INJURED ON THE JOB—
“THE JOURNEY BACK TO WORK”
CASE REPORT

INTRODUCTION
An on-the-job injury may result in permanent disability, but the combination of a patient who is motivated to return to work and a good medical team can provide the foundation for success. Return to work is attributed not only to the doctors involved, but also to the knowledgeable nurse case managers navigating their patients to success and a cooperative patient. Here we discuss the case of a remarkable young man who was injured while working for a landscaping firm.

PHYSICIANS
Dr. David Hahn – Orthopedic Surgeon
Dr. Ronald Hugate – Orthopedic Surgeon
Dr. Omar Mubarak – Vascular Surgeon
Dr. David Schnur – Plastic Surgeon
Dr. Matthew Terra – Infectious Disease

NURSE CASE MANAGERS
Candace Addlesperger, RN
Catherine Patrick, RN
Anna Ver Hage, RN

CASE PRESENTATION
LS, an 18-year-old man was injured at a landscaping job site in June 2012. A forklift fell onto his left leg and he sustained a grade III-B open tibia-fibula fracture with severe comminution and contamination. His initial debridement and external fixation took place at a local trauma center. Shortly thereafter, he was transferred to The Denver Clinic for Extremities at Risk (DCER) at Presbyterian/St. Luke’s Medical Center (P/SL) through the DCER emergency replant service (fig 1).

Upon arrival to P/SL, LS was evaluated by orthopedic surgeon, Dr. Ron Hugate. Upon examination, Dr. Hugate identified three main issues: 1. deep infection inside of the wound; 2. bony deficits; and 3. soft tissue injury requiring reconstruction. He discussed each of these challenges with LS and his family while detailing a realistic evaluation of potential outcomes – a 50% chance of success and a 50% chance that LS would lose his limb.

Following his evaluation, Dr. Hugate performed an aggressive irrigation and debridement, transposed the fibula, inserted antibiotic beads, placed a wound vac, and reassembled the original external fixator. At this time, Dr. Hugate debrided the flexor hallucis longus muscle belly, the peroneus brevis, and the tibialis anterior muscle belly and tendon due to necrosis.

Dr. Hugate was concerned about the blood flow to the lower leg therefore he consulted vascular surgeon Dr. Omar Mubarak, MD. Dr. Mubarak performed an aortogram two days later to explore the blood flow to the injured limb. He found that the posterior tibial artery remained intact to the ankle. However, the other two leg arteries were not functional.

Dr. Hugate next consulted plastic surgeon Dr. David Schnur regarding the soft tissue injury. Dr. Schnur determined that the best approach to address the soft tissue deficit was to utilize a rectus abdominus free flap. However, the extent of vascular damage presented a challenge – only one of the three arteries to the leg was intact– and required that the surgery be performed with concurrent management of the patient’s vascular issues.

After consultation with the DCER team, Dr. Mubarak and Dr. Schnur took LS back to surgery. Dr. Mubarak harvested the right greater saphenous vein and bypassed from the popliteal artery to the rectus abdominus flap that Dr. Schnur had harvested and placed along the anterior wound. For venous outflow, Dr. Mubarak exposed the left greater saphenous vein for end-to-end anastomosis with...
the deep inferior epigastric vein of the flap. Additionally, Dr. Schnur performed a debridement, filled the 12cm tibial bone deficit with an antibiotic cement spacer and placed a skin graft. After closure, the external fixator was reapplied. Later that day, LS developed a venous thrombosis leaving the flap congested which Dr. Schnur repaired successfully.

Orthopedic surgeon Dr. David Hahn first saw LS on July 23, 2012, approximately 6 weeks post-injury. X-rays at this time revealed a 12 cm bone deficit in the mid to distal 1/3 of the tibia (fig 2). The free flap was intact and there was about 1/3 functional vasculature in the foot. Despite the decreased circulation, LS’s foot remained quite functional. Upon examination, Dr. Hahn presented LS with four treatment options to treat the tibial deficit: 1) free vascularized bone flap; 2) allograft; 3) bone transport; or 4) amputation. Due to the large bone deficit on a significant weight bearing bone and a history of infection, Dr. Hahn strongly recommended bone transport or amputation over the other two options. LS and his family decided bone transport was the best option for him even though this meant that he would miss one semester of college at his out-of-state university. At this time, the treatment plan was also discussed with Anna Ver Hage, RN, nurse case manager. On August 28, 2012, Dr. Hahn removed previous hardware, performed a double level corticotomy in the tibia and placed a Taylor Spatial Frame to begin the arduous process of bone transport. Cultures from this surgery grew out P. acnes, and LS began IV antibiotics under the treatment of infectious disease specialists Dr. Matthew Terra.

LS was compliant with the bone transport process and progressed nicely with very few complications. In December 2012, approximately five months after the bone transport began, Dr. Hahn noticed premature consolidation of the proximal corticotomy and brought LS back to surgery for a corticotomy revision. Cultures from this procedure grew out S. lugudunensis which was treated by Dr. Terra with six weeks IV daptomycin and oral fluconazole. In January 2013, LS resumed college. He remained compliant with his

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**TREATMENT OF A TRAUMATIC ON THE JOB HAND AMPUTATION**

**INTRODUCTION**

Occupations requiring the use of heavy machinery carry great risk for injury. When injuries do occur, they are typically traumatic and complicated to treat. The torque and force utilized by the machine can damage the human body in unexpected ways. Successful treatment of complex injuries requires teamwork from various healthcare professionals – surgeons, therapists and sometimes nurse case managers. For discussion below is the case of a man who was injured by a power take off machine while on the job.

