

LEG CONQUASATION CAUSED BY PETROL TILLER WITH OPEN LOWER LEG FRACTURE

Ivan Golubović¹, Predrag Stojiljković¹, Zoran Golubović¹, Stevica Jeremić¹, Milan Radojković³, Goran Stevanović³, Stevo Najman³, Dragan Mihailović³, Slađana Petrović², Zoran Radovanović³, Sonja Stamenić¹, Saša Stojanović¹, Marija Trenkić Bozinović³, Lazar Lazović², Vladimir Živković¹, Aleksandar Tasić², Miroslav Trajanović⁴

We present a 71-year old patient admitted to Plastic and Reconstructive Surgery Clinic, Clinical Center Niš for the right leg conqasation. The patient was injured accidentally by a petrol tiller. On admission, both thigh and lower leg conqasation was observed with large wound on anteromedial thigh and one on medial side of the lower leg. Soft tissue and bones were covered with dirt and pieces of clothing. The wounds were thoroughly rinsed and dirt was removed followed by detailed debridement. After primary surgical treatment of the wound, open proximal lower leg fracture was stabilized with external skeletal fixation using two nails in the proximal and two nails in the distal fragment. Soft tissue defect was treated by plastic surgeon. The patient was administered anti-tetanus protection, antibiotic treatment and anticoagulant prophylaxis of deep vein thrombosis and pulmonary thromboembolism. Physical therapy was initiated subsequent to successful healing of the soft tissue wounds. External skeletal fixation was removed after three months for infection around the proximal nails and the treatment was continued using functional Sarmiento's plaster immobilization leading to full recovery of open lower leg fracture. *Acta Medica Medianae* 2014;53(1):34-41.

Key words: leg conqasation, petrol tiller, open lower leg fracture, primary surgical treatment, external skeletal fixation

Clinic of Orthopedics and Traumatology, Clinical Center Niš, Serbia¹
Institute of Radiology, Clinical Center Niš, Serbia²
Faculty of Medicine in Niš, Serbia³
Faculty of Mechanical Engineering in Niš, Serbia⁴

Contact: Ivan Golubović
Clinic of Orthopedics and Traumatology, Clinical Center Niš
Bul. Zorana Đinđića 48, 18000 Niš, Serbia
E-mail: golubowici@gmail.com

Introduction

Both thigh and lower leg conqasation injuries caused by engine tiller are among the most severe ones in bone and joint traumatology. The injury mechanism consists of firm strokes produced by sharp tiller knives which produce strong force easily damaging both soft tissues and bones. Since tillers are used in soil processing, the wounds are highly contaminated with anaerobic spore-forming bacteria, such as Clostridia. Skin and soft tissue destruction, comminution and bone defect, high level of both anaerobic and aerobic contamination and threatening infection make the treatment of these injuries, particularly open lower leg fracture, complex and challenging (1,2). Meticulous irrigation of these wounds, removal of all foreign bodies and dirt and thorough surgical debridement of damaged tissue are the prerequisites of successful

prevention of healing complications, especially infection, both non-specific and specific (tetanus and gas-gangrene). Also, fracture stabilization with external skeletal fixation, antibiotic therapy and anti-tetanus protection are of greatest importance. High-quality physiotherapy following successful healing of soft tissue wound(s) and bone fracture(s) is necessary for patient early recovery and faster return to everyday activities. The most common complications of leg conqasation include soft tissue and bone infection, gas-gangrene, fracture malunion and finally amputation (3-6).

Aim

The aim of the paper was to present our results in the treatment of severe thigh and lower leg conqasation injury with open lower leg fracture made by petrol tiller. Moreover, we aimed to highlight the therapeutic difficulties and complications of these complex injuries.

Case report

We present a 71-year old patient referred from regional hospital and admitted to Plastic and Reconstructive Surgery Clinic, Clinical Center Niš

for right leg conqasation with lower leg open fracture, Gustilo type IIIB (7,8). The patient was injured accidentally by a petrol tiller. He was administered anti-tetanus protection and anti-coagulant prophylaxis of deep vein thrombosis and pulmonary thromboembolism. After preoperative evaluation, the patient underwent surgery.

