

Early Changes in Nutrient Artery Blood Flow Following Tibial Nailing With and Without Reaming: A Preliminary Study

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Objective: To quantify the changes in nutrient artery blood flow following reamed and unreamed nailing of intact canine tibiae.

Design: In vivo animal study.

Intervention: Eighteen dogs underwent nutrient artery blood flow measurements over a fourteen-day period. The intervention groups consisted of controls (Group I), nailing without reaming (Group II), and nailing with reaming (Group III).

Main Outcome Measurements: Nutrient artery blood flow was measured through implantable ultrasonic blood flow probes placed around the nutrient artery of the tibia.

Results: Nutrient artery blood flow averaged 1.94 milliliters per minute over the fourteen-day period in Group I (no reaming or nailing performed). Nutrient artery blood flow following nailing without reaming (Group II) decreased to 44 percent of baseline

values immediately after the procedure. By postoperative day 1, flow had decreased to 23 percent of baseline; over the fourteen-day period, nutrient artery blood flow recovered toward baseline values. Immediately following nailing with reaming (Group III), nutrient artery blood flow measured zero milliliters per minute. Over the fourteen-day period, nutrient artery blood flow in this group averaged 39 percent of the baseline level (range 19 to 58 percent). Whereas nutrient artery blood flow recovered toward baseline values (99 percent of baseline) by fourteen days in Group II, nutrient artery blood flow measured only 26 percent of the baseline level on postoperative day fourteen in Group III.

Conclusions: The preliminary data suggest that nailing with reaming provides a double insult to the nutrient artery distribution.

Key Words: Tibia, Nutrient artery, Flow, Reaming, Nailing.

Intramedullary nail fixation of long bone fractures is a well-accepted and commonly employed technique. Excellent results using intramedullary nail fixation have been reported for both closed and open fractures (3,8,9,11, 18,23,25,27). Some investigators have cautioned against the use of intramedullary reaming in open fractures because of concerns of injury to the endosteal circulation that may result in an impaired cortical blood flow (5,16). In response to concerns regarding intramedullary reaming of open fractures, unreamed techniques have been developed in an effort to minimize damage to the endosteal blood supply and thereby improve cortical circulation. Small-diameter

nails have been developed in an effort to allow passage of the nail without reaming. Whereas these nails offer the theoretical advantage of improved cortical blood flow, they provide less canal contact (and thus a less stable construct) and have been shown to have a higher implant failure rate (12,26).

Prior studies have been performed to quantitatively measure alterations in bone blood flow associated with intramedullary nailing (10,13,14,17). Although these studies have documented vascular changes associated with intramedullary nailing, they have been limited by their ability to repeatedly measure blood flow over time and have also been limited by the fact that measurements were performed on anesthetized animals.

The purpose of the current investigation was to measure the changes in nutrient artery blood flow associated with tibial reaming and nailing. This study was designed to determine changes in nutrient artery blood flow over a fourteen-day period. More specifically, this study aimed to discover the effect of nailing without reaming and of nailing with reaming on nutrient artery blood flow. To the best of our knowledge, such a study has not been previously reported in the literature.

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