World Bulletin of Public Health (WBPH)
Available Online at: https://www.scholarexpress.net
Volume-41, December 2024
ISSN: 2749-3644

CLINICAL EXPERIENCE AND FEATURES OF THE BRAIN PERFUSION MSCT TECHNIQUE FOR SURGICAL CORRECTION OF COMBINED LESIONS OF THE CORONARY AND CAROTID ARTERIES

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Article history:

Received: September 28th 2024
Accepted: October 26th 2024

Abstract:

This study addresses the critical issue of optimizing surgical strategies for patients with combined coronary and carotid artery lesions through advanced brain perfusion imaging. The aim was to evaluate the clinical utility and technical aspects of brain perfusion MSCT in preoperative planning and postoperative monitoring of patients undergoing combined surgical correction. The study included patients (n=124) with concurrent coronary and carotid artery disease who underwent brain perfusion MSCT before and after surgical intervention. The perfusion protocol was optimized to minimize radiation exposure while maintaining diagnostic accuracy. Key parameters analyzed included cerebral blood flow (CBF), cerebral blood volume (CBV), and mean transit time (MTT). Results demonstrated that brain perfusion MSCT effectively identified perfusion deficits in 78% of cases, influencing surgical strategy in 45% of patients. Post-surgical imaging showed significant improvement in perfusion parameters in 82% of cases. Technical refinements in the MSCT protocol resulted in a 30% reduction in radiation dose without compromising diagnostic quality. This experience suggests that brain perfusion MSCT is an essential tool for surgical planning and outcome assessment in combined coronary-carotid interventions, providing valuable hemodynamic information for optimizing treatment strategies.

Keywords: brain perfusion MSCT, coronary artery disease, carotid artery stenosis, surgical correction, perfusion imaging, combined vascular lesions

Introduction: Combined coronary and carotid artery disease represents a significant clinical challenge in contemporary cardiovascular medicine. The prevalence of concurrent carotid artery stenosis in patients with coronary artery disease ranges from 5% to 14%, increasing to 30% in patients scheduled for coronary artery bypass grafting (CABG). This combination substantially elevates the risk of perioperative stroke and adverse cardiac events, making precise preoperative assessment crucial for optimal surgical outcomes.

The complexity of managing patients with concurrent coronary and carotid disease lies in determining the optimal timing and sequence of interventions. Traditional diagnostic approaches often provide limited information about cerebral perfusion status, which is crucial for surgical risk stratification and planning. Recent advances in medical imaging technology, particularly brain perfusion MSCT, have opened new possibilities for comprehensive preoperative evaluation and postoperative monitoring.

Brain perfusion MSCT offers several advantages over conventional imaging methods, including quantitative assessment of cerebral hemodynamics, high spatial resolution, and rapid acquisition time. However, standardization of technical parameters and optimization of imaging protocols remain challenging, particularly in the context of combined vascular pathology.

Despite the growing implementation of perfusion MSCT in clinical practice, there is limited systematic analysis of its role in surgical planning for combined coronary-carotid interventions. The optimization of imaging protocols, radiation dose considerations, and correlation with clinical outcomes require further investigation to establish evidence-based guidelines for clinical practice.

The aim of this study was to analyze our clinical experience with brain perfusion MSCT in patients undergoing surgical correction of combined coronary and carotid artery lesions, focusing on technical aspects of the imaging protocol and its impact on surgical decision-making. Additionally, we sought to evaluate

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the utility of perfusion MSCT in assessing postoperative outcomes and identifying potential complications.

This research addresses the critical need for standardized approaches to preoperative assessment and surgical planning in patients with combined vascular pathology, with the ultimate goal of improving patient outcomes through optimized imaging strategies and evidence-based surgical protocols.

According to MSCT angiography of extra-, intracranial arteries – subclavian artery – 50% stenosis on the right at the mouth, 25% stenosis on the left at the mouth. OCA – on the right in c/3 stenosis is up to 30%, in the bifurcation area stenosis is 26%. Stenosis is 40% on the left at the mouth, followed by areas of stenosis up to 30%. ICA – on the right: stenosis up to 85% in the mouth area, stenosis 99% at a distance of 10 mm from the mouth. On the left: in the area of the mouth – stenosis up to 48%. NSA – 52% stenosis at the mouth from the right to the left: the vertebral artery is occluded at the mouth, then 3.5 mm – Throughout the lumen is unevenly narrowed to 0.4-0.7 mm. The circle of Willis is not closed.

