



“DETERMINATION OF RELATIONSHIP OF COMPUTED TOMOGRAPHY HOUNSFIELD UNIT(HU) VALUES OF AORTA WITH HEMOGLOBIN AND HAEMATOCRIT”

Radio-Diagnosis

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ABSTRACT

Aims: To determine the effect of CT Hounsfield unit (HU) values of Aorta with hemoglobin and hematocrit. **Materials and methods:** A cross-sectional study was done by including subjects of different age groups. The subjects referred for CT thorax were taken into consideration. Aortic HU values were measured 1cm above the sinotubular junction. The size of the region of interest was between 4 to 9 mm² with the best-fit method. **Results:** Aortic attenuation on non-contrast CT of thorax, significantly depends on hemoglobin/ hematocrit values. A high degree of positive correlation was observed between hemoglobin/ hematocrit levels with Aortic attenuation. **Conclusion:** The conclusion of my study suggests that we can rely on the HU values for relative anaemia/ polycythemia in emergency cases where a complete blood count was not available at the time of the scan. A high degree of positive correlation was observed between hemoglobin/ hematocrit levels with Aortic attenuation.

KEYWORDS

Computed tomography, Hounsfield units, Hemoglobin, Haematocrit, Aorta.

INTRODUCTION

Early in the 1970s, computed tomography (CT) was developed, which completely changed how medical imaging was done. The development of faster and more powerful computers has made it possible for CT to combine a densely collimated x-ray beam with detectors that spin around the patient. As the tube rotates around the patient, X-ray transmission levels are continuously measured. Data is then digitalized and transferred to the computer^[1].

The Hounsfield unit is a measurement of the quantitative amount of radiodensity used in the evaluation of computed tomography (CT) images. (HU). The levels of hematocrit (HCT) and haemoglobin (HB) in the individual have an impact on the intraluminal blood's HU value. The HU value ranges from -1024 to > +1000. Computed tomography readings for fat, CSF, air, bone, and fluids (blood) range from -30 to -70, 0, -1000, >+1000, and +15 to +85, respectively. The final HU value is determined by the electron density in the region of interest (ROI) cursor studied area^[2].

Hemoglobin (HB), the main component of red blood cells, carries oxygen and carbon dioxide throughout the body. Hemoglobin concentration is often expressed in terms of grams of haemoglobin per deciliter of blood (g/dL). HB is a two-way respiratory carrier that transports oxygen from the lungs to the tissues as well as carbon dioxide back to the lungs. In the arterial circulation, HB has a strong attraction for oxygen but weak affinities for carbon dioxide, organic phosphates, hydrogen, and chloride ions. Anemia or polycythemia can be detected using the HB level. The typical HB ranges fluctuate between men and women (with specific levels for pregnancy), different age groups, different altitudes and smokers. Although it is generally known that hemoconcentration, high levels of HB, or hematocrit (HCT) result in increased x-ray attenuation inside the vasculature, the evidence for this link is fairly scant^[3].

AIMS OF THE STUDY

Aims of the study are:

- To determine the effect of CT Hounsfield unit (HU) values of Aorta with hemoglobin and hematocrit.

Inclusion Criteria:

- All subjects having optimal quality plain CT thorax studies alone or as a part of contrast-enhanced computed tomography (CECT).
- All subjects who have complete blood count (CBC).

Exclusion Criteria:

- Subjects whose blood analysis has not been performed or has been done after 24 hours from the time of CT imaging.
- Subjects with congenital heart disease.
- Subjects who had recent blood loss.
- Subjects who have undergone blood transfusion within the previous 48 hrs.

- Intravenous iodinated contrast-based administration within last 48 hours at the time of CT scan.

Sample size: 50

MATERIALS & METHODS

- Informed written consent was taken for each case.
- All patients were scanned using non-contrast or as a part of contrast sequences.
- Scanning commenced from the neck till diaphragm.
- Aortic HU values were measured 1cm above the sinotubular junction.
- The size of the region of interest was between 4 to 9 mm² with the best-fit method.

