Original Article

CT perfusion study of lung: Normal and in its various diseases

Arunan Murali[1*], Bhasker Raj T[2], Venkata Sai P M[3], Poornima Ravichandran[4]

[1,2]Associate Professor, [3]Professor and HOD, [4]Technologistist, Department of Radiology, Sri Ramachandra Medical College, Porur, Chennai – 600 116, Tamil Nadu, INDIA.
Email: dr.arunan@gmail.com

Abstract

Introduction: Dynamic contrast material–enhanced (DCE) wide-coverage computed tomography (CT), such as the "shuttle-scan" and the dynamic wide-area detector volume CT techniques. **Aims and Objectives:** To study perfusion of Lung in Normal and In its Various Diseases. **Methodology:** This was Prospective study of 2 months (March 2014 - April 2014) duration at sriramachandra hospital, A tertiary care teaching hospital, Department of Radiology and Imaging Sciences. 10 patients of either sex presented themselves in Radiology department. Their reports and image data's were collected prospectively during the study period between March 2014 to April 2014. A detailed history of various patients data includes patient demographic details, hospital ID, radiology accession number, and the study reports were collected and entered in a specially designed Proforma. The acquired study data of "CT Perfusion data" of each patients were then post processed by using a GE ADVANTAGE WORKSTATION (software version 4.4) **Result:** CT perfusion of the thorax was performed on two patients. One was on a patient who presented with generalized complaints and another on a patient who presented with complaints of Hemoptysis. The CT perfusion parameters were normal for the first patient. However, the CTP parameters of the patient with hemoptysis showed increased values of blood volume (BV), blood flow (BF), mean transit time (MTT) and surface permeability (SP) within a cavity of active extravasation **Conclusion:** The CTP parameters of the patient with hemoptysis showed increased values of blood volume (BV), blood flow (BF), mean transit time (MTT) and surface permeability (SP) within a cavity of active extravasation

Keywords: CT perfusion of Lung, blood volume (BV), blood flow (BF), mean transit time (MTT) and surface permeability (SP).

[*]**Address for Correspondence:**
Dr. Arunan Murali, Associate Professor, Department of Radiology, Sri Ramachandra Medical College, Porur, Chennai – 600 116, Tamil Nadu, INDIA.
Email: dr.arunan@gmail.com
Received Date: 19/06/2016 Revised Date: 19/06/2016 Accepted Date: 19/06/2016

Access this article online

Quick Response Code:

Website: www.statperson.com

DOI: 01 July 2016

INTRODUCTION

Dynamic contrast material–enhanced (DCE) wide-coverage computed tomography (CT), such as the "shuttle-scan" and the dynamic wide-area detector volume CT techniques[1–3], expands traditional regional CT perfusion to whole-organ CT perfusion, thereby providing comprehensive perfusion information. However, whole-organ perfusion at CT exposes a large volume of tissue to additional radiation exposure, resulting in a higher radiation dose and longer acquisition time[4]. CT perfusion requires dynamic CT acquisition, typically 10–20 intermittent scans with 1–2-second intervals during a breath hold of 20–30 seconds. It is difficult to integrate such dynamic scanning of a whole organ into a routine multiphasic CT examination. These factors, have, perhaps, contributed to the slow adoption of whole-organ CT perfusion techniques. By employing the Fick principle[5,6] in a single-compartment model with no venous outflow, one can extract perfusion data (blood flow) by dividing the increase in CT numbers by the area under the arterial input function (AIF). Thus, we hypothesized that renal perfusion (or renal blood flow [RBF]) and regional perfusion data can be obtained by using biphasic CT with single-section tracking images. We designed this investigation to determine the protocol feasibility and accuracy. The CT signs of pulmonary viral

How to site this article: Arunan Murali, Bhasker Raj T, Venkata Sai P M, Poornima Ravichandran. CT perfusion study of lung: Normal and in its various diseases. *International Journal of Recent Trends in Science and Technology*. July 2016; 19(3): 343-345. http://www.statperson.com (accessed 02 July 2016).

