Cadaveric Dissection of the Lower Extremity: A Comprehensive Study of the Female Knee Joint and Anterior Cruciate Ligament Injury

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Introduction

Problem: Females have up to eight times higher incidence of **Anterior Cruciate Ligament (ACL)** injury when compared to males, due to a variety of anatomical and physiological factors[1].

Goal: To gain a deeper understanding of the anatomical differences in the lower extremity of females versus males, as well as explore the factors that lead to higher incidence rates of ACL injury.

Methods

Dissection tools/techniques:

- Scalpels, surgical scissors, forceps, probes, saw, and bone saw
- External structures were either removed or reflected to observe deeper structures

Figure 1. Dissection Tools

Anatomical Differences

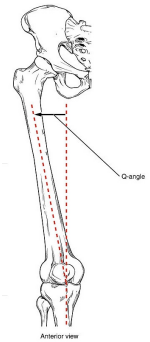

Figure 2. Q-angle

Figure 3. Intercondylar Notch

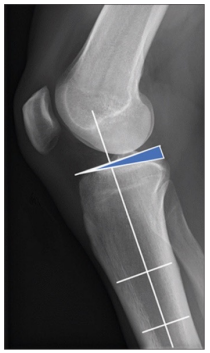

Figure 4. Tibial Slope

Females tend to have larger Q-angles, smaller intercondylar notches, and steeper tibial slopes than males. These anatomical differences can lead to ACL injury in combination with muscular weakness or poor movement patterns.

Posterolateral Hip

Weakness of the **external rotators** of the hip is negatively correlated with knee valgus, suggesting that activation and strengthening of these muscles could prevent ACL injury[2].

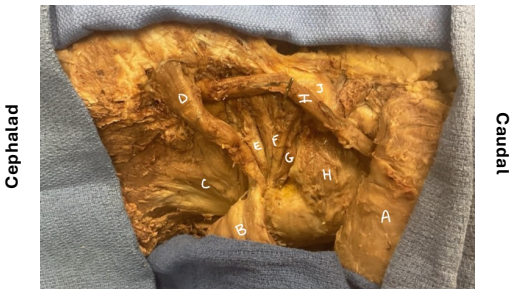

Figure 5. Posterior Hip After Definition of External Rotators. Glutes maximus (A), gluteus medius (B), gluteus minimus (C), piriformis (D), superior gemellus (E), obturator externus (F), inferior gemellus (G), quadratus femoris (H), sciatic nerve (I), and sacrotuberous ligament (J) are identified.

Knee

The **ACL** is the primary structure restricting anterior tibial translation and plays a part in resisting axial rotation of the lower leg[3].

Figure 6. Anterior View of the Knee Joint. The ACL (A), meniscus (B), patella (C), and patellar tendon (D) are identified.

Medial Ankle

The ankle is a developing topic in ACL research. There is a link between subtalar pronation and ACL injury[4]. Activation of the ankle **invertors** may counteract this and decrease injury risk.

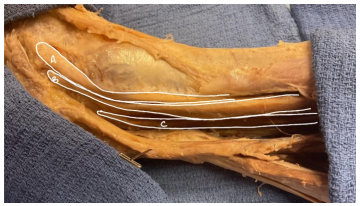

Figure 7. Medial View of the Ankle Joint
Tendons of the tibialis posterior (A), flexor digitorum longus (B), and flexor hallucis longus (C) are identified.

Drop Jump Biomechanics

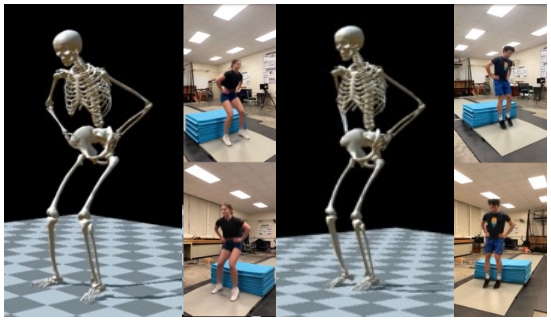

Figure 8. OpenCap Video Analysis

Females tend to land from a drop jump or cutting maneuver with lower degrees of knee flexion, hip abduction, and greater hip flexion[5].

Surgery and Rehabilitation

The most widely used surgical reconstruction techniques are bone-patellar-bone grafts and hamstring grafts[6]. New techniques such as bridge-enhanced ACL repair (BEAR) are being explored[7].

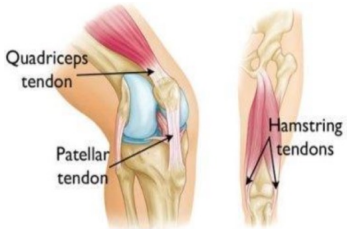

Figure 9. Anatomical locations of common graft sites

Rehabilitation focuses on restoring range of motion, strength, and balance[8].

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