On admission, both thigh and lower leg conqasation was observed with large wound on anteromedial thigh and one on medial side of the lower leg (Figure 1).

Soft tissue and bones were covered with dirt and pieces of clothing. Wounds were thoroughly rinsed and dirt was removed followed by detailed debridement (Figure 2).



Figure 1. Large right thigh and lower leg conqasation injury



Figure 2. Removal of dirt and pieces of clothing

Wounds were thoroughly rinsed with saline, hydrogen peroxide and iodine solution (Figure 3). Detailed debridement followed (Figures 4,5,6). Soft tissue defect was treated by plastic surgeon using Thiersch-Ollier's skin graft (Figures 7,8,9).

Subsequently, the patient was transferred to Orthopaedics and Traumatology Clinic. Two directions X-rays of lower leg with knee joint was done (Figure 10). Afterwards, he was released and the treatment continued ambulatory with regular 7-day follow-up that included wound cleaning and changing of the dressing (Figure 11).

Gradually, progressive increase of injured leg usage was then allowed and physical therapy was initiated. However, on follow up three months after external skeletal fixation, an infection around the proximal nails was observed (Figure 12).

Antibiotic treatment and everyday wound cleaning and dressing were introduced, but without expected results. As infection persisted, the external skeletal fixation was removed and the treatment was continued using functional Sarmiento's plaster immobilization leading to full recovery of the open lower leg fracture (Figure 13). Right lower leg X-ray was performed through plaster (Figure 14). The patient continued walking with crutches and with full leaning on the injured leg. Six months after sustaining the injury, the plaster was removed followed by control X-rays that revealed the healed lower leg fracture (Figure 15).

Subsequently, the patient was referred to Ribarska spa for further physiotherapy which led to full recovery and return to normal life.



Figure 3. Meticulous wounds irrigation



Figure 4. Detailed wound debridement



Figure 5. Removed devitalized tissue

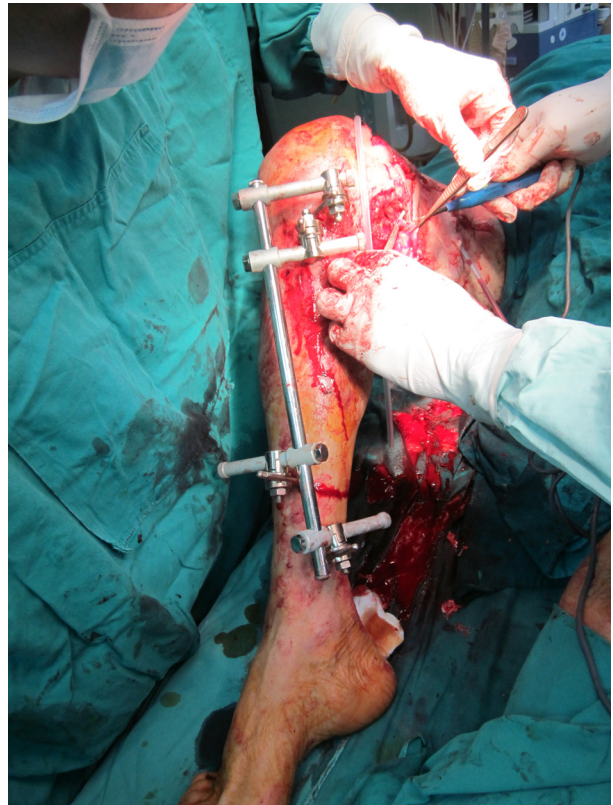


Figure 7. Placement of external skeletal fixation after reposition of proximal tibia open fracture

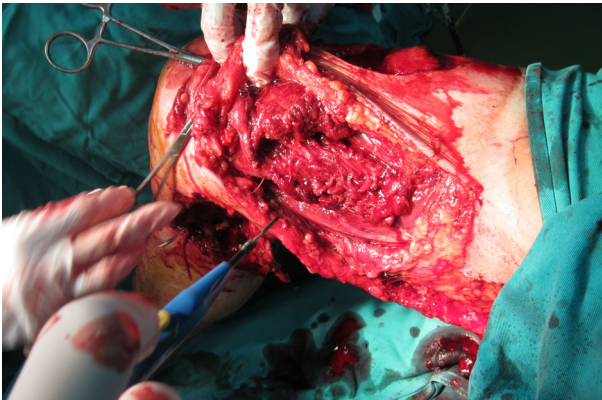


Figure 6. Wound appearance after detailed debridement and irrigation



Figure 8. The appearance of the wounds after application of Thiersch-Ollier's skin grafts



