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ORIGINAL ARTICLE

Are Hospitalizations for Percutaneous Coronary Procedures Missed Opportunities for Teaching Rules of Secondary Prevention?

I ricoveri per procedure di interventistica coronarica percutanea sono occasioni mancate per l'educazione sulle norme della prevenzione secondaria?

Ricarda Marinigh, Paolo M. Fioretti, Rosa Pecoraro, Claudio Fresco, Silvio Brusaferro[1]

ABSTRACT: ***Are Hospitalizations for Percutaneous Coronary Procedures Missed Opportunities for Teaching Rules of Secondary Prevention? R. Marinigh, P.M. Fioretti, R. Pecoraro, C. Fresco, S. Brusaferro.***

Background and aims: **Percutaneous coronary intervention (PCI) is the most frequently used revascularization approach, often repeatedly applied. The quest for the ultimate revascularization procedure however may capture cardiologist's attention and lead them to minimize the issue of secondary prevention in their patients. Aims of this study were to assess: 1. The individual risk factor profile, 2. The relation between the risk factors correction and the number of hospital admissions for elective procedures, 3. The appropriateness of medical treatment in patients admitted for elective coronary invasive procedures (diagnostic and interventional). 4. The patients knowledge of threshold values for cardiovascular risk factors.**

Patients and Methods: **100 patients (71% males, mean age 68 years) consecutively admitted for elective coronary angiography or PCI. They underwent a classical risk factors assessment and were divided in three groups according to the number of admissions for coronary angiography and in two groups according to the number of PCIs.**

Results: **Fifty-seven % of patients had been previously admitted for invasive examination at least three times and 58% had already been treated with at least one PCI. Seventy-one % were treated with beta-blockers but only 25% of them received a dosage found effective in RCTs (randomized clinical trials). Sixty % were treated with ACE-inhibitors and 83% received the dosage found effective in RCTs. Fifty-two % were treated with statins and 95% received a dosage found effective in RCTs. Nine % were still active smokers. Fourty-nine % had a LDL cholesterol level above 100 mg/dL. The percentage of patients not on target was unrelated to the number of hospital admissions for invasive procedures.**

Conclusions: **Modern cardiology is quickly embracing high tech procedures and trials results but often fails to spend enough time teaching how to control risk factors according to the recommendations of the evidence-based guidelines, even independently of the number of hospitalizations for invasive cardiovascular procedures.**

Keywords: secondary prevention, chronic ischemic heart disease, cardiovascular risk profile, cardiovascular therapy, percutaneous coronary intervention, hospital admission.

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Department of Cardiopulmonary Sciences and [1] Dipartimento di Patologia e Medicina Sperimentale e Clinica. Azienda Ospedaliero-Universitaria di Udine, Italy.

Corresponding author: Ricarda Marinigh; E-mail address: rmarinigh@libero.it

Introduction

In recent years satisfactory results have been obtained in the definition of guidelines on the treatment of acute cardiac ischemic events. These guidelines were developed in order to optimize pharmacological, haemodynamic and surgical approach to acute coronary syndrome. The purpose was to achieve the most cost-effective strategy of intervention, reducing relapse of ischemic events and post-infarction mortality rate. In this scenario haemodynamic invasive procedures have grown to the role of protagonists. Newly designed high tech stents and devices are increasingly used in patients with acute ischemic heart disease, and it is not infrequent to see patients treated repeatedly with PCIs. These efforts have been successful in reducing the mortality rate and improve the prognosis in patients with acute coronary syndrome, but a further effort was required to shelter the survival gain and avoid the events recurrence [1]. As an answer new in-depth guidelines were developed with the purpose of reducing the risk profile of the patients and define the primary goals of secondary prevention. These guidelines clearly established recommendations and threshold values for the main cardiovascular risk factors such as cholesterol, hypertension and glycaemia. The quest for the ultimate revascularization procedure however may capture cardiologist's attention and lead them to forget to teach patients and follow the implementation of patient's secondary prevention items. Many international studies underlined the difficulty to overcome the distance between evidence and practice [2-3]: the risk profile and the knowledge of risk factors is nowadays unsatisfactory in patients with chronic ischemic disease. Another

weak point is represented by the pharmacological treatment after the acute event: the studies highlighted the fact that frequently a premature suspension or a suboptimal dosage follow a correct prescription at the time of the event.

