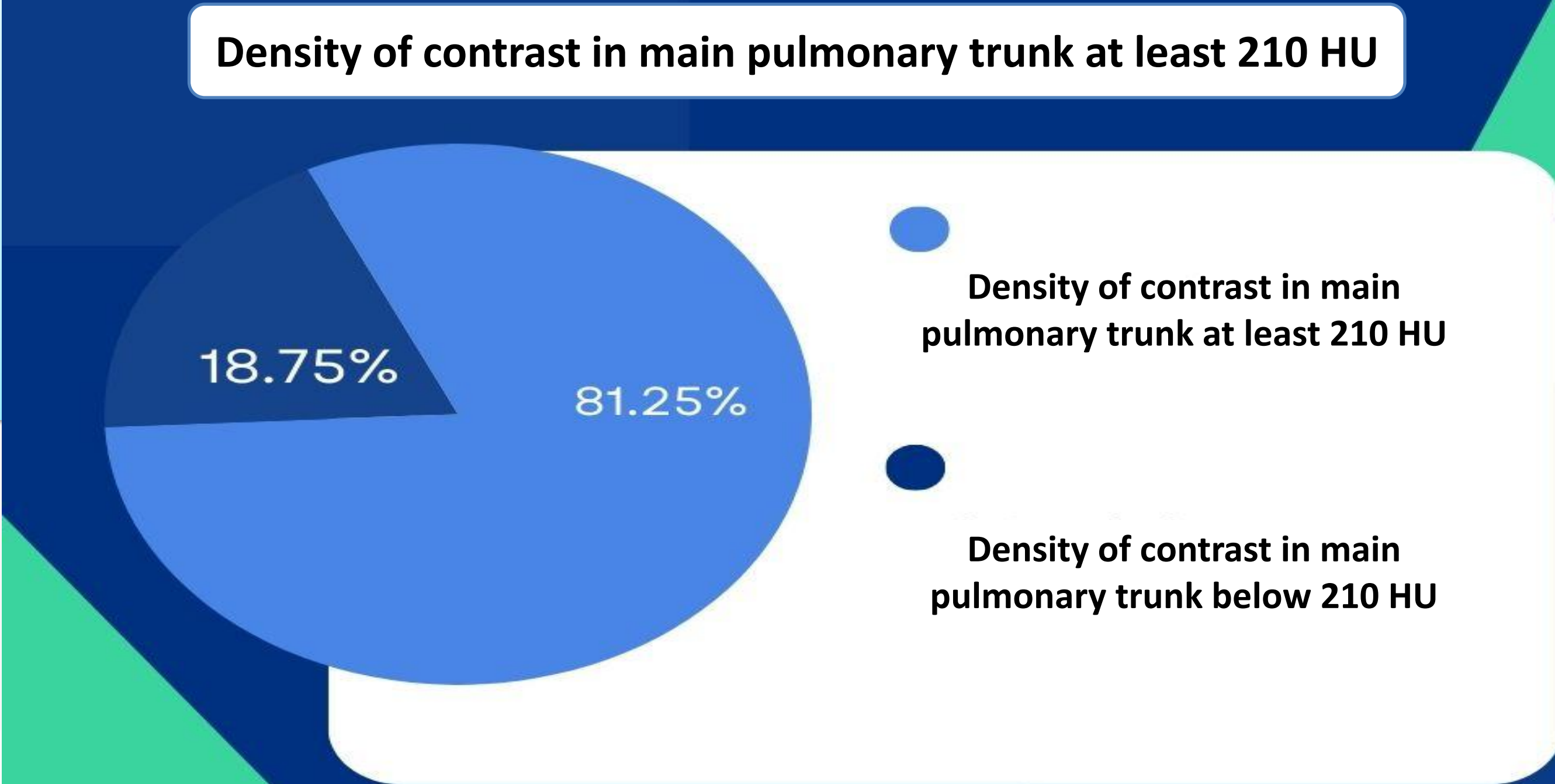
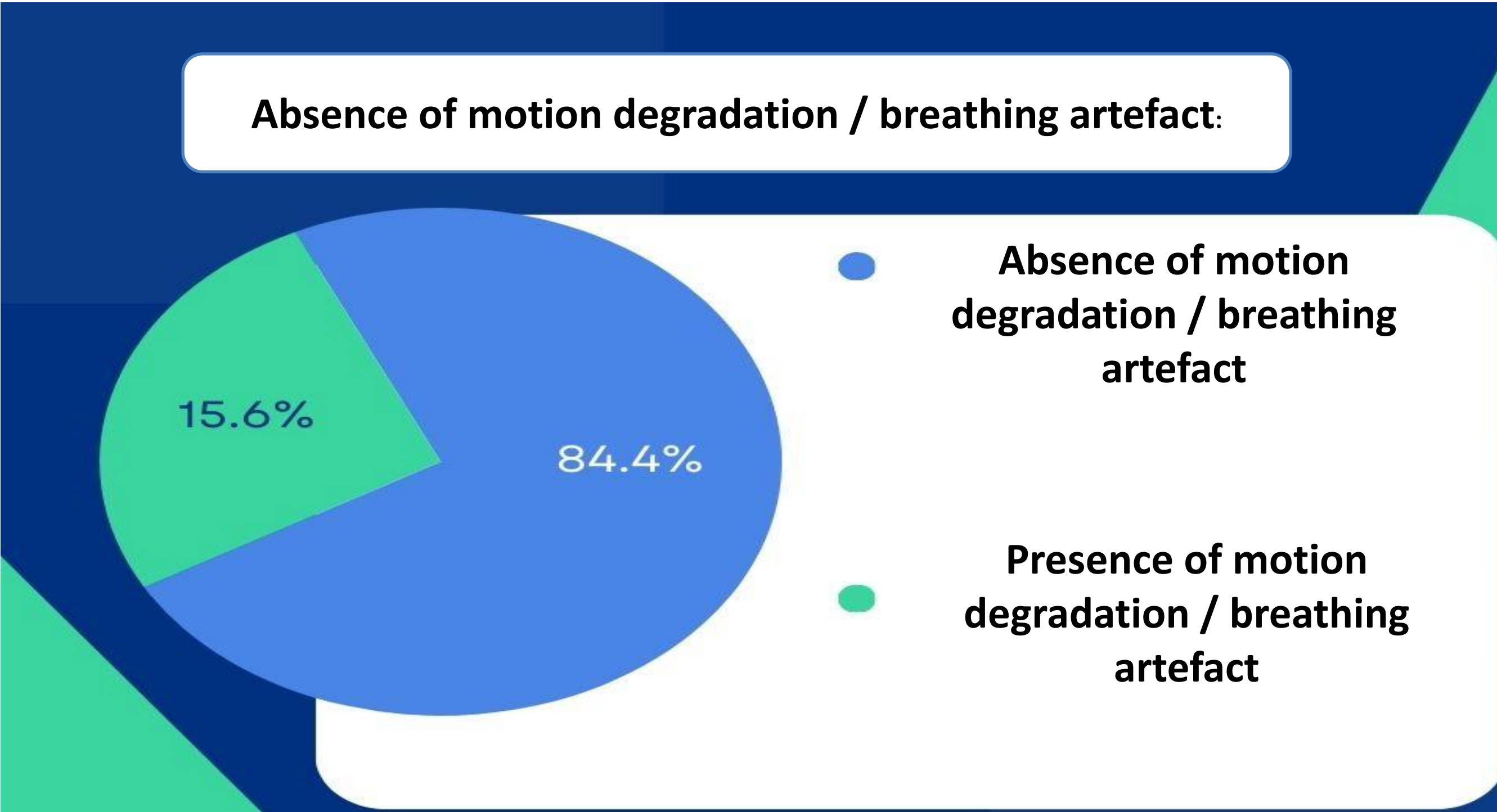


Audit on the quality of CTPA scans in pregnancy

Authors: Dr. Sri Teja Chikkala (Junior Clinical Fellow, General Medicine), Dr. Suraj Amonkar (Consultant Radiologist), Gary Fotitt(CT Radiographer), Adam Dawson(CT Radiographer)

BACKGROUND:	METHODOLOGY:	CRITERIA AND STANDARDS:	Audit on general/non-pregnant population ¹ (used for comparison)
CTPA is the main examination used to diagnose pulmonary embolism. Currently the technique is automated and controlled by the scanner. However, of late we have noticed poor quality CTPA studies in patients who are pregnant or post partum. We want to investigate if this is a common issue and if so how we can improve the quality.	Review: Retrospective review of all consecutive CTPA scans among Royal Oldham Hospital, Fairfield hospital and Rochdale Infirmary from December 31st, 2023 Pregnancy Cases: Identified 32 scans in pregnant women (including 1 postnatal) in 2023. Data Collection: Assessed contrast density, motion artifacts, and thoracic coverage. Analysis: Evaluated compliance with criteria and identified improvement areas.	Density of contrast in main pulmonary trunk at least 210 HU: 100%	From the prospective review of 100 consecutive CTPA images and reports from January 3rd, 2023 among general population/ non-pregnant population ¹ :
		Full coverage of the thorax: 100%	
		Absence of motion degradation / breathing artefact: 100%	Only, <u>11 of the 100 CTPAs (11%)</u> showed opacification of the pulmonary trunk less than 210 HU¹
AIM AND OBJECTIVES:			
Aim: The aim of the audit is to find out accuracy of PE detection in CTPA scans in pregnant women. To check for the quality of imaging and improve the standards of the imaging in pregnant women to detect PE as currently there is a challenge of hyper dynamic circulation in pregnant women which makes it difficult to detect PE accurately.			
