States of Grace CASE HISTORY

GRACE DAMMANN CASE HISTORY

Accident and Emergency Treatment at John Muir:

Grace Dammann is a 68 y/o female physician who was driving across the Golden Gate Bridge on 5/21/2008. She was restrained. Her daughter was sitting beside her in the front seat, and their dog was in the back seat. She was traveling northbound in the far left lane, when a driver going south had a symptomatic episode of atrial fibrillation (which had never been diagnosed), passed out, crossed over the median strip of the bridge, and hit the car in front of Grace's, then hit Grace's car directly on the driver's door.

Bridge traffic was stopped for an hour while the police and fire departments extricated Grace from her vehicle. Initial notes by the first responder gave her a 10/10 pain score and noted that she had obvious four extremity fractures. She was given a Glasgow Coma Score of 15, and vital signs of: BP 122/71, HR 124, pao2 79, RR 22, pain 10/10. She was taken by helicopter to John Muir Hospital, in Walnut Creek, the nearest trauma center. En route, she was given 50 mcg of Fentanyl IVP, and 4 mg of Zofran. She received another 50 mcg of Fentanyl, during helicopter transport, for pain.

Transport records include the following physical findings:

General: *able to speak in complete sentences*

Back: *unable to lie flat. Rotated at pelvic level. Lt iliac crest 1.5 inches higher than right*

Chest: *equal rise and fall bilaterally. c/o difficulty breathing*

Rt leg: *open tib/fib fx at level of ankle, cannot move foot, distal pedal pulse present*

Lt leg: *tib/fib deformity above ankle, obvious deformity upper femur. Intact sensation and circulation*

Rt arm: *multiple abrasions r hand and forearm, tenderness w/o loss of function or obvious deformity*

Lt Arm: *deformity mid radius/ulna. Intact sensory, limited motor, circulation intact*

On arrival at John Muir, helicopter trauma crew noted that VS were now BP 85/40 with all other VS being the same (HR, RR, GCS, Pain).

In the ER, the patient was noted to be pale, shocky, able to answer some questions, with a BP of 80/40, HR 130-140, decreased breath sounds on the left. She was initially treated for profound anemia with uncrossmatched blood. She was intubated for severe respiratory failure, and given normal saline for hypovolemic shock. A chest x-ray was done which showed haziness, thought to be caused by a ruptured diaphragm.

The patient was triaged directly to the OR for presumed eventration of abdominal viscera into left lung cavity, with some component of a tension pneumothorax. She also had open fractures of the left upper extremity at the level of the elbow, and both lower extremities at the level of the ankles. There was a femur fracture on the left and "multiple other fractures".

In the OR on the day of admission, the following procedures were performed:

1) diaphragm tear/perforation repaired and abdominal viscera returned to abdominal cavity

2) chest tube placed in left chest

3) liver lacerations repaired

4) right radial artery laceration repair

5) retroperitoneal bleed around the pelvis packed.

6) abdomen, which was developing severe swelling and could not be closed (compartment syndrome) was left open, covered with saran-wrap, and a wound VAC was placed

7) multiple I&D's were done of open joints and external fixator's were placed

8) left femur fracture repaired with an intra-medullary rod

9) intra-operatively, multiple x-rays were done. They showed:

a. severe comminution for a segment of about 4 cm up the tibia/fibula associated with proximal fibula fracture on the left

b. right tibial bi-malleolar type pattern with possible fracture below the level of the talus laterally on the fibula with a comminuted fibula fracture starting about 4 cm from the joint extending proximally

c. severe comminution medially (on right?) as well and a subluxed ankle joint which was open

d. superior and inferior pubic rami fractures on the left, with no femoral neck fracture, but type I sacral fracture posteriorly

e. left forearm with segmental radius and ulnar fractures at the proximal third of the radius and ulna about 6 cm from the radius and olecranon respectively; another segmental fracture was oblique and comminuted, about 2 to 3 cm from the ulnar head; and there was a comminuted extra-articular fracture of the distal radius

f. left femur with a comminuted mid-shaft to proximal third femur fracture with medial comminution

g. previously mentioned chest x-ray with elevation of the diaphragm

The patient was then triaged to the ICU for warming and treatment of developing coagulopathy.

