

WCHCC INCIDENT REVIEW

This incident review is the result of WCHCC's internal examination of the facts and circumstances surrounding the events of an incident that occurred on July 27, 2001.

I. FACTS

The patient, a six-year old child, was transferred from Phelps Hospital to Westchester Medical Center on 7/24/01. The child had no significant past medical history except for a fall without a loss of consciousness that occurred on 7/23/01. The record reflects that a CT Scan done at Phelps demonstrated a right-sided cystic lesion on the right side of the brain. Following transfer the patient received initial doses of Decadron and was scheduled for an MRI in the morning and surgery in the afternoon on 7/25/01.

On that date, the neurosurgeons performed a right parietal frameless stereotactic guided craniotomy and resection of the tumor. Initial pathology confirmed an astrocytoma.

The patient was transferred to the Pediatric Intensive Care Unit and was followed by several specialists including Neurosurgery and Pediatric Neurology.

On 7/26/01 the child was transferred to the pediatric floor (3 South) in the evening. No neurological deficits were noted. The patient was awake and alert receiving IV Decadron and was maintained on "nothing by mouth" for an MRI.

On 7/27/01 at approximately 11:15 to 11:30 AM the patient was taken to MRI from 3 South by a courier with family members in attendance. He was alert but anxious and crying. The anesthesiologist was working with the child in the patient care alcove of MRI to prepare for the scan. Sedation was initiated by the anesthesiologist intravenously. In the alcove the patient was transferred to the MRI compatible stretcher and moved into the MRI room. The technologist assisted with preparation of the room and the patient; the oxygen flowmeter was turned on; the pulse oximeter was attached to the patient. The patient was placed into the tunnel of the scanner. The monitor in the room measures oxygen saturation of the patient's blood, the heart rate and end tidal carbon dioxide. The technologist left the MRI room to go into the Console Room to start the MRI study; the anesthesiologist remained in the MRI room with the patient.

Immediately prior to beginning the actual filming, the anesthesiologist attempted to turn the oxygen flowmeter to 4 Liters without any success. As there was no direct microphone communication between the MRI technologist and the anesthesiologist, the anesthesiologist knocked on the window between the MRI room and the Console Room to get the technologist's attention. The technologist responded by leaving the Console Room and going to the door of the MRI room. The anesthesiologist informed the technologist he had no oxygen. The technologist left the MRI room, walked through the Console Room into the Computer Room (which is the location of the oxygen flow into

the MRI room). A second technologist who was in the Console Room at the time accompanied the first technologist into the Computer Room to assist in addressing the oxygen supply. The source of this oxygen was from H cylinders secured to the wall with a connection through a line into the MRI room with a flowmeter on the inside wall of the MRI room. There was a gauge above the tank to indicate the psi of oxygen in the cylinder. There is no gauge to indicate psi attached to the flowmeter in the MRI room.

A nurse preparing to leave the MRI suite was passing the MRI door, which she observed to be wide open, saw and heard the anesthesiologist. In response to the apparent urgency of his concern the nurse noticed 2 E cylinders in a hand cart on the floor in the patient care alcove across the hall from the door of the MRI. She recalls one was empty and one was 3/4 full. The nurse recalls lifting the cylinder by the regulator and transferring it to the anesthesiologist. At approximately 12:15 PM the oxygen cylinder was introduced into the magnetic field surrounding the MRI and was drawn to the core of the magnet causing head trauma to the patient.

The nurse recalls that the anesthesiologist took the oxygen cylinder from her while she was in the hallway. She states she is not certain as to how many inches or feet he may have been from the inside of the MRI room or out of the doorway (which is recessed from the hallway by 8 inches).

The anesthesiologist recalls that a nurse brought the cylinder into the MRI room. As it was being drawn into the bore of the magnet he tried to catch it but could not.

In the initial interview by WCHCC and the State Department of Health, another healthcare worker who works in the MRI area only recalled facts concerning what happened after the accident occurred. However, a follow up interview was conducted by WCHCC and in that interview the healthcare worker revealed that she had in fact responded to the initial urgent sounds coming from the anesthesiologist prior to the accident by walking down the hallway toward the MRI room. While she was walking down the hallway, she observed the nurse in the hallway in the vicinity of the doorway to the MRI room. The worker now recalls that she saw the nurse while in the hallway pick up the oxygen cylinder. The worker further states that she saw the nurse hand the oxygen cylinder to the anesthesiologist and while the worker is certain that the nurse was in the hallway and that the nurse did not enter the MRI room when the transfer of the oxygen cylinder occurred, she is uncertain as to exactly where the anesthesiologist was standing at the time of the transfer.

After the patient was injured, he was pulled from the MRI tunnel and carried to the patient care alcove immediately adjacent to the MRI room and was observed to have facial trauma and bleeding around his mouth. He was quickly intubated by the anesthesiologist and ventilated. Stat Team, Neurosurgery and Pediatric Intensive Care staff members arrived. The child was transported to the Emergency Room and managed as a level one trauma.