Aims of this study were to assess: 1. the individual risk factor profile, 2. the relation between the risk factors correction and the number of hospital admissions for elective procedures, 3. the appropriateness of medical treatment in patients admitted for elective coronary invasive procedures (diagnostic and interventional). 4. the patients knowledge of threshold values for cardiovascular risk factors.

Patients and Methods

Study population

One hundred patients (71 M; mean age 68 years) consecutively admitted for elective coronary angiography for suspected or proven coronary disease or for recurrence of ischemia after PCI were included in the study (table 1). These patients underwent a thorough classical risk factors assessment. Patients who accepted to enter the study were divided in 3 groups according to the number of admissions for coronary angiography (less than 3 admissions, 3 or 4 admissions, more than 4 admissions).

Questionnaire and data collection form

A data collection form was conceived including demographic data, risk factors (Serum determination of total cholesterol, HDL cholesterol, LDL cholesterol (calculated), triglyceride, fasting plasma glucose, blood pressure at rest, BMI and abdominal circumference. Part of the form was dedicated to the assessment of the amount and intensity of daily physical exercise (measured in METs), previous hospital admissions, coronary angiograms and PCIs. A special section was related to class and dosage of pharmacological treatment.

A specific questionnaire was designed at exploring: knowledge of the thresholds for the most important cardiovascular risk factors (thresholds for LDL cholesterol, arterial blood pressure, glycaemia if diabetics) and attitude towards a healthy lifestyle (smoking, diet, physical exercise, BMI, abdominal circumference).

Statistical analysis

Comparison between groups was tested for statistical significance using the chi-squared test. The following aspects were considered to potentially influence threshold limits knowledge and risk factor control of the patients included in our study, and were included in the logistic analyses: the number of previous admissions for invasive procedures and the presence of a previous PCI in the clinical history of the patient.

We studied the statistical correlation between the number of hospital admissions for invasive procedures and both threshold limits knowledge for the cardiovascular risk factors and risk factor control. Secondarily we studied the statistical correlation between the presence of a previous PCI in the clinical history of the patient and the same variables considered before: threshold limits knowledge for the cardiovascular risk factors and the risk factor control. All logistic models were performed using the likelihood ratio test until only variables with $P<0.05$ remained in the model. All statistical analyses were carried out using SPSS statistical package (Version 7.0 for Windows; SPSS, Chicago, III). This study was intended to be a descriptive one so we refrained from more complex statistical analyses.

Results

The risk factors profile and pharmacological treatment of the overall population were as follows:

1) Smoking habits: 57% were former smokers, and only 9% were still active smokers.

2) Lipid profile: 61% of the patients had a LDL cholesterol level above 100 mg/dL, 46% had a HDL cholesterol level below 45 mg/dl and 28% had a triglyceride level above 150 mg/dl (table 2).

3) Diabetes: 27% of the patients were diabetics (24 type II, 3 type I).

4) Arterial hypertension: 67% of the patients had a history of arterial hypertension (table 3, I column).

5) Physical activity: sixty percent of participants (table 3, II column) included in the study practiced predominantly a light physical activity (3-5 METs), 21% a moderate physical activity (5-7 METs), 5% a very light physical activity (less than 3 METs), 12% an intensive (7-8 METs) and 4% a very intensive physical activity (9 METs).

6) BMI and abdominal circumference: 50% had a BMI greater than 25 30 Kg/m^2 (overweight) and 18% of the patients had a BMI greater than 30 Kg/m^2 (obese) (table 3, III/IV column). There was an elevated percentage of patients with an abdominal circumference associated with an increased cardiovascular risk (46% of the males had an abdominal circumference above 102 cm, 59% of the females had an abdominal circumference above 88 cm).

7) Pharmacological treatment: 71% of our patients were treated with beta-blockers but only 25% of them received a dosage found effective in RCTs. 60% of our patients were treated with ACE-inhibitors and 83% of them received the dosage found effective in RCTs. Only 52% of our patients were treated with statins but 95% of them received a dosage found effective in RCTs.

8) Knowledge of threshold limits for blood pressure and cholesterol. Only 36% of interviewed patients were able to indicate the correct threshold limits of total cholesterol, 17% those of HDL cholesterol, and only 38% those of arterial blood pressure; in addition, among diabetic patients (26 patients) only 24% were able to indicate the correct limits of glycaemia.

The secondary purpose of this study was to assess if the risk factors control and the learning of the secondary prevention items was related to the number of hospitalizations for invasive procedures.

