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Tom is a 26-year-old husband, and son who underwent a 16 foot fall off a roof at his construction job in Maine, resulting in a severe brain injury with multiple subsequent hospitalizations. Immediately following his injury, Tom presented to an outside hospital where he was found to have a trace left subdural hemorrhage and temporal contusion. This blossomed over several days, causing a 2.5 cm midline shift, entrapment of his right lateral ventricle, and ultimately requiring an emergent left hemi-craniectomy with placement of a left frontal EVD (extra ventricular drain). Following this procedure, Tom was found to have left ACA/MCA/PCA territory infarctions leading to brain herniation, after which he was transferred to MGH for further neurological and medical management. Tom was determined to be in a Minimally Conscious State as a result of his brain injury, and once medically stabilized, he was discharged to a local rehabilitation facility at the LTAC level to continue his rehabilitative course.

Tom then returned to MGH two months later for a left synthetic cranioplasty. Unfortunately, again, Tom's hospital course was halted following the development of worsening mental status post-operatively due to a new left epidural hematoma causing a 1.3 cm midline shift. This resulted in returning to the OR emergently for a decompressive left craniotomy to relieve the blood and pressure on his brain. Post-operatively, he suffered from a seizure following extubation, impacting his arousability in the setting of a post-ictal state. Once stabilized from a medical standpoint, Tom was again discharged back to rehab. However, soon afterwards he returned back to MGH from rehab following an additional seizure, requiring the need for careful alteration of anti-epileptic drugs.

I had the opportunity to be involved in the care for Tom during each of his hospitalizations and would like to focus on the progress we made during his lengthy, second hospitalization.

Tom was first evaluated on Lunder 7 following his left synthetic cranioplasty by my colleague. When I came in on Monday morning, being in the Neuro ICU, I was concerned to see Tom's familiar name on my caseload. Tom had come back to the ICU after his initial surgery following the development of a left epidural hematoma, requiring urgent decompression. To prepare for my re-evaluation, I reviewed his medical chart, reading admission notes, nursing notes, my colleague's initial evaluation, and most recently, neurosurgical and operative notes. Based on the location of his initial infarctions two months prior, in addition to the new insult to his brain caused by the left epidural hematoma, I began to anticipate the impairments he may present with—language, cognition, initiation, memory, motor weakness, perception, balance—using my knowledge of neuroanatomy. Also due to his post-operative seizures, I suspected his mental status and arousal may be altered at this time. I approached his nurse, asking specifically how his mental status and arousal had been that morning, in addition to his most recent blood pressure trends; if they were within recommended parameters. I coordinated a time with

her that would best work for me to re-evaluate Tom—early mobility is highly valued in the ICU to facilitate a patient’s recovery, and teamwork and collaboration are critical. Though Tom’s arousal had been poor that morning, I knew I wanted to evaluate the level of his arousal through interpreting his response to stimuli, in addition to the range of motion of his extremities, and if he was developing any increased muscle tone which may impact his ability to mobilize in the future (especially given his young age). Using past experiences and knowledge regarding neurological pathology following a seizure or post-neurosurgical procedure, I hypothesized that these may be impairments of Tom’s which should be addressed early. Before entering Tom’s room, I quietly observed him for a few moments from the hallway to gather resting data, noting his vital signs (stable, within recommended parameters), his positioning in the ICU bed (trunk and head in neutral alignment with his upper extremities supported on pillows though his left arm resting in slight internal rotation and elbow partially flexed, a blanket covering his lower extremities), and for any spontaneous movement of his body (none)—all observations which I would use to compare to my exam.

I entered his room, greeting his worried mother and wife at the bedside—both surprisingly recognized me from his prior admission two months ago. It was clear they were relieved to see me, as by this time, they were very familiar with how important physical therapy was as part of his recovery. Tom was laying in the ICU bed with his eyes closed. I said “Hi, Tom” in a clear voice, and gently touched his hand to see if he would have any response—he remained unchanged, and in looking at his monitor, I noted his heart rate and blood pressure remained relatively unchanged as well. I asked Tom if he could open his eyes, and after waiting a few moments, I told him I would gently help him to open his eyes with my hands. Even with manual eye opening, he was not maintaining his eyes open. Given his little response, I knew I would need to be a bit more aggressive with my attempts to awaken Tom. I continued to provide him increasing tactile stimulation with my hands, in particular deep pressure at his arms and legs in a methodical fashion in order to illicit an arousal or motor response, and carefully observed his limbs for any response. With use of a sternal rub, he did open both of his eyes briefly and was noted to move his right hand partially towards mine at his sternum in addition to move his right leg through partial hip and knee flexion. With removal of my pressure, his eyes returned to being closed. Based on his responses Tom was in a Minimally Conscious State, a term used to describe altered levels of consciousness in those with traumatic brain injuries.