Objectives: - To assess the density of contrast in the main pulmonary trunk, aiming for at least 210 Hounsfield Units (HU)^{1,3,4,5,6} - To evaluate the presence or absence of motion degradation or breathing artifact in CTPA scans. - To determine the extent of thoracic coverage achieved in CTPA scans, ensuring full coverage of the thorax for comprehensive evaluation.			
CHALLENGES OF CTPA SCANS IN PREGNANCY:			
<u>Physiological Changes During Pregnancy:</u> Increased Blood Volume²: The increased plasma volume during pregnancy can dilute the contrast material, leading to suboptimal contrast enhancement. Changes in Cardiac Output²: Altered hemodynamics, including increased cardiac output and faster heart rates, can affect the timing and distribution of contrast material.			
<u>Technical Challenges:</u> Motion Artifacts: Pregnant women may have difficulty holding their breath due to discomfort or the physiological changes in lung capacity, leading to motion artifacts. Optimization of Contrast Delivery: Ensuring adequate and timely delivery of contrast material can be challenging due to altered venous return and cardiac output.			
	Density of contrast in main pulmonary trunk at least 210 HU : (26/32) 81.25% (n=32)	Density of contrast in main pulmonary trunk at least 210 HU  18.75% 81.25% - Density of contrast in main pulmonary trunk at least 210 HU - Density of contrast in main pulmonary trunk below 210 HU	
	Full coverage of the thorax : 100% (32/32) (n=32)		
	Absence of motion degradation / breathing artefact: (27/32) 84.4% (n=32)	Absence of motion degradation / breathing artefact:  15.6% 84.4% - Absence of motion degradation / breathing artefact - Presence of motion degradation / breathing artefact	
	<u>Non-diagnostic scans:</u> 2/32= <u>6.3%</u>		
	<u>Number of scans reported as suboptimal scans:</u> 7/32 = <u>21.9%.</u> (Among them, 4 scans achieved contrast density above 210 HU and were reported as suboptimal) (2 scans among those 4 suboptimal scans had motion/breathing artefacts		
		Discussion: -Among the <u>two non-diagnostic scans</u>, one failed due to incorrect cursor placement in the lung area instead of the pulmonary trunk before the scan was initiated and the use of only 50 ml of contrast instead of the standard 70 ml. The second scan, involving a patient with a large body habitus, was non-diagnostic due to the use of a hand cannula instead of an elbow cannula, reducing contrast flow, and insufficient contrast volume. -Additionally, <u>two scans</u> were reported as <u>suboptimal</u> despite having contrast enhancement above 210 HU, with adequate opacification for diagnostic purposes. The remaining suboptimal scans were impacted by motion artifacts, incorrect cannula placement, or low contrast flow rate. -In the non-pregnant population, 11% of CTPA scans had opacification below 210 HU ¹. <u>In comparison, this figure was higher at 18.75% in this audit on pregnant women.</u>	- To trail and reduce the Hounsfield Unit (HU) threshold for triggering the scan from 180 HU to approximately 150 HU. - Ensure accurate cursor placement by radiographers before initiating the scan to avoid errors. - Use a pink cannula for optimal contrast flow rate and place it ideally in the elbow. -Enhance communication between the machine operators and interpreters to minimize breathing artifacts. - Ensure proper placement of lead. - Record the correct contrast flow rate, ideally around 4.5 ml/s. - Allow injection of 20 ml contrast before triggering the bolus tracking to thus address challenges posed by hyperdynamic circulation. -Ensuring the patient is positioned correctly to optimize venous return and reduce pressure on the inferior vena cava, which can improve contrast delivery to the pulmonary arteries. (the left lateral decubitus position)
		ACKNOWLEDGEMENTS: -Northern care alliance - Picture Archive and Communication Systems department - Clinical audit facilitator and Radiology audit team Dr. Suraj Amonkar (Consultant Radiologist) -Gary Fotitt -Adam Dawson	
			REFERENCES 1. Adequacy and reporting of CTPA contrast enhancement Audit reg. No: 2023 279: Northern Care Alliance, performed by Dr. Sri Teja chikkala, Dr. Afaq Siddiqui 2. https://www.rcog.org.uk/media/wj2lpc05/gtg-37b-1.pdf 3. rcr.ac.uk 4. Wittram C, Maher MM, Halpern E, Shepard JO. Hounsfield unit values of acute and chronic pulmonary emboli. Radiology 2005: 235; 1050-1054. 5. https://epos.myesr.org/poster/esr/ecr2013/C-1718/References 6. https://link.springer.com/referenceworkentry/10.1007/978-3-030-70904-4_64-1