



Original Contribution

Multiple Trauma: A Team Effort

David Gallant, RN, OTC, Portland, ME

Introduction

The purpose of this paper is to relate the case of a multi trauma patient, the care and treatment that was given, and to recognize the team effort that is so important in trauma management. The original Emergency Room X-rays were not available when this paper was composed, nor were preoperative wound photos taken. Some later immobilization was reconstructed and photographed for demonstration purposes. The author wishes to thank the surgeons, colleagues, and allied practitioners for their assistance in their superb treatment of the patient and for helping me in the many difficult stages of preparing this article. But most of all, I would like to thank the patient for allowing me to retell her story of pain, recuperation, and resolve.

The Accident

June 29th was a gorgeous Saturday afternoon to be cruising on the scenic Kancamagus Highway in Northern New Hampshire. The "Kank" (as it is affectionately called) is a twisty road that snakes its way East to West up and over the White Mountains. Thought by many to be one of the most beautiful roads in North America, it treats one to majestic pines, rock strewn rivers, and awesome vistas. It was on such a day and place that our victim's life took a dramatic detour.

Our patient, a 50 year old healthy and vibrant female resident of New Hampshire, was out crusin' on her Harley Davidson Dyna Rider motorcycle with family and friends; most on "hogs" and some in cars. Their ride was more than halfway complete on the Westerly route when they came to the section of road where there are several hairpin turns. Apparently her bike went over the double yellow line and when she veered back into the correct lane the momentum of the turn and the angle of the road prevented her from straightening the bike out and sent her careening into the guard rail on the right hand side of the road. Her right lower leg injuries were caused by the leg being ground, twisted, crushed and mangled between the heavy bike

and the metal rail. When her front wheel finally jack knifed, she was tossed off of the bike, over the guard-rail, and sailed like a torn rag doll 25 feet whereupon landing head first on rocks she fractured her left hand and arm. Although her helmet probably saved her life, it was now up to her entourage and the Emergency Medical System to prevent her from succumbing to her injuries.

While her friends went to her side, her son was in his car calling 911. During the long 18 minutes that it took the rescue unit to arrive, they manually immobilized her neck and extremities to prevent further trauma. Upon arrival at the scene, the EMTs further stabilized her and then transported her to the regional medical center in North Conway, New Hampshire, some 30 miles away.

Although, she was semiconscious for the next eight days, she remembers only fragments of what occurred. She remembers being awakened by the cries of her loved ones just before she was wheeled off to the operating room. The orthopaedist had just told them that it was highly unlikely that he would be able to save her right lower leg. She remembers the face of an unknown nurse who was holding her right hand and mouthing words of apparent comfort. She remembers a lot of pain.

She entered the hospital with multiple abrasions, deep lacerations and fracture dislocations of her right tarsometatarsal joints 1 through 5, dislocation of the 1st MPJ, fracture of the 2nd metatarsal shaft mid shaft open fractures of the right tibia and fibula, left olecranon fracture, and mid shaft fracture of the left fifth metacarpal shaft. Open reduction internal fixation (ORIF) of all the fractures was then carried out.

The metacarpal fracture was fixed with two percuta-

Address correspondence to: David Gallant, OTC, 14 Fairlawn Ave, Westbrook, ME. Tel: (207) 828-2149; email: dgallan1@maine.rr.com.



Photo 1

neous pins (see photos 1-2). The elbow fracture was fixed with two K-wires and Figure 8 circlage wires (see photos 3-4). The incisions were closed, the abrasions were covered with "non-adherent" dressings, and then the arm was immobilized: A fiberglass ulna gauntlet cast (UGC) was applied and then covered with a long arm fiberglass posterior splint.

The tibia shaft fracture was fixed with a statically locked intramedullary rod, the distal fibula fracture was plated and screwed, (see photos 5-6), and following exploration and debridement, the foot injury was temporarily stabilized with screws and pins. Following dressing of the incisions and packing of the wounds, a short leg posterior splint was applied.

Due to the severity of the foot injury, she was transferred three days later, 75 miles east to The Maine Medical Center in Portland for further repair by Foot and Ankle and Plastic Surgery specialists. She would undergo immediate foot reconstruction and later forearm based free flap coverage once the viability of the of the tissue on the dorsum of the foot became clearer.

On July 3 she underwent: 1) Irrigation and debridement of the foot wounds; 2) Open reduction and percutaneous K-wire stabilization of the tarsometatarsal joints, second metatarsal fracture, and intercuneiform joints; 3) Repair of the medial first metatarsal phalangeal joint capsule with the remaining portion of the anterior tibialis tendon; 4) Repair of the extensor

hallucis longus tendon and, 5) Tenodesis of the extensor hallucis brevis to the extensor digitorum longus.