The patient was transferred from the Emergency Department to the Pediatric Intensive Care Unit and was treated with maximal medical therapy; he remained in critical condition with a poor prognosis. The brain death protocol was initiated and the patient was pronounced dead at 5:40 PM on 7/29/01.

II ISSUES

A. System

1. The system in place related to the delivery of oxygen safely to the patients during performance of MRI was not effective. 2-H cylinders secured to the wall in the computer room were the source for oxygen for patients during MRI scanning. There was a flowmeter in the MRI room.

The practice was to change the cylinder when it was at or below 500 psi.

Action

Remove the H cylinders as the oxygen source for patients during MRI. Only non-ferrous oxygen cylinders will be used for those patients requiring oxygen during scan. Currently the patients requiring oxygen will be met at the entrance of the MRI unit by MRI personnel who will transfer the patient from the regular hospital cylinder to a non-ferrous aluminum cylinder and escort patient into MRI Suite. For outpatients who bring their own tanks this unit will be stored in the patient's automobile during the procedure. When the patient's study has been completed the patient will be switched from MRI compatible tank to either a hospital cylinder or to the patient's own tank outside the MRI area.

2. The general practice was to replace the H cylinder when the gauge indicated the tank was at 500 psi.

When the patient first entered the MRI room the flowmeter was turned on and indicated oxygen flow. Immediately before the scanning was begun the anesthesiologist attempted to increase the flow without success.

Action

The source for patients requiring oxygen during a MRI scan will be exclusively non-ferrous cylinders. A full non-ferrous E cylinder will be provided for each patient. It will be the responsibility of the MRI technologist/RN's to ensure a full cylinder is provided per patient. MRI personnel will monitor pressure readings of the tank in use every 15 minutes; if the reading reaches 500 psi, the tank will be replaced with a full cylinder.

3. An effective policy is not in writing. The Department of Radiology has written policies/procedures related to MRI scanning and safety. There was no written policy related specifically to the provision of oxygen during the MRI Scan.

Action

Written policy/procedure to include training of responsible personnel will be developed.

4. The policy related to the oxygen supply was not in writing resulting in potential for inconsistent understanding and application.

Action

The written policy and associate training will be communicated to involved staff by Respiratory Therapy Department. Documentation of training and on-going competency will be maintained. This will include current staff and new staff members as part of general orientation to the MRI milieu.

5. In the absence of written policy with related education and training the procedure followed was not consistent.

Action

Development of written Policies/Procedures related to training and education of appropriate staff and on-going competencies will be maintained.

B. Human Resources

1. No written procedure existed for management of oxygen delivery sources for patient undergoing MRI studies. Competencies have not been developed.

Action

Upon completion of policy/procedure and appropriate training, competencies will be developed and assessed according to organizational policy.

2. MRI orientation and inservice training did not include adequate or effective methods to maintain a safe level of awareness on an on-going basis.

Action

Development of an orientation and inservice program for all staff who enter this area including but not limited to staff, visitors, contracted services. Develop methods to address maintenance of an on-going safe level of awareness related to the MRI.

C. Environment of Care

1. The physical environment was not appropriate for the processes/treatment being carried out. When the oxygen source for a patient in the MRI room was not adequate, an attempt was made to provide supplemental oxygen. Ferrous oxygen E canister was introduced into the magnetic field. The patient care area adjacent to the MRI Scanner was not treated as a restricted magnetic field area.

Action

The restricted magnetic field area around the magnet should be expanded to include the alcove or patient care area. Non-compatible MRI equipment (i.e. oxygen tanks, pulse oximeters, ventilators, stretchers, fire extinguishers etc.) where available will be utilized.

Utilize additional signage and physical markings to identify and secure area. Reinforce Policy and Procedures for screening all who enter the secure area and include use of screening tool. Develop screening tools that give consideration to methods and limitation in vision, fluency, language and literacy.

2. Policies exist to address specific risks but a comprehensive risk assessment process was not in place.

Action

An environmental MRI risk assessment will be conducted by an outside expert.

3. Emergency and failure-mode responses. The fire extinguishers adjacent to the MRI scanner were ferro-magnetic.

A code cart with ferro-magnetic materials was in the patient care area adjacent to MRI scanner

Action

Replace with MRI compatible fire extinguishers. Revise and review Policies/Procedures for emergency for cardiac and respiratory events including delineation of responsibilities. Assure appropriate staffs are trained accordingly. Door to console room has been removed to minimize obstacles in technologist response to patient care needs. (or staff)

A plastic "break away" chain has been placed across the scan room as a visual reminder that this is a restricted area.

Code cart has been relocated to safe area.

4. There is no documentation of emergency preparedness testing.

Action

Upon completion of Policies/Procedures and education and training department will conduct mock drills and document response.

5. Controllable equipment factors did contribute to the event. H cylinders as oxygen source for patients.

Action

Only MRI compatible oxygen cylinders will be permitted anywhere in the MRI Suite.

