NATIONAL TRANSPORTATION SAFETY BOARD

Office of Research and Engineering
Washington, DC

April 10, 2014

Medical Factual

Mary Pat McKay, MD, MPH
Chief Medical Officer

A. ACCIDENT: DCA13MR004

Accident Type:	Train Collision at Grade (Diamond Interlock Interchange)
Location:	BNSF Railroad Mile 131, Chaffee, MO
Date:	May 25, 2013
Time:	2:30 AM (CDT)
Trains#1:	BNSF Train UKCKHKMO-05T
Carrier #1:	Burlington Northern Santa Fe Railroad
Train #2:	UPRR Train 2ASMAR-2

B. GROUP IDENTIFICATION:

No group was formed for this activity.

C. SUMMARY

On May 25, 2013 at approximately 2:30 a.m., central daylight time, near Chaffee, Missouri, Union Pacific (UP) southbound freight train, 2ASMAR-2 collided with BNSF southbound freight train U-KCKHKMO-O5T, where UP and BNSF tracks cross at Rockview interlocking. The BNSF train was occupying the interlocking when the UP train struck the 12th car behind the locomotives of the BNSF train. As a result of the collision, 13 cars of the BNSF train were derailed. Two locomotives and 11 cars on the UP train were derailed. Spilled diesel fuel from the derailed UP locomotives caught fire. Missouri State Highway M bridge is above the Rockview interlocking and collision forces resulted in the collapse of portions of the highway bridge. The engineer and conductor on the UP train were the only crew members that were injured and they were transported to a local hospital. Subsequent to the bridge collapse, two motor vehicles struck damaged highway elements and were involved in fires. Five occupants of the motor vehicles were transported to a local hospital. It was clear and 48° F at the time of the accident.

D. DETAILS OF INVESTIGATION

1. Purpose of Study

Medical evaluation of the conductor and engineer of the striking train, Union Pacific 2ASMAR-2, which ran through an advanced approach and approach signal and failed to stop at a stop signal.

2. Methods

The Union Pacific (UP) medical records, as well as the post-accident ambulance and emergency department medical records were reviewed for both the engineer and conductor. In addition, pre- and post-accident medical records were obtained regarding the engineer of the UP train.

3. Findings:

I. UP Conductor

A. Official UP Medial Record

The UP conductor was a 33 year old man whose last UP physical exam was performed on 5/14/2010 in order for him to return to work after being furloughed. At that time he was 5 feet 10 inches tall and weighed 202 pounds. The history form he completed was entitled "Interval Medical History". On this form, the conductor answered "no" to a question about whether he was being returned to work after an illness or injury; a question about requiring work restrictions or accommodations; and a question asking if he had limitations to his ability to wear safety protective equipment. In addition, he answered "no" to the following question, "Do you have health condition, take any medications, treatment, or depend on any medical devices which do (or might) adversely affect your judgment, alertness, balance, coordination, or which might in any way interfere with your ability to safely and efficiently perform your job functions?".

On this visit the conductor passed the visual acuity testing without glasses or contact lenses (20/15) and color vision testing (14/14 Ishihara plates correct). Hearing testing was performed 2/25/2010 and the conductor had no deficits above 10 db.

On the conductor's initial physical 9/4/2008, he reported only a previous knee surgery, denied any medical problems, and answered "no" to a host of specific health problems. At that time, he was recorded as 5 feet 10 inches tall and 200 pounds. His binocular visual acuity was 20/15, and he passed the Ishihara color vision plate test with 13/14 correct answers.

B. Post-Accident Emergency Medical Care

Following the collision, the conductor was ambulatory at the crash scene but was transported to the hospital by ambulance. The ambulance run sheet notes "no significant PMH" (past medical history) and "None" under medications. The conductor awake and alert with a Glasgow Coma Score of 15/15 and was noted to have a scalp laceration, skinned knuckles on both hands, and was complaining of pain in his left elbow and right knee. The narrative note

from the emergency medical services provider says, "The pt stated they attempted to stop but could not stop in time."

In the emergency department, the conductor reported no medical history and denied taking any medications to both the triage nurse and the physician. He was recorded to weigh 95.3 kg and being 177cm tall with a calculated BMI of 30.42. The conductor was diagnosed with a scalp laceration and had the laceration repaired. A second diagnosis was "multiple contusions". CT scans were performed of his head, entire spine, chest, abdomen, and pelvis but no significant traumatic findings were uncovered. Laboratory testing revealed normal blood counts, electrolytes, liver and kidney function. His random glucose was mildly elevated at 133 mg/dL (high normal in this lab 113mg/dL). The conductor was discharged from the emergency department to home.

C. Post-Accident Toxicology testing

Following the conductor's emergency treatment, post-accident DOT required toxicology testing was performed. The alcohol test was negative. Urine testing demonstrated medications documented to have been given during his emergency treatment and was deemed by the medical review officer to be negative.

