REHAB CASE STUDY

WHEELCHAIR SEATING AND MOBILITY FROM ACUTE CARE TO HOME

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Like many acute care hospitals, Denver Health has an early mobilization program directed toward getting the client up in the appropriate wheelchair as soon as the client is medically stable. In addition to decreasing the sequelae of bed rest, such as pneumonia and pressure injury, early mobilization allows the trial of different mobility bases and seating systems to facilitate a recommendation for discharge equipment. Following this plan can be challenging when working with clients who have an acute traumatic brain injury (TBI). Each client with TBI presents differently on initial assessment and progresses differently over time. As a result, it is difficult to predict what will be needed at discharge as well as in the years following injury. This case study illustrates the need to continually assess clients with acute TBI to assure that we are 1) utilizing the appropriate mobility base and seating system to facilitate mobility in the hospital and 2) writing an appropriate order for the client's own equipment.

Dan is a 23-year-old male who lived with his parents and younger siblings in a two-story home and worked with his father laying concrete. In late 2016, he was struck by a car while riding his motorcycle. He was traveling at highway speeds without a helmet and was thrown from his bike. He was transported to Denver Health, a level one trauma, safety net hospital. In the emergency room, he presented with a Glasgow Coma Scale (GCS) of 5. A GCS of 5 classifies the brain injury as severe. His respirations were agonal — a gasping pattern controlled by a brainstem reflex, which is another indication of severe brain injury. A CT scan revealed an acute left subdural hematoma (SDH) with an 8 mm shift. An acute SDH is a blood clot that forms after a high-speed impact to the skull. The impact causes stretching and tearing of the blood vessels on the brain's surface and a clot develops between the surface and the dura mater that covers the brain. The clot can cause a distortion of the brain stem and high intracranial pressure which causes a shift of the brain past its center line. A midline shift greater than 5 mm is an indication for emergency surgery to evacuate the hematoma to reduce pressure and prevent further tissue damage. Dan's CT scan also showed multiple areas of diffuse axonal injury (DAI). DAI is a widespread, sheering injury that occurs as the brain tissue accelerates and decelerates within the skull. In addition to his brain injury, Dan also had multiple skull and facial fractures as well as a left proximal radial fracture in his forearm and metatarsal fractures in his right foot.

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To reduce the pressure caused by the SDH, Dan underwent an emergent hemicraniectomy with removal of a portion of his skull, evacuation of the SDH, and placement of an intracranial pressure monitor. After surgery, he was admitted to the trauma intensive care unit (ICU). While in ICU, Dan had a trach and feeding tube placed. His ICU course was complicated by hydrocephalus, or increased fluid in the brain, requiring placement of a shunt to drain the fluid.

On initial therapy assessment in the ICU, Dan presented with a dense right hemiparesis and global aphasia. He had poor trunk control in sitting on the edge of the bed and was not able to safely attempt a stand pivot transfer or ambulation. He was dependent in transfers and required a mechanical lift. He was unable to verbalize, but was able to follow single step directions with 40 percent accuracy. To begin mobilization, Dan was positioned in a manual tilt wheelchair with a contour back and an air seat cushion. The therapy staff limited his time up in the chair, progressing in 15 minute increments until he was able to tolerate several hours without increased agitation or risk of pressure injury. Nursing staff performed position

Picture 1: Foam wedge used to decrease right lateral trunk lean

Picture 2: Rotation of feet due to existing tibial torsion

Picture 3: Fitting Dan to his new wheelchair

changes with posterior tilt in space every 15-20 minutes. As Dan's seated time increased, the therapists trialed different seat cushions, including combinations of foam, gel and air, while monitoring his skin for signs of potential pressure injury with each trial. They eventually decided a gel cushion was the best option for positioning and skin protection.

One month after injury, Dan was able to have the skull bone flap replaced and he was transferred to the progressive care unit (PCU) for continued monitoring. His intracranial pressures remained stable and he was then transferred to a medical-surgical floor. Although he made some cognitive improvement with decreased receptive aphasia, he continued to be non-verbal and dependent in all mobility and ADLs. At that point, Dan was not a candidate for acute inpatient rehabilitation services as he was unable to participate in this intensive therapy. Subacute rehab was recommended, but his family was very supportive and wanted Dan to return home. The team began to address the equipment and services needed for a safe discharge to home.

