Lesser Tuberosity Perfusion after Ligation of the Anterior Humeral Circumflex Artery: Dual-Energy Computed Tomography Cadaveric Study

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Introduction:
A lesser tuberosity osteotomy (LTO) is commonly utilized during shoulder arthroplasty. However, LTOs are associated with nonunion rates as high as 13%. The anterior humeral circumflex artery (AHCA)—the primary blood supply to the lesser tuberosity—are commonly ligated during the approach which may compromise blood flow and contribute to nonunion. Dual-energy computed tomography (DECT) is a novel advanced imaging modality used to evaluate intraosseous perfusion. This study hypothesized that AHCA ligation would reduce perfusion to the lesser tuberosity on DECT in a cadaveric model.

Methods:
Ten cadaveric shoulders were prepared via a standard deltopectoral approach. The axillary artery was cannulated for contrast injection. Two experimental sequences were performed on each cadaver: 1) With the AHCA provisionally suture ligated, a radiopaque contrast agent was injected to visualize and quantify perfusion using dual-energy computer tomography (DECT). 2) Suture ligature was removed to restore AHCA patency, and the axillary artery was flushed with saline. Radiopaque contrast was again injected, and perfusion was visualized and quantified using dual-energy computed tomography (DECT). Perfusion was quantified on virtual non-contrast (VNC), conventional mixed (CM), and mixed images using Hounsfield units (HU.)

Results:
The mean cadaver age was 50.7 years. The AHCA, posterior humeral circumflex artery, and ascending branches were visible in all specimens. AHCA ligation resulted in 32.5% total perfusion loss compared to patent AHCA cadaver models (VNC: 87.5 HU vs 105 HU; CM: 133.3 HU vs 218.8 HU; Mixed: 221 HU vs 324 HU, respectively).

Discussion/Conclusion:
In this cadaveric model, AHCA ligation resulted in markedly reduced perfusion to the lesser tuberosity on DECT. Future studies are warranted to evaluate whether AHCA ligation may contribute to LTO nonunion in the setting of shoulder arthroplasty.

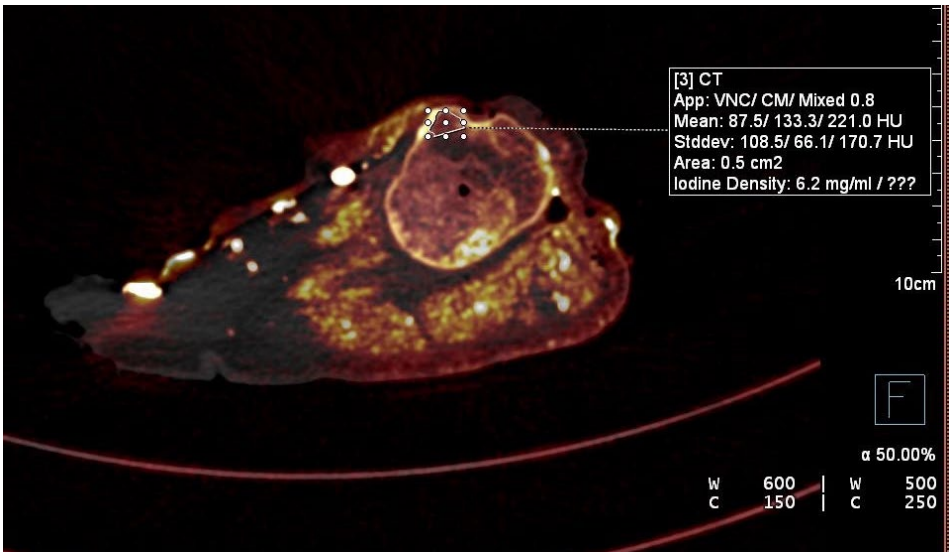

Figure 1: DECT perfusion imaging with ligated ACHA (VNC 87.5 HU, CM 133.3 HU, Mixed 221 HU)

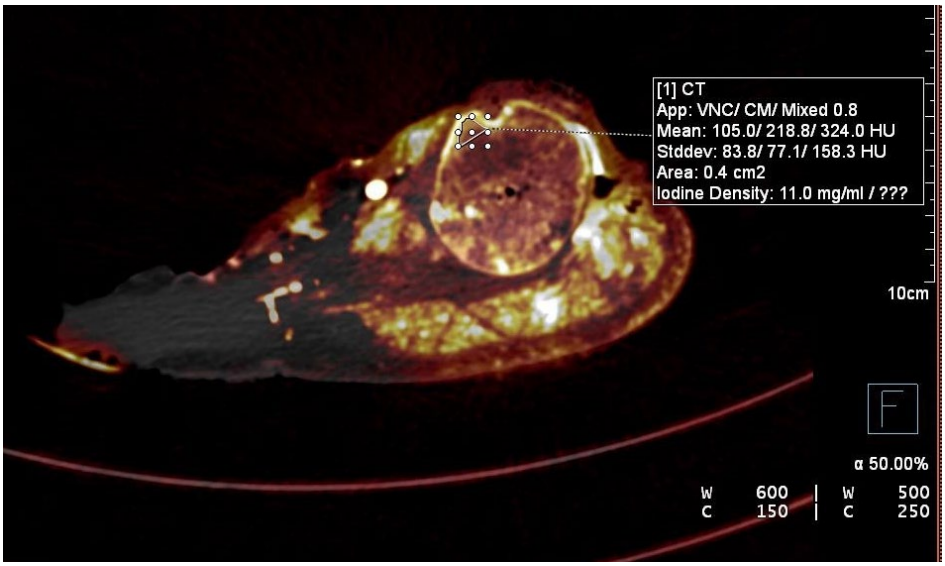

Figure 2: DECT perfusion imaging with patent ACHA (VNC 105 HU, CM 218.8 HU, Mixed 324 HU)