infection will depend on the underlying pathologic process. They are quite similar simply because the underlying pathogenic mechanism, depending on the virulence of the virus, is related to variable extents of histopathologic features such as diffuse alveolar damage (intraalveolar edema, fibrin, and variable cellular infiltrates with a hyaline membrane), intraalveolar hemorrhage, and interstitial (intrapulmonary or airway) inflammatory cell infiltration [7,8]. The spectrum of CT findings encountered in various pulmonary viral diseases is not particularly wide and encompasses five main categories: *(a)* parenchymal attenuation disturbances; *(b)* ground-glass opacity and consolidation; *(c)* nodules, micronodules, and tree-in-bud opacities; *(d)* interlobular septal thickening; and *(e)* bronchial and/or bronchiolar wall thickening[9,10]. *Parenchymal attenuation disturbances.*—Patchy inhomogeneities in the attenuation of lung parenchyma (mosaic attenuation pattern) are a recognized finding in some viral infections caused by hypoventilation of alveoli distal to bronchiolar obstruction (inflammation or cicatricial scarring of many bronchioles), which leads to secondary vasoconstriction (and, consequently, underperfused lung) and is seen on CT scans as areas of decreased attenuation[11,12,13]. Paired CT scans obtained in inspiration and expiration are useful for differentiating bronchiolar disease from pulmonary vascular.

AIMS AND OBJECTIVES

To study perfusion of Lung in Normal and In its Various Diseases.

MATERIAL AND METHODS

This was Prospective study of 2 months (March 2014 - April 2014) duration at sriramachandra hospital, A tertiary care teaching hospital, Department of Radiology and Imaging Sciences. 10 patients of either sex presented themselves in Radiology department. Their reports and image data's were collected prospectively during the study period between March 2014 to April 2014. A detailed history of various patients data includes patient demographic details, hospital ID, radiology accession number, and the study reports were collected and entered in a specially designed Proforma. The acquired study data of "CT Perfusion data" of each patients were then post processed by using a GE ADVANTAGE WORKSTATION (software version 4.4)

RESULT

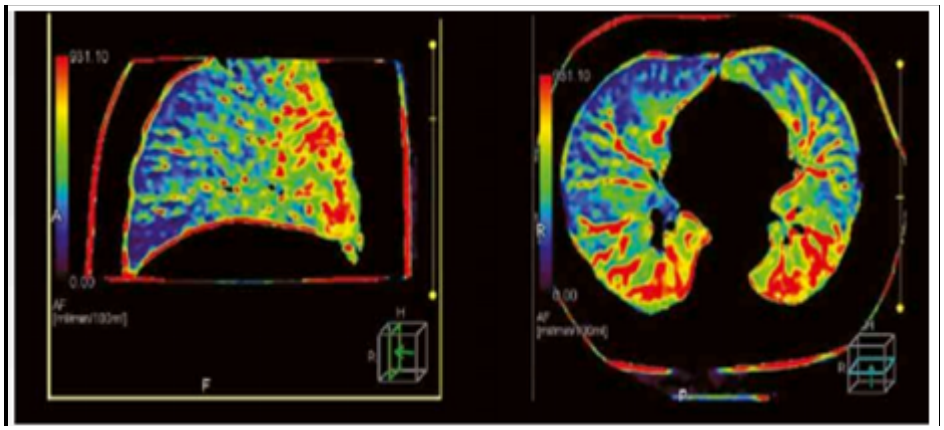
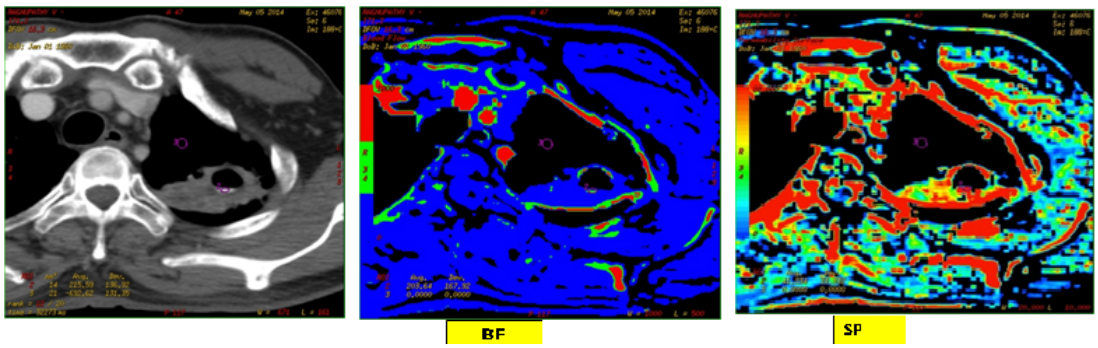