The medial wound was closed but the edges of the dorsal wound were necrotic requiring debridement and partial closure with stay sutures and loose approximation of the edges. All bones and tendons had skin coverage. The procedures necessitated the placement of nine (9) percutaneous pins (photos 7 - 8). The wounds were then covered with Adaptic and Xeroform followed by a bulky Jones dressing and plaster posterior and U-stirrup splint to the lower leg.

On to the Cast Room: The Left Arm

On July 10 she was discharged from the hospital with instructions to stop in to see the team of technologists at Orthopaedic Associates of Portland. Our orders were to remove all of the post operative casts, splints and dressings, remove all sutures and skin staples from the original surgery, and apply new immobilizing devices.

She arrived at the cast room in a wheelchair pushed by her husband and accompanied by a friend. Getting her up onto the cast bed (plinth) was quite difficult as she also contused her right shoulder in the accident and only had her unaffected left leg for support. She had been medicated for the ride home prior to leaving the hospital so we all thought that would suffice - we were wrong.



Photo 2



Photo 3



Photo 4

Removal of the elbow splint was uneventful, but before I could remove the UGC, the post operative elbow dressing was dried hard with blood and needed to be soaked off with a mixture of hydrogen peroxide and normal saline ($H^2O^2 + NS$). Much to our dismay, it was not the elbow incision that was the problem, but a large abrasion which had stuck to the cast padding. Apparently the Xeroform that had been applied to protect the wound had slipped away during the application process. Mepitel, a newer type of non-adherent dressing, was applied followed by dry sterile dressings.

Next came the most difficult task: Removal of the UGC. It was made quite difficult because fiberglass casting and cotton padding were used over the percutaneous pins. The pin sites bled as usual post operatively and that blood dried rock hard. I could not remove the cast as usual. I was forced to cut the cast away in sections and after soaking the hardened mess with $H^2O^2 + NS$. That process took at least 30 minutes before the skin was exposed.

Although the percutaneous pins entered the "dorsum" of the 5th MCP, it is our practice to apply a UGC to include the middle finger. We do it this way so that when we cut the window to expose the pin (which will allow the patient to do pin care) there is enough of the cast remaining on the radial side to provide adequate structural support to the cast. The exposed pins were domed with cast padding, the MCP's were flexed and

then the cast was applied (photo 9). A thermoplastic hood was then molded over the cast. Once the plastic cooled and became rigid, the pin site was windowed sufficiently large enough to allow for pin care (photo 10).

Unfortunately, our progress was further impeded by an unexpected problem. While I was applying the UGC, the patient would wince with pain whenever I brushed against her thumb. Our suspicions were confirmed by one our Orthopaedists - she had sprained her Ulna Colateral Ligament in the accident and that also would require immobilization. As the heating pan still contained hot water, we cut another piece of thermoplastic and immobilized the thumb (photos 11 - 12).

Once the hand was immobilized, we returned to the elbow which we then fit to a RCI / Medical Designs Universal Elbow Brace locked at 90 degrees. Her husband was shown how to adjust the hinge range of motion (ROM) which would be slowly progressed by her Physical Therapist as the elbow motion improved (photo 13).

On to the Cast Room: The Right Leg

Our Foot and Ankle surgeon was concerned that the tibia and fibula fracture, although fixed, would still need support and he wanted us to come up with some type of immobilization that would protect both areas of the leg, allow for easy access to the pin sites, and be adjustable to the variations in dressing changes and tech-



Photo 5



Photo 6

niques. For that problem we decided upon a Focused Rigidity Cast using DePuy Casting Delta Cast Conformable (DCC).

We removed the most recent post operative dressing and were frankly surprised to see that the poor lady's foot looked as if it had been attacked by a surgical porcupine (photos 14 - 15). After removing her previous surgery skin staples, we applied Mepitel and then dry sterile dressings to the wounds, scrapes, and abrasions covering the lower leg. Bulky padding was then applied over the pins in order to create a protective cavity that the foot would be placed into once the cast was finished.