ICU Hospitalization at John Muir:

On hospital day 1 (5/22), a right chest tube was placed to treat hydrothorax and treatment was continued for diffuse intravascular coagulopathy (with all Factors including 7, platelet transfusions, and 48 units of red blood cells.) She had a cardiac echo and a CT scan of the head showing multiple small hemorrhagic injuries enhanced by the diffuse intravascular coagulopathy. Cervical spine CT was negative. Cardiac echo was also negative.

On hospital Day 2 (5/23), an IVC filter was placed. On hospital day 4 (5/25), a right thoracostomy tube was placed and the patient returned to the OR for open reduction and internal fixation of the right radius and ulna, with two plates placed; and right upper extremity unstable elbow dislocation with open repair of the lateral ligament.

On hospital day 6 (5/27), she underwent a second look laparotomy with removal of packing and primary closure of the abdomen. In addition, in consultation with an ID specialist, her antibiotics were changed. On hospital day 9 (5/30), patient underwent an open reduction/internal fixation of the surgical neck humeral fracture, comminuted intra-articular distal humerus fracture, comminuted radius and ulnar forearm fractures proximally. Distal radial and ulnar fractures on the left also received internal fixation. She had a total of three plates placed on the left side.

Hospital day 14 (6/4), the patient underwent an open reduction and internal fixation of the right humeral fracture and also the open right ligamentous repairs. On hospital day 16 (6/6) she underwent open reduction of the left tibia plateau and had three plates placed. On hospital day 20, (6/10), patient underwent a tracheostomy and percutaneous gastric tube placement for feeding. Throughout this period she had persistent fevers (with negative cultures) which subsided with conservative management. She was treated, at one point, with Vancomycin for staff epidermidis.

At the point she was ready for transfer to a lower-level facility on hospital day 27 (6/17), patient was neurologically able to open her eyes to sound and spontaneously moved her left upper extremity and both lower extremities. She was not awake or alert enough to answer anything or speak. She had an elevation of liver function tests on the day of transfer with an alkaline phosphatase of 594 and an ALT of 21 and SGPT of 190. She had a total bilirubin of 1.39 (down from the high 5's). Previous liver ultrasounds and gallbladder ultrasound had only shown sludge in the gallbladder with no thickening of the gallbladder wall. She had been in the IUC throughout her hospitalization at John Muir.

First Rehabilitation Stay – Kentfield:

On 6/19/2008, 29 days after the accident, she was discharged to Kentfield Rehabilitation Facility, across the Bay, having emerged to a vegetative state with eye opening. On admission to Kentfield, she had no evidence of visual fixation, no evidence of visual tracking, no command following and no evidence of meaningful interaction with the environment.

At Kentfield, her hospital course was notable for the following problems:

1) ***Grand mal seizure*** *(7/10/08—more than 6 weeks after MVA) initially treated with Dilantin then switched to Keppra. No further seizure activity, ever.*

2) ***Heterotopic ossification*** *(HO) seen on multiple x-rays performed at a John Muir follow-up visit with her orthopedist on 9/10/08. Reviewing her films, her orthopedist stated: "Currently, upper extremities are dominated by essentially bony ankyloses and heterotopic ossification, causing no motion at the left elbow. Patient was started on Didronel. Surgery was planned on her left elbow. She was not a candidate for any PT of those extremities until the HO matured.*

3) ***Vegetative state.*** *Treated with Sinemet and amantadine, patient awoke on July 4 after about 45 days in a comatose state.*

