Referral physicians' indications for myocardial perfusion scintigraphy

Myokard perfüzyon sintigrafisi için klinisyenlerin endikasyonları

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Özet

Amaç: Bu çalışmada hangi klinik endikasyonlarla hastaların myokard perfüzyon sintigrafisine (MPS) sevk edildiğini araştırmayı amaçladık.

Yöntem: Bölümümüze MPS için gönderilen hastaları, koroner arter hastalığı (KAH) öyküsü, KAH için risk faktörleri, yaş ve cinsiyete göre retrospektif olarak inceledik. MPS için endikasyonlar şu şekilde beş kategoriye ayrıldı: KAH tanısı; koroner stenozun etkisinin araştırılması; canlılık tayini; kardiak-dışı cerrahi için cerrahi öncesi risk tayini; tedavi etkinliğinin araştırılması.

Bulgular: Toplam 770 hasta çalışmaya dahil edildi. Hastaların çoğunluğu (531 hasta, %69) KAH tanısı için MPS' ye sevkedildi ve bunların çoğunluğu KAH için düşük riskli hastalardı (369 hasta, %69,5). 531 hastanın 128'i KAH için orta riskli, 34'ü ise yüksek riskli hasta grubundaydı. MPS için diğer endikasyonlar, tedavi etkinliğinin belirlenmesi (%24,9), koroner stenozun etkisinin tayini (%3,8), cerrahi öncesi risk değerlendirmesi (% 1,7) ve canlılık tayini (%0,6) idi.

Sonuç: Bulgularımız MPS' nin bölgemizde etkin bir şekilde kullanılmadığını göstermektedir. Cerrahi öncesi risk değerlendirmesi, canlılık ve koroner stenozun fonksiyonelliğinin araştırılmasını içeren birçok endikasyon nadiren kullanılmaktadır. KAH için düşük risk grubundaki hastalar ise uygunsuz olarak MPS'ye gönderilen hastaların çoğunluğunu oluşturmaktadır.

Anahtar Kelimeler: Myokard perfüzyon sintigrafisi, koroner arter hastalığı, risk faktörleri.

Abstract

Objective: We aimed to investigate which clinical indications led to referrals for myocardial perfusion scintigraphy (MPS).

Method: We retrospectively analyzed patients referred to our department for MPS based on previous history of coronary artery disease (CAD), risk factors for CAD, age, and gender. Clinical indications for MPS were sorted into the following five categories: diagnosis of CAD; assessment of the impact of coronary stenosis; viability assessment; preoperative risk assessment of non-cardiac surgery; estimation of treatment effects.

Results: A total of 770 patients were included in the study. Most of the patients were referred for MPS for diagnosis of CAD (531 patients, 69%), and most had a low probability of CAD (369 patients, 69.5%). Of the 531 patients, 128 patients had an intermediate probability and 34 patients had high probability of CAD. Other indications for MPS included estimation of treatment effects (24.9%), assessment of the impact of coronary stenosis (3.8%), preoperative risk assessment (1.7%), and viability assessment (0.6%).

Conclusion: Based on our results, MPS is not used effectively in our region. Most of the indications, including preoperative risk assessment and viability were rarely used. In a high proportion of cases, MPS was used inappropriately to evaluate patients with a low probability of CAD.

Keywords: Myocardial perfusion imaging, coronary disease, risk factors.

Introduction

Coronary artery disease (CAD) is among the leading causes of morbidity and mortality all over the world with increasing prevalence (1). Diagnostic tests are important in the early diagnosis, treatment, prognosis, and determination of risk for patients in the early stages of CAD. Coronary angiography is considered the gold standard, but it is invasive. Myocardial perfusion scintigraphy (MPS) is a non-invasive test that can reveal physiological significance of coronary artery stenosis. MPS is most beneficial for patients with a medium risk of CAD (2, 3).Therefore, in terms of both cost and time management, effective use of MPS for risk stratification before testing is impor-tant when considering appropriate patient selection. In this study, we aim to investigate which clinical indications led to the referral of patients for MPS based on clinical characteristics of patients referred to our department for MPS.

Materials and Methods

In total, 807 patients were referred to our clinical laboratory for MPS between January 2012 and June 2013. Among these patients, demographic data from 770 subjects were evaluated retrospectively. Patients were classified as having a low, intermediate, or high

likelihood of CAD based on the Framingham Risk Score (2). Myocardial perfusion SPECT images were obtained in a standard one-day stress-rest protocol. Patients underwent a symptom-limited treadmill test (Bruce, modified Bruce protocol). Technetium-99m sestamibi (Tc-99m) was injected intravenously (8-10mCi) and patients exercised for 1 minute after the injection. Patients unable to exercise or those who failed to achieve their age predicted heart rate underwent a pharmacologic stress test with a 6-minute adenosine infusion protocol. Tc-99m sestamibi was injected at the third minute of the adenosine infusion. SPECT images were acquired 45-60 minutes after the injection of a radiotracer using a dual headed detector gamma camera (Siemens, e-cam), fitted with low energy, high resolution collimators. Rest images were obtained after the injection of 24-30 mCi Tc-99m sestamibi. Gated SPECT left ventricular ejection fraction was measured using QGS software (Cedars-Sinai Medical Center, Los Angeles, California). Patients' characteristics and indications for MPS were retrieved from the hospital database. MPS indications were categorized into the following five main indications: 1. Diagnosis of CAD, 2. Assessment of the impact of the coronary stenosis, 3. Distinguish viable myocardial segment from scar, 4. Pre-operative risk assessment for non-cardiac surgery, and 5. Estimation of treatment effects on patients with CAD (4).

