A Study to Compare the Diagnostic Accuracy of CTPAs Performed in CT2 -

Before and After Increasing the Injection Rate to 5 mls/sec

NHS
Buckinghamshire Healthcare
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Introduction

Pulmonary embolism is a life-threatening condition in which one or more emboli obstruct the pulmonary arterial system. A CT pulmonary angiogram (CTPA) is offered to anyone with a Wells score of 4 or higher, indicating that a pulmonary embolism is likely[1]. The technical adequacy of the scan is determined by the contrast opacification within the pulmonary artery, with a minimum threshold of 250 Hounsfield units (HU)[2].

There are many factors that can affect contrast enhancement such as patient inspiration causing transient interruption phenomena, strength, rate and volume of contrast[3]. Radiologist feedback indicated that a change needed to be made to improve the diagnostic enhancement of CTPAs performed within this trust.

After seeking advice from other CT departments, an increase in flow rate was the preferred option. By changing the flow rate from 4 mls to 5 mls/sec and injecting 80 mls Omnipaque 350, it was also necessary to change from a 20G IV cannula with injection port to an 18G or the flow rate could be accommodated by the 20G Introcan Safety® 3 Non-Ported Closed IV Catheter.

Aims and Objectives

The aim was to improve the diagnostic accuracy of CTPAs performed at Stoke Mandeville Hospital (SMH) by improving contrast enhancement within the pulmonary trunk.

The objective was to compare HUs measured within the pulmonary trunk, before and after increasing the injection flow rate from a rate of 4 mls/sec to 5 mls/sec.

Methods

The audit was carried out at SMH and focused on patients scanned on the A&E CT scanner (Siemens Definition AS, 64 slice scanner) only. 300 studies were reviewed before the change in protocol was made, i.e., prior to January 2022 and 300 studies after this date.

The reports were reviewed for each patient to check if the Radiologist had stated the HUs within the pulmonary trunk. If this information was absent from the report the HUs were measured on the PACS system.

Results were recorded on excel spreadsheets, as either diagnostic (HU >250) or undiagnostic (HU <250).

Conclusion

Suboptimal enhancement of CTPAs leads to non-diagnostic studies, thus delaying patient diagnosis and often requiring repeat scanning. Repeating scans comes with added risks surrounding contrast safety and additional radiation exposures.

From the results of this study, we can conclude that increasing the injection flow rate to 5 mls/sec has improved the diagnostic accuracy of CTPA scans carried out at SMH. The diagnostic accuracy improved from 81% to 93% following this change in scan protocol. As mentioned previously and due to human physiological factors, a diagnostic rate of 100% is difficult[4], however the change in protocol at SMH has enabled an increase in diagnostic scans by 12%.

This positive result will have reduced repeat scans, minimising radiation and contrast exposures and enabled efficient and timely treatment for patients following diagnosis.

Results

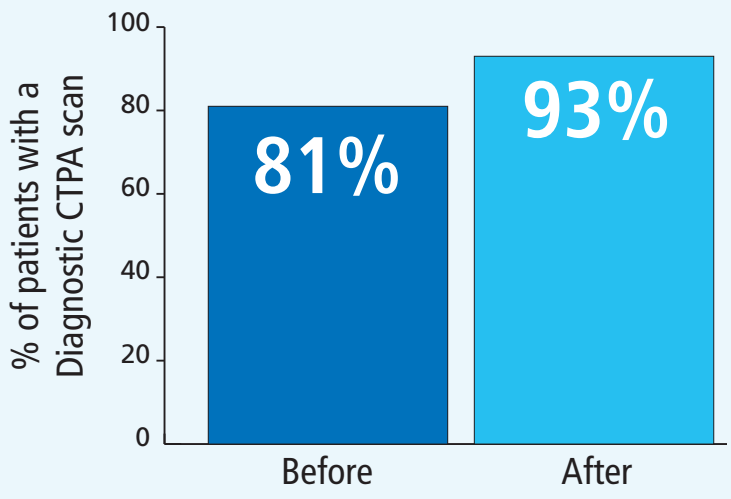

FIGURE 1

Diagnostic CTPA Scans - Before and After Flow Rate Change

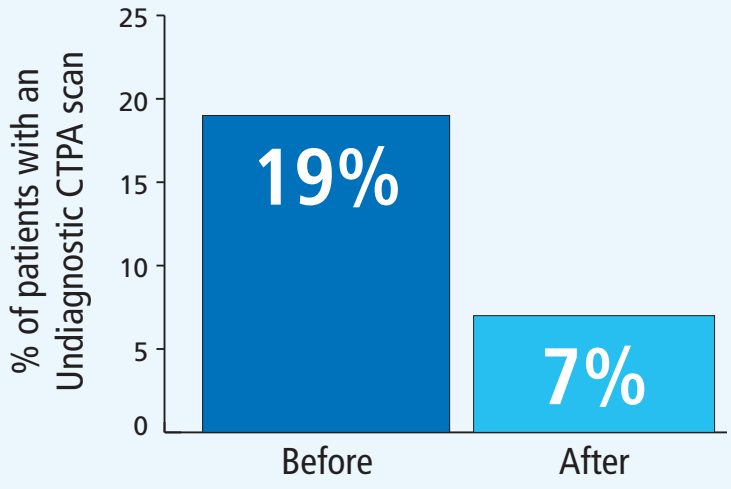

FIGURE 2

Undiagnostic CTPA Scans - Before and After Flow Rate Change

References

1. National Institute of Care and Excellence. (2023). Scenario: Suspected Pulmonary Embolism> NICE. Retrieved August, 10, 2023 from https://cks.nice.org.uk/topics/pulmonary-embolism/management/suspected-pulmonary-embolism
2. Chen, M., Mattar, G., & Abdulkarim, J. A. (2017). Computed tomography pulmonary angiography using a 20% reduction in contrast medium dose delivered in a multiphasic injection. World Journal of Radiology, 9(3), 143. doi:10.4329/wjr.v9.i3.143
3. Adequate contrast enhancement of CT pulmonary angiograms (2013). The Royal College of Radiologists. Retrieved August, 8, 2023 from https://www.rcr.ac.uk/audit/adequate-contrast-enhancement-ct-pulmonary-angiograms
4. Chaturvedi A, Oppenheimer D, Rajiah P, Kaproth-Joslin KA, Chaturvedi A. (2016) Contrast opacification on thoracic CT angiography: challenges and solutions. Insights Imaging. 8(1), pp. 127–140. doi:10.1007/s13244-016-0524-3.

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