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Perceived and actual risk of cardiovascular disease in patients with rheumatoid arthritis in Korea

A cross-sectional study

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Abstract

The purposes of this study were to compare the perceived and actual 10-year risk for cardiovascular disease (CVD) and to evaluate the influence of cardiovascular risk factors on perceived CVD risk in patients with rheumatoid arthritis (RA) in Korea. Additionally, the attainment of CVD prevention guideline goals by 3 levels of CVD risk (low, moderate, and high) was presented.

For this cross-sectional study, data were collected from 208 patients with RA. Actual CVD risk was estimated with the Systematic Coronary Risk Evaluation (SCORE), and goal attainment was assessed based on the European League Against Rheumatism guidelines. Actual CVD risk and perceived risk were compared with cross-tabulation. Chi-square tests were used to evaluate differences in cardiovascular risk factors by perceived risk. Levels of goal attainment were presented in percentages.

Among patients with RA, 13.9% were identified as being at high risk for CVD, whereas 39.9% were at moderate risk, and 46.2% were at low risk. The majority of those at high risk (96.6%) underestimated their risk for CVD. The use of antihypertensive or lipid-lowering medications and having a parental history of CVD significantly increased the likelihood that subjects with RA would perceive themselves as being at high risk for CVD. Diabetes, smoking, physical inactivity, and obesity did not affect perceived risk. A substantial proportion of the subjects with RA did not meet the prevention guideline goals.

Patients with RA who are at increased risk of developing CVD must be managed as soon as possible to attain the guideline goals and, accordingly, lower their risk of future CVD.

Abbreviations: BP = blood pressure; CCP = cyclic citrullinated peptide; CRP = C-reactive protein; CVD = cardiovascular disease; EULAR = European League Against Rheumatism; HDL-C = high-density lipoprotein cholesterol; LDL-C = low-density lipoprotein cholesterol; MDHAQ = Multidimensional Health Assessment Questionnaire; NSAID = nonsteroidal antiinflammatory drug; RA = rheumatoid arthritis; SCORE = Systematic Coronary Risk Evaluation; TC = total cholesterol.

Keywords: cardiovascular disease, guideline adherence, rheumatoid arthritis, risk factor, risk perception

1. Introduction

Rheumatoid arthritis (RA) is a chronic, systemic, inflammatory, and autoimmune disease that leads to progressive joint

destruction and disability. The incidence of RA is 4 to 5 times greater in women than men under the age of 50, and it is 2 times greater in the 60 to 70 age group.^[1] RA affects about 2% of the Korean population.^[2] Despite the relatively low prevalence of the disease, the need to improve outcomes for patients with RA is especially important because the prevalence of RA has been consistently and rapidly increasing in Korea and, more importantly, people with RA have a much higher risk for developing cardiovascular disease (CVD) than people without RA.^[3]

CVD accounts for about one-third to half of all RA-related deaths.^[4,5] Evidence shows that the risks for atherosclerosis and coronary calcification are extremely high in RA patients.^[6-8] In addition to traditional cardiovascular risk factors, RA-related inflammation is partially responsible for the increased risk of CVD.^[9,10] Medications to reduce symptoms of RA, such as glucocorticoids, also may affect cardiovascular risk factors.^[11,12] Based on a large prospective cohort study, people with RA were 2 times more likely to develop CVD than those without RA.^[13] Furthermore, RA patients are less likely to experience symptoms of angina. Thus, the majority of their CVD goes unrecognized or unmanaged, which can lead to sudden cardiac death.^[14] Therefore, efforts to prevent CVD are especially important in this population. The increased risk for CVD in patients with RA means they should be screened on a regular basis to identify those at high risk for future cardiac events to provide interventions that are effective in preventing CVD.

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Evidence-based clinical guidelines are available to assist in quantifying CVD risk with sufficient accuracy to allow logical management decisions.^[15–17] The European League Against Rheumatism (EULAR) recommends that patients with RA be assessed for 10-year CVD risk with the Systematic Coronary Risk Evaluation (SCORE) model at least once a year and after any changes in medications.^[15] Based on the SCORE, patients with RA can be classified into 4 risk subgroups (low, moderate, high, and very high) with specific therapeutic goals for each subgroup that have been validated empirically.^[17] The EULAR guideline emphasizes risk reduction through adequate control of modifiable cardiovascular risk factors and inflammation to prevent CVD in RA patients.^[15] Even though there is a dearth of prospective studies showing reduction in morbidity and/or mortality associated with CVD in patients with RA as a result of controlling their cardiovascular risk factors, adherence to the empirically validated guideline may make it possible to reduce the risk of CVD to the maximum extent possible.

