



# CONTRAST AND COMPARE THE NEW IMAGING MODALITIES FOR ANGIOGRAPHY INTERVENTION

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**Abstract:** The goal of this review is provide the Imaging modalities intervention of the Cardiovascular disease. Cardiovascular disease is the globally affecting disease and leads to severe problems. With the evaluation of the diseases the diagnosis and the treatment has also got advanced. There are invasive and non-invasive procedure to guide the diseases. Angiography is the significant imaging modalities to figure out the blood vessels of the heart. Cardiovascular disease (CVD) is sometimes life threatening conditions when it is poorly understood and also involves the hemodynamic changes parameter to get worsened. The imaging techniques play a important role for the diagnostic techniques for the diseases. The ideal method for observing the coronary arteries is to use non-invasive magnetic resonance imaging (MRI) and computed tomography (CT) scan Optical Coherence Tomography (OCT)and Intravascular guided Ultrasound (IVUS)based angiography is the invasive procedure to diagnose or to understand the features of the coronary arteries disease which gives the exact intervention. Fractional flow reserve (FFR) is the functional assessment of the stenosis of the blood vessels. FFR guided angiography has the better outcome of the percutaneous coronary intervention

**KEYWORDS-** Cardiovascular disease, Optical Coherence Tomography, Magnetic resonance imaging, Intravascular Ultrasound, Fractional flow Reserve, Imaging techniques

## 1.INTRODUCTION

Cardiovascular disease leads to more death more than 20 million per year. Imaging techniques modalities has developed a lot for intervention and has its own advantage and limitations. It depends on patient clinical indications or patient characteristics which shows the factors and also that imagining techniques will have it own pros and cons according to them. This advancement in the technology helps enhancing the abilities and improving the patient outcome. Early diagnosis of the cardiovascular disease can lead to less complications and essential for timely intervention and management of the diseases. Timely assessment for the diseases can lead to prevent risk factors such as hypertension, obesity, high cholesterol, etc. Routine check should be done for monitoring the high blood pressure, heart rate , weight which can indicate potential cardiovascular disorders. Cardiac biomarkers are the blood test which also indicates the cardiovascular disease but have only limited information. The imaging modalities is the best way to view the exact anatomical views of the coronary vessels and for the clinical indications. Catheter based optical Coherence Tomography angiography or the IVUs technique is the accurate and assessment of the coronary arteries lesion and stent placement is critical for optimizing outcomes.

## **2. OPTICAL COHERENCE TOMOGRAPHY (OCT) GUIDED ANGIOGRAPHY**

OCT based Angiography is the intravascular imaging techniques which uses infrared light to detect the blood flow of the coronary vessels during cardiac catheterization. It has got high resolution image which detect the culprit lesion and also guide with the right strategies for ballooning and stenting during angioplasty procedure. It gives the exact diameters of the stenting procedure during angioplasty. It also reduces radiation exposure as compared with normal angioplasty. OCT guided Angiography provided detailed micro structure of the coronary artery and have the best patient outcomes with this procedure.

## **3. INTRAVASCULAR ULTRASOUND BASED ANGIOGRAPHY (IVUS)**

IVUS is catheter based angiography which helps to evaluate the whole internal segments of the coronary arteries and provide the wider view. It has got probe which continues emits the sound waves to produce the real time image on monitor. IVUS provides the 360 degree views of the blood vessels lumens and easily identify any rupture or dissection on aorta as well as blood vessels wall as compared to the general angiography. IVUS has got very high resolution images to detect the calcification on the blood vessels wall and also detecting the correct stenting diameter while percutaneous angioplasty.

## **4. COMPUTED TOMOGRAPHY (CT) BASED ANGIOGRAPHY**

CT angiography uses a CT scanner to visualize the coronary arteries. This is the non-invasive procedure which uses contrast media to view the flow of the coronary arteries usually looking for the narrowed arteries or the blockage or the plaque formation on the arteries. This procedure have minimal radiation exposure and also helps detecting or evaluating the extent of blockages without the need for invasive cardiac catheterization.

## **5. MAGNETIC RESONANCE IMAGING (MRI) BASED ANGIOGRAPHY**

MRI based angiography plays a important role on the diagnosis of the cardiovascular disease which includes cardiomyopathy, congenital anomalies, pericardial effusion, valvular disease, cardiac masses ,etc. In this technique continues images are captures to make the cine. It has got LGE particles ( Late gadolinium Enhancement) which helps on finding the difference on scar tissues leading to assessment of myocardial durability. It gives the angiographical assessment of severity of the stenosis and also evaluate the blood flow within the heart. Basically cardiac based MRI involves the anatomical and functional views of the heart and leads to maintenance to the patient outcome.