4) ***Status/post multiple traumatic fractures.*** *The patient was noted to have generalized weakness (R>L). She was also noted to have a tightness of the ankles particularly on the left with an equina varus deformity which was not helped by splinting, PT, or ROM enough to allow weight-bearing through a plantigrade foot. Nerve conduction studies were performed on 10/31/08 and showed lower motor neuron deficits including severe bilateral peroneal neuropathy with acute denervation, and moderate tibial neuropathy on the left and mild tibial neuropathy on the right, all with acute denervation noted.*

5) ***Impaired functional ability.*** *The admitting physician at Kentfield stated: "Dr. Dammann had marked contractures of virtually all joints due to her multiple fractures, and forced immobilization due to these fractures. Aggressive occupational and physical therapy was provided."*

At the time of admission, the patient was completely dependent in all aspects of basic care. She was incontinent of bowel and bladder, she was dependent on a tracheostomy and required frequent suctioning. At the time of discharge, she was able to participate in all activities of daily living although she was limited by four-extremity weakness, right side greater than left, and by the bony ankyloses and contractures throughout her body. At discharge, almost 6 months later, as a result of her elbow contractures in relative extension, she required maximum assistance for grooming, hygiene, and dressing. Commode transfers (via sliding board) improved to a minimal to moderate assist. She was practicing ambulation using the LiteGait device. She was continent of bowel and bladder. The feeding tube had been removed and she was on a regular diet. The tracheostomy had been weaned. The IVC filter had been removed. Patient was discharged from Kentfield on 12/13/08.

Transfer to Lower Level of Care at Care Meridian, and elbow repair at UCSF:

Grace was admitted to Care Meridian on 12/13/08, a facility at a lower level of care than Kentfield. The plan was for her to have surgery on her left elbow to remove the heterotopic ossification in hopes that she would get some function and therefore be able to participate in acute rehabilitation. That surgery was performed at University of California San Francisco on January 8, 2009.

Elbow contracture release and lateral ulnar collateral ligament reconstruction, an 8 hour procedure, was performed by Dr. Lisa Lattanza. The patient was placed in a continuous motion machine and returned to Care Meridian for care. When she was seen by Dr. Lattanza at 3 weeks post-op, it was clear that the lateral collateral ligament repair had been destroyed by the CPM Machine. She had heard the ligament snap.

On February 20, 2009, Grace simultaneously underwent two surgeries:

1) repeat reconstruction of the left collateral elbow ligament and 2) a left open Achilles tendon lengthening, open z-lengthening of the flexor hallcuis longis tendon(making it 3-3.5 cm longer), and open flexor tonotomies on toes #2, #3, #4, #5.

Once again, Grace returned to Care Meridian, non-weight bearing on the left, with a directive to remain in the continuous motion machine 20 hours/day while her arm healed. She was strictly non-weight bearing on her leg for 6-9 weeks.

Transfer to Ralph K. Davies Rehabilitation Facility for Acute Rehab:

Grace was admitted to Ralph K. Davies, a rehabilitation facility, on 4/15/09 for acute rehabilitation. She had the following findings on initial history and physical examination:

Affect appropriate, no changes in level of consciousness. Manual muscle testing revealed:

1) symmetrical weakness about the shoulder external rotators

2) severe weakness of hindfoot and ankle muscles on the right

3) seemingly less severe weakness on the left (the lower limb placed in splint that was not to be removed)

4) right elbow nearly flexed in contracture

5) bilateral hand intrinsic muscles, symmetrically weak, with some wasting of the interosseus, without fasciculation

6) no spasticity found in upper limbs, but Ashworth I spasticity of right knee

7) great toe interphalangeal joint position intact on the right, equivocal on left

8) testing of gait and station not possible (not safe to do so)

On discharge two months later, findings included:

1) A left wrist and finger drop and paresthesias about dorsal left web space were attributed to aggressive use of the CPM machine. EMG studies revealed severe axon loss left radial neuropathy, severe left ulnar neuropathy at the elbow, longstanding

