Key Takeaways

- The Radimetrics™ Enterprise Platform, which offers radiation dose and contrast dose analytics, can help users identify dose outliers and probable cause of such outliers. The use of this platform may provide users the opportunity to educate and train their staff to avoid such issues in the future.
- For an effective radiation dose optimization program, contrast injection technique needs to be assessed along with the scanning protocol.

Computed Tomography Pulmonary Angiogram (CTPA) for Pulmonary Embolus (PE) is a commonly ordered study in CT. For proper diagnosis of PE with CTPA, contrast injection is required. When the contrast enhancement is not adequate for diagnosis, repeat scans and repeat injections can result.

The following customer experience comes from an imaging department that employs the Bayer Radimetrics™ Enterprise Platform for both contrast dose and radiation dose management. Radimetrics™ Enterprise Platform captures quality metrics such as IV contrast details and radiation exposure in a central location, creating a readily available repository of information to identify variations in performance, patterns, and trends. Investigating and addressing these variations can provide opportunities for improved performance and compliance.

A 70-year-old female was referred for a chest CTPA to assess for PE. The standard imaging protocol for this study includes:

- imaging with an A/P and Lateral scout
- a pre-monitoring series to locate the area of interest
- a monitoring phase for the bolus tracking technique
- the diagnostic imaging series

The standard injection protocol employed includes a saline test inject to evaluate the vein patency, 75 mL of contrast at 4 mL per second for the bolus tracking and diagnostic phase, followed by a saline flush. (Figure 1)

The American College of Radiology (ACR) has supported improved radiation dose management through the As Low As Reasonably Achievable (ALARA) concept, which recommends the minimum level of radiation necessary be used to produce the desired results. The ACR has also introduced Imaging 3.0™ to assist radiology with the challenge of government and private insurers moving health care payment and delivery away from fee-for-service toward value-based, collaborative systems.

Navigating this changing landscape requires radiology to look at all aspects of their department including contrast injection techniques and radiation dose to assess opportunities for quality improvements and time management improvements.

Contrast Injection Techniques May Increase Radiation Dose

Over the past several years, diagnostic imaging has faced increasing challenges, including regulations around radiation reduction and optimization. Additionally, The Joint Commission of Diagnostic Imaging Standards has standards suggesting that all contrast agent information (dose, route of administration, and rate of administration) be documented for every patient.
Despite three unsuccessful saline test injections, the decision was made to continue the study. The initial contrast injection produced a pressure limit at 325 psi. This reduced the flow rate from 4mL/sec to 1.23mL/sec. The technologist made the decision to terminate the study after 34mL of contrast agent had been injected. (Figure 6)

Review of the scanning acquisitions by series demonstrates the technologist initiated a repeat scan series in an attempt to visualize the anatomy with the injected 34 mL of contrast. (Figure 7a)

An Anomaly Appears: Following an imaging event, an email alert was generated due to exceeding the Dose Reference Level (DRL) for radiation. This alert, along with detailed documentation provided by the platform, allowed further investigation to understand what occurred during the study that resulted in this alert.

When reviewing the enterprise DRL for this scan type, the Max DRL indicated was to be approximately 10 mSV (see Figure 2). The study under investigation delivered approximately 29 mSV.

Investigators were able to review the study and injection documentation in detail and discovered that the saline test inject was acquired a total of three times. Using the platform to visualize the saline test details in greater granularity, the documentation revealed three aborted attempts. (Figures 3, 4 and 5)

Despite three unsuccessful saline test injections, the decision was made to continue the study.

The initial contrast injection produced a pressure limit at 325 psi. This reduced the flow rate from 4mL/sec to 1.23mL/sec. The technologist made the decision to terminate the study after 34mL of contrast agent had been injected. (Figure 6)

Review of the scanning acquisitions by series demonstrates the technologist initiated a repeat scan series in an attempt to visualize the anatomy with the injected 34 mL of contrast. (Figure 7a)

Patient information listed on the GUIs has been changed to fictitious information.
At this point, it was determined a new IV should be inserted. After successful insertion of a new IV, the imaging series of pre-monitoring, monitoring and the diagnostic CTA Chest acquisition is repeated. (Figure 7b)

A completed injection is delivered with expected pressure readings, flow rate and desired volume of 75 mL. (Figure 8)

Customer Experience Summary
In the experience above, a total of seven imaging acquisitions (excluding scouts) were obtained. The organization’s standard protocol for this same exam would typically include only three imaging acquisitions. Due to challenges with the patient’s IV, the resultant patient radiation dose was more than double the expected dose for this exam type. It should also be noted the patient received 45 percent higher contrast volume when compared to the standard volume for this exam type. (Figure 9)

Here we describe a case study where this imaging department could utilize the combined contrast and radiation details in Radimetrics™ Enterprise Platform to identify an opportunity for improving patient care and imaging performance. The use of this platform may provide users the opportunity to educate and train their staff to avoid such issues in the future.
Value of Combined Platform for Contrast and Radiation Details

The Bayer Radimetrics™ Enterprise Platform offers users the ability to view both radiation dose and contrast details in central locations at the examination and patient level.

The platform’s ability to provide alerting capabilities for contrast and radiation offers the users a unique ability to investigate outliers to determine if protocol or process enhancements can be employed. As radiology shifts from a volume based to value based entity with increasing compliance requirements, a tool like Radimetrics™ Enterprise Platform can assist radiology in tracking and trending various elements across scanners, protocols, staff and patients.

Patient information listed on the GUIs has been changed to fictitious information.

References

1 American College of Emergency Physicians - Five Things Physicians and Patients Should Question
2 State-of-the-Art Multi-Detector CT Angiography in Acute Pulmonary Embolism: Technique, Interpretation and Future Perspectives
4 ACR statement on recent studies regarding CT scans and increased cancer risk. 2009 [cited 2014 December 13]
5 ACR Imaging 3.0™ FAQ - Why is ACR leading the Imaging 3.0™ initiative?