Individuals' willingness to initiate risk reduction efforts is related to their perception of their own CVD risk.^[18,19] A more accurate perception of risk motivates the initiation and/or maintenance of healthy lifestyles. Assessing how an individual perceives her or his risk for CVD and identifying those who underestimate their risk may be an important first step in effectively preventing CVD. Therefore, in this study, we evaluated the perceived CVD risk among patients with RA in Korea and determined whether the rating was associated with their actual CVD risk, which was estimated using the SCORE. Additionally, the influences of cardiovascular risk factors on CVD risk perception and the levels of attainment of the guideline goals recommended by EULAR were assessed to identify the proportion of patients with RA who are in need of preventive care.

2. Patients and methods

2.1. Study design, sample, and procedure

This cross-sectional study recruited a convenience sample of women and men with RA who were scheduled for regular follow-ups in an outpatient clinic of a university-affiliated hospital in South Korea. The hospital is an academic medical center with more than 1100 patients' beds and approximately 1000 RA outpatients. Subjects were eligible for this study if their ages were between 40 and 65, and they had been diagnosed with RA. This age range was chosen because the SCORE model was developed for people in this age group.^[20] Patients with RA were approached while they were waiting for their appointments with their physicians. Upon completing the informed consent, subjects were asked to complete the questionnaires, which took approximately 5 to 10 minutes. The respondents were given a small gift with a value of \$10. Data were collected in December 2015. Of the 210 patients who completed the survey, 2 did not have some of the main variables required by the study, so they were excluded, leaving a final sample of 208 patients.

2.2. Measurements

2.2.1. Cardiovascular risk factors and actual CVD risk. The cardiovascular risk factors that were included were hypertension, diabetes, dyslipidemia, family history of CVD, overweight/obesity, smoking, and sedentary lifestyle. Hypertension was defined as a systolic or diastolic blood pressure (BP) of 140/90 mm Hg or more or taking antihypertensive medications.^[21] BP was measured

twice after a rest of at least 5 minutes, and the average of the 2 BP measurements was used for this study. RA and cardiovascular-related laboratory data were obtained from the most recent medical records. Diabetes was defined as a self-reported previous history of diabetes, use of glucose-lowering medications, or a fasting blood glucose level of 126 mg/dL or more.^[22] Family history of CVD was defined as a self-reported parental history of heart attack, angina pectoris, or stroke. Body mass index (kg/m²) was calculated with self-reported height and weight. A body mass index of 25 kg/m² or more was considered an indication of obesity based on the obesity criteria for Asians.^[23] Smoking habits and frequency of physical activity were self-reported.

The high-risk SCORE model was used to estimate actual CVD risk in this study because no specific CVD risk assessment tool for Koreans was available.^[20,24] The SCORE is a simple, office-based screening tool that predicts the probability of developing CVD in the next 10 years based on gender, age, systolic BP, smoking status, and the ratio of total cholesterol (TC)/high-density lipoprotein cholesterol (HDL-C). A higher 10-year risk reflects a greater probability of having a cardiovascular event occur within the next 10 years. In accordance with EULAR recommendations and local guidelines for managing CVD risk in people with RA, the risk estimate calculated with the SCORE was multiplied by 1.5 for those with at least 2 of the following criteria, that is, disease duration of more than 10 years, positive rheumatoid factor and/or anticyclic citrullinated peptide (anti-CCP) antibody, and the presence of extra-articular disease.^[15,25] To identify whether the patients had any of the specific extra-articular diseases, they were asked if they had been told at any time that they had arthritis other than in the joints, for example, in the eyes, nerves, vascular system, or other organs. Then, the subjects were classified as low risk (SCORE < 1%), moderate risk (1% to <5%), high risk (5% to <10%), or very high risk (those with established CVD or diabetes and SCORE ≥ 10%) for future CVD.^[17]

2.2.2. Perceived CVD risk. The subjects' perception of CVD risk was assessed with the following question: "How likely is it that you will have a CVD in the next 10 years? Is the probability very low, low, moderate, high, or very high?" This question was singled out from the index of perceived risk that was developed to quantify the perceived risk of CVD in high-risk groups.^[26] The "very low" and "low" responses were combined into 1 group, that is, low risk, to compare perceived and actual CVD risk in the analyses conducted in this study.