6. Controllable environmental factors did contribute to the event. Ferrous materials were in an area adjacent to the magnet and were easily accessible to restricted magnetic field.

Action

Revised restricted field area surrounding the magnet to include the alcove or patient area.

7. The emergency preparedness plan in place does not include specific delineation of staff responsibilities.

Action

Revise and review Policies/Procedures for emergency response including delineation of responsibilities to staff and conduct drills with documented response.

D. Information Management

1. Necessary information was not available. No clock in the MRI room to provide accurate documentation of timing.

Action

MRI compatible clock installed.

2. Communication among participants was not effective. Communication between a person other than the patient in the MRI room during the scan is achieved by that individual knocking on the window between the MRI and console room to attract the attention of the MRI technologist performing the scan.

Action

Evaluate MRI compatible communication enhancements.

E. Other Factors

1. A prior incident occurred in 1997 where an oxygen tank was introduced into the magnetic field. This incident occurred at a time when the MRI was owned and operated by a private entity and the Medical Center was the Department of Hospitals under the County of Westchester. There was no patient in the MRI at the time.

Action

The disclosure of events to WCHCC necessary to support compliance with regulations by vendors with service agreements will be addressed in those vendor contracts.

III. EXECUTIVE SUMMARY

The critical factors associated with the delivery of oxygen to patient undergoing MRI:

1. A poorly designed oxygen delivery and monitoring system that failed to ensure the continuous delivery of oxygen and deprived the Attending anesthesiologist of the means to both determine the availability of oxygen and to switch sources without assistance.
2. Ineffective communication systems impeded the anesthesiologists attempts to communicate his concern for the patient's safety to the others in the MRI Suite and to monitor their efforts to assist him.
3. The storage of MRI incompatible material in the MRI Suite.
4. The failure to safely identify and safely secure the restricted magnetic field area.
5. Ineffective education of both hospital and non-hospital staff regarding the dangers associated with MRI magnetic fields.
6. Absence of and incomplete written policies and procedures related to the provision of oxygen in MRI.

Immediate steps have been taken to address MRI practices and equipment currently in use.

The investigation of the 1997 event is on going.

Considering the different levels of individual involvement, the facts ascertained are generally consistent and any differences do not relate to the outcome.

Emmanuel Kanal, M.D., a consultant on MRI safety, has been scheduled for a site visit this month. His recommendations will be addressed as part of this on-going plan of correction. The current suite will be closed as part of on-going constructions and demolition on or about August 24, 2001. MRI procedures will be done in the Cassette Building adjacent to the WMC Main Tower. Dr. Kanal will review the safety procedures in that area as part of his site visit.

Westchester Medical Center is committed to assessing the safety of high-risk areas but also to developing a comprehensive hospital-wide safety program.

6-year-old male child transferred from Phelps Memorial Hospital 7/24/01 to Westchester Medical Center s/p falls. MRI 7/25/01 noted cystic astrocytoma of right parietal lobe. Astrocytoma resected 7/25/01 via frameless stereotactic laser guidance. Child admitted post-operatively to Pediatric Intensive Care Unit for monitoring and IV Decadron. On 7/26/01 child was transferred to general pediatric care after no neuro deficits noted. The child was transferred to MRI Suite for Post-operative MRI (s/p right fronto-parietal craniotomy for cystic tumor) Friday morning approximately 11:30 AM July 27, 2001. The child was anxious alert and crying. Sedation was initiated by the anesthesiologist in the patient care alcove across from the MRI. The child was transferred to a MRI-compatible stretcher and moved into the MRI room. Pulse oximetry, oxygen and end tidal carbon dioxide monitoring was initiated. The M.D. motioned to the MRI technologist in the console room because the M.D. was unable to achieve desired amount of oxygen. The MRI technologist responded by leaving the console room and going to the door of the MRI. The anesthesiologist expressed the need for oxygen. In response, the MRI technologist went through the console room into the computer room, which is the location of the oxygen source. A second technologist that was in the console room accompanied the first technologist. To assist in changing the oxygen to a full cylinder. Concerned with the continuous absence of oxygen the M.D. in the MRI Suite loudly called for oxygen and a nurse walking by responded by securing the only available portable oxygen source which was one of two E cylinder oxygen tanks in a hand cart on the floor in the alcove across from the door of the MRI. At approximately 12:15 PM, a metal oxygen canister was introduced into the exam suite and was magnetized and drawn to the bore/core of the MRI machine causing head trauma to the child. The child was removed from the imaging tunnel and immediately intubated within the MRI Suite. Adequate ventilation was achieved and child was taken to Emergency Department, where a level-one trauma team was assembled and readied. A STAT CT of the brain demonstrated diffuse cerebral edema with small left subarachnoid hemorrhage, new right temporal and parietal skull fracture and resolving pneumocephalus. Despite all emergency measures and maximum medical therapy including ICP monitoring, the young child expired w/in 2 days on 7/29/01 at 5:40 PM in the Pediatric Intensive Care Unit after institution of brain death protocol.