Secondary Intramedullary Nailing Following External Fixation for Tibial Shaft Fracture: What are the Factors that Affect Infection?

Joon-Woo Kim, MD*; Chang-Wug Oh, MD; Il Seo, MD; Kyeong Hyeon Park, MD; Jeong Heo, MD*
Kyungpook National University Hospital, Daegu, Korea, Republic of

Purpose: External fixation (EF) is a safe option for stabilization of tibial fractures in the polytraumatized patient as well as in fractures with severe soft-tissue damage. Intramedullary nailing (IMN) is the standard of treatment for the tibial shaft fractures. Sometimes, temporary EF is used before definitive nailing in case with compromised soft tissue or multiple injuries. Secondary IMN following EF of tibial shaft fracture is controversial, notably due to the infection risk, which is not precisely known. The purpose of the present study was to evaluate the incidence of infection and to identify its influencing factors after secondary IMN of tibial shaft fractures.

Methods: A prospective analysis was performed on 29 patients who were available to follow up for longer than 12 months from among those who underwent secondary IMN after EF for tibial shaft fractures. The patients included 26 men and 3 women, with a mean age of 51.4 years. The causes of injury were traffic accidents (n = 24), direct hit (n = 4), and a fall from height (n = 1). According to the AO/OTA classification, 11 were type A, 5 were type B, and 13 were type C fractures, including 17 open fractures (I: 3, II: 6, IIIA: 7, IIIB: 1 [Gustilo-Anderson criteria]). Acute compartment syndrome was accompanied in 5 cases. 20 patients had fractures other than tibia that required stabilization. 17 patients had non-orthopaedic injuries at head, chest, or abdomen.

Fracture was stabilized with EF initially, and internal conversion with IMN was done at an average of 19.8 days after patients' general condition and/or open wound improved. At the time of internal conversion, the EF pin site grades were 0 in 8 cases, 1 in 14 cases, 2 in 5 cases, and 3 in 2 cases, as described by Dahl. Additional procedures for soft-tissue coverage were required in 6 cases (skin grafting: 5, free flap: 1). Results were assessed according to the achievement and time to osseous union and complications, especially infections, at the final follow-up. Statistical analysis was performed to identify factors influencing results.

Results: Primary union was achieved by 27 of the 29 study subjects (93.1%) at an average of 18.8 weeks. Of 2 cases of nonunion, 1 had segmental bone loss at the index injury and healed after early autogenous bone graft. The other case of aseptic nonunion was healed after autogenous bone graft at 7 months post-initial surgery. There were 2 cases of deep infection (6.9%). Although the presence of open fracture and the duration of EF were not related to the occurrence of infection, pin site of grade 3 at the time of internal conversion had a strong relation to the development of infection versus pin site grade <3 ($P = 0.013$, Pearson's $\chi 2$ test).

Conclusion: Our findings demonstrate secondary IMN for thbial shaft fracture showed a low infection rate, considered to be a reliable procedure. However, caution should be taken to manage the EF pin site. Definitive surgery should be performed early, before onset of EF pin site infection.