Executive Summary

Economic evaluation of CT coronary angiography and cardio SPECT in patients with low/intermediate risk of coronary artery disease

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▢ Study Background

Chest pain, one of the most frequent symptoms that physicians encounter, is a symptom that warns of potentially dangerous myocardial ischemia and therefore warrants the highest diagnostic attention. Several noninvasive testing are utilized to determine which patients who present with chest pain have significant myocardial ischemia and which patients require invasive procedures. The emergence of coronary computed tomography angiography (CCTA) produced a substantial shift in diagnostic strategy for patients with suspected coronary artery disease (CAD), based on the diagnostic performance of CCTA and short-term outcomes following the test, relative to functional tests. Clinicians have rapidly adopted these noninvasive imaging studies for

evaluation of patients with chest pain. This, in turn, has lead to the ever-increasing health-related cost spent in the evaluation of chest pain, necessitating the comparison of cost-effectiveness between each imaging modalities. Studies on this issue, whether by modeling or by retrospective analysis, has demonstrated that CCTA may be more cost-effective than myocardial single photon emission computed tomography (SPECT). However, the cost-effectiveness of these imaging studies has never been compared in a prospective, randomized clinical trial. In this trial, we compared the cost-effectiveness between CCTA and myocardial SPECT, the most widely used noninvasive imaging modality currently, in patients with intermediate risk chest pain.

▢ Objectives

This study aimed to compare the cost-effectiveness of the two most widely used noninvasive imaging test for evaluation of chest pain, coronary computed tomography angiography (CCTA) or myocardial single photon emission computed tomography (SPECT).

▢ Systematic review and meta-analysis

We searched PubMed, EMBASE and the Cochrane Library for randomized controlled trials (RCTs) that compared clinical outcomes during ≥6 months of follow-up between initial anatomical testing by CCTA and the initial functional testing in patients with suspected CAD. Occurrence of all-cause mortality, nonfatal myocardial infarction (MI) and major adverse cardiovascular events (MACE), and use of invasive coronary angiography (ICA) and coronary revascularization were compared between the two diagnostic strategies. Twelve RCTs, one case-control study and two prospective cohort studies were included (23,862 patients; mean follow-up duration, 20.5 months).

Patients who underwent CCTA as the initial noninvasive testing had lower risk of myocardial infarction compared to those who underwent functional testing (RR, 0.74; 95% CI, 0.55 – 0.99; P = 0.04). Risk of all-cause mortality

and MACE did not differ statistically between the two diagnostic strategies. Compared to functional testing, the anatomical testing strategy increased the use of ICA (RR, 1.65; 95% CI, 1.05 – 2.60; P = 0.03) and coronary revascularization (RR, 1.57; 95% CI, 1.14 – 2.18; P = 0.006). Anatomical testing with CCTA, as the initial noninvasive diagnostic modality in patients with suspected CAD, resulted in lower risk of nonfatal MI than functional testing, at the expense of more frequent use of invasive procedures.

▢ Economic evaluation of noninvasive imaging test

Patients with 10~90% pre-test probability of coronary artery disease from 3 high-volume centers in Korea (n=965) were randomized 1:1 to either CCTA or myocardial SPECT as the initial noninvasive imaging test. The primary outcome was cost-effectiveness, analyzed using the downstream outcome following the initial noninvasive test, the quality-adjusted life years (QALYs) by the EuroQoL-5D questionnaire and all medical costs related to the evaluation and follow-up.

A total of 903 patients underwent testing with the initially randomized study (460 for CCTA and 443 for SPECT). There were 65 (14.1%) admissions for invasive coronary angiography in the CCTA group and 85 (19.2%) in the SPECT group (p-value=0.0412). There was no significant difference in the clinical events following the initial noninvasive test (21 for CCTA vs. 24 for SPECT, p-value=0.4554). Since the utility difference between CCTA and SPECT was smaller than the pre-defined minimally important difference, 0.07, cost-minimization analysis was carried out instead of cost-effectiveness analysis. In base case which was based on the total medical cost, mean cost for CCTA group was lower than that of SPECT group (6.470 million KRW vs. 7.460 million KRW) indicating that CCTA was the cost-effective alternative. In the sensitivity analysis, we utilized cardiovascular-related medical cost and found that similar results: SPECT was 0.99 million KRW more expensive than CCTA. In the subgroup analysis, we examined the cost-effectiveness of CCTA and SPECT based on pre-test probability using cardiovascular medical cost.

When the pre-test probabilities were 10-29% or 30-59%, the cost of CCTA group was lower than that of SPECT by 0.5 million KRW, 0.59 million KRW, respectively, meaning that CCTA was the cost-effective alternative. However, in the group of pre-test probability with 60-90%, the cost for SPECT was 0.2 million KRW more expensive than that of CCTA, so that CCTA was not cost-effective.

▢ Conclusion

Anatomical testing with CCTA, as the initial noninvasive diagnostic modality in patients with suspected CAD, resulted in lower risk of nonfatal MI than functional testing, at the expense of more frequent use of invasive procedures. Although there was no differences of QALYs gained between CCTA and SPECT, CCTA tended to be lower cost in Korean patients with intermediate risk chest pain.

Key words

:chest pain, coronary computed tomography angiography, myocardial single photon emission computed tomography, anatomical testing, functional testing, cost-effectiveness, meta-analysis