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Treatment of diabetic foot ulcer complications with the combination of compartment-anatomy based longitudinal incision and NPWT

„Technique is not being able to juggle a ball 1000 times. Anyone can do that by practicing. Then you can work in the circus. Technique is passing the ball with one touch, with the right speed, at the right foot of your team mate." Johann Cruyff

Background

Necrotizing fasciitis (NF) is a rare but potentially fatal infection. Only early diagnosis (massive leg swelling, elevated inflammatory blood and D-dimer markers, air bubbles in the X-ray imaging) and aggressive surgical treatment can reduce mortality and morbidity. It mostly occurs in immune-compromised individuals like diabetic patients who often have a history of a minor trauma or tissue loss of the foot. In these cases major amputation widely used as the only option for removing the septic source. But life expectancy of limb amputated diabetic patients is very poor, more than 50% of them will die in a 5-year period.

Aim

In our clinical practice foot compartment based longitudinal incision and negative pressure wound therapy (NPWT) could improve limb salvaging ratio and life expectancy of DFU patients with CP and NF.

From Sep 2014 to Dec 2018 50 diabetic patients were treated with leg and / or shank phlegmone or NF. Early emergency diagnosis of the phlegmone and NF was helped by MINO wireless color doppler ultrasound system which is easy to pocket, handle, connects and shows high resolution image even on a mobile phone, or tablet PC.

Our primary goal was limb AND life saving. Patients' age were 54 ± 8 years on average Female: male was 13:37.

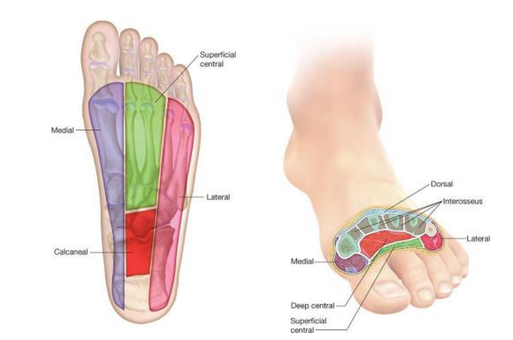
Method

Acute treatment is wide longitudinal incision based upon which foot compartment is affected by inflammation (see below). ***It is very important to cannulate and incise all of the involved compartments at the first time.*** Thereafter spare necrectomy and fragmentectomy are performed, amputation was only required in cases of definite toe gangrenes.

Applying period of NPWT was 6 ± 3 days on average. Systemic antibiotic therapy was continued 2 to 4 weeks. After NPWT removal we continued open (moist) wound management with compression therapy, nutritional supplement and half-, or full-foot offloading depending on the wound location. In our practice open wound management is preferred to secondary closure or skin grafting - a slightly longer but safer wound healing period with no additional surgical sites.

Compartment Anatomy

Compartment is the area of the foot which is surrounded by non-expandable structures of bone and fascia. Oedema and inflammation can cause increased pressure and causing circulatory disturbance in that space that can lead to ischaemia and necrosis.



Patient 3. : 61-year-old-male with multiple fissures on the left heel – contamination with cow manure results in a necrotizing fascitis just in a few days

Patient 7. 61-year-old male – history of Charcot osteoarthropathy with multiple toe amputation – neglected plantar ulcers were leading to forefoot phlegmone complicated with the fasciitis of the crus

Patient 9. 45-year-old-male - Charcot foot with a lateral ankle phlegmone – skin incisions from a previous insufficient surgical exploration

Patient 12. : 45-year-old-male – previous 4th and 5th toe amputation of the left leg with primary wound closure led to massive necrotizing fasciitis involving the ankle and the crus

Patient 15. 70-year-old male – previous 2nd and 3rd toe amputation of the left leg – forefoot phlegmone and medial compartment syndrome as the consequences of insufficient offloading

Patient 19. : 48-year-old-female – despite of the amputations of 1st and 2nd toes on the right leg, she kept on wearing high heel shoes - resulting medial forefoot phlegmone

Patient 20. : 45-year-old-male – double plantar ulcers of the left foot, with the osteomyelitis of all the metatarsal bones

Patient 23. : 45-year-old-male with medial foot compartment phlegmone and fasciitis – transmetatarsal amputation was offered to him in spite of all of the toes were viable

Patient 27. : 52-year-old-male with Charcot-osteoarthropathy and multiple toe amputation – neglecting the offloading shoes for years resulting bilateral ankle phlegmone with osteomyelitis of the tarsal bones

Patient 31. : 67-year-old-male – left 3rd toe gangrene with dorsal compartment phlegmone – double dorsal longitudinal incision and 3rd toe amputation was necessary

Patient 33. : 57-year-old-male – suffered left femoral amputation due to diabetic foot complications – during the rehabilitation period right calcaneal and plantar phlegmone has developed

Patient 38. : 55-year-old-female – left foot medial compartment phlegmone – simultaneous plantar et dorsal incisions of the medial foot compartment result in toe-, and limb saving

Patient 42. : 57-year-old-male – left hallux amputation because of a simple XR osteomyelitis sign (please always try to save the halluces!) ended in a medial compartment phlegmone and fasciitis – **please God Save the halluces!!**

Patient 43. : 59-year-old-male – shortly after a 3rd and 4th right toe amputation, medial deep compartment fasciitis and phlegmone has occured

Patient 47. : 56-year-old-male – Left lateral foot compartment phlegmone and fasciitis originated from a neglected 5th metatarsal plantar ulcer

Patient 48. : 60-year-old male – left medial compartment phlegmone due to Charcot osteoarthropathy with insufficient offloading

Results

Average hospitalization was 10 ± 3 days. 49 patients were without major amputation during the 12 ± 6 months follow-up period. We lost 1 patient due to cardiopulmonary complications. Minor amputation was necessary in 11 cases due to gangrene. 40 of 50 patients regained full or limited working ability in 40 ± 16 days.
Wound healing period was 160 ± 146 days.

Summary

Appropiate surgical technique and the application of NPWT could significantly improve limb salvage ratio in severe DFU complications.
As the perfect pass technique in football, the perfect incision should be NOT traverse but longitudinal with the proper length in the corresponding foot compartment(s).
Early diagnosis and patient education should also be improved using wide population accessing IT technologies and wound-healing / diagnosing mobile applications.