Accordingly, our population was divided in three groups: 43% of the patients were at their first or second admission for invasive examination, 38%

Table 1. - Study population characteristics subdivided by number of admissions

	1-2 Admissions	3-4 Admissions	>4 Admissions	All Patients
Number of patients (% of the population)	43	38	19	100
Mean age	68	70	65	68
Males (%)	29	27	15	71

Table 2. - Study population lipid profile

Number of admissions (% of the population)	Tot Chol >200mg/dl	LDL Chol >100mg/dl	HDL Chol <45mg/dl	TGs >150mg/dl
≤2 (43%)	17 (40%)	29 (67%)	20 (47%)	10 (23%)
3-4 (38%)	17 (45%)	23 (60%)	16 (42%)	10 (26%)
>4 (19%)	6 (32%)	9 (47%)	10 (53%)	8 (42%)
Tot (100%)	40 (40%)	61 (61%)	46 (46%)	28 (28%)

Table 3.

Number of admissions (% of the population)	BP>140/90 mmHg	Physical Activity <5 METs	BMI>25 Kg/m^2	BMI>30 kg/m^2
≤2 (43%)	23 (53%)	24 (56%)	21 (49%)	9 (21%)
3-4 (38%)	27 (71%)	25 (66%)	16 (42%)	8 (21%)
>4 (19%)	17 (89%)	11 (58%)	13 (68%)	1 (5%)
Tot (100%)	67	60	50	18

were at their third or fourth admission and 19% of our population had been previously admitted at least four times. Fifty-eight % had already been treated with at least one PCI.

The percentage of not on target patients were similar, independently of the number of hospital admissions or PCIs. In addition, the knowledge of threshold levels for total cholesterol, HDL cholesterol, blood pressure, glycaemia (if diabetics) were also similar despite being admitted to cardiological wards several **times.**

Discussion

The main findings of the present study are the following:

1. Patients who underwent a single or repeated coronary angiogram or PCI did not follow a correct lifestyle and a substantial percentage of them were not on target for the usual risk factors.

2. Lipids, blood pressure and body weight were the most frequently poorly controlled factors.

3. The lifestyle and risk factors control was not related to the number of previous hospitalisations for invasive procedures.

4. The use of medication for secondary prevention was rather satisfactory.

5. Patients' knowledge of target values for blood pressure and cholesterol levels was poor.

Our study shows that the risk factor control in this patients population is unsatisfactory and that the risk factors control did not improve in patients who presented with a greater number of hospitalizations or in patients who underwent invasive procedures more than once; this disappointing finding is similar to that of larger trials on secondary prevention [6-7].

One of the positive aspects is the low prevalence of smoking in the patients included in the study.

As far as lipid profile is concerned the results are less encouraging. As recently underlined by the Adult Treatment Panel III (ATP) of the National Education Program on Cholesterol management, therapeutic lifestyle changes remain an essential modality for lipid control, particularly in patients who have lifestyle-related risk factors like obesity, elevated triglycerides, low HDL-C or metabolic syndrome [8-9]. INTERHEART, a large controlled study conducted in 52 different countries, showed that smoking and unsatisfactory lipid control are responsible, independently from other cardiovascular risk factors, of the two/thirds of the risk to develop an acute myocardial infarction [10]. The newly modified international guidelines on lifestyle for patients with CHD recommend to follow a nutrition plan and to

practice exercise therapy in order to achieve a negative energy balance, with the ultimate goal of decreasing both body weight and insulin resistance. Unfortunately our patients presented with both an uncontrolled lipid profile (46% had a LDL-C>100 mg/dl) and an ineffective weight control. An important percentage of the patients (18%) had a BMI>30 Kg/m^2 and a great percentage of them had an abdominal circumference associated with a substantial cardiovascular risk (46% of the males had an abdominal circumference above 102 cm, 59% of the females had an abdominal circumference above 88 cm according to EuroAction risk stratification).

It is well-known that regular physical exercise increases exercise capacity, improves quality of life and reduces symptoms in CHD patients [11-12]. Moderate to high-intensity aerobic conditioning can increase maximal exercise tolerance by 30 to 50% and peak exercise oxygen consumption by 5 to 20%. The ability to perform daily activities is also significantly improved. Many epidemiologic and secondary prevention studies have consistently demonstrated a close relation between regular physical activity and reduced risk of mortality and morbidity from CHD. Nevertheless, patients included in our study practiced predominantly (60%) a light physical activity (3-5 METs) and only 21% practiced a moderate physical activity (5-7 METs) as suggested by the guidelines.