**PHYSICIANS**

Dr. Conrad Tirre, Plastic Surgeon  
Dr. Armodios Hatzidakis, Orthopedic Surgeon  
Dr. Allison Franklin, Physiatrist  
Julie Klarich, OT/CHT

**NURSE CASE MANAGER**

Michelle Rodriguez, RN

**CASE PRESENTATION**

Gi is a 49-year-old man who works as a laborer at a Groundwater Development company. On December 27, 2013 a rope wrapped around his left forearm and pulled him into a hydro machine that caused his left hand to be amputated just above the wrist and also injured his left brachial plexus. Gi was referred to The Denver Clinic for Extremities at Risk at Presbyterian/ St. Luke’s Medical Center via the emergency replant service and was accepted by Dr. Conrad Tirre for possible replantation of the left hand.

Upon initial exam, Dr. Tirre immediately realized that the hand was mangled beyond repair/replantation. The carpus and mid palm were open with dislocations and tendons avulsed from the mid-forearm. The ulna was fractured at the mid-forearm and the radius was dislocated anteriorly as shown in figure 5. Due to the dislocation of the elbow, Dr. Tirre called orthopedic surgeon Dr. Armodios Hatzidakis for a consult.

A revision amputation was performed ~5cm proximal to the exposed distal radioulnar joint. Dr. Hatzidakis reduced the elbow, which in turn reduced the ulna. The radius, however, remained degloved and dislocated anteriorly. At this time, Dr. Hatzidakis and Dr. Tirre decided that the distal forearm amputation would be more stable and have fewer complications if the entire radius were removed (fig 6).
bone transport protocol and kept in contact with Catherine Patrick, RN, another nurse case manager who maintained excellent communication between LS and the treatment team throughout his treatment (fig 3).

LS continued to progress with few complications, and on October 21, 2013, after 15 months of bone transport, his frame was removed (fig 4). He was placed in a boot and began physical therapy. He had a slight valgus deformity in his left lower leg, however Dr. Hahn felt that this would not be a problem. At one month post frame removal, LS was swimming and riding an exercise bicycle. Currently, LS is eight months post frame removal and reports a Lower Extremity Functional Scale score of 59% (Brinkley et al., 1999) and his pain at 4/10. He states he is continuing to improve, and is grateful to have his leg.

CONCLUSION
Traumatic on-the-job injuries can be complex to treat. One of the most important components to returning an injured worker to work is communication between the treatment team, patient and the nurse case managers. For the treatment team, it is important to give realistic evaluations of success and to ensure the patient’s long term goals (return to work vs. permanent disability) are reflected in the treatment plan.

The multi-disciplinary expertise offered by the Denver Clinic for Extremities at Risk team enables us to effectively treat complex problems. Our abilities to communicate quickly, operate collaboratively and address unique issues as they arise, facilitate superior outcomes and high patient satisfaction.

Once this was done, Dr. Hatzidakis focused on reconstruction of the ulnohumeral joint for a stable fulcrum for future prosthetics, and transferred the distal biceps tendon to the distal aspect of the coronoid process. He also repaired the lateral collateral ligament. Dr. Tirre performed the final debridement prior to closure.

Post-operatively, GJ experienced phantom pain and pain in his residual limb. He managed this pain with several different prescription pain medications. GJ also began occupational therapy for elbow range of motion and pre-prosthetic training with Julie Klarich, OT/CHT on how to complete daily living activities. At four days post-op,

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GJ stated that his phantom pain was well controlled with neurontin. Six days after surgery, GJ was discharged from the hospital.

Two months after the injury, GJ reported that he had significantly decreased his pain medication and was only taking hydrocodone-acetaminophen (10-325), neurontin and ibuprofen. His incisions had healed, and his biceps and triceps were both functional. He did, however, still have residual numbness on the posterior side of his residual limb. He also had begun working with a hook prosthesis to assist him both at work and with other activities of daily life.

At three months post-op, GJ rated his pain a 6 out of 10. He had returned to work in late January 2014 and had been adjusting to his prosthesis. Currently, GJ is six months post-op, is still attending occupational therapy and is being fit for his myoelectric prosthesis. While it is clear GJ’s life will never be the same as before his on-the-job injury, he is certainly working hard to adjust to his new normal.

In the case of GJ, his case manager, Michelle Rodriguez, RN, played an essential role in the coordination of follow-up care. GJ resides out of state, and Ms. Rodriguez was essential in scheduling multiple appointments in one trip. She also stayed in communication with each of GJ’s specialists to discuss his progress and coordinate his eventual return to work.

CONCLUSION

Injuries induced by heavy machinery can be complex to treat. One of the most important components of successful treatment is the collaboration of the medical team. In this case, the surgical strategy utilizing both an orthopedic and a microvascular surgeon was critical in creating the most functional/least painful residual limb. Pain management and prosthetic training are also critical components for the patient to learn success strategies for everyday life.