2.2.3. Goal attainment. Goal attainment for cardiovascular risk factors was based on the EULAR recommendations for CVD prevention.^[17] The goal for BP was <140/90 mm Hg; the goal was set at 130/80 mm Hg for those with diabetes. TC of 190 mg/dL was considered high, and HDL-C levels of less than 40 mg/dL in men and less than 45 mg/dL in women were considered low in this study. The goal for low-density lipoprotein cholesterol (LDL-C) levels depends on the actual CVD risk. For individuals at very high or high risk for CVD, the LDL-C goals are <70 and <100 mg/dL, respectively. Those with an LDL-C goal of <115 mg/dL were assigned to a moderate- or low-risk group.

In addition, patients' disease features were measured with the Multidimensional Health Assessment Questionnaire (MDHAQ).^[27] The MDHAQ includes questions related to physical function (10 items) and psychological distress (3 items to assess poor sleep, depression, and anxiety) measured with a 4-point Likert scale from 0 (without any difficulty) to 3 (unable to do).

Points for physical function and psychological distress were summed and then transformed into a scale, with 10 points representing the maximum possible score for each domain. The MDHAQ also included 10-cm visual analogue scales to assess general health status, pain, and fatigue. Higher scores indicated worse levels of physical function, psychological distress, and general health status and more severe levels of pain and fatigue. The MDHAQ was validated in Korean RA patients, and permission to use the MDHAQ was obtained from the developers and translators.^[27,28] In addition, the most recent medical records were reviewed for C-reactive protein (CRP), rheumatoid factor, anti-CCP antibody, and types of medications. Duration of RA and extra-articular disease status were self-reported.

2.2.4. Ethical concerns. The institutional review board approved the study (IRB #: SBR-SUR-15-288) before any data were collected. Informed consent was obtained from each subject before any data were collected.

2.3. Statistical analyses

The data were analyzed descriptively using SPSS version 22.0. All study variables were screened for suspected errors, missing data, and outliers. Distributions for continuous variables were examined before analysis. The characteristics of the subjects were presented with frequencies and percentages for categorical variables and means (\pm standard deviations) and/or medians for continuous variables. Perceived CVD risk was compared with actual CVD risk estimated using the SCORE with cross-tabulations. Chi-square tests or Fisher exact tests were performed to identify any differences in patients' cardiovascular risk factors by perceived CVD risk. Percentages were presented to describe proportions of patients with RA who did not attain CVD prevention guideline goals by actual CVD risk based on the EULAR recommendations. The level of significance was set at 0.05.

3. Results

The patients' demographic and disease-related characteristics are summarized in Table 1. Most of the subjects were women (89.9%), and the average age was 52.7 (\pm 7.9). The average duration of the disease was 6.8 (\pm 5.3) years. About 58.7% of the subjects had positive RA factors or positive anti-CCP antibody. Extra-articular disease was present in 24.5%. The average functional score measured with the MHAQ was 0.9 out of 10, meaning that the subjects were able to perform most daily activities without any difficulty. The average score for psychological status was 2.7 (\pm 2.5) out of 10. The mean scores for pain, fatigue, and general health were 3.6 (\pm 2.6), 4.7 (\pm 2.7), and 4.8 (\pm 2.4) out of 10, respectively.

The status of cardiovascular risk factors in the subjects is presented in Table 2. About 4 in 10 had BP >140/90 mmHg or were taking antihypertensive medications, and 17.8% were receiving lipid-lowering therapy. A history of CVD was reported in 3.9% of the subjects, and 7.2% had blood glucose \geq 126 mg/dL or were taking glucose-lowering medications. Overall, 10.6% (n=22) subjects had established CVD or diabetes. Current smoking was recorded in 5.3%, and about 18% were categorized as obese. Most of the subjects (76.4%) were physically inactive, exercising less than 3 times/week.