2) The heterotopic ossification was stable, with right elbow severely fused. Her right ankle was essentially fused (later surgery on both was planned)

3) A bilateral foot drop, which was found at Kentfield, was the result of peronal and tibial neuropathies and presumed sciatic neuropathy found at RKD

4) The symmetrical proximal weakness improved, and was thought to be the result of critical illness myopathy

5) A restless leg syndrome was controlled on Mirapex

6) A late post-traumatic seizure was controlled on Keppra with plan to continue anticonvulsants for 2 years

7) Hypothryroidism: stable on levothyroxine

8) Depression: stable on Sertraline

9) Pain: well controlled on 25 micrograms of Fentanyl

Because of limitations in use of both her arms and legs, the patient returned home somewhat dependent in all of her ADL's. She was continent of B&B. In terms of her traumatic brain injury (TBI), she was found to be without functional sequelae.

First Discharge to Home (13 months after the accident) and further elbow surgery:

The patient was discharged home on 6/16/2009, where she stayed until February 11, 2010 when she was admitted to UCSF for the debridement of right elbow heterotopic ossification, with contracture release, anterior capsulectomy, ulnar nerve neurolysis, transition medial collateral ligament reconstruction with tendinous allograft.

Second Admission to Ralph K. Davies for Rehab

She was admitted to Ralph K. Davies, from UCSF, on 2/18/10 for progression of her gait ambulation, and ADLs, for a safe transition back to the community. At the time of admission, she was non-weight bearing on her right upper extremity.

On admission to RKD, physical exam was notable for the following:

Age-appropriate woman, neurocognitive exam grossly within normal limits (higher executive function and testing, deferred). Alert, oriented to person, place, date and hospital name, without delay in rhetoric or verbal responses, without perseveration, tangentiality or impairment of language pragmaitics. She was organizing well. She was able to problem solve complex hypothetical clinical situations well. Cranial nerve exam was without abnormality.

Right upper extremity in a CPM machine, currently at 0-135 with 80 degrees supination, 80 degrees pronation, non-weightbearing.

Weakness of 4 extremities without interval change from last admission, except that LUE shows ataxia.

Sensation appears otherwise intact, patchy in upper and lower extremities.

Second Discharge Home (22 months after the accident)

Grace spent almost a month at Ralph K. Davies Acute Rehabilitation facility and was discharged to home on 3/15/2010.

On discharge, her condition was as follows:

1. ***Activities of Daily Living:*** *At the time of discharge, pt. required max assistance for upper and lower extremity dressing, moderate assistance for bathing, supervision eating and grooming. She required minimal assistance transferring to and from bed, chair, wheelchair, tub, and ambulating on level surfaces. She requires max assistance for negotiating stairs.*

2. ***Right ankle pain*** *in the context of HO and contracture prompted the fabrication of a patellar tendon bearing orthosis to unload the affected joint. Ankle surgery planned for three months.*

3. ***Possible cognitive impairment*** *after severe closed head injury can be further evaluated when a return to work is anticipated.*

Final Reconstructive Surgery at UCSF and Third Rehab Admission to Ralph K. Davies:

Grace underwent her final surgery, again with Dr. Nancy Kadel at UCSF on 9/03/2010 to correct a severe eqinovarus deformity in her right leg/foot. She underwent a Splatt procedure (transfer anterior tibia tendon transfer, posterior tibia tenodesis and medial ankle joint contracture release. She was transferred to Ralph K. Davies as non-weightbearing for nine weeks for rehabilitation on 9/07/2010.