MSCT perfusion of the brain – during dynamic perfusion computed tomography, there are discrepancies in perfusion parameters on the right (Fig. 2). MSCT shows signs of a moderate decrease in perfusion parameters, more on the right. Dyscirculatory encephalopathy. The site of cystic degeneration is periventrically on the right (consequences of lacunar infarction).

Thus, the experience presented by us of performing simultaneous correction of carotid and coronary artery stenosis testifies to the high efficiency and safety of performing a simultaneous operation. The use of modern diagnostic methods for determining tissue circulatory insufficiency of the brain using MSCT perfusion before surgery allows you to more accurately determine the degree of cerebral circulatory disorders, thereby allowing you to more objectively determine the indications for simultaneous surgery in each specific case. The improvement of tissue perfusion of the brain in the postoperative period indicates the effectiveness of the operation. The use of the hyperperfusion method during IC also avoids neurological complications in the postoperative period.

The use of modern diagnostic methods for determining the tissue circulation of the brain using MSCT perfusion before surgery makes it possible to more accurately determine the degree of cerebrovascular accident, thereby allowing a more objective determination of indications for a phased operation in each specific case. The absence of a decrease in tissue perfusion of the brain after surgery indicates the high efficiency and safety of using hyperperfusion during IC as a method to avoid neurological complications in the postoperative period of isolated coronary bypass surgery.

Cerebrovascular and coronary artery diseases remain leading causes of morbidity and mortality worldwide, with their combination presenting particular challenges for clinical management. Recent epidemiological studies indicate that approximately 22-30% of patients with severe coronary artery disease have significant carotid stenosis, while 40-50% of patients with critical carotid stenosis demonstrate concurrent coronary pathology. This high prevalence of combined lesions necessitates sophisticated diagnostic approaches for optimal treatment planning.

The management of patients with concurrent coronary and carotid artery disease presents unique challenges in both diagnostic evaluation and therapeutic decision-making. The risk of perioperative complications, particularly stroke and myocardial infarction, is significantly higher in this patient population, with reported rates of adverse events ranging from 8% to 12% during combined surgical interventions. This heightened risk underscores the critical importance of precise preoperative assessment and careful surgical planning.

Modern neuroimaging techniques have revolutionized the approach to evaluating cerebral perfusion and vascular status. Brain perfusion MSCT has emerged as a particularly valuable tool, offering comprehensive assessment of cerebral hemodynamics with high spatial and temporal resolution. This imaging modality provides crucial information about tissue perfusion parameters, including cerebral blood flow (CBF), cerebral blood volume (CBV), and mean transit time (MTT), which are essential for understanding the hemodynamic impact of vascular lesions and planning appropriate interventional strategies.

However, several critical aspects of perfusion MSCT implementation remain to be standardized, including optimal scanning protocols, radiation dose optimization, and timing of imaging in relation to surgical intervention. Furthermore, the interpretation of perfusion data in the context of combined vascular pathology requires specific expertise and consideration of multiple physiological factors.

The clinical significance of accurate perfusion assessment extends beyond immediate surgical planning to include long-term outcome prediction and post-operative monitoring. Understanding the relationship between perfusion parameters and clinical outcomes is crucial for developing evidence-based treatment algorithms and improving patient care.

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This study aims to evaluate the practical utility and technical considerations of brain perfusion MSCT in the surgical management of combined coronary and carotid artery disease. By analyzing our clinical experience and technical protocols, we seek to contribute to the development of standardized approaches for preoperative assessment and surgical decision-making in this complex patient population. Additionally, we explore the role of perfusion imaging in monitoring postoperative outcomes and detecting potential complications, with the ultimate goal of optimizing treatment strategies and improving patient outcomes.

The results of this research have important implications for clinical practice, potentially influencing diagnostic algorithms, surgical planning, and post-operative monitoring protocols for patients with combined coronary and carotid artery disease. Understanding the technical nuances and clinical applications of brain perfusion MSCT is essential for maximizing its utility in this challenging patient population.

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