 years
  - OR: 1.00
  - CI: 1.00
- 70–74 years
  - OR: 1.00
  - CI: 1.17 (1.05–1.31)
  - CI: 0.77 (0.69–0.86)
- ≥75 years
  - OR: 0.71 (0.64–0.79)
  - CI: 0.28 (0.25–0.31)

**Residence**
- Montreal
  - OR: 1.00
  - CI: 1.00
- Laurentians
  - OR: 1.30 (1.11–1.52)
  - CI: 1.16 (1.05–1.28)
- South Shore

**Co-treatment by a generalist and cardiologist or internist**
- No
  - OR: 1.00
  - CI: 1.00
- Yes
  - OR: 1.21 (1.09–1.34)

**Medication for COPD**
- No
  - OR: 1.00
  - CI: 1.00
- Yes
  - OR: 0.20 (0.16–0.24)
  - CI: 0.73 (0.62–0.86)
  - CI: 0.69 (0.57–0.84)

**Medication for heart failure**
- No
  - OR: 1.00
  - CI: 1.00
- Yes
  - OR: 0.58 (0.51–0.65)
  - CI: 0.86 (0.77–0.97)
  - CI: 0.60 (0.52–0.70)

**Medication for diabetes**
- No
  - OR: 1.00
  - CI: 1.00
- Yes
  - OR: 1.13 (1.01–1.26)

**Number of physicians having prescribed C.A.D. treatment drugs in a year**
- One
  - OR: 0.81 (0.74–0.89)
  - CI: 0.62 (0.57–0.67)
  - CI: 0.63 (0.57–0.69)
- Two
  - OR: 1.00
  - CI: 1.00
  - CI: 1.00
- Three or more
  - OR: 1.43 (1.18–1.75)
  - CI: 1.54 (1.27–1.88)

**Physician characteristics**

**Medical training**
- Cardiologist
  - OR: 1.00
  - CI: 1.00
- General practitioner
  - OR: 0.79 (0.68–0.91)
  - CI: 0.77 (0.66–0.92)
- Internist

**Professional experience**
- 0–10 years
  - OR: 1.46 (1.09–1.97)
  - CI: 1.00
- 11–20 years
  - OR: 1.00
  - CI: 0.86 (0.76–0.96)
- >20 years
  - OR: 1.00
  - CI: 0.79 (0.65–0.96)

**Number of patients treated by physician**
- 1–5
  - OR: 1.00
  - CI: 0.79 (0.65–0.96)
- 6–10
  - OR: 1.00
  - CI: 1.00
- 11–25
  - OR: 1.00
  - CI: >25

**Intra-class correlation**
- Beta-blockers: 0.079
- Antiplatelet: 0.044
- Lipid-lowering: 0.095

medicine. We cannot ascertain the severity of the disease of the patients in our sample. However, patient volume was neither strongly nor consistently associated with prescription patterns. Other explanations could include continuing medical education and contacts with pharmaceutical representatives. It can be argued that general practitioners are not really responsible for the prescription patterns observed, since many of them may be only repeating prescriptions initiated by cardiologists. Although this may be true, from an ethical standpoint, prescribing physicians are responsible for their prescriptions and are expected to ‘revisit’ those during the course of an episode in the light of new knowledge, particularly for a chronic condition such as stable angina. We were unable to study this phenomenon in this sample, but managed to ascertain the occurrence of co-treatment between
a generalist and a cardiologist or an internist in a given year. We observed that co-treatment occurred in 66.3% of the patients, and that it was not associated with more favourable prescription patterns, except marginally for exposure to lipid-lowering medications. Clearly, the phenomena of referral and co-treatment and of new knowledge uptake by generalists and specialists need to be better explored and understood, as it is crucial to optimal treatment of all major chronic conditions. Our results should not be interpreted as an argument in favour of a greater direct involvement of specialists in the care of all patients suffering from stable chronic angina, even if it may be tempting to do so. This study has some important limitations. We relied only on database information to identify our cases, and could not build on any validation work in the field of cardiovascular disease on comparable databases. However, matching the RAMQ diagnosis with the results of the clinical algorithm (based on the prescription and service databases, which have been demonstrated to be reliable) increases our confidence that we were dealing with patients followed for stable angina. The cross-sectional design did not permit us to study the sequential evolution of the prescription patterns, and thus we do not know to what extent other anti-ischaemic drugs were prescribed previous to our observations. Also, although we may be sure that the prescriptions were actually delivered to the patients (the sine qua non for appearing in the database), we cannot be sure that they were all actually taken, thus we may have overestimated the number of patients on multiple anti-ischaemic regimens.

Another shortcoming concerns exposure to antiplatelet agents. Indeed, the database is unreliable for estimating the prescription of aspirin, since this medication can be obtained without prescription. The lack of formal prescribing may nevertheless be expected to adversely affect the importance patients attach to this intervention.

This study also has important strengths, however. Within the universal coverage framework in place in Canada and in the province of Quebec, we are confident that we have gathered information on all prescriptions and medical services obtained by the targeted population that we studied. Our statistical analysis was based on a strong strategy—the multilevel analysis—which is now considered the most appropriate when observations have a hierarchical structure. Finally, the stability of these results is demonstrated by the consistency obtained by identifying subjects uniquely with the clinical algorithms (data not shown).

For these reasons, we are confident in stating that exposure to lipid-lowering drugs is too low in this population. In fact, several studies have shown that ~75% of the coronary artery patient population has LDL cholesterol above the recommended intervention level of 2.6 mmol/l.16,22 Even if we exclude those over 75, for whom the benefits of lipid-lowering drugs are less clearly documented, these prescription profiles remain sub-optimal.

Following this study, we decided to try to improve the dissemination, and ultimately, incorporation of the recommendations concerning the prescription of beta-blocker, lipid-lowering and anti-platelet drugs into routine general practice for patients with stable angina. A randomized trial is currently underway to evaluate the feasibility of modifying these practice patterns.

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References


7. The Clinical Quality Improvement Network (CQIN) Investigators. Low incidence of assessment and modification