The comparison between actual and perceived CVD risk is presented in Table 3. Based on the SCORE, 46.2% of subjects were at low risk, 39.9% were at moderate risk, and 13.9% were at high or very high risk for future cardiovascular events.

Table 1

Characteristics of participants (n=208).

Characteristics	n (%) / mean \pm SD	Median	Range
Female, n (%)	187 (89.9)		
Age, years	52.7 \pm 7.9	54.0	30.0–60.0
Education (college or above), n (%)	61 (29.3)		
Employment (employed), n (%)	77 (37.0)		
Disease duration, years	6.8 \pm 5.3	6.0	1.0–31.0
RF or anti-CCP antibody positivity, n (%)	122 (58.7)		
CRP, mg/dL	0.3 \pm 0.8	0.1	0.0–6.0
Extra-articular disease (yes), n (%)	51 (24.5)		
Function (0–10)	0.9 \pm 1.3	0.3	0–7.0
Psychological status (0–10)	2.7 \pm 2.5	2.2	0–9.9
Pain (0–10)	3.6 \pm 2.6	3.0	0–9.0
Fatigue (0–10)	4.7 \pm 2.7	5.0	0–10.0
General health (0–10)	4.8 \pm 2.4	5.0	0–10.0
RA treatment, n (%)			
Being treated with DMARDs, n (%)	197 (94.7)		
Hydroxychloroquine	150 (72.1)		
Methotrexate	77 (37.0)		
Bucillamine	52 (25.0)		
Tacrolimus	24 (11.5)		
Leflunomide	23 (11.1)		
Sulfasalazine	14 (6.7)		
Mizoribine	10 (4.8)		
Being treated with biologics, n (%)	11 (5.3)		
Being treated with glucocorticoid, n (%)	135 (64.9)		
Glucocorticoid current dose (mg prednisolone equivalent/day)	2.67 \pm 2.94		
Being treated with NSAIDs, n (%)	194 (93.3)		

anti-CCP antibody = anticyclic citrullinated peptide antibody, CRP = C-reactive protein, DMARD = disease-modifying antirheumatic drug, n = total sample, NSAID = nonsteroidal antiinflammatory drug, RA = rheumatoid arthritis, RF = rheumatoid factor, SD = standard deviation.

Table 2

Cardiovascular risk factors in patients with rheumatoid arthritis (n=208).

Cardiovascular risk factors	n (%) / mean \pm SD
BP	
Hypertension, n (%)	84 (40.4)
Systolic BP, mmHg	127.2 \pm 16.1
Diastolic BP, mmHg	75.7 \pm 12.9
Taking antihypertensive medication, n (%)	56 (26.9)
Lipid values	
TC, mg/dL	183.0 \pm 32.4
HDL-C, mg/dL	61.6 \pm 15.2
LDL-C, mg/dL	99.3 \pm 30.0
Taking lipid lowering medication, n (%)	37 (17.8)
Diabetes, n (%)	15 (7.2)
Fasting blood glucose, mg/dL	95.4 \pm 17.0
Taking insulin or antidiabetic drug, n (%)	10 (4.8)
BMI (kg/m ²)	22.7 \pm 3.4
BMI \geq 25 kg/m ² , n (%)	38 (18.3)
History of CVD, n (%)	8 (3.9)
Parental history of CVD, n (%)	37 (17.8)
Current smoker, n (%)	11 (5.3)
Physical inactivity, n (%)	159 (76.4)

CVD refers to self-reported diagnosed heart attack, angina pectoris, or stroke; diabetes refers to fasting blood glucose \geq 126 mg/dL or taking glucose lowering medications; hypertension refers to BP \geq 140/90 mmHg or on antihypertensive medication; n refers to total sample; and physical inactivity refers to physical activity less than 3 times/week. BMI = body mass index, BP = blood pressure, CVD = cardiovascular disease, HDL-C = high-density lipoprotein cholesterol, LDL-C = low-density lipoprotein cholesterol, SD = standard deviation, TC = total cholesterol.

Table 3

Cross-tabulation between actual and perceived CVD risk in patients with rheumatoid arthritis (n=208).

