Pneumatic Tubes: A Possible Patient Safety Vacuum?

ABSTRACT

With more than 600 reports submitted to PA-PSRS, the subject of pneumatic tubes used as material transport in hospitals has proven to be a patient safety concern. While mechanical breakdowns of the pneumatic tube systems are responsible for some transport issues, staff misuse and breaks in communication are factors in material transport as well. Many reports relate to specimen delivery, where samples were damaged, lost or delayed in transit. Additionally, cases mention having to redraw or recollect the specimen. Guidelines for proper use of pneumatic tube systems are available from several sources. Further considerations for improvement include setting up process control strategies, posting lists of authorized materials and schedules for labs, and checking the stations for tubes. (Pa Patient Saf Advis 2008 Mar;5[1]:28-30.)

While a great deal of patient information is becoming computerized, the need to rapidly collect and transport physical materials for examination and diagnosis still exists. Examples of these materials include specimens obtained for laboratory testing. An efficient, rapid, and secure means of transporting various items such as blood and tissue samples, drugs, radiographs, and documents throughout the facility can be life saving. Pneumatic tube systems (PTS) allow fast and reliable transport of medical material. There are numerous advantages in using a PTS, perhaps the most important among them being improved turnaround time for transported items. Others include the reduced risk of contamination, loss, or error by eliminating some human factors, assuming that the specimens are prepared accordingly and transported in the correct containers.

However, as can happen with even a well-maintained electromechanical system, the human element may be the most important cause of system failure. The following report submitted to PA-PSRS is an example of what can happen when staff fail to follow established PTS procedures:

Stool sample for C. diff sent to lab via tube system. Stool specimens must be hand delivered in lab due to possible exposure of contamination to tube system and lab personnel. In addition, container is screw-top and not vacuum closed. Only vacuum-closed containers (like blood tubes) can be sent via the pneumatic tube system . . .

To date, more than 600 PTS reports have been submitted to PA-PSRS. Approximately 80% of PTS reports involve transport of specimens; the rest mainly comprise delivery of medications from pharmacy, with approximately 1% related to the transmission of paperwork (e.g., orders, charts). None were reported as Serious Events in of themselves. A little more than 5% of the reports fault a mechanical breakdown of the PTS as the cause of these Incidents.

Specimens Lost or Delayed

Three out of four reports submitted to PA-PSRS addressed specimen transfers through PTSs in which the samples were lost or delayed in transit. Approximately one-third of these specimens required a redraw or recollection of the sample. Not all the specimen transport errors were explained, but some reports submitted to PA-PSRS offered information concerning root causes for the loss or delay of these samples:

- Specimens were discovered to have never been sent or left unretrieved at the destination.

Specimens found in the tube system the following morning. Blood for IgM, IgA, and gastrin level unable to be run.

- Specimens were not sent in a timely fashion; that is, the specimens were either sent too late to be processed in the laboratory or delayed long enough as to be considered compromised.

"Last carrier of day at 5 p.m. on Thursday (outpatient phlebotomy draw lab—first floor) did not get sent through pneumatic tube system until 7 a.m. on Friday. Some specimens too old for testing; patient [specimens] will have to be recollected."

- Specimens were routed to the wrong department, either due to system malfunction or human error.

At 3 p.m., HIV, hepatitis A, B, C, macrophage inflammatory protein specimens collected and sent to lab; results not in computer at 6:15 p.m. According to the computer, labs were ordered but not in process yet. Telephoned lab and was told they never received said specimens. Asked lab to please check carefully, and if not found, to send new labels. Lab tech stated that perhaps the specimens were “lost” in the tube system. Needed to restick patient and resend blood to lab.

- Communication was inconsistent between departments, such as between nursing and the laboratory staff, or even intra-departmentally.

"Patient in postop at 8:30 p.m. Unasyn due at 10 p.m. I called the pharmacy at 11 p.m. and asked if they had the Unasyn ready yet. (Medication not in patient’s cassette or on the counter despite a runner.) Pharmacy tech said she sent the Unasyn up a while ago in the lab tubes. I let pharmacy know that when they send us meds via the lab tube, they need to call because the tube system does not beep, and we have no idea that there are meds out there in an area where staff is seldom present."
Inappropriate Use Leads to Breakage, Loss, and Possible Contamination

About one-fifth of reports submitted on specimens transported through the PTS mention either a breakage and/or a leakage of specimens. Inappropriate use of the PTS includes transporting specimens outside of the facility’s approved material list or using an improper transport method or carrier. Breakage and leaks not only compromise the integrity of the sample, which could delay treatment, but may cause a biohazard risk that could endanger staff and require a shutdown and decontamination of the PTS. Hospitals vary on the types of material considered suitable for transport, so facilities may consider posting reminders at PTS stations. Here are three examples of such reports submitted to PA-PSRS:

Red top for cryoglobulin sent through tube system. Notified unit clerk to recollect and walk down in warm bath or hot towel.