II. UP Engineer

A. Official UP Medical Chart

The UP engineer was 58 years old at the time of the accident. His last routine medical certification exam occurred on 7/20/2012. At that visit only vision and hearing were tested; no questions were asked regarding medical problems or medications and no other physical examination was performed. At that time his corrected binocular visual acuity was 20/30 and he passed the Ishihara color vision plate test with 13/14 correct. He had chronic partial hearing loss with 40-55db loss in the higher frequencies ($\geq$3,000 Hz) in the right and 60-70 db at 4,000 Hz and above on the left. This approximate degree of high frequency hearing loss had been present for many years. (In 1994 he was able to pass at 40db in every frequency 4,000 Hz and below.) There are no measurements of height or weight nor any mention of medication use or chronic medical problems in the last 15 years of the medical record.

In 1986, the then 31 year old UP engineer suffered a knee injury that required surgery and several months of physical therapy. He was eventually returned to full duty.

The only time the UP medical record includes a relatively complete medical history form is a 1974 entry from the Missouri Pacific and Texas Pacific Railroad when the then 19 year old was asked a series of history questions that included, "Do you now or have you ever had…" followed by a list, to which he responded "No" each time. This list includes a question about Diabetes. In addition, he replied "No" to the question "Are you taking drugs of any kind?" At that time, the engineer is recorded at 6 foot three inches and 190 pounds. His examination was otherwise unremarkable.

B. UP Medical Records from Carpal Tunnel Litigation

In 2001(left wrist) and 2002 (right wrist), the engineer underwent surgery to release the median nerve in the carpal tunnel of each wrist. Each time, he spent some weeks off work. In 2007, he brought a suit against the Union Pacific regarding the source of the carpal tunnel syndrome, believing it to be work related. As part of the suit, his personal medical records from 2001 and 2002 were provided to the UP. Recorded within this extensive information is the detail

that the engineer had been diagnosed as diabetic and treated with insulin beginning in 1997 when his Hemoglobin A1C was measured as high as 16%.[1]

C. Personal Medical Records

Pre-accident personal medical records were obtained from the engineer's primary care physician. The engineer had begun to visit this physician on 12/2/2010 after his previous physician closed his office. The engineer visited his physician about every 6 months for routine follow up of his Type II diabetes. His blood pressure was normal throughout his outpatient care but his heart rate (pulse) was generally measured above 100, ranging from 90 to 120 bpm on routine visits. Over the time between the initial visit and the accident, the engineer's weight increased from 275 pounds to 291 pounds in January 2013. His weight was noted at 287 pounds just after the accident (5/28/2013). The engineer was initially being treated with a NovoLog FlexPen[2] using 70/30 insulin.[3] He continued to use the FlexPen as a delivery device but his daily dosing increased over the course of the years from 46 units twice a day to 60 units twice a day. He did not routinely perform blood glucose monitoring tests at home.

Over the 21/2 years his primary physician cared for him before the accident, the engineer's Hemoglobin A1C varied from a high of 9.1% in July 2011 to a low of 7.2% in 12/2012. The engineer underwent post-accident Hemoglobin A1C testing the last week of August, 2013 and at that time his level was 7.6%.

D. Post-Accident Emergency Medical Care

After the collision, the UP engineer was transported to the hospital by ambulance. The ambulance run sheet notes under "Medications": "Other – Not Listed. Note: Insulin" and under "Past Medical History" it states "Diabetes". The ambulance assessment identified a laceration of the left arm, pain with some swelling on the left chest, and that the engineer was "neuro intact" and oriented to events, person, place, and time. His Glasgow Coma Score was 15/15 points. His blood pressure was measured twice at 162/104 and 174/107 and his pulse was 113 and 114. The ambulance personnel noted that "he was the conductor of the train… and was pulled out of the train when the fire broke out by his partner." He was ambulatory at the scene by the time the ambulance arrived.

The record from the receiving emergency department includes information from the triage nurse that states, "Pass, train accident – pt does not remember events prior to conductor rousing him – pain left ribs/upper left abd, pain rt leg below knee with movement." The triage note recorded the weight as 130.6kg and the height at 193 cm, with a BMI of 35.06. "Novolog FlexPen" was recorded as the engineer's only medication and the Medical History noted "History of diabetes, That is currently treated with insulin." In the physician's notes regarding

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[1] When exposed to high levels of circulating glucose (sugar), hemoglobin molecules become glycosylated; the sugar molecule attaches, creating a molecule known as Hemoglobin A1C. The percent of hemoglobin that is glycosylated is used as a measure of average glucose control over the preceding 6 weeks or so. Normal (non-diabetic) is considered a Hemoglobin AIC % of less than 5.6 %. Among diabetics, a Hemoglobin A1C level below 7% is considered good control with an average blood glucose around 150 mg/dL.

[2] This is the brand name of a device that delivers insulin.