> *On admission, she was noted to be age-appropriate, alert, oriented x 3, able to follow 1-step lateralized commands, exhibiting no paroxysmal changes in level of consciousness or affect, without aphasia or neglect. Cranial nerve examination revealed no abnormalities. Motor exam revealed symmetrical bilateral weakness in the upper extremities with bilateral wasting of hand intrinsic muscles, with no fasciculation. Right leg was casted.*

Third Discharge to Home:

At discharge, the patient was listed as requiring the following assistance: maximal for bathing, upper body dressing and grooming, and total assistance with lower body dressing, toileting, and household ambulation. She required minimum assistance with transfers and had a trial with a sling based walker.

Grace continued with outpatient rehab. In June of 2010, she had extensive neuropsychological testing to determine if her cognitive function would be improved with the addition of methylphenidate—either 5mg QD or BID, or 10mg QD or BID. Each dose and dosing schedule change (e.g. QD or BID) was followed by extensive neuro-psychological testing in order to determine the optimal dose. Grace's was found to be 5mg BID.

In October of 2011, Grace's physiatrist cleared her to practice medicine without restrictions. She established a clinic for residents with chronic pain at Laguna Honda Hospital, the largest SNF in the United States.

In January of 2012, Grace experienced 2 falls within 3 days of each other. Neither resulted in LOC. Both involved unprotected damage to the head. In the first instance, she hit her head sharply on the corner of a dining room table, in the temporal area. The second resulted in loss of balance in the bathroom where the back of her head got the full, unbroken force of her head making contact with a tile floor. An MRI of the cervical spine done on 02/10/12 showed no evidence of severe canal stenosis or myelopathy. Nonetheless, self-care skills, particularly involving transfers, suffered. A head CT of 2/1/2012 revealed no subdural bleeding. B-12, methylmalonic acid and copper were all normal. Because she suffered a slow decline, she was readmitted to RKD on 3/04/2013 for acute rehabilitation for increased disability resulting from spasticity.

Fourth Rehab Admission to Ralph K. Davies:

On admission, pertinent new physical findings were:

1. *Motor exam revealed Ashworth 2 right upper and lower limb spasticity.*
2. *Interval worsening of right (60-130 degrees) but not left (35-140 degrees) passive elbow range of motion.*
3. *Weakness affecting right shoulder external rotation and flexion, right ankle dorsiflexion and plantar flexion, left finger abduction, and ulnar dip flexion muscles and left interosseus manus atrophy.*
4. *Sensory exam revealed ataxia on left finger-nose with eyes closed.*
5. *Gait exam not safe to perform.*

Review of hospital course, by problem, revealed the following new findings:

1. *Cognitive impairment predominately affecting attention, especially in regard to self-monitoring moor procedures.*
2. *Heterotopic ossification of right elbow confirmed by asymmetrical uptake (versus left elbow) on triple phase bone scan. Initiation of further treatment with Indomethicin was begun, with no positive results.*
3. *Spasticity treated with 5mg of diazepam daily resulted in significant functional improvement.*
4. *Single post-traumatic seizure with no recurrence. On long slow Keppra taper.*
5. *Pain: well controlled on 37microgm/hr. of Fentanyl.*

Fourth Discharge Home:

On discharge (3/22/2013), examination of gait and sit to stand revealed that they (sit-stand) were performed independently with the following gait abnormalities: a) fixed and internally rotated right hip and associated narrowing of base of support; b) severe compensated right stance phase Trendelenberg with associated foreshortening of right stance phase; and c) moderately severe right hemi-ataxia.

Surgery for Small Bowel Obstruction:

Grace had one more hospitalization for a small bowel obstruction in January of 2014. Conservative attempts at management failed and a previous midline incision (from repair of the diaphragm) was reopened both above and below the umbilicus. Extensive and dense omental adhesions prevented the use of a laparoscopic procedure. Adhesions were lysed, but there was evidence of chronic obstruction from a tight adhesive band. Further exploration revealed two other areas of tight obstruction. In one case, the small intestine was twisted around the adhesive band. Two different areas were resected. Grace spent three days in acute rehab after the abdominal surgery, at which point, she was declared at baseline, and that is where she has remained.

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