Figure 1: CT Perfusion in normal lungs



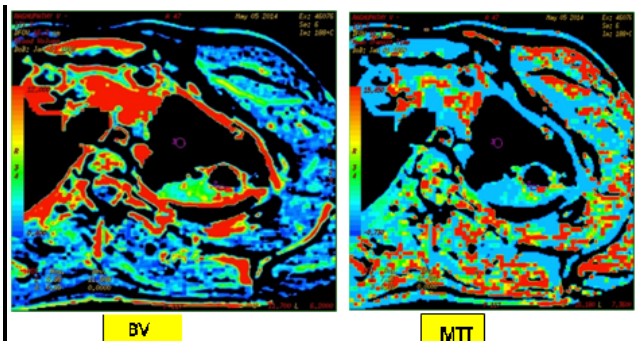


Table 1: Distribution of the Normal and Patients with Lung infection with respect to CT Lung perfusion

Region	Blood Volume (BV)	Blood Flow(BF)	Mean Transit Time (MTT)	Surface Permeability (SP)
Normal Lung parenchyma	0	0	0	0
Lung (infection)	9.98	203.6	7.23	41.2

CT perfusion of the thorax was performed on two patients. One was on a patient who presented with generalized complaints and another on a patient who presented with complaints of Hemoptysis. The CT perfusion parameters were normal for the first patient. However, the CTP parameters of the patient with hemoptysis showed increased values of blood volume (BV), blood flow (BF), mean transit time (MTT) and surface permeability (SP) within a cavity of active extravasation.

DISCUSSION

The CT perfusion of a patient who presented with hemoptysis showed CTP parameters with significant increase of blood flow (BF), blood volume(BV),mean transit time (MTT) within a cavity of contrast extravasation which suggested active bleed within the cavity. Hence, the CTP of lungs can be used as a valuable tool in early detection and quantification of lung diseases.

CONCLUSION

The CTP parameters of the patient with hemoptysis showed increased values of blood volume (BV), blood flow (BF), mean transit time (MTT) and surface permeability (SP) within a cavity of active extravasation.

REFERENCES

1. Tacelli N, Remy-Jardin M, Copin MC, et al. Assessment of non-small cell lung cancer perfusion: pathologic-CT correlation in 15 patients. Radiology 2010; 257(3):863–871.
2. Okada M, Kim T, Murakami T. Hepatocellular nodules in liver cirrhosis: state of the art CT evaluation (perfusion CT/volume helical shuttle scan/dual-energy CT, etc.). Abdom Imaging 2011; 36(3):273–281.
3. Yuan X, Zhang J, Quan C, et al. Differentiation of malignant and benign pulmonary nodules with first-pass dual-input perfusion CT. EurRadiol 2013;23(9):2469–2474.
4. Shankar JJ, Lum C, Sharma M. Whole-brain perfusion imaging with 320-MDCT scanner: Reducing radiation dose by increasing sampling interval. AJR Am J Roentgenol 2010; 195(5):1183–1186.
5. Peters AM, Gunasekera RD, Henderson BL, et al. Noninvasive measurement of blood flow and extraction fraction. Nucl Med Commun 1987;8(10):823–837.
6. Peters AM. Fundamentals of tracer kinetics for radiologists. Br J Radiol 1998; 71(851): 1116–1129.
7. Franquet T, Rodriguez S, Martino R, Giménez A, Salinas T, Hidalgo A. Thin-section CT findings in hematopoietic stem cell transplantation recipients with respiratory virus pneumonia. AJR Am J Roentgenol 2006; 187(4):1085–1090.
8. Kanne JP, Godwin JD, Franquet T, Escuissato DL, Müller NL. Viral pneumonia after hematopoietic stem cell transplantation: high-resolution CT findings. J Thorac Imaging 2007; 22(3):292–299.
9. Müller NL. High-resolution computed tomography of diffuse lung disease. CurrOpinRadiol 1989; 1(1):5–8.
10. Müller NL. Differential diagnosis of chronic diffuse infiltrative lung disease on high-resolution computed tomography. SeminRoentgenol 1991; 26(2):132–142. CrossRef, Medline
11. Sherrick AD, Swensen SJ, Hartman TE. Mosaic pattern of lung attenuation on CT scans: frequency among patients with pulmonary artery hypertension of different causes. AJR Am J Roentgenol 1997; 169(1):79–82.
12. Worthy SA, Müller NL, Hartman TE, Swensen SJ, Padley SP, Hansell DM. Mosaic attenuation pattern on thin-section CT scans of the lung: differentiation among infiltrative lung, airway, and vascular diseases as a cause. Radiology1997; 205(2):465–470.
13. Remy-Jardin M, Remy J, Gosselin B, Copin MC, Wurtz A, Duhamel A. Sliding thin slab, minimum intensity projection technique in the diagnosis of emphysema: histopathologic-CT correlation. Radiology 1996; 200 (3):665–671.

Source of Support: None Declared
Conflict of Interest: None Declared