Intensive Care Unit Radiography and the Beginning of the Imaging Value Chain

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DESCRIPTION OF THE PROBLEM

In a 1,098-bed institution with nine intensive care units, there was a high degree of variability in the response time of our technologists to orders for stat radiography. Our medical intensive care unit (MICU) colleagues came to us dissatisfied with our response times, stating that the information on those images was needed for urgent patient care decisions and that we were not currently meeting their expectations. The radiographic report was not their primary concern, as they felt comfortable with their preliminary interpretations of intensive care unit (ICU) radiographs for life-threatening conditions. However, obtaining the image itself as fast as possible was critically important to them. At the start of the study, the median time it took a technologist to reach the bedside to begin a stat examination in the MICU was 46 min 46 seconds after the order was placed. Our MICU colleagues told us that this was unacceptable.

WHAT WAS DONE

Baseline data were obtained from the radiology information system and were analyzed at the end of November 2013 for the previous 12 months (December 2012 to November 2013). After some discussion, our MICU colleagues told us that the metric they would like us to measure was the time it took a technologist to reach a patient's bedside, as they realized that many patient-specific factors might delay the completion of the image after the technologist had arrived. We therefore defined this metric (order to start) as our radiographic turnaround time (TAT) for the purposes of the project. After being told that our baseline TAT measurement of 46 min 46 seconds for stat radiography was not acceptable, we asked our MICU colleagues what length of time would meet their needs. The attending physicians in the MICU believed that a stat radiographic examination was a rare event, but a critical one, and should be treated as such. They told us that they needed a technologist to arrive at bedside for all stat radiographic examinations within 15 min, without exceptions. Establishing that as a demanding target given the current median, we began our project. To work within a reasonable time frame and on a reasonable scale, the scope of this project was initially limited to the MICU. We also limited the project to portable chest and abdominal radiography; stat foot radiography would not be held to the 15-min TAT.

We started by simply walking the process, establishing the steps and flow of the information from the time an order was placed until the image was sent to the PACS. Following the technologist around while morning radiographs were taken, watching the clinicians place an order, and speaking with everyone from MICU nurses to radiology clerks shed a lot of light on the workflow [1]. Technologist surveys, feedback from clinicians, and data analysis from the radiology information system eventually led us to identify three major problems we could address:

- a traditional culture of ordering that resulted in marked overuse of the term stat,
- outdated equipment that was often physically located far from where it was needed, and
- lack of timely communication of the stat order to the technologist.

The MICU attending physicians felt that a true stat radiographic examination was a rare event, perhaps occurring three or four times a day. From a practical standpoint, however, the number of stat examinations ordered was often much greater. The term stat was creeping into orders placed for tomorrow's early-morning chest radiographic study or "follow-up pneumothorax" radiography for 6 hours from now. Looking at our 12-month baseline data, we found clinicians who had placed one stat order during the whole year and others who had placed 103 stat orders during a 1-month rotation. This variability

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came from multiple sources, including uncertainty about when a routine might be performed and a fundamental belief that "it's an ICU case, therefore it's stat." This gave rise to our first intervention: order patterns.

Intervention 1: Ordering

The radiologists on the team did not try to dictate what a stat radiographic examination was to the MICU physicians. We defined a true stat versus a false stat examination quite simply: a true stat study had to be ordered for, and needed, right now. Any radiographic examination that was ordered for some time in the future and marked "stat" was considered false. Typical baseline data are shown in Figure 1 for October 2013. At the beginning of December 2013, the lead author attempted to change order patterns singlehandedly, by directly informing the residents and fellows on the MICU service that the processes had changed and that the term stat should be used judiciously, and only for examinations absolutely needed immediately. The complete lack of effect of this intervention, and in fact worsening of the problem, was shown by the data analysis at the end of that month. It became clear that alterations in MICU culture and workflow could not be effected by what was perceived as a purely external source [2]. Therefore, starting in January 2014, the lead author would drop by early-morning rounds near the first day of the rotation. The MICU attending physician on service would personally pull all the residents and fellows aside, have them listen to the radiologist's presentation on the need to limit the number of stat orders to critical studies needed now, and then verbally reinforce his or her support for the new workflow. The change in order patterns was immediate and long-standing. This workflow has been holding well in the MICU culture, and the introduction is in the hands of the MICU charge nurse during orientation.

Intervention 2: Equipment

During our analysis, we found that the portable equipment being used was often shared between different towers of the building. The battery life on the machine shared by the MICU tower was dismal (∼12-14 images before the battery died and the unit had to be recharged), it took 6.3 min to boot up, and a tethered cord required a full wipe-down after each bed, slowing the technologist down. The TAT data and documentation of workflow for this unit and others were used to help show that the equipment itself resulted in delays. Additional equipment was bought for the hospital as a whole,

Fig 1. Average number of stat radiographic examinations per day, divided over the month. "False" stat orders were defined as stat examinations ordered for some time in the future, such as chest radiography to follow up pneumothorax in 6 hours. True stat examinations were defined as those ordered to be performed immediately.

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