Figure 9. The appearance of the wounds after application of Thiersch-Ollier's skin grafts – another angle



Figure 10. Right lower leg X-rays depicting tibia's proximal third fracture after reposition and stabilization with external skeletal fixation



Figure 13. Right lower leg immobilized with functional Sarmiento's plaster



Figure 11. Patient's status on regular follow up



Figure 12. Infection around proximal nails of external skeletal fixation



Figure 14. Right lower leg x-rays through plaster depicting healing of tibia's proximal third fracture

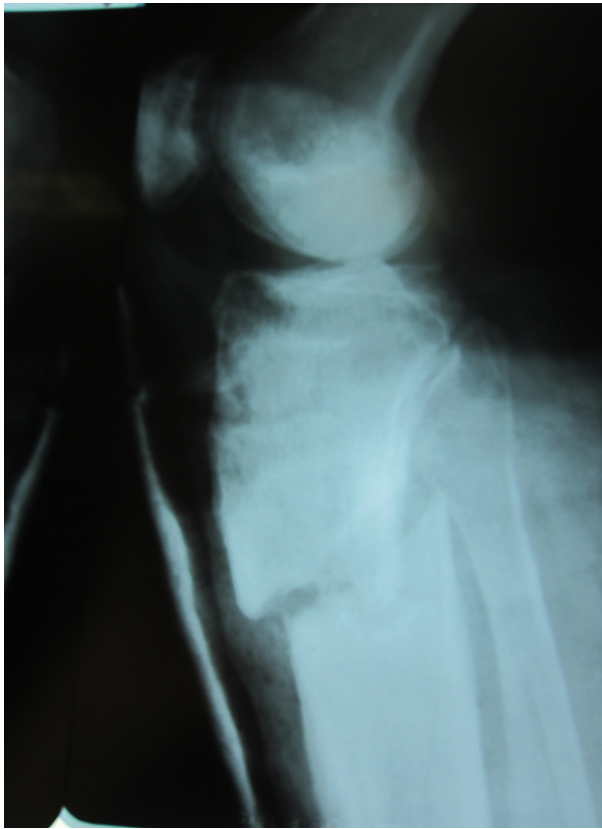


Figure 15. Healed right lower leg fracture after plaster removal



Figure 16. Patient's status after plaster removal

Discussion

A conqasant injury with open fracture of the lower leg requires urgent surgical treatment assuming good general status of the patient. It includes thorough wound rinsing and removal of the dirt, foreign bodies and cellular debris, followed by primary surgical care – debridement, fracture stabilization with external skeletal fixation, antibiotic therapy, anti-tetanus protection and delayed wound closure (1,6).

Primary surgical care – debridement of the open fracture wound is crucial for prevention or successful treatment of infection (non-specific soft tissue infection and osteitis, gas gangrene and tetanus). If possible, it has to be done within six hours after injury, since delayed primary surgical treatment - debridement allows progressive wound contamination. Wound smear, microbiological examination for contaminating microorganisms' identification and their sensitivity to antibiotics (biogram and antibiogram) are necessary before primary treatment. First step is meticulous wound irrigation using saline and hydrogen peroxide (sometimes more than 10L) followed by detailed cleaning and removal of all foreign bodies – dirt, pieces of clothing and cellular debris. Debridement must include extensive surgical removal of devitalized soft tissue (skin, fat, fascia, muscle and bone) (8,9). Since necrotic muscle tissue represents the environment susceptible for both aerobic and anaerobic bacteria, special care has to be made during muscle debridement regarding adequate assessment of its color, consistence, contractility and bleeding. If necessary, open fracture wound debridement may be repeated after 24 or 48 hours (secondary debridement) after demarcation and exposure of further (new) tissue devitalization. Successful prevention and curing of infection, especially deep osteitis, is one of the most important factors for leg salvation (9-11).