	Actual CVD risk, n (%)			
	Low	Moderate	High	Very high
Perceived CVD risk				
Low	24 (25.0)	11 (13.3)	2 (33.3)	1 (4.3)
Moderate	50 (52.1)	44 (53.0)	3 (50.0)	12 (52.2)
High	16 (16.7)	12 (14.5)	–	10 (43.5)
Very high	6 (6.3)	16 (19.3)	1 (16.7)	–
Total	94 (100.0)	83 (100.0)	6 (100.0)	23 (100.0)

Actual CVD risk was estimated using SCORE; low risk = SCORE < 1%; moderate risk = 1 ≤ SCORE < 5%; high risk = 5 ≤ SCORE < 10%; and very high risk = SCORE ≥ 10% or those with diabetes or established CVD. CVD = cardiovascular disease, SCORE = Systematic Coronary Risk Evaluation.

However, 18.3% perceived their CVD risk as low, 52.5% perceived it as moderate, and 29.4% perceived it as high or very high. The chance of perceiving oneself as being at high risk for CVD generally increased as actual CVD risk increased, but there were substantial gaps between them. Among those at very high risk, 56.5% perceived themselves at low or moderate CVD risk, whereas 75% of subjects with low risk for CVD overestimated their risk.

To identify the influence of cardiovascular risk factors on perceived CVD risk in RA patients, we assessed the prevalence of cardiovascular risk factors by perceived CVD risk (Table 4). The proportion of cardiovascular risk factors was generally unfavorable among those perceiving themselves at high risk for CVD. Taking medications to control BP or blood lipids and having a parental history of CVD were significantly associated with perceived high risk for CVD. However, diabetes, obesity, smoking status, and physical inactivity were not associated with the perceived CVD risk in a statistically significant manner.

Table 5 shows the proportions of patients with RA who did not attain CVD prevention guideline goals based on their actual CVD risk. Generally, the failure to attain the goals was most prevalent in the high and very high risk groups. About 45% in the high-risk group did not have their BP under control; 69% had LDL-C levels higher than the recommended level; and 31% were obese.

4. Discussion

Persons with RA suffer from high mortality from CVD.^[13] To effectively prevent CVD in this group, accurate estimation of the risk for CVD is an important 1st step. In this study, we estimated CVD risk using the SCORE and compared it with perceived CVD risk in patients with RA.

Before discussing the findings of this study, several limitations should be acknowledged in order to appropriately interpret the results. First, we compared perceived and actual risk of CVD with cross-tabulation. The end point for the SCORE is fatal atherosclerotic events, such as heart attack, stroke, or other occlusive arterial disease. Subjects may not have understood the meaning of the terms “cardiovascular disease” or “at risk,” and they may have perceived the term “risk of cardiovascular disease” somewhat differently. Self-reported data for extra-articular diseases may have affected the study’s findings, that is, under-representing the true finding may involve bias due to memory problems. Also, 89.9% of the subjects in the study were women. The average age of the subjects was 52.7 (±7.9), and the incidence of CVD in this age group is higher in men. Future studies should oversample men to have parity and to be able to make gender specific analyses. Nevertheless, important findings from this study were that patients with RA who are at high risk for future CVD underestimate their risk and the proportion of patients with

Table 4

Prevalence of cardiovascular risk factors by perceived CVD risk in rheumatoid arthritis (n=208).

Cardiovascular risk factors	Perceived CVD risk, n (%)			χ ²	P
	Low (n=38)	Moderate (n=109)	High or very high (n=61)		
Hypertension	12 (31.6)	41 (37.6)	31 (50.8)	4.330	0.115
Taking antihypertensive medication	6 (15.8)	28 (25.7)	22 (36.1)	6.742	0.034
TC ≥ 190 mg/dL	13 (34.2)	42 (38.5)	26 (42.6)	0.713	0.700
High LDL-C	9 (23.7)	39 (35.8)	26 (42.6)	3.668	0.160
Low HDL-C	6 (15.8)	10 (9.2)	7 (11.5)	1.269	0.530
Taking lipid lowering medication	2 (5.3)	20 (18.3)	15 (24.6)	6.030	0.049*
Diabetes	1 (2.6)	9 (8.3)	5 (8.2)		0.554*
Taking insulin or antidiabetic drug	1 (2.6)	5 (4.6)	4 (6.6)		0.752*
BMI ≥ 25 kg/m ²	7 (18.4)	14 (12.8)	17 (27.9)	5.914	0.052
Parental history of CVD	4 (10.5)	15 (13.8)	18 (29.5)	8.308	0.016
Current smoker	2 (5.3)	6 (5.5)	3 (4.9)		0.100*
Physical inactivity	31 (81.6)	84 (77.1)	44 (72.1)	1.210	0.546

