How-I-Do-It: Teaching Root Cause Analysis

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We describe our method of exposing radiology residents to root cause analysis. Our interactive case-based, small-group teaching session uses a flipped classroom approach which allows the session to focus primarily on working through the case in small groups. This methodology can be easily integrated at other institutions.

Key Words: Root cause analysis; case-based review; flipped-classroom approach.

BACKGROUND

Error has been long recognized as ubiquitous to the practice of medicine. In the Institute of Medicine's report *To Err is Human: Building a Safer Healthcare System,* nearly 100,000 deaths annually can be attributed to medical error (1). Learning from our mistakes is one aspect of error reduction. Root cause analysis (RCA) is an established method by which to systematically analyze the contributing factors accounting for a medical error and to guide implementation of system-wide change to prevent future mistakes. The Joint Commission for Accreditation of Healthcare Organizations (JCAHO) requires that an RCA be completed within 45 days of any major or sentinel event (2). A sentinel event is defined by JCAHO as an unexpected occurrence involving death or serious physical or psychological injury, or the risk thereof (2). For radiology, examples of sentinel events would include wrong site procedures, retained foreign bodies, or prolonged fluoroscopy resulting in >1500 rads cumulative dose to a single field.

At its core, RCA is a retrospective process used to identify errors underlying variation in performance and allows for the development of effective strategies to decrease the likelihood of similar adverse events occurring in the future (3). The two major categories of error include active and latent error. Active errors occur during the interaction of people and complex systems. Latent errors represent inherent system failures. As active errors are difficult to predict, RCA aims to identify and reduce systemic errors that can be rectified preventing adverse events. RCA entails five key steps: (1) define the problem and gather data; (2) identify, classify, and prioritize possible contributors; (3) identify root causes; (4) generate solutions; and (5) implement system change and disseminate results.

In our department, introducing residents to RCA is part of a broader training in quality, safety, and other practice management skills. Resident exposure to these areas includes a dedicated lecture series, mandatory mentored Practice Quality Improvement (PQI) projects, and the opportunity to join our department's Radiology Leadership Academy. Exposure to RCA was deemed important as not only will residents be future leaders in our field, but also the ability to conduct an RCA can fulfill a component of the American Board of Radiology's Maintenance of Certifications process (3) and plays a role in Systems-Based Practice, an Accreditation Council for Graduate Medical Education core competency (4). To engage residents, we designed an interactive case-based, small-group teaching session that occurs during dedicated didactic time. In this article, we highlight how we conduct this interactive session using a sentinel event and applying principles of RCA.

CHOOSING THE CASE

Selection of an appropriate case is the important first step in creating a case-based, small-group teaching session. The case must be comprehensive to cover all stages in the process. The case presented later, a case of wrong site injection, was selected by a consensus of the authors through a review of our department's quality improvement database (5). This database consists of all imaging cases entered in real-time by any departmental trainee or faculty member. Cases are de-identified and some details are changed to protect identities and maximize the learning process. Although we certainly welcome resident input to case selection, the reality is that most residents do not personally experience an RCA during their training, and therefore, we believe that this simulated exercise provides an opportunity to develop this critical skill set.

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CASE SUMMARY—WRONG SITE INJECTION

A 53-year-old male with chronic foot pain presented for a fluoroscopically guided steroid injection of his right foot after having experienced no pain relief following an injection performed in the orthopedic office. After obtaining written informed consent and performing a time-out, the radiology fellow and attending radiologist successfully injected 40 mg of Depomedrol and 0.5% Sensorcaine into the second and third metatarsophalangeal joints (MTP). After the procedure was completed, the patient commented that the band-aid was in a different location compared to the prior procedure. A review of the requisition showed the order to be "please inject steroids into the 2nd and 3rd MTT joints." After realizing that the wrong joints were injected, an apology was issued and the correct joints were injected.