Further treatment includes bones reposition and external skeletal fixation which is the method of choice for lower leg open fracture stabilization except for Gustilo type I fractures when internal fixation is possible. External skeletal fixation provides optimal biomechanical conditions for successful fracture healing, good approach for wound care and does not interrupt knee and ankle joint movements. Postoperatively, patients are being mobilized early and start walking (12). Recently, in contemporary traumatology, primary intramedullary fixation of types I, II and IIIA open fractures preceded by thorough wound debridement is becoming more and more preferable (13,14). However, the role of intramedullary fixation in type IIB open fracture treatment is still controversial. Also, delayed intramedullary fixation after primary external skeletal fixation may be used as alternative treatment method for severe open fractures (11,15). If lacking external skeletal fixation devices, plaster immobilization of the

fracture may be applied after primary surgical care of the wound, with creating an aperture in the plaster above the wound site for wound assessment and care. In these circumstances, wound care is much more difficult compared to external skeletal fixation. Functional Sarmiento's plaster immobilization in the treatment of open lower leg fracture provides satisfactory results and is applicable upon healing of the wound and removal of external skeletal fixation.

Problems related to external skeletal fixation include common soft tissue and bone infection around the device nails, especially if applied more than six months (12,16-18). Edwards and al. reported 50 (29,24%) patients with soft tissue infection and 4 (2,33%) with local osteitis around the nails in a study of 171 patients with open fracture treated with external skeletal fixation (19). Marsh et al. reported the incidence of 39 (38,61%) patients with complications related to device nails among 101 patients with open tibia fracture treated with external skeletal fixation and 10 of them required device replacement (20). However, in the same study low incidence of deep bone infection around fracture (6%) was observed (20).

Open fracture wound, after primary surgical treatment and external skeletal fixation, is not to be closed primary. Delayed wound closure is preferable and is performed after infection is definitely ruled out, using suturing or plastic and reconstructive surgery procedures (fasciocutaneous or microvascular flap), depending on the soft tissue defect size (4,12,21).

Early intravenous antibiotic therapy in patients with lower leg open fractures should be initiated immediately on admission (22). It may include benzylpenicillin for anaerobes (4-6000000 IU/4h) and aminoglycoside for gram-negative flora (1gr/24h). In cases of highly contaminated open fracture (dirt), additional metronidazole or lincosamide may be administered to prevent gas gangrene. Suggested treatment should be administered three days after which benzyl-

penicillin should be replaced with third or fourth-generation cephalosporin. After completed microbiological examination, further antimicrobial treatment should be administered according to antibiogram results and continued for additional 48-72 hours for types I and II open fractures and 120 hours for type III (22-25). Anti-tetanus protection is mandatory for all patients with open fractures.

Conclusion

Conquasant lower leg injuries caused by petrol tiller are among the most severe ones in bone and joint traumatology. Since tillers are used in soil processing wound are almost always covered with dirt. Therefore, beside soft tissue and bone destruction, high level of both anaerobic and aerobic contamination of the wound are very common. Most frequent complications of these injuries include soft tissue infection and deep osteitis, fracture malunion and loss of the limb – amputation. Thorough irrigation of these wounds, removal of all foreign bodies and dirt and adequate surgical debridement of damaged tissue are mandatory for successful prevention of infection, both non-specific and specific (tetanus and gas-gangrene). Also, fracture stabilization with external skeletal fixation, antibiotic therapy and anti-tetanus protection are of greatest importance. Early physiotherapy following successful healing of soft tissue wound and bone fracture is necessary for full recovery. Strict adherence to these basic principles of open conquasant lower leg fracture treatment in presented patient resulted in good clinical and functional outcome and return to normal life.

Acknowledgement

This paper is part of the project III 41017 Virtual human osteoarticular system and its application in preclinical and clinical practice, funded by the ministry of Education and Science of Republic of Serbia.