A formal assessment for a wheelchair and seating system was performed. On mat evaluation, Dan presented with a flexible posterior pelvic tilt and a partially flexible right pelvic obliquity (right side low). In sitting, he demonstrated a flexible right lateral trunk lean with a tendency to pull his trunk forward when agitated, and flexible right cervical rotation with a lateral flexion preference. The staff was using foam wedges and rolled towels to minimize his lateral tendencies (see Picture 1). He had a right anterior shoulder rotation with a 1-2 cm subluxation. He had mild extensor tone in both lower extremities, but his tone did not interfere with positioning. He also presented with fixed bilateral tibial torsion, more significant on the left, resulting in a left foot position of internal rotation and supination. This presentation was a bit puzzling, as tibial torsion is not typically seen in acute traumatic brain injury without concomitant lower extremity fractures. The mystery was cleared up, however, when Dan's sister reported that "he has always been bowlegged. They tried braces when he was little but his feet have always been like that." Although Dan's lower extremity bony distortion did not impair his ability to walk or work in construction prior to his accident, it was now a complicating factor in positioning his legs safely on the front rigging and foot plates (see Picture 2).

In developing recommendations for the wheelchair, the effectiveness of the mobility base and the seating systems trialed during his stay was considered. His limited progression in regaining upper and lower extremity movement, functional mobility, or improved cognition during the two months post-injury was also key as it suggested his prognosis for making significant improvement in the next year was guarded.

Because Dan did not have sufficient trunk or extremity control to safely perform stand pivot transfers or position changes, we recommended that he continue to use a manual tilt wheelchair. His family demonstrated good ability to operate the tilt mechanism on the Quickie IRIS used during his hospital stay and were agreeable to the recommendation of a Quickie IRIS for the mobility base. Potential concerns for transportation due to weight and a non-folding frame were discussed. Dan's father reported they could easily transport the chair in the family van. To support Dan's trunk and pelvis, we recommended a Jay 3 posterior-lateral positioning back with swing-away laterals, a Jay Fusion seat cushion with solid seat insert and right obliquity overfill to accommodate his

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right pelvic obliquity, an anterior chest strap to decrease his forward trunk movement, and a two-point pelvic positioning belt with 45 degree angle of pull to limit posterior pelvic tilt

WE WERE ABLE TO ACHIEVE GOOD TRUNK AND PELVIC ALIGNMENT WITH THE OBLIQUITY OVERFILL IN THE SEAT CUSHION AND LATERAL SUPPORTS ON THE BACK.

We added a right facial swing-away lateral pad to a 10" head support to facilitate midline positioning of his head and neck. To provide sufficient upper extremity support to prevent further shoulder subluxation, we recommended a full lap tray with gel elbow pads and a right posterior elbow block. For lower extremity positioning, we recommended 70 degree, swing-away hangers, a posterior calf panel, and angle adjustable foot plates with heel loops. We also added an 8" long foot block on the medial edge of the left foot plate to control excessive internal rotation. The request for authorization for the recommended mobility base and seating system was submitted to Colorado Medicaid.

Three months after his injury, the team recommended a short stay on the acute inpatient rehabilitation unit to provide caregiver training, evaluate the home to make recommendations for improved accessibility, and to finalize equipment needs for discharge. After a two-week rehab stay, Dan was discharged home. Medicaid authorization for his wheelchair and seating system had not yet been received, so a loaner manual tilt was provided.

Two months after discharge and five months after injury, Dan's chair and seating system were ready. The delivery and fitting occurred in his home with both parents involved. Although Dan was still dependent in transfers and continued to present with no functional movement in his right arm and leg, he had made cognitive improvements. He was able to follow single step commands more consistently, laughed appropriately, and offered fist bumps when greeting others. He also had full head control and could actively lean forward and then return to upright sitting. He continued to present with a right lateral trunk lean with prolonged sitting. With these motor improvements, we were able to remove the right lateral pad from the head support, as well as the anterior chest strap. We were able to achieve good trunk and pelvic alignment with the obliquity overfill in the seat cushion and lateral supports on the back (see Picture 3).

Observing Dan in his new wheelchair interacting with his family and his environment, he will likely continue to make gradual improvements both functionally and cognitively. Once he is able to progress to standing to perform assisted position changes, he will be ready to trial an ultralightweight manual wheelchair. We advised his family to discuss this recommendation with the home health therapy staff and physicians involved in outpatient follow-up in the Physical Medicine and Rehabilitation Clinic to assure that re-assessment occurs on a timely basis. As Dan continues to progress, his seating and mobility base needs are likely to change.

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