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Total Knee Arthroplasty Positively Influences The Progression Of Arteriosclerosis Over Time: An Evaluation Using The Cardio-Ankle Vascular Index

Orthopaedics / Knee & Lower Leg / Joint Replacement - Primary

YOSHINORI ISHII, Hideo Noguchi, Junko Sato, Ikuko Takahashi

Ishii Orthopaedic & Rehabilitation Clinic, Gyoda, Saitama, Japan

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Background
Physical function is expected to improve with an increase in physical activity owing to improvement of knee joint pain after total knee arthroplasty (TKA).

Objectives
This study was performed to evaluate the impact of TKA on arteriosclerosis by measuring the cardio-ankle vascular index (CAVI) before and after surgery. The hypothesis is that TKAs have positive effects on the CAVI, which is reported to deteriorate over time (0.5 per 10 years), by increasing activity after TKA.

Study Design & Methods
A total of 206 consecutive primary knees (206 patients, Male 32/ Female 174) that underwent unilateral TKA from May 2011 to February 2021 were evaluated. The mean age at the time of surgery was 73 years (range 39–90 years). The preoperative diagnosis for all patients was osteoarthritis. The CAVI, an index of the overall stiffness of the artery from the origin of the aorta to the ankle, was used to evaluate the degree of arteriosclerosis. The CAVI was measured with a standardized method using a noninvasive blood pressure-independent device. The examination was performed in a room in which a standard temperature (22–26°C) was maintained. At first, the length was measured from the origin of aorta to the ankle after the patient lies on supine position on the bed at rest. Next, cuffs used to measure blood pressure are wrapped around the right and left upper arms, as well as the right and left ankle joints, and a microphone that detects heart sound is attached to the chest. At the flip of a switch, the instrument automatically measures pulse wave and blood pressure and calculates the CAVI value. The entire measurement takes about 15 minutes, and the test is painless. The CAVI cut-off values of 8 and 9 were proposed by the Japan Society for Vascular Failure (<8.0, normal; 8.0 to <9.0, borderline; and ≥9.0, abnormal). The CAVI of the TKA side and non-TKA side was compared before and 1 year after TKA. Continuous variables are expressed as median [25th percentile, 75th percentile].

Results
Clinical scores evaluated by Hospital for Special Surgery Score were improved from 45 [36, 52] preoperatively to 92 [92, 94] at 1 year postoperatively. There were no differences in the CAVI before and after TKA on the TKA side (8.8 [7.8,9.5] and 8.9 [8.0, 9.6] respectively; $p = 0.356$) and non-TKA side (8.8 [7.9, 9.6] and 9.0 [8.1, 9.7] respectively; $p = 0.200$). The CAVI, which did not differ between the two sides preoperatively ($p = 0.625$), differed significantly between the two sides postoperatively ($p = 0.013$). A generalized linear model showed no interaction between each time point and the measured sides in terms of the CAVI ($p= 0.013$). The relationship between the preoperative CAVI and the difference between the preoperative and postoperative CAVI was examined, showing that $R = -0.428$ ($p < 0.001$) for the TKA side and $R = -0.416$ ($p < 0.001$) for the non-TKA side (significant negative correlation).

Conclusions

CAVI did not significantly worsen over time on both sides, and postoperative values were significantly better on the operative side, suggesting that TKA may slow the progression of atherosclerosis (especially on the operative side). In addition, the negative correlation between preoperative values and postoperative changes revealed that the effect of TKA was greater the higher the CAVI (i.e., the more advanced the atherosclerosis). This study demonstrated that the positive effect of total knee arthroplasty for osteoarthritis of the knee on progression of arteriosclerosis evaluated by cardio-ankle vascular index.