INTRODUCTION:
Single-bundle anterior cruciate ligament (ACL) reconstruction has demonstrated good clinical outcome for ACL injury. However, residual rotational instability has been reported. A recently published biomechanical study showed that double-bundle ACL reconstruction restores knee kinematics more closely to normal than single-bundle ACL reconstruction. Although femoral tunnels are commonly created arthroscopically through the tibial tunnel in ACL reconstruction, another cadaveric study demonstrated that the transtibial drilling method tends to place the femoral tunnel high in the notch, and out of the femoral footprint. Therefore, many surgeons have attempted to create femoral tunnels through the far anteromedial portal. However, this anteromedial drilling technique has the potential risk of peroneal nerve injury, since the pins tend to go through the posterolateral side of the lateral femoral condyle. The purpose of this study was to investigate the risk of common peroneal nerve injury with the anteromedial drilling technique.

MATERIALS AND METHODS:
We used 10 human cadaveric knees (mean age, 83.1 years, range, 49-102 years, 4 men and 6 women). Height and weight measurement were not available. All cadaveric knees had an intact ACL and minor cartilage and meniscal lesion. The skin, muscles and extensor mechanisms were sharply resected, leaving the capsule, collateral ligaments, cruciate ligaments, meniscus. The intact ACL was identified and dissected from its femoral and tibial insertion, leaving a 2-mm soft tissue footprint. The femoral and tibial insertions of anteromedial bundle (AM) and posterolateral bundle (PL) were outlined. Centers of both the AM and PL were carefully marked on the femoral and tibial sides. Subsequently, a one-third tubular 2-hole plate (Zimmer, Inc. Warsaw) was placed on each bone with an open hole over the central AM and PL insertions. A screw was placed through the other hole in each plate, securing it to the bone. In the first and second groups (FM-PL group, FM-AM group), the pin was drilled in the empty hole on the PL or AM bundle femoral insertion though the far anteromedial portal (FM), which was 5mm above the meniscus and 5mm away from the articular cartilage of the medial condyle at a knee flexion of 90° and 120°. In the third group (PL-PL group), the pin was drilled antegrade from the PL bundle femoral insertion to the PL bundle tibial insertion at a knee flexion of 90° and 120°. In the fourth group (AM-AM group), the pin was drilled antegrade from the AM bundle femoral insertion to the AM bundle tibial insertion at a knee flexion of 90° and 120°. We measured the minimum distance between the point at which the pin emerged from the lateral cortex of the femur and the ipsilateral common peroneal nerve. (Fig.1)
The result for knee flexion at 90° and 120° were analyzed by the use of a T-test, and compared among 4 groups using the ANOVA method. P < 0.05 was considered to be statistically significant.

RESULTS:
At a knee flexion of 90°, the mean distance to the peroneal nerve was 15.3mm in the FM-PL group (range, 6 to 25mm; SD, 9.11mm), 13.4mm in the FM-AM group (range, 3 to 30mm; SD, 7.45mm), 27.9mm in the PL-PL group (range, 9 to 52mm; SD, 14.5mm), and 30.8mm in the AM-AM group (range, 19 to 58mm; SD, 10.19mm). (Fig.2)
At a knee flexion of 120°, the mean distance was 17.3mm in the FM-PL group (range, 9 to 28mm; SD, 6.44mm), 18.1mm in the FM-AM group (range, 11 to 27mm; SD, 4.95mm), 32.2mm in the PL-PL group (range, 18 to 65mm; SD, 14.87mm), and 36.6mm in the AM-AM group (range, 21 to 60mm; SD, 11.01mm). (Fig.2)
Significant differences were observed between 90° and 120° of knee flexion in the FM-AM, PL-PL and AM-AM groups. In addition, there were significant differences between the FM-PL group, the FM-AM group and the AM-AM group at knee flexion of 90° and 120°.

DISCUSSION:
Our results revealed that the distance to the peroneal nerve in far anteromedial drilling (FM-PL, FM-AM) groups was shorter than in transtibial technique (PL-PL and AM-AM) groups. This indicates that far anteromedial drilling has a relative higher risk of peroneal nerve injury in comparison to the transtibial drilling technique. Nevertheless, various studies demonstrated the advantage of using the far anteromedial drilling technique for tunnel placement in anatomical double bundle ACL reconstruction. However, the risk of the peroneal injury would be decreased at a higher knee flexion angle. This impression is agreement with a study by Nakamura.

Our results thus may indicate that far anteromedial drilling in ACL reconstruction should be carefully undertaken with a higher knee flexion angle in order to avoid the common peroneal nerve injury.

Fig 1. Measurement method.

Fig 2. Mean distance to peroneal nerve

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