CVD refers to self-reported diagnosed heart attack, angina pectoris or stroke; physical inactivity refers to less than 3 times/week of moderate exercise; hypertension refers to BP ≥ 140/90 mmHg or on antihypertensive medication; high LDL-C refers to LDL-C ≥ 115 mg/dL for low or moderate risk group, LDL-C ≥ 100 mg/dL for high risk group, and LDL-C ≥ 70 mg/dL for very high risk group; low HDL-C refers to HDL-C < 40 mg/dL for men and HDL-C < 45 mg/dL for women; diabetes refers to fasting blood glucose ≥ 126 mg/dL or taking glucose lowering medications. BMI = body mass index, CVD = cardiovascular disease, HDL-C = high-density lipoprotein cholesterol, LDL-C = low-density lipoprotein cholesterol, TC = total cholesterol.

* Fisher’s exact test.

Table 5
Proportions of patients with rheumatoid arthritis who did not attain CVD prevention guidelines by risk groups (n=208).

	Actual CVD risk, n (%)			χ^2	P
	Low (n=96)	Moderate (n=83)	High or very high (n=29)		
High BP	13 (13.5)	29 (34.9)	13 (44.8)	16.335	0.000
Taking antihypertensive medication	9 (9.4)	31 (37.3)	16 (55.2)	31.374	0.000
High LDL-C	25 (26.0)	29 (34.9)	20 (69.0)	17.928	0.000
Low HDL-C	5 (5.2)	14 (16.9)	4 (13.8)	6.409	0.041
Taking lipid lowering medication	5 (5.2)	21 (25.3)	11 (37.9)	21.638	0.000
High glucose	–	–	10 (34.5)	–	–
Taking insulin or antidiabetic drug	–	–	10 (34.5)	–	–
BMI \geq 25 kg/m ²	13 (13.5)	16 (19.3)	9 (31.0)	4.658	0.097
Current smoking	2 (2.1)	6 (7.2)	3 (10.3)		0.106*
Physical inactivity	81 (84.4)	55 (66.3)	23 (79.3)	8.261	0.016

High BP refers to BP \geq 140/90 mmHg, if diabetes is present BP \geq 130/80 mmHg; high LDL-C refers to LDL-C \geq 115 mg/dL for low or moderate risk group, LDL-C \geq 100 mg/dL for high risk group, and LDL-C \geq 70 mg/dL for very high risk group; low HDL-C refers to HDL-C $<$ 40 mg/dL for men and HDL-C $<$ 45 mg/dL for women; high glucose refers to FBS \geq 126 mg/dL, if diabetes is present FBS \geq 100 mg/dL; physical inactivity refers to less than 3 times/week of moderate exercise. BMI = body mass index, BP = blood pressure, CVD = cardiovascular disease, FBS = fasting blood sugar, HDL-C = high-density lipoprotein cholesterol, LDL-C = low-density lipoprotein cholesterol.

* Fisher's exact test.

RA who did not meet the prevention guideline goals is substantial.

Based on the SCORE, 14% of subjects with RA in this study were identified to be at very high or high risk for CVD, 39.9% at moderate risk, and 46.2% at low risk. The proportion of those at moderate or high risk for CVD is high compared to the general population of Korean women.^[29] The risks for RA and CVD are in opposite directions for women and men, that is, the risk for RA is higher in women, and the risk for CVD is higher in men. Although 10.1% of the subjects in this study were men, the excessive CVD risk found in this study may be partially attributable to RA. The best possible way to reduce the increased risk in this group may be comprehensive CVD risk assessment on a regular basis and risk reduction efforts based on empirically validated guidelines.

Risk perception influences an individual's risk reduction efforts.^[18,19] Understanding the perceived risk of developing CVD in people with RA might give us better insight into how they see CVD, thereby facilitating the development of effective interventions for CVD prevention. More than half of the subjects perceived their 10-year CVD risk to be moderate, 18.3% to be low, and 29.4% to be high or very high. Substantial gaps existed when perceived risk was compared with the actual risk of CVD. Overall, 75.1% of patients at low risk overestimated their 10-year CVD risk, while 96.6% of those at high or very high CVD risk underestimated it. Underestimation of their own risk among those at high CVD risk is especially of concern because they may be less likely to adopt or maintain risk-reduction behaviors. Patients who have severe RA symptoms, such as morning stiffness or pain, might have a poor perception of their health and therefore overestimate their CVD risk. Further studies are warranted to assess the relationships among RA-related symptoms, risk perception, and healthy behavior.

