

Stair-step artifact seen in coronal and sagittal reformatted images because of misalignment of computed tomography tube, in a positron emission tomography/computed tomography scanner

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ABSTRACT

Reconstruction artifacts often affect the image quality. An unusual wavy imaging pattern was seen on computed tomography (CT) part of positron emission tomography/CT, on sagittal and coronal images. This pattern was corrected on realignment of CT tube. This artifact, popularly known as stair step artifact, is rarely cited in the literature and our case generates a practical scenario of how it affects the image quality and how it is corrected.

Keywords: Artifact, computed tomography tube, coronal, misalignment, sagittal

INTRODUCTION

Artifacts in medical imaging lead to degradation of image quality, which is an integral part of the imaging process.^[1] Some minor artifacts do not have final impact on diagnosis and easily recognized by expert. Few artifacts may bring serious impact on the image quality and finally lead to wrong diagnosis.^[2] Understanding the causes of artifacts is of utmost important to optimize the image quality by preventing, suppressing or recognizing the artifacts. There are three main cause of artifacts observed in computed tomography (CT)-physics based artifacts, patient based artifacts and scanner based artifacts. Physics based artifacts are due to the physical process involved in the CT acquisition. Patient based artifacts are due to patient motion or metallic prosthetic implant or any other metallic object present in the scan field of view. Scanner based artifacts are due to improper functioning and poorly set quality control parameters of the scanner.^[3,4] There are numerous acquisition and processing algorithms available with commercial vendors to suppress most of these artifacts.

CASE REPORT

We report a scenario in our department following the replacement of old CT tube with a new CT tube in our existing positron emission tomography (PET)/CT scanner, Discovery ST, GE Medical Systems, USA, by the service engineer. The machine was eventually handed over to us for clinical use and we started acquisition of the whole body PET/CT studies. When we scanned the first patient, we found wavy pattern in the subcutaneous and skin region on coronal [Figures 1b and 2a-arrows] as well as sagittal reformatted [Figures 1a, 3a-arrows] images. However, trans-axial image was completely normal and free of any artifact [Figure 4]. Hence, we immediately consulted the service engineer and asked about that abnormality found in the image. After discussion with departmental colleagues and service engineer, we decided to do the realignment of the CT tube. Service engineer realigned the CT tube and performed phantom imaging. We reconstructed the phantom image in all three planes. Wavy artifact observed in earlier image was not there in the phantom sagittal or coronal slices. Since much time had not elapsed after the first scan, we then decided to reacquire the whole body PET/CT study in the same acquisition parameter. Acquired image was reconstructed in coronal and sagittal slices and we found the wavy pattern was not there in the image [Figures 1c and d, 2b, 3b-arrows].

DISCUSSION

Stair step artifacts appear around the edges of sagittal and coronal

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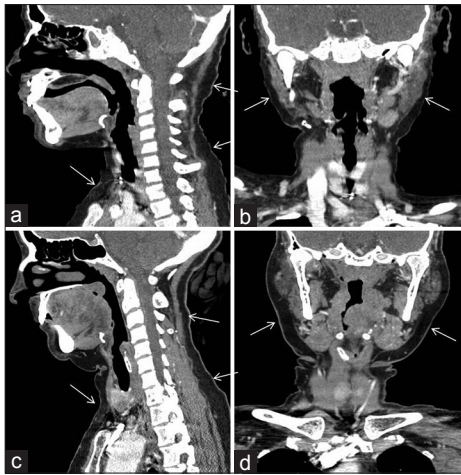


Figure 1: Sagittal (a) and coronal (b) images showing a wavy pattern (arrows) in skin and subcutaneous region, which after computed tomography tube realignment is corrected and resolved. (c, d-arrows)

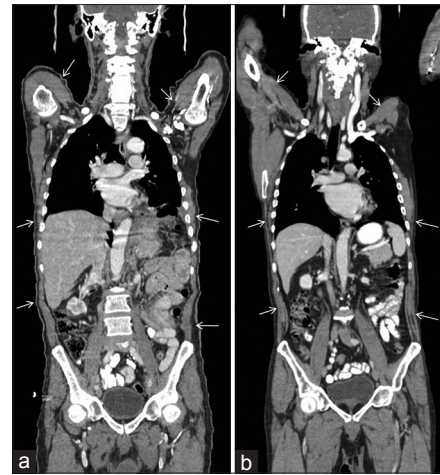


Figure 2: Coronal image showing wavy pattern (a-arrows) in skin and subcutaneous region, which resolves on computed tomography tube realignment (b-arrows)

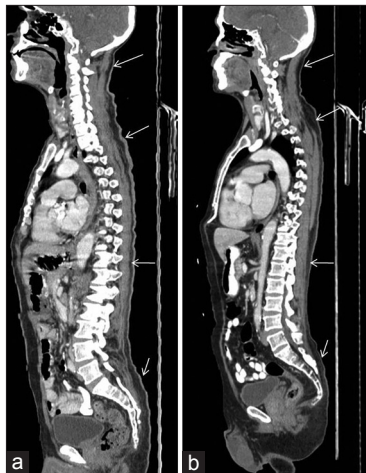


Figure 3: Sagittal image showing wavy pattern (a-arrows) in skin and subcutaneous region, which resolves on computed tomography tube realignment (b-arrows)



Figure 4: Trans-axial computed tomography image showing no artifact

reformatted images when wide collimations and non-overlapping reconstruction intervals are used. This can be minimized by, using smaller collimation and overlapping reconstruction in helical imaging.^[3,4] The wavy pattern observed at the margin of sagittal and coronal CT images after the replacement of CT tube in our PET/CT scanner are disappeared in post realignment scan in the same collimation and reconstruction parameters. This confirmed that the observed artifact was not related to the collimation or reconstruction, but was a result of misalignment of the CT tube. There was no appreciable change in the trans-axial image performed before and after alignment of CT tube. Though there might be some minor improvement in image quality and resolution on trans-axial image, this was not appreciable.

Though there is mention of this artifact in the literature in a very few reports, we put forward a unique cause of this artifact. This cause of the artifact finds no mention in literature and is a valuable addition, which will be of great technical use in future.

CONCLUSION

The wavy artifact seen in coronal and sagittal reformatted image can be termed as step wedge artifact, which can be categorized in the scanner based artifact section. Proper alignment of CT tube is utmost important to avoid this artifact.

REFERENCES

1. Seeram E. Image quality. In: *Computed Tomography: Physical Principles, Clinical Applications and Quality Control*, 2nd ed. Philadelphia, Pa: Saunders, 2001. p. 174-99.
2. Hsieh J. Image artifacts: Appearances, causes and corrections. In: *Computed Tomography: Principles, Design, Artifacts and Recent Advances*. Bellingham, Wash: SPIE Press; 2003. p. 167-240.
3. Wilting JE, Timmer J. Artefacts in spiral-CT images and their relation to pitch and subject morphology. *Eur Radiol* 1999;9:316-22.
4. Barrett JF, Keat N. Artifacts in CT: Recognition and avoidance. *Radiographics* 2004;24:1679-91.

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