Stool sample sent to lab via pneumatic tube system. Lid for sample was not securely fastened and biohazard bag was not closed. Sample leaked into tube. Sample was C. difficile and could have posed serious health risks to laboratory staff. Lab: specimen container cleaned and lid securely fastened. Tube was decontaminated. Specimen taken to microbiology to be processed. Lab protocol states that all stool specimens must be hand-delivered to laboratory and specimen lids must be securely fastened. Infection control issue. Emergency room to investigate and finalize. Emergency room: discussion with the involved staff regarding proper utilization of tube system. Specimen was recollected and sent.

Specimen sent down in the paper tube instead of the blood tube system. Specimens should never be sent down via the paper tube.

Another inappropriate use of the PTS relates to sending certain medications. To reiterate, policies differ from facility to facility, but many hospitals bar controlled drugs and unstable medications from transport through the PTS, as evident in the following reports to PA-PSRS.

Prescription returned to pharmacy via pneumatic tube—should not have been sent this way. Called nurse to reinforce this policy and asked her to write “vaccines” on their “do-not-tube” list.

Controlled medication sent by tube system.

Fentanyl drip, a Schedule II narcotic, was sent back from intensive care unit to pharmacy via tube system instead of being hand delivered.

Communication Issues

One of the inherent problems in using a PTS is a lack of communication between departments due to the lack of human interaction. These breaks in communication, such as those listed below, often cause delays that may mitigate the advantages of tube systems.

Ancef ordered from pharmacy; delay in dispensing. Medication found removed from tube system. Nurse was not notified that the medication was in the unit, resulting in a delayed administration.

Blood specimens received in the main lab from the emergency department. Lab returned the specimen through the pneumatic tube, where it sat for almost three hours. Computer tech did not relay the information that the emergency department lab was closed.

Rapid test obtained by doctor and sent via tube system at 8:20 p.m. By 8:55 p.m.—no results. Called lab, they still had not found it. Called central receiving, who stated that they do not log in when specimens are received. Lab called emergency room at 9:30 p.m. and stated that they just received specimen. Doctor aware.

Order for Zosyn faxed to pharmacy at approximately 5:20 a.m. Called pharmacy at 6:30 a.m. after rechecking tube system. Pharmacy stated patient “not in computer and assumed it was taken care of.” Confirmed with admissions that patient in computer and manually admitted in Accudose.

A unit of packed red blood cells was sent to the unit at 9 a.m. and called to nurse at 10 a.m. Nurse called looking for blood and found it in pneumatic tube station. Unit returned to blood bank and discarded.

Strategies for Safer Tube Use

A PTS can promote rapid sample and medication delivery to remote parts of the hospital. Education of all users is essential to ensure that the tube system does not suffer downtime due to carelessness or lack of understanding. Hospital-wide and individual department policies and procedures may help to set expectations, but consider whether visual reminders at the tubing stations or forcing functions could promote better adherence to procedures. One comprehensive set of guidelines developed by the Massachusetts General Hospital with their rules for using the PTS may provide a useful example (see http://mghlabtest.partners.org/pts.htm). Also, Vanderbilt University Medical Center published a concise explanation of the policy and procedures for their pharmacy PTS, including a competency checklist (see http://vumcpolicies.mc.vanderbilt.edu/EManual/HPolicy.nsf/AllDocs/536D894BF9EC341C86256FB0E051E2A3). Consider these additional strategies on improving the PTS:

Set up a process control that provides a means of ensuring that the time requirement for material delivery is satisfied every time. When used
properly, the PTS can be a valuable strategic device in providing timely and appropriate patient care.

- Johns Hopkins University asks their pharmacy services staff to assure patient identification is correct for material being transported.\(^1\) Consider including all labels and paperwork with any tubed material, as well as a routing slip in the case of a misrouted delivery.

- Make clear how often staff are expected to check the station to help ensure timely removal of material in tubes.\(^7\)

- Post a list of banned materials that are unsuitable for transport at tube stations.\(^5\) Avoid use of the PTS for anything but its designed intention. Inappropriate use of the PTS compromises the integrity of the system and restricts the hospital's ability to ensure good patient care.

- Post a schedule of when approved items can be sent to specific locations.\(^8\)

The first PA-PSRS report cited in this article goes on to demonstrate the PTS policy of that facility. The following is the narrative of the report pertaining to the facility’s policy:

. . . Only vacuum-closed containers (like blood tubes) can be sent via pneumatic tube system. Refer to procedure on hospital intranet, department, laboratory test directory, procedures, and pneumatic tube system. Refer to graph in procedure for quick reference. Specimen sent to microbiology for testing.

Notes


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