

**Incidence of Vacuum Phenomenon-Related Intra-Articular or Subfascial Gas Found on CT Scans of Closed Lower Extremity Fractures**

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**Purpose:** Recent work has proposed CT to be a more reliable alternative to the traditional saline load test when evaluating for traumatic arthrotomy, based on the presence or absence of intra-articular air. Vacuum phenomenon (VP), an accumulation of gas pulled out of solution, is a well-known entity primarily occurring within the vertebral column and associated with chronic degenerative changes. This phenomenon has been shown to occur, in case reports alone, along with lower extremity fracture. As VP may occur in association with closed lower extremity fractures, this could potentially limit the diagnostic potential of CT in the diagnosis of open fracture. Our purpose was to determine both the frequency at which VP occurs in association with closed lower extremity fractures and which fracture patterns are more likely to display VP.

**Methods:** A retrospective database review was conducted at a Level I community academic trauma center to identify all patients who sustained a closed fracture of the tibia or femur. Patients were included if a CT scan of the fracture was obtained. Fractures of the proximal femur and any periprosthetic fractures were excluded. After all inclusion and exclusion criteria were applied, a total of 153 patients were included in the final analysis. Age, gender, mechanism of injury, fracture location, and OTA classification were recorded for all patients. All CT scan axial cuts were reviewed to identify the presence or absence of gas.

**Results:** 27 (17.6%) of the 153 fractures were found to have intra-articular or subfascial gas on CT despite clear documentation indicating a closed injury with no significant skin compromise. Of the intra-articular fractures (OTA 33B/C, 41B/C and 43B/C), 20% (23 of 113) were found to have gas on CT. All cases were associated with fracture of the tibia ( $P = 0.002$ ). OTA type 43-C fractures were statistically significantly more likely to have presence of gas on CT when compared to other fracture types ( $P = 0.0002$ ).

**Conclusion:** CT demonstrated the presence of intra-articular or subfascial gas in 17.6% (27 of 153) of closed lower extremity fractures and in 20% (23 of 113) of closed intra-articular fractures. The possibility of vacuum phenomenon must be considered when utilizing this imaging modality as the confirmatory test for open intra-articular fracture or traumatic arthrotomy.