RESULTS & ANALYSIS

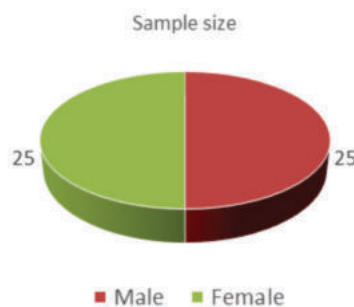


Fig 1: PIE Diagram Showing Sample Size Of Male And Female Subjects

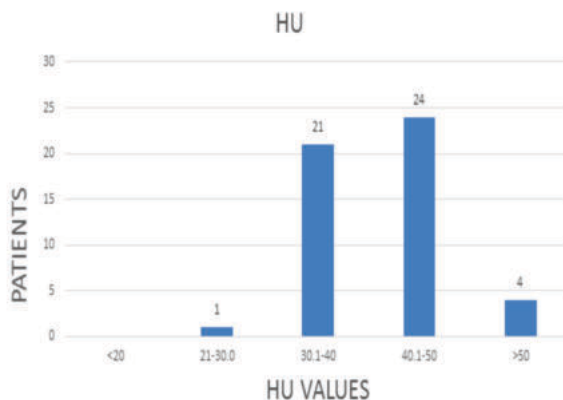


Fig 2: Bar Diagram Showing HU Values In Different Patients

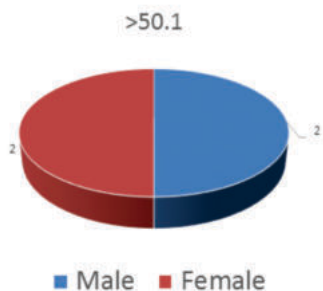


Fig 3: PIE Diagram Showing HU Value >50.1 In Aorta In Both Genders

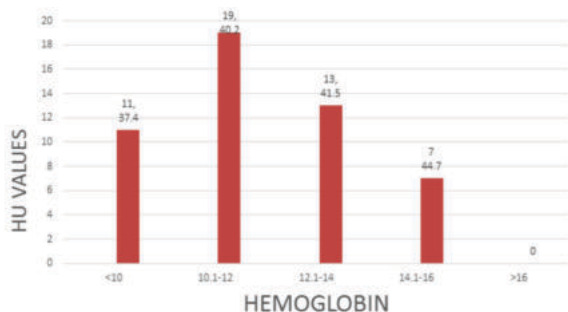


Figure 4: Bar Diagram Showing Relationship Between HU Values And HB

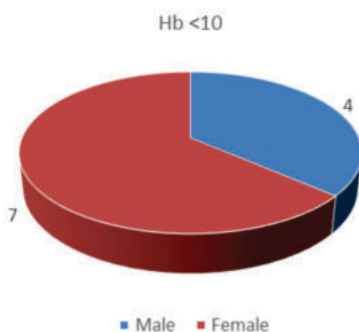


Figure 5: PIE Diagram Showing Hemoglobin <10 In Male And Female Subjects

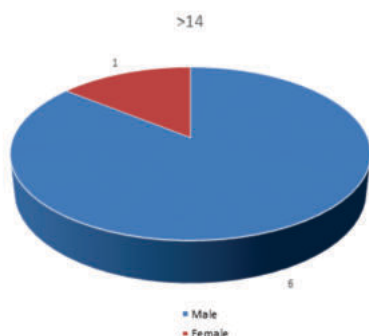


Figure 6: PIE Diagram Showing Hemoglobin >14 In Male And Female Subjects

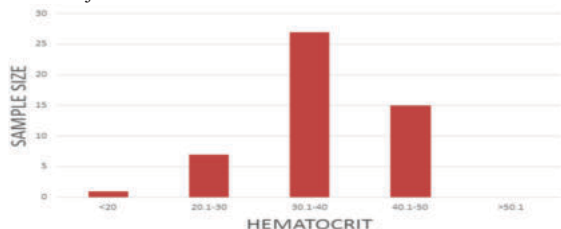


Figure 7: Bar Diagram Showing Relationship Between HU Values and HCT

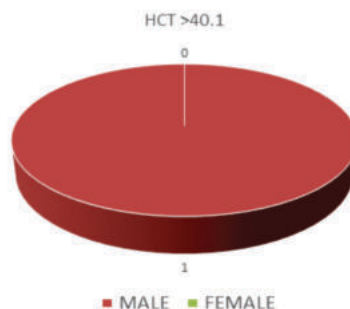


Figure 8: PIE Diagram Showing HCT >40.1 In Male And Female Subjects

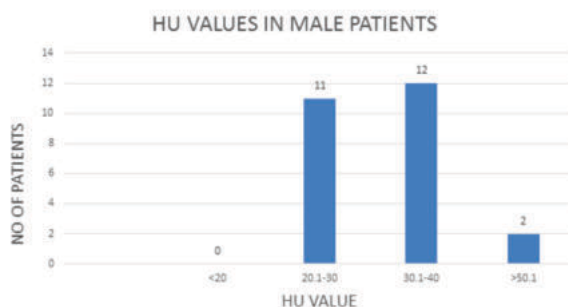


Figure 9: Bar Diagram Showing HU Values In Male Patients

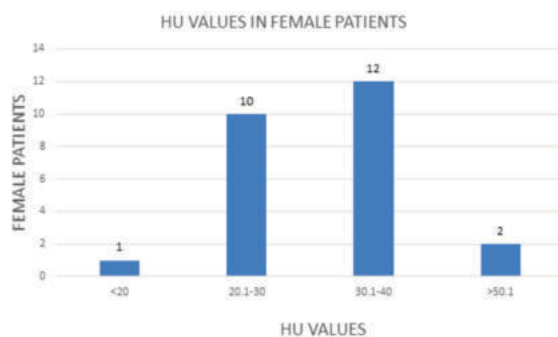


Figure 10: Bar Diagram Showing HU Values In Female Patients

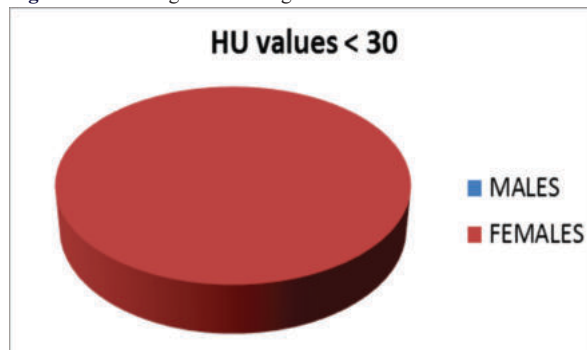


Figure 11: PIE Diagram Showing HU Values <30 In Both Sexes

DISCUSSION:

Following points can be drawn from my study-

- Attenuation of aorta on non-contrast CT of thorax, significantly depends on hemoglobin/ hematocrit values^[4].
- A high degree of positive correlation was observed between hemoglobin/ hematocrit levels in aorta attenuation.
- Most of the HU values are between 30 to 50 HU when calculated in aorta.