On the opposite, we found that beta-blockers and ACE-inhibitors were correctly used in the majority of our patients with a dosage found effective in RCTs. A weak point was represented by statins: only 52% patients with above target LDL-cholesterol were treated with this drug.

It was disappointing to find out that only a small part of our patients was aware of the correct threshold value for the main cardiovascular risk factors. But even more discouraging was finding out that their knowledge did not improve when repeatedly admitted to hospital and repeatedly exposed to revascularization procedures. The hospital admissions to invasive procedures should be considered a chance to teach the patients the secondary prevention guidelines, to monitor their risk factor profile and to carry out a plan to reduce their cardiovascular risk. A greater effort should be applied in order to provide a long term protection with an effective secondary prevention plan in addition to an optimal coronary repair.

Study Limitations

This study has several limitations. Firstly, we have to underline the limited number of patients who entered the study (100 patients), coming from a single reference centre. Secondly, we examined selected patients who were admitted to undergo an invasive procedure. Thirdly, we must consider that the patients who presented with a greater number of admissions and procedures in their clinical history are the most complex patients and they are the ones who should benefit the most of an adequate secondary prevention program. This should be considered a pilot study which underscores the need for a long term prevention program after invasive coronary procedures.

Conclusions

Modern cardiology is quickly embracing high tech procedures but often fail to spend enough time teaching how to control risk factors according to the recommendations of the evidence based guidelines, even in patients hospitalized for invasive procedures. There is a need to develop and update a comprehensive plan to improve high risk patients' risk profile and knowledge of the main cardiovascular risk factors, providing training and cooperation between health care professionals in order to support cardiovascular health and education. Continuous effort should be done, in order to increase in high risk patients the awareness of lifestyle changes and correction of risk factors as described by the most recent international guidelines on secondary prevention [13].

Riassunto

L'approccio alla rivascolarizzazione più frequentemente utilizzato nella società occidentale è l'Angioplastica Coronarica Percutanea. Nei pazienti con cardiopatia ischemica cronica vengono utilizzati in numero sempre maggiore stent e attrezzature ad alta tecnologia e non è infrequente che questi pazienti vengano trattati ripetutamente con procedure di rivascolarizzazione coronarica. La ricerca della rivascolarizzazione definitiva, tuttavia, può assorbire l'attenzione del cardiologo e portarlo a dimenticare sia l'educazione del paziente che la messa in atto dei presidi di implementazione della prevenzione secondaria indicati dalle linee guida. Lo scopo di questo studio è stato quello di determinare il profilo di rischio dei pazienti ricoverati per eseguire procedure di interventistica coronarica in elezione e, secondariamente, di determinare se e in quale misura il controllo dei fattori di rischio e la conoscenza degli stessi fosse correlato al numero di procedure subite. Dallo studio è emerso come il controllo dei fattori di rischio sia soddisfacente dal punto di vista dell'abitudine al fumo con una percentuale molto bassa di fumatori attivi (9%) mentre sia deludente sul versante del controllo dei lipidi plasmatici: il 49% dei pazienti ha un livello di colesterolo LDL superiore ai 100 mg/dL. Si è osservato inoltre come la percentuale di pazienti con valori di colesterolo LDL superiori al limite fosse indipendente dal numero di ingressi ospedalieri o di procedure interventistiche subite. Inoltre solo il 36% dei pazienti erano in grado di individuare i valori ideali di colesterolo plasmatico e di pressione arteriosa corretti nonostante le numerose occasioni di informazione cardiologica professionale sui fattori di rischio.

Possiamo concludere osservando come la cardiologia moderna si possa oggi avvalere di procedure ad alta tecnologia e dei risultati di validati trials clinici, ma non dedichi abbastanza tempo nell'educare i pazienti al controllo dei fattori di rischio, in accordo con le raccomandazioni fornite dalle linee guida basate sull'evidenza. Questo ultimo dato risulta indipendente dal numero di ospedalizzazioni effettuate per eseguire procedure invasive in elezione.

Parole chiave: prevenzione secondaria, cardiopatia ischemica cronica, profilo di rischio cardiovascolare, terapia cardiovascolare, angioplastica coronarica percutanea, ricovero ospedaliero.

ABBREVIATIONS

BMI: body mass index
BP: Blood Pressure
HDL: high density lipoprotein
LDL: low density lipoprotein
METs: metabolic equivalents of task
PCI: percutaneous coronary intervention
RCTs: randomized clinical trials
TGs: triglicerides

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