References

1. Butković I. Prelomi potkolenice. U: Banovic D, ed. Traumatologija koštano-zglobnog sistema. Beograd: Zavod za udzbenike i nastavna sredstva; 1998: 39-46.
2. Chapman MW, Olson SA. Open fractures. In: Rockwood CA, ed. Rockwood and Green's fractures in adults. Philadelphia: Lippincott-Raven; 1996: 305-52.
3. Golubović I, Stojiljković P, Golubović Z, Stevanović G, Višnjić A, Trenkić M, et al. Gasna gangrena nakon otvorenog preloma potkolenice. Prikaz Slučaja. Acta Medica Medianae 2012; 51(2): 25-30. [[CrossRef](#)]
4. Golubović Z, Stojiljković P, Mačukanović-Golubović L, Milić D, Milenković S, Kadija M, et al. External fixation in the treatment of open tibial shaft fractures. Vojnosanit Pregl 2008; 65(5): 343-7.
5. Okike K, Bhattacharyya T. Trends in the management of open fractures. A critical analysis. J Bone Joint Surg Am 2006; 86: 2739-48. [[CrossRef](#)] [[PubMed](#)]
6. Olson SA. Instructional Course Lectures, The American Academy of Orthopaedic Surgeons - Open Fractures of the Tibial Shaft. Current Treatment. J Bone Joint Surg Am 1996; 78: 1428-37.
7. Gustilo RB, Anderson JT. Prevention of infection in the treatment of one thousand and twenty-five open fractures of long bones. Retrospective et prospective analyses. J Bone Joint Surg Am 1976; 58: 453-8. [[PubMed](#)]
8. Gustilo RB, Mendoza RM, Williams DN. Problems in the management of type III (severe) open fractures. A new classification of type III open fractures. J Trauma 1984; 24: 742-6. [[CrossRef](#)] [[PubMed](#)]
9. Clancey GJ, Hansen ST. Open fractures of tibia. A review of one hundred and two cases. J Bone Joint Surg Am 1978; 60: 118-22. [[PubMed](#)]
10. Kinsfater K, Jonassen EA. Osteomyelitis in grade II et III open tibia fractures with late debridman. J Orthop Trauma 1995; 9: 121-7. [[CrossRef](#)] [[PubMed](#)]
11. Golubovic I, Vukasinovic Z, Stojiljkovic P, Golubovic Z, Stamenic S, Najman S. Lecenje otvorenih segmentnih preloma potkolenice metodom spoljne skeletne fiksacije. Srp Arh Celok Lek 2012;140(11-12): 737-7.
12. Mitković M. Spoljna fiksacija u traumatologiji. Niš: Prosveta; 1992.
13. Court-Brown CM, McQueen MM, Quaba AA, Christie J. Locked intramedullary nailing of open tibial fractures. J Bone Joint Surg Am 1991; 73: 959-64. [[PubMed](#)]
14. Henley MB, Chapman JR, Agel J, Swiontkowski MF, Benirscke SK, Mayo KA. Comparison of unreamed tibial nails and external fixators in treatment of grade II and III open tibial shaft fractures. Orthop Trans 1995; 19: 438-9.
15. Tornetta P 3rd, Bergman M, Watnik N, Berkowicz g, Steur J. Treatment og grade IIIb open tibial fractures. A prospective randomized comparasion of external fixation and non-reamed locked nailing. J Bone Joint Surg Am 1993; 76: 13-9. [[PubMed](#)]
16. Bednar DA, Parikh J. Effect of time delay from injury to primary management on the incidence of deep infection after open fractures of the lower extremities caused by blunt trauma in adults. J Orthop Trauma 1993; 7: 532-5. [[CrossRef](#)]
17. Spencer J, Smith A, Woods D. The effect of time delay on infection in open long bone fractures: a 5-year prospective audit from a distict general hospital. Ann R Coll Surg Engl 2004; 86: 108-12. [[CrossRef](#)] [[PubMed](#)]
18. Golubović I, Stevanović G, Stojiljković P, Golubović Z, Stojiljković D, Višnjić A, et al. Konkvasantni prelom potkolenice nakon gaženja autobusom, lečen metodom spoljne skeletne fiksacije. Acta Fac Med Naiss 2012; 29(2): 103-9.
19. Edwards CC, Simmons SC, Browner BD, Weigel MC. Severe open fractures. Results treating 202 injuries with external fixation. Clin Orthop Relat Res 1988; 230: 98-115. [[PubMed](#)]
20. Marsh JL, Nepola JV, Wuest TK, Osteen D, Cox K, Oppenheim W. Unilateral external fixation until healing with the dynamic axial fixator for sever open tibial fractures. J Orthop Trauma 1991; 5: 341-8. [[CrossRef](#)] [[PubMed](#)]
21. Fischer MD, Gustilo RB, Varecka TF. The timing of flap coverage, bone grafting and intramedullary nailing in patients who have a fractura with extensive soft-tissue injury. J Bone Joint Surg Am 1991; 73: 1316-22. [[PubMed](#)]
22. Patzakis MJ, Harvey JP, Ivler D. The role of antibiotics in the management of open fractures. J Bone Joint Surg Am 1974; 56: 532-41. [[PubMed](#)]
23. Behrens F, Searls K. External fixation of the tibia. Basic concepts and prospective evaluation. J Bone Joint Surg Am 1986; 68: 246-54. [[PubMed](#)]
24. Caudle RJ, Stern PJ. Severe open fractures of the tibia. J Bone Joint Surg Am 1987; 69: 801-7. [[PubMed](#)]
25. Blachut PA, Meek RN, O'Brien PJ. External fixation and delayed intramedullary nailing of open fractures of the tibial shaft. A sequential protocol. J Bone Joint Surg Am 1990; 72: 729-35. [[PubMed](#)]