Continuous variables were shown as mean ±SD, and frequencies were reported as percentage and absolute values. The Mann-Whitney U test was used for comparison of variables. All differences were considered significant at the p<0.005 level. Statistical analyses were performed using SPSS package, version 20.0.

Results

In our center, 807 patients were referred for MPS within 18 months. Thirty-seven patients' data was not available; thus, 770 patients were included in the study. The mean age of the patients was 55.7±11.9, of which 51.4% (n: 396) were female and 48.6% (n: 374) were

male. Patients' characteristics are summarized in Table 1.

Table 1. Characteristics of patients.

Age	55.7±11.9
Hypertension	407 (52.9%)
Family history of CAD	344 (44.7%)
Hypercholesterolemia	279 (36.2%)
Smoker	138 (17.9%)
Diabetes Mellitus	205 (26.6%)

Data are shown as mean ± standart deviation or number (percentage). CAD: coronary artery disease

All patients were categorized based on risk factors for CAD; 440 subjects (57.1%) had low, 225 subjects (29.2%) had intermediate, 105 subjects (13.6%) had a high probability of CAD. Most women referred for MPS had a low probability of CAD (75%, n: 297) and most men referred for MPS had an intermediate probability of CAD (40.1%, n: 150). There was a statistical significant difference between genders based on risk categories (p<0.000) (Table 2).

Table 2. Risk assessment by gender.

Risk of CAD	Female	Male
Low	297 (75%)*	143 (38.2%)
Intermediate	75 (18.9%)	150 (40.1%)
High	24 (6.1%)	81 (21.7)

*p<0.000

Most of the patients were referred for MPS to detect CAD (69%, n: 531). Of those 531 patients, 369 subjects (69.5%) had a low probability of CAD, 128 subjects (24.1%) had an intermediate probability, and 34 subjects (6.4%) had a high probability of CAD. A statistical significant difference existed between the number of men (58%, n: 217) and the number of women (79.3%, n: 314) (p<0.00) referred for the diagnosis of CAD, indicating a greater number of women were referred. Furthermore, the most frequent indications for MPS were the estimation of treatment effects (24.9%, n: 192). Other indications for MPS included assessment of the impact of coronary stenosis (3.8%, n: 29), preoperative risk assessment (1.7%, n: 13), and viability assessment (0.6%, n: 5).

Discussion

With an increase in the number of imaging modalities for CAD, discussions are focused on the safety and effective use of coronary artery imaging modalities. An appropriate use of criterion for cardiac radionuclide imaging was published in 2005 and revised in 2009, after which numerous studies were published about the appropriateness of MPS (5). This study does not discuss the appropriateness of MPS, rather, it represents an overall view of indications for MPS in our region, and gives information on the characteristics of patients referred for cardiac radionuclide imaging. To our knowledge, only one study has investigated clinical indications for MPS (6) in Turkey.

Our results show that patients with a low probability of CAD constituted a big proportion of those referred for MPS (57.1%). Although we used a different risk scoring system from the previously reported study (6), we found similar rates to Yapıcı et al. (59%). One of the interesting findings of our study is the gender differences in patients in the low probability group; 75% of women referred for MPS had a low probability of CAD. Furthermore, referral physicians' indications are changing in respect to gender. While most of the women (79.3 %, 314/396) and the men (58%, 217/374) were referred for MPS to detect CAD, there was a statistically significant difference between genders (p<0.00). MPS may be preferred for women after non-diagnostic electrocardiographic changes and atypical chest pain, and because of women's limited exercise capacity compared to men. Gulati et al. reported that even if symptomatic women had a non-obstructive CAD, they had an elevated risk of a cardiac event compared to asymptomatic women (7). Women may have a different presentation of angina. Therefore, clinicians may need to confirm chest pain with diagnostic imaging modalities such as MPS. It is known that the exercise stress test has some limitations for women, especially because of the limited exercise capacity of women and non-specific changes on an ECG. On the other hand, Iskandar et al. recently published a study stating that MPS has a similar diagnostic accuracy for both genders (8).

MPS has a wide range of indications, which we summarize into five categories. Our results show that diagnosis of CAD was the most frequent indication for MPS in our center. These findings reflect the reliance of clinicians on cardiac radionuclide imaging. Much published literature declares that MPS has a prognostic value for patients suspected of and diagnosed with CAD (9, 10). For example, Elhendy et al. declared that after a normal myocardial perfusion imaging test, the annual cardiac event rate was less than 1% in a five-year period (11). Knowing this, clinicians may want to use MPS to exclude CAD. On the other hand, applying MPS to patients with a low probability of CAD may decrease the sensitivity of the test. Currently Khawaja et al. showed that patients referred to MPS under appropriate criterion resulted in a higher percentage of abnormal outcomes requiring revascularization (12).

Our study revealed that the majority of men referred for MPS had an intermediate risk of CAD, which showed effective and beneficial use of the MPS. One of our study's limitations was that we did not discuss the myocardial perfusion results. Nevertheless, we assume that our normality rate for MPS is high.

Referral physicians in our center rarely preferred other indications of MPS such as viability and preoperative risk assessment. This result correlated with the results of Yapıcı et al. Our study showed regional results based on one center; however, future studies could include multicenter research to understand countrywide results.

In conclusion, our results show that most of the indications, including preoperative risk assessment and viability and assessment of functional stenosis, were rare indications for MPS in our region. Diagnosis of CAD was the most preferred indication for MPS by clinicians. In a high proportion of cases, MPS was used inappropriately to evaluate patients—especially women with a low probability of CAD.

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