Applying this type of cast is not as difficult as it appears. First, I angled the cutting strip that is used in the technique, from the patella down over the shin, over the dorsum of the ankle, and down towards the little toe. A well laterally stretched length of Delta Terry Net "S" stockinet was then gently pulled (not rolled) onto the leg. Pre-cut pieces of Delta Terry-Net Adhesive Felt Liner were next applied over bony prominences and around the complete foot. While I was applying the padding, my colleagues were making the foot plate and stirrup out of 4" DCC which would add the structural support to the finished product. The struts were encircled by two rolls of 3" DCC. Once the material had hardened (about 5 minutes), I used scissors to cut from the proximal end down along the cutting edge,



Photo 7



Photo 8

along the lateral side of the foot and around the tip of the toes to about midway on the medial side of the foot. A transverse cut from the lateral malleolus to the medial side of the foot was then made. This particular cut made it easier to remove the cast but still retained the toe cap as a big flap. I do it this way because I know how flexible the DCC is and how often caps or window hoods are lost in the great beyond (photos 16 - 17).

Changes

As most often is the case with multi trauma, time is allowed to pass after the initial surgery to allow for rest, healing and a "second wind" before resumption of the next round of procedures. Six weeks after the accident, our patient was back in the cast room for removal of the metacarpal pins and two pins foot. She was still being followed by the Plastic Surgeon for possible skin grafting to the dorsum of the foot. Both of our teams were going to be more aggressive with debridement of the necrosis and on this day we trimmed some of the blacked eschar away from the wound edges and started her on a regimen of Sugardine^{1,2}.

The pin removal went without incident and we placed her hand into a FRC dorsal splint with a ulna gauntlet and thumb extension(photos 18-20).

Seven weeks following the accident, our patient again found herself in the operating room for further debridement of the foot by both the Orthopaedist and the Plastic Surgeon. During this procedure, the overlying eschar was surgically removed and dead bone was noted. This bone was rongeuired to healthy bleeding bone. It was determined at that time that due to the extensive nature of the wound, a future free tissue transfer would be required. The wound was jet lavaged with 3 liters of antibiotic solution, and a VAC dressing applied.

The following week she returned to the OR - this time for flap coverage by a team of plastic surgeons. On this day a Free Radial Forearm Fasciocutaneous Flap to the right foot wound and a 50 sq. cm Split-thick-

ness skin graft to the right forearm was performed following debridement of the remaining eschar.³

At 15 weeks, the remaining pins were removed. Evidence of preserved alignment of the Lisfranc interval was seen. The Short leg FRC was discontinued and she was placed in an Aircast Pneumatic Walker for

partial weight bearing.

At seventeen weeks she began full weight bearing (with the boot in place) and her flap and graft site are healing quite well (photos 21-23). The prominent elbow hardware continued to be a problem for her thin arm (photo 24). So we fabricated a protective elbow pad of a style that we have found to be quite effective and practical⁴ (photo 25).

Anticipation

Eighteen weeks have now passed since that terrible afternoon on the "Kank". Her spirits are much better, and post traumatic stress is being managed. She is getting back to her hobby of painting with watercolors. Her ambulation is quite independent although the tibia fracture has been quite slow to unite (probably due to lengthy non-weight bearing period). Her hand is almost back to normal but although her elbow has almost full ROM, her only real pain is from the elbow hardware. Removal of that elbow hardware is anticipated for at a time when she is totally off of her crutches and will be coordinated with possible screw removal from the tibial hardware.

Conclusion

In this article I have attempted to give an overview of some of the complex aspects of multi trauma and how our team chose to manage the problems presented to us. She will do well. Her Harley has been rebuilt and repainted however, her present plan is to sell it and put the proceeds towards the purchase of a Hummer. She is a survivor. And she will get by with a little help from her friends...a team of friends.



Photo 15



Photo 16



Photo 17



Photo 18



Photo 22



Photo 23



Photo 19



Photo 20



Photo 21



Photo 24



Photo 25



ABOUT THE AUTHOR

David Gallant has worked as an Orthopaedic Technologist for over 30 years, 11 years on the inpatient Orthopaedic Unit at the Maine Medical Center and over 21 years at Orthopaedic Associates of Portland. Gallant graduated from University of Southern Maine with a Baccalaureate in Nursing in 1981 and certified in orthopaedic technology in 1983. He has served as NBCOT Chairman, Vice President of NAOT, President of the International Society of Orthopaedic Technologists and President and Vice-President of the New England Society of Orthopaedic Technologists (NESOT). He presently serves as Editor of the NESOT journal, NEWSBREAK. David has received the NBCOT Service Award (1991), The Canadian Society of Orthopaedic Technologists Presidential Award (1992), NAOT President's Award (1993), and was inducted into the NAOT Honor Society in 2001. Mr. Gallant resides in Westbrook, ME with Jeannie, his wife of 32

years and has two grown children, Meghan and Jason.

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