[3] This is a pre-prepared mix of 70% NPH insulin and 30% regular insulin. Although all insulin works to get glucose molecules (sugar) into cells, different kinds of insulin provide different timing of the effect. NPH insulin or "N" insulin is a form considered "intermediate acting": onset of action is 1-3 hours, the effect peaks between 6 and 12 hours, and the total duration of action is up to 24 hours. Regular insulin is considered "short acting": effects begin within about 30 minutes, peak between 2 and 5 hours and are gone within 8 hours after a dose.

the chief complaint, there is a note, "Uncertain as to whether or not loss of consciousness occurred." In the notes from the physician's initial physical exam, the engineer was noted to be tachycardic[4] and to have pain in the left chest and left upper abdomen.

The engineer underwent computed tomography (CT) scans of his head, spine, chest, abdomen, and pelvis. No acute traumatic injuries were identified. Laboratory tests including a complete blood count, electrolytes, kidney and liver function tests were performed and were generally normal or negative. His glucose was 90 mg/dL (normal range in the lab was 72-113 mg/dL). Throughout the engineer's emergency department stay, the Glasgow Coma Score remained 15/15; his systolic blood pressure ranged from 164 to 189 and his diastolic from 80 to 150. He remained tachycardic with a heart rate between 109 and 112. The final diagnoses were multiple contusions and multiple abrasions and the engineer was discharged to home.

E. Post-Accident Toxicology testing

Post-accident DOT required toxicology testing was carried out after the engineer's emergency care was completed. The alcohol test was negative. Urine testing demonstrated medications documented to have been given during his emergency treatment and was deemed by the medical review officer to be negative.

F. Post-Accident Neurology Evaluation

Following the accident, on 7/18/2013 and 7/29/2013, the engineer visited a neurologist for further evaluation. The note from the first visit includes the following as part of the history of the present illness, "The last thing he remembers was talking to the conductor. After that, he remembers waking up with glass at his side and have the conductor over him calling his name. he states that he felt disoriented. He remembers EMS coming and putting his neck in a brace.. . He denies any headaches, vision changes or nausea at that time. He feels that he did black out. He has not talked to the conductor who was the only witness due to investigational purposes. He states that after the accident he had bruises in the back of his head on the right side behind his ear and on the shoulder and lower back… he states that the total time of his memory lapse was less than two hours. Prior to this incident, he states that he was having trouble with names and word finding an would lose track of what he is saying during sentences…"

The neurologist recorded that the past medical history was significant for "arthritis, back problems, diabetes, head injury, and neuropathy." The engineer's medications were listed as NovoLog, tapentadol, and baby aspirin. Novolog is a brand name of insulin, tapentadol is Schedule II controlled substance that is an opiod analgesic (narcotic pain medicine) marketed under the brand name Nuycnta.

At this exam, the engineer was noted to be 6 feet 3 inches tall and weigh 280 pounds.

On the mental status exam, the engineer was oriented to person, place, and time. His speech was described as "fluent, clear and coherent." To the neurologist, "the memory, judgment, and insight seem(ed) intact." The remainder of the physical exam was unremarkable.

Following the initial evaluation, the engineer underwent magnetic resonance imaging (MRI) of the brain with and without contrast which was interpreted as demonstrating "no acute intracranial process". Under "findings", the MRI report states, "There is no restricted diffusion to suggestion hyperacute/acute ischemia or cytotoxic edema. There was no evidence of mass, mass effect, midline shift, hemorrhage or acute/subacute focal infarct. The ventricles and cisterns are normal in size and configuration. There is no epidural or subdural hematoma.

[4] His pulse was measured at 110-113; above 100 is considered fast or "tachycardic" for an adult.

Significant white matter signal abnormalities are not identified. The sella turcica and pituitary are unremarkable. Postcontrast imaging demonstrates no abnormal enhancement." In addition, an electroencephalogram (EEG) performed in both awake and drowsy states was interpreted as normal.

The engineer followed up with the neurologist after this testing was performed. On the second visit, he reported being "amnestic to the event and 30-40 minutes prior to the event." The final diagnosis was "Neurogenic Spell – questionable syncope; transient global amnesia."

G. NTSB Requested Sleep Evaluation

The engineer in this accident was obese, had diabetes, and was unable to recall events or his behavior prior to the accident. Other information (See the Human Performance Group Chairman Factual Report) suggested the engineer was not operating the train as required for several minutes prior failing to obey the wayside signals and the collision. As a result, the NTSB requested that the engineer undergo a diagnostic evaluation by a sleep specialist including a polysomnography to evaluate him for a possible diagnosis of obstructive sleep apnea. Although the engineer initially agreed to undergo this evaluation, he did not comply with repeated requests or sign the required paperwork. No sleep study was performed.

E. SUMMARY OF MEDICAL FINDINGS

The conductor was in good health at the time of the accident and recalled events surrounding the collision. The engineer was obese and had been treated for Type II diabetes for many years prior to the accident. Based on documentation they provided, the UP knew of these conditions. Just after the accident, the engineer's blood glucose was normal, and his Hemoglobin A1C was 7.6% in the week following the accident. The engineer has no recall of events immediately prior to the accident; the exact source of this amnesia was not determined by his physicians.

References:

Drugs.Com. Nucynta Official FDA information, side effects, and uses. http://www.drugs.com/pro/nucynta.html . Accessed 2/26/2014.