ANALYZING THE CASE

One week prior to the 1-hour interactive learning session, a representative case is distributed to the residents along with instructions to read two articles explaining the RCA process (6,7). This flipped-classroom approach allows the session to focus primarily on working through the case in small groups rather than just reviewing the basic concepts. The session starts with a 15–20 minute review of the five key steps of RCA as well as the commonly used RCA tools, such as Ishikawa/fishbone diagrams, Pareto charts, and causal tree maps. The residents are then divided into five groups of four to five residents, with each group being instructed to tackle one of the five major tasks (Table 1). Typically, accounting for call responsibilities and offsite rotations, approximately 25 residents attend each session, and each small group comprises five residents divided at random by the program director facilitators. Ideally, each group is composed of residents across all four years of training as each resident brings different levels of expertise and experience to the discussion. As our program conducts one RCA session annually as part of our broader curriculum encompassing approximately 10 to 15 lectures directed to quality and safety, we have found attendance to be excellent. Over the course of the entire residency, each resident has exposure to at least two to three RCAs during their training.

As groups assigned tasks downstream in the root cause process are not privy to information from the other groups, they are provided with standardized "answers" to the upstream tasks to ensure continuity. Each group is given specific tasks to accomplish within their group, as defined in the following discussion.

TABLE 1. The Five Major Tasks of Root Cause Analysis

Task 1: Define the problem and gather data and evidence.
Task 2: Identify, classify, and prioritize possible contributors.
Task 3: Identify root causes.
Task 4: Generate solutions.
Task 5: Implement solutions and disseminate results.

Group 1: Define the Problem and Gather Data and Evidence

After recognizing a sentinel event, a multidisciplinary team composed of different stakeholders is assembled to gather data. Residents are asked to view the case from multiple perspectives which, in this case, includes the radiology attending physician, radiology fellow, nurse, technologist, and orthopedic surgeon. The group is asked to compose a narrative of the event with specific instructions not to point blame at a specific person (Fig 1), as well as a timeline (Fig 2). A key to the effectiveness of the multidisciplinary team meeting is the establishment of a "just culture" in which participants are free to express their opinions without fear of blame.

Group 2: Identify, Classify, and Prioritize Possible Contributors

During this stage, residents are asked to analyze the event in a systematic way and identify possible causal factors. Various

"A musculoskeletal fellow under supervision of the attending radiologist performed a foot steroid injection. Patient informed written consent was obtained for a "2nd and 3rd MTP joint injection." A pre-procedural time out was performed with only the fellow confirming the procedure. The requisition stated "2nd and 3rd MT-Tarsal articulation" steroid injection. The injection was performed, but the patient noted that the band-aid was at a different location from the pain. The mistake was realized and an apology issued. The correct joints were injected."

Figure 1. Narrative of the event. Note that the narrative is free of personal identifiers and is written in an objective manner void of blame.

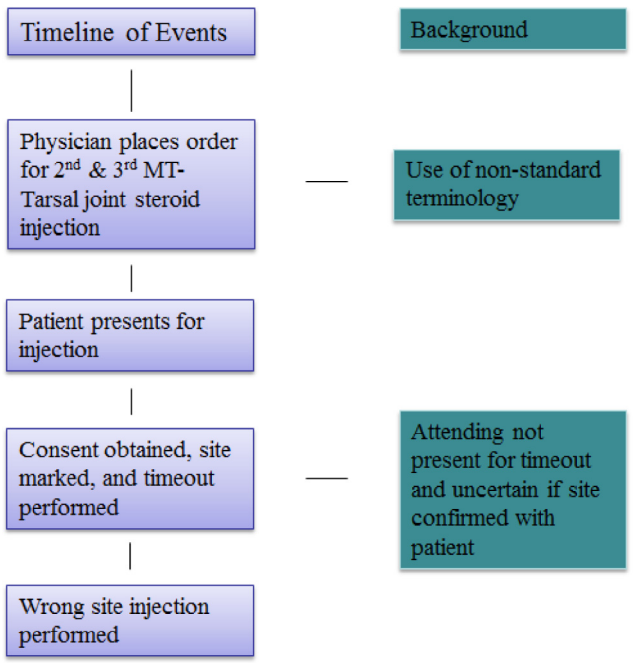

Figure 2. Timeline of adverse events with deviation from the standard of care highlighted in green. (Color version of the figure is available online.)