Before proceeding with further arousal stimulation techniques, I examined the available range of motion at his arms and legs, taking him through each plane of movement at varying speeds to also assess his muscle tone, noting mentally in my mind the grades on the Modified Ashworth Scale at each joint. I felt increased flexor tone on both sides of his body, though more notably in his left-side (which though this did not make sense from a neuroanatomical perspective, had always been Tom’s more impaired hemibody from past notes and admissions), especially at his left gastrocnemius causing him to have decreased range of motion at his ankle. I was concerned that his decreased spontaneous movement and increased tone would cause shortening of his muscles, and thus decided to passively range each of his extremities through the available joint planes (with special attention at his ankles), incorporating intermittent rhythmic rotation of his limbs for tone inhibition in

order to improve his stretching capability. Proper positioning is also critical in preventing the development of contractures, and I educated Tom's family in the importance of maintaining Tom's head and trunk in neutral alignment with pillows or towel rolls, in addition to using a resting multipodus boot (which I had delivered to his room) to maintain ankle flexion while lying in bed.

Following discussion with the nurse, we agreed upon how important it would be for Tom to be upright in the chair—for his arousal, ventilation, and skin integrity. Based on my information gathered thus far in Tom's motor exam, I recommended we use the ceiling lift to transfer him to the recliner. I again closely monitored his heart rate and blood pressure to make sure they remained stable, as this had been the first time he had been upright since his craniotomy (orthostasis is a frequent complication of positional changes). From the chair, I was able to assess Tom's trunk and postural control in unsupported sitting by bringing his torso forward with my hands supporting him on either side of his trunk. He required maximal assistance to maintain this position, and with attempts to lessen my support, Tom demonstrated loss of balance towards his left, though he did not display any clear automatic righting or balance reactions of his extremities or trunk in attempts to maintain his sitting posture.

At the end of my session, Tom's family thanked me for coming in to work with him. They had many questions for me about what I found, if I expected him to recover, when I would return next, and what they could do in the meantime. I had heard in rounds that there were issues with Tom's "family dynamics", as his family had been viewed as overbearing towards the team with their concerns and frequent questions. Instead of dismissing them or coming up with an excuse to quickly leave the room, I made the decision to sit down with them to answer each question to the best of my knowledge and scope of practice. I knew I needed to gain their trust and develop a rapport, so that future sessions would continue to be successful. I described my role during his acute phase, and I explained how in a post-ictal state and post-surgical procedure, the brain required time to heal from a neurological perspective. Tom's mom and wife were so grateful I had sat down with them for a few extra moments.

Two days later, I was able to return to Tom's room for continuation of physical therapy—specifically, trialing sitting at the edge of the bed. When I entered his room, he was asleep (with mom at bedside), however upon greeting him he slowly opened his eyes and said "hi" back to me. Taking into consideration that Tom's left side of his brain (where the language center of ~95% of individuals resides) was more involved compared to his right, I continued to utilize short, clear phrasing in order to allow him to best comprehend my commands. Using short verbal phrases such as "let's sit up", I allowed my hands to facilitate his movement towards the side of the bed, starting with guiding his right upper extremity to the bed rail towards a side lying position while also assisting his weaker, left hemibody and trunk with my opposite arm. Repeating my command one more time, I provided tapping cues to his right UE to facilitate an active pushing up into a sitting position, while providing pressure at his contralateral hip simultaneously. Once upright, Tom was even more bright and engaging, and from here we were able to work on his trunk control in sitting with a focus on maintaining midline with his right arm on the bedrail for

support. We progressed to reaching activities with incorporation of his left hemibody, which moved with some flexor synergy influences.

As his sitting balance improved, I looked at Tom and asked him if he wanted to try to stand. Though he had not had much verbal output during our session, he exclaimed "Yes!" and it was clear we were on the same page. I helped place his feet at an appropriate base of support and told him to hold onto the bedrail with his right hand. I placed myself to the left of Tom, so that I could block his left knee and foot with my foot and knee and ultimately have more control of his movement. I told him to "stand up!", while using my hands at his pelvis and trunk to assist in his forward weight shifting. Our first stand was unsuccessful; reaching only about 50% of a standing position. I could tell Tom was frustrated, but he was eager to try three more times. On that final attempt, he reached nearly full standing, though only briefly in duration.

At the end of the session, I asked for his nurse to see if she would be able to help me to transfer Tom to his recliner chair. Instead of the ceiling lift, I suggested we trial stand-pivoting him over to his chair. I instructed her in best placement of the recliner chair for a successful transfer. I could tell Tom was exhausted, but I saw how proud he was of his progress. Mom was also thrilled, again graciously thanking me for working with Tom on his mobility.