## **6.OCT GUIDED ANGIOGRAPHY VERSUS IVUS GUIDED ANGIOGRAPHY**

Both IVUS and OCT guided imaging is the best technique for the visualization of the coronary arteries of heart. OCT having limitations of using contrast media insight it have got higher spatial resolution and makes it more precise and widely used for the patient outcome for percutaneous angioplasty procedure. IVUS has also wide range that doesn't uses contrast media which makes the procedure different from the OCT guided.

### **6.1 HIGHER RESOLUTION**

OCT guided based angiography have higher spatial resolution which helps to visualize the cross sectional view of the arterial wall. It is much better than IVUS guided Angiography.

IVUS based angiography have low spatial resolution as compared to OCT guided angiography. However it is highly recommended as it provides with 2d images of the coronary vessel wall. It have lower penetrating power as compared to OCT guided based angiography.

### **6.2 CONTRAST MEDIA AND BLOOD VESSELS CAVITY**

OCT guided Angiography uses a contrast media for the visualization of the coronary arteries. Basically contrast media remove the blood throughout the vessels then the vessels are clearly seen. This is the only limitations which makes Oct guided Angiography procedure to use more contrast as compared to the general angiography.

IVUS guided Angiography doesn't uses a contrast media that makes it perfect to chronic kidney patients(CKD) and also blood from the vessels are not removed. IVUS images are not able to see blood vessels through heavy calcification.

### 6.3 RADIATION

IVUS and OCT based angiography doesn't include radiation exposure which makes it more easier, safer for the CKD (Chronic Kidney Disease) patient.

### 6.4 ACCURATE ASSESSMENT AND STENT OPTIMISATION

OCT based Angiography can assess the stent related problems like effective stent expansion to prevent complications. Looking for the best position and accurate size of the stent. Identification of the lesion whether it is soft, fibrinous or calcified.

IVUS based Angiography also characterize thrombus, necrosis, lesion, plaque. It also assess the stent expansion and stent malposition or the accurate size and insertion of the stent.

## 7. CT BASED ANGIOGRAPHY VERSUS MRI BASED ANGIOGRAPHY

In short both CT based Angiography and MRI based angiography are the powerful non- invasive procedure which detailly diagnose the coronary arteries of the heart. Both of the imaging techniques have its own advantage and limitations and preferred according to the patient clinical indications.

### 7.1 RADIATION EXPOSURE

CT based Angiography uses a technique X-ray to produce 3d images of the blood vessels of the heart. CT based Angiography includes radiation exposure which makes it unsafe for the patient who is undergoing repeated imaging scans.

MRI uses strong magnetic waves with the radio waves technique to produce the image of the blood vessels. Due to non radiation exposure it makes the procedure friendly and safer for the patient.

### 7.2 INTRAVENOUS CONTRAST

CT based Angiography requires a contrast media to identify the blood vessels of the heart. It uses iodine based agents which makes the procedure unsafe for the CKD patient and also excessive presence of dye on CKD patient can lead to Contrast Induced Nephropathy.

MRI based angiography may or may not require the contrast media for the visualization of the blood vessels. Depending upon the situation sometime it uses Gadolinium based contrast which is safest for the CKD patient.

### 7.3 IMAGE RESOLUTION

CT based Angiography provides high spatial resolution images which provides the detailed images of the coronary arteries that is tortuous and small.

MRI based angiography also uses high resolution which helps in capturing the motion of the heart and also see the function of the heart.

### 7.4 SCAN DURATION

CT based Angiography usually takes 20 minutes scanning time. CT based Angiography takes shorter time as compared to MRI based Angiography So it is preferable to patients who have difficulties for holding themselves or lying flats or in emergency cases for viewing the detailed images of the coronary arteries.

MRI based Angiography usually takes 30 minutes which detailly diagnose the anatomical structure of the coronary arteries and specially preferable for viewing of the congenital anomalies or congenital heart disease or the valvular disease.

## 8. CONCLUSION

Imaging techniques plays a very important roles on the diagnosis of the cardiovascular disease intervention. Angiography is very significant whether it is invasive or non- invasive. However non- invasive is the low risk procedure which does not includes radiation that makes it easier and safer. Moreover invasive procedure includes minimally catheter based procedure to treat the underlying cardiovascular disease for patient better outcome. Both of the procedure plays the crucial role on understanding and dealing with the diseases. The

standard coronary angiography done by OCT and IVUS guided offers a very high resolution images and the CT and MRI on non-invasive provides the better 3d images which makes the better modalities for the future and for the flexibility of the coming generation. Various AI powered analysis are also included to make the images more precise and improving the diagnostic techniques accurate

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