KONKVASANTNA POVREDA NATKOLENICE I POTKOLENICE FREZOM SA OTVORENIM PRELOMOM POTKOLENICE

Ivan Golubović, Predrag Stojiljković, Zoran Golubović, Stevica Jeremić, Goran Stevanović, Stevo Najman, Dragan Mihailović, Slađana Petrović, Zoran Radovanović, Sonja Stamenić, Saša Stojanović, Marija Trenkić-Božinović, Lazar Lazović, Aleksandar Tasić, Miroslav Trajanović

Bolesnik S.B., star 71 godinu, primljen je na Kliniku za plastičnu i rekonstruktivnu hirurgiju KC u Nišu zbog konkvasantne povrede desne potkolenice i natkolenice. Prilikom obavljanja poljoprivrednih poslova, ubacio je frezu u rikverc i ona je promenila smer kretanja, podvukla se ispod njega i teško ga povredila. Pri prijemu, kod bolesnika je registrovana konkvasantna povreda desne potkolenice i natkolenice sa velikom ranom na prednjoj medijalnoj strani desne natkolenice i medijalnoj strani desne potkolenice. Meka tkiva i koštano tkivo potkolenice i natkolenice bila su veoma zaprljani delovima zemlje i odeće. Urađeno je obilno ispiranje svih delova povređene potkolenice i natkolenice i odstranjivanje delova zemlje i odeće. Urađen je detaljan debridman oštećenih tkiva natkolenice i potkolenice. Otvoreni prelom potkolenice u proksimalnoj trećini nakon primarne obrade rane otvorenog preloma stabilizovan je spoljnim skeletnim fiksatorom sa dva klina u proksimalni fragment i dva klina u distalni fragment. Defekt mekih tkiva zbrinut je od strane specijaliste plastične i rekonstruktivne hirurgije. Bolesniku je ordinirana antitetanusna zaštita, antibiotska terapija (Amp. Azaran a 2,0g/24h, Amp. Amicacin a 1g/24h i Amp. Orvagila a 500mg/8h), kao i Amp. Fraxiaparine 0,6 mg u prevenciji duboke venske tromboze i tromboembolije pluća. Po saniranju rana mekih tkiva, bolesnik je uključen u fizikalnu terapiju. Zbog infekcije oko proksimalnih klinova spoljnog skeletnog fiksatora, nakon tri meseca od povrede i operativnog zahvata, spoljni skeletni fiksator je odstranjen, a lečenje nastavljeno funkcionalnim gipsom po Sarementu, što je dovelo do zarastanja otvorenog preloma potkolenice. *Acta Medica Medianae 2014;53(1):34-41.*

Ključne reči: *konkvasantna povreda noge frezom, otvoreni prelom potkolenice, primarna obrada rane, spoljna skeletna fiksacija*