- All the HU values <30 are seen in female patients.
- Most of the HU values >50 are seen in male patients.
- The mean HU values of hemoglobin and hematocrit in females were found to be less as compared with the male subjects, eventually having an effect on HU values being slightly less in females in comparison with male subjects.

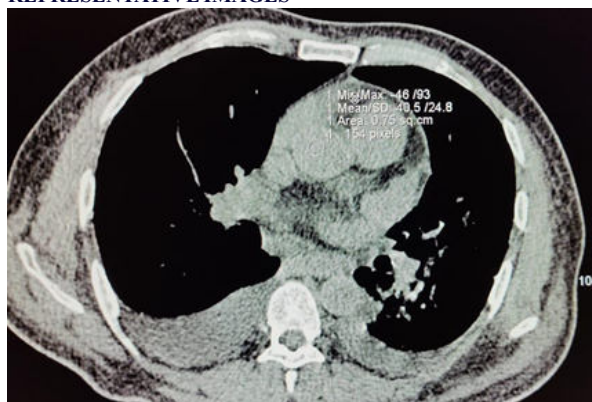
REPRESENTATIVE IMAGES

Figure 12: Selected NCCT axial image of thorax in mediastinal window showing HU values (+40.5) in the Aorta above the sinotubular junction.

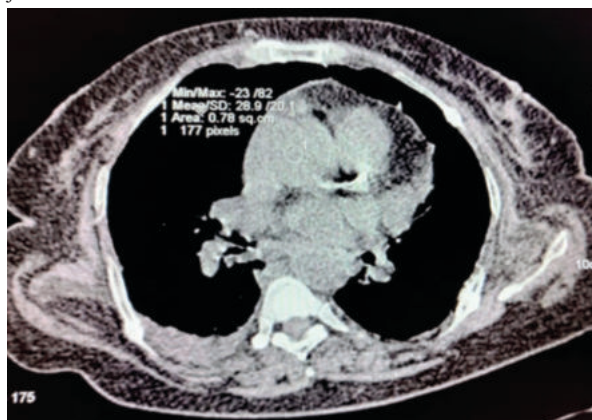


Figure 13: Selected NCCT axial image of thorax in mediastinal window showing HU values (+28.9) in the Aorta above the sinotubular junction.

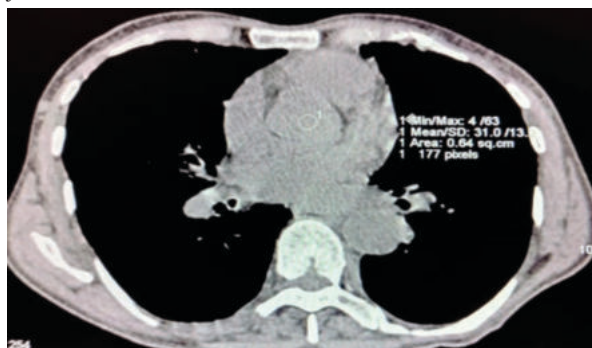


Figure 14: Selected NCCT axial image of thorax in mediastinal window showing HU values (+31.0) in the Aorta above the sinotubular junction.



Figure 15: Selected NCCT axial image of thorax in mediastinal window showing HU values (+40.9) in the Aorta above the sinotubular junction.

CONCLUSION:

In conclusion of my study suggests that we can rely on the HU values for relative anemia/ polycythemia in emergency cases where a complete blood count was not available at the time of the. The mean HU values of hemoglobin and hematocrit were found to be less in female subjects as compared with the male subjects.

LIMITATIONS:

Artefacts caused due to the atherosclerotic calcifications of the aorta.

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