Following review of current literature, I wanted to make sure that I was helping to guide Tom's rehabilitative progress in the best, most direct fashion for our future sessions. In neurological rehabilitation for brain injured individuals, a strongly functional based program which is goal-oriented allows for the greatest recovery in patients. With this in mind, we continued to focus future sessions in progressing his sit-to-stand and transfer repetitions, static and dynamic standing balance with progression to eventual gait training.

In two more sessions, Tom was able to take a few steps across the room (with my and my aide's assistance), while his wife followed with a chair. To prepare for the weekend, I knew how important it was to prescribe an exercise program which Tom's family could perform with him to maintain the gains we had made until my return on Monday. I reviewed the frequency and duration of lower extremity range of motion and stretching exercises with Tom's mother, which I had taught her on a prior session. Tom's wife was also eager to assist Tom in a standing program. Following education about safe guarding techniques, demonstration, and the assessment of her ability to appropriately assist Tom, I recommended they continue to work on sit-to-stand repetitions and his static standing balance over the weekend once Tom had been assisted to the chair with nursing staff. After our session, I reviewed this weekend plan with his nurse, and my recommendation for a standing transfer with two-staff members to assist him.

Early the next week, Tom was approaching medical readiness to discharge to rehab. I could see Tom's family was nervous by this, as I had recognized their difficulty transitioning to new situations, especially as Tom had had multiple hospitalizations, and providers involved in his care. Prior to this hospitalization, Tom had been at an LTAC. I knew that based on the literature, his progress, and his current level of participation, what

Tom really needed was an aggressive, multidisciplinary program at the acute inpatient rehab level. During multidisciplinary rounds I advocated that acute rehab would truly be best for him, and we were all on the same level of agreement. As his family expressed concerns of discharging to a new facility to me, I coordinated with his case manager to meet together with Tom's family to further educate them on acute rehab during this phase of his recovery—especially given Tom's young age, his injury, and his potential to improve. I emphasized that such a facility would really provide him with a maximal rehabilitative potential, and that though a new facility would bring another environment, daily schedule, and care-team to get used to, studies have shown that patients have improved outcomes in such intense programs with a neurological focus. At the end of this meeting, we suggested they tour the facility before making a final decision. With great relief, they were thrilled with the facility, and Tom left for rehab soon thereafter.

As previously mentioned, Tom had a third readmission to MGH for new seizure activity. I was thrilled to be able to continue to care for Tom and focused on reassuring Tom, his wife, and his parents that though he had a mild set back in his strength, return of increased muscular tone, and decreased activity tolerance, I expected him to return to his most recent prior level of function as he progressed through his post-ictal state and had his AEDs adjusted. I educated Tom and his family how important it was to continue to work on his mobility (despite being more fatigued from side effects of new medications) in order to prevent further deconditioning and loss of strength and function.

On his final hospital day, I had the pleasure of working with Tom and his family one final time before the EMTs came to transport him back to rehab. When I entered his room, he was waiting on the side of his bed with his left trial AFO (which I had introduced to him to improve his foot clearance and reduce knee hyperextension during stance) and sneakers already donned. Tom told me "I'm going to make it all the way around the floor". Proudly with the hand-held assistance of me and my aide, and his wife following closely with a wheelchair, we headed towards the hallway. I provided Tom intermittently with verbal cues for upright gaze to improve his posture, increasing his stepping on the left in order to improve his foot clearance, and for pushing his knees back in stance to promote knee extension and to facilitate a more fluid gait pattern. Though he needed several seated rest breaks every 30-40 feet due to fatigue, Tom made the whole loop back to his room. It was the perfect way to culminate our time together, meeting a shared goal that he was now able to verbally express himself. Though I haven't heard from Tom, nor his family, I am optimistic that he continued to work hard towards his recovery and ultimately return home to Maine with his loving family's support.

SAMPLE QUESTIONS:

Clinician/Patient Relationship:

1. When you were first working with Tom in the ICU, when he was in a minimally conscious state, can you speak to how you were able to develop a rapport with him and how is this balanced with developing rapport with his wife and Mom especially with known "family dynamics?"

Clinical Decision Making:

1. When you were first working on standing with Tom, you discuss that he needed 3 trials before he was able to briefly achieve standing. You also mention that you could tell Tom was exhausted. What led you to know that he was exhausted and talk to us about your clinical decision making to progress to transferring him to a chair.

Collaboration/Teamwork:

1. You discuss that you were able to coordinate with Tom's nurses on several occasions and this was successful. Going back to that first time you were going to transfer him to the chair without the lift and asked his RN for help. What would you have done if the RN did not feel comfortable not using the lift or disagreed with this step?

Movement:

1. You tell us how initially you let your hands facilitate Tom's movement to transferring to the edge of bed, progressing to verbal cues during gait. Can you speak to how you use your hands to facilitate movement and how they guided you?