To identify cardiovascular risk factors that affect perceived CVD risk in this population, the prevalence of cardiovascular risk factors by perceived CVD risk was examined. The percentages of patients on antihypertensive or lipid-lowering medications were significantly higher in those perceiving themselves to be at high risk for CVD, but taking medications to lower glucose levels did not affect the perceived risk status. Having a parent diagnosed with CVD increased the likelihood of perceiving themselves to be at high risk for CVD, presumably by making the individual more

aware of the disease and potential role of genetics. Regrettably, unhealthy lifestyles such as cigarette smoking, physical inactivity, and obesity did not affect the perceived risk for CVD in this population. Among Koreans at high risk for CVD, levels of CVD knowledge is the significant predictor of CVD risk perception.^[30] Subjects in this study may lack knowledge about the role of lifestyle factors in the development of CVD and thus may not accurately perceive their risk for future cardiac events. Tailored educational programs on CVD and risk-factor control should be developed and applied as a part of each patient's visit.

Strict adherence to evidence-based guidelines may maximize the benefits of risk reduction. However, this study showed suboptimal attainment of cardiovascular risk factors based on the EULAR guidelines. The effects of risk reduction were most beneficial in the high-risk group,^[31,32] but unfortunately, the attainment of the goal was the worst in this group. About 45% of subjects at high risk had a BP higher than recommended, 69% did not attain the LDL-C goal, 31% were obese, and most of them (79%) were physically inactive even though they were able to perform most daily activities without any difficulty. Major symptoms of RA, such as fatigue, pain, and stiffness, also may affect physical activity levels. Physical activity can be improved substantially through better disease control and vice versa.^[33] Motivation and attitude toward exercise also make a difference in the levels of physical activity in patients with RA.^[34] The subjects need further emphasis on the importance of exercise through education and counselling. Also, they need to develop better behavioral skills that allow them to recognize and react proactively to the importance of a healthy lifestyle for preventing CVD.

For those at high risk, lifestyle modification alone often is insufficient to meet the guideline's goals. Current CVD prevention guidelines suggest using medications to lower blood lipids.^[15,17] In this study, we found a significant treatment gap in patients with RA in Korea. About half of patients at high risk for CVD were treated with lipid-lowering medications, but only about 33% of them met the LDL-C goal (data not shown). In people with RA, the effective suppression of inflammation also affects their cholesterol levels in a paradoxical way, that is, increasing both LDL-C and HDL-C when the patient's CRP level decreases.^[35] This suggests that information about the inflammatory state has additional importance for the interpretation of

lipid levels and CVD risk. The TC/HDL-C ratio, rather than LDL-C or HDL-C alone, and CRP levels should be considered in conducting CVD risk assessments and managing lipids in patients with RA.

In conclusion, in this study, we found suboptimal attainment of the CVD guideline goals in patients with RA. Gaps between perceived and actual risk for CVD may be partially attributable to the low levels of goal attainment. Efforts to prevent CVD are especially important in RA patients, given that these patients carry a heavy burden of CVD risk, and the prevalence of RA is currently increasing in Korea.^[3] RA patients at high risk for developing CVD should be counselled about their increased risk. Detection in asymptomatic patients who are at high risk for CVD is crucial for adequate prevention of CVD. Routine screening and strict adherence to guideline goals are necessary in this population. Tight control of disease activity may also be important in lowering the risk of CVD. Healthcare providers should actively disseminate information about the increased risk of CVD and the ways to reduce this risk. Informing RA patients how to estimate their CVD risk with simple, office-based risk assessment tools, such as the SCORE, can be effective in fostering accurate risk perception. It may also motivate them to reduce their increased risk of CVD, especially those who underestimate their high risk. Further studies are warranted to evaluate RA patients' knowledge of CVD and predictors of lack of goal attainment to help these patients effectively reduce their risk for CVD.

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