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# The CHA2DS2-VASc risk score in patients with Non-ST Elevation myocardial infarction to predict total occlusion in infarct-related arteries

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**Abstract**
Patients with non-ST elevation myocardial infarction (NSTEMI) had a better chance of survival fewer ischemic sequelae after undergoing percutaneous coronary intervention (PCI). Patients undergoing percutaneous coronary intervention (PCI) are susceptible to contrast-induced nephropathy (CIN), which poses serious risks such as kidney failure, an upsurge in cardiovascular events, an extended duration of hospitalization, or even mortality. A low beginning estimated glomerular filtration rate (eGFR), poor contrast volume, or reduced blood volume overall are among the several potential causes of chronic interstitial pneumonia (CIN). It highlights the need of identifying individuals who are at risk of CIN during PCI operations. The original intent of the CHA2DS2-VASC score was to categorize patients' risk of stroke due to atrial fibrillation (AF). Older individuals, those with hypertension (HT), diabetes mellitus (DM), heart failure, or who are female are more likely to have poor cardiovascular disease outcomes when using the CHA2DS2-VASC score. The CHA2DS2-VASC score may also be helpful in populations who do not have AF, according to recent studies. Our goal in doing this evaluation is to determine how well CHA2DS2 VASC scores predict complete blockage in infarct-related arteries in patients who have had a non-ST elevation myocardial infarction. Finally, some thoughts: The CHA2DS2-VASC score has recently shown its capacity to forecast adverse clinical outcomes in patients with coronary artery disease, making it a useful tool for stratifying embolic risk in atrial fibrillation. In patients undergoing percutaneous coronary intervention (PCI) for non-ST elevation myocardial infarction (NSTEMI), we investigated if there was a link between the CHA2DS2-VASC score CIN.

**Key word :** Heart Attack, CHA2DS2-VASc Risk Score, Non-ST Elevation, Total Occlusion, Arteries Related to Myocardial Infarction

## 1. Introduction

Acute One of the top killers in industrialized nations is acute coronary syndromes (ACSs). Research by [1].

Both elevation MI (STEMI) non-elevation MI (NSTEMI) are subtypes of acute coronary syndromes (ACSs). Very comparable to non-ST-elevation myocardial infarction (NSTEMI) is unstable angina. Nevertheless, there is no elevation in cardiac markers. Citation: [2].

The Main Coronary Intervention (PPCI) is an invasive, non-surgical technique that aims to improve blood flow to ischemic tissue by releasing the coronary artery from its constriction or blockage. A stent to maintain blood flow or inflating the narrow section are two popular ways to do this. This is according to [3].

The main method for diagnosing ACS starting a reperfusion plan is electrocardiography (ECG). In patients with non-ST elevation myocardial infarction (NSTEMI), however, it is well established that electrocardiogram (ECG) detection of a complete occlusion (TO) in the infarct related artery (IRA) is inadequate. Researchers Birnbaum colleagues [4].

Delayed treatment, greater infarct sizes, increased fatality rates in individuals with NSTEMI may occur when the electrocardiogram (ECG) does not show the usual symptoms of complete blockage. In a recent study,. [5].

The CHA2DS2-VASc score has been widely used to predict thromboembolic events in patients with non-valvular atrial fibrillation to determine the use of anticoagulant or anti-platelet drugs. The score includes the following: age (≥65 = 1 point, ≥75 = 2 points), hypertension, diabetes, stroke/transient ischemic attack [TIA][2 points], vascular disease, previous myocardial infarction [MI] aortic atheroma. The source is Carr et al. [6].

Multiple recent studies have linked the CHA2DS2-VASc score to various cardiac complications, including acute stent thrombosis, right ventricular dysfunction, contrast-induced nephropathy following primary coronary intervention (PPCI) for acute coronary syndrome, acute stent restenosis, acute stent thrombosis, mechanical mitral valve thrombosis, prognosis. Based on the research conducted by [7].

Prediction of complete occlusion in infarct-related arteries using CHA2DS2 VASC scores in patients with non-ST elevation myocardial infarction was the purpose of this review.

## 2. Chronic Total Occlusion

The treatment of chronic complete occlusions (CTOs) with coronary intervention (PCI) has advanced considerably during the last several years. CTOs are rather prevalent, affecting about 20% of patients sent for coronary angiography. individuals with a history of coronary artery disease (CAD) have a frequency of 30–50% for CTO, that number becomes even more for individuals who have had CABG in the past. Nikolakopoulos et al. (2022) noted that revascularization rates of CTO have traditionally been poor.

Only 10% to 15% of individuals with CTO had a coronary intervention (PCI) attempt. Accumulation of Proof Clinical guidelines provide support for the indications of CTO therapy with PCI. The procedure's technically demanding nature is another factor.

With the development refinement of CTO-specific procedures equipment, the procedural risk of has been continuously decreasing in centers with expertise.(The recent study by [8]. The criteria for a CTO include an atherosclerotic full blockage of a vessel, the presence of Thrombolysis in Myocardial Infarction (TIMI) grade 0 flow inside the blocked area, an expected duration of at least three months for the blockage. The total incidence of CTO in the general (asymptomatic) population is unclear, since data on the prevalence are gathered from registries of patients having coronary for suspected CAD.Citation: [5].

The percentage of patients with at least one CTO was 36.5% in patients under the age of 65, 39.1% in patients aged 65 to 79, 40.7% in patients aged 80 beyond. Affected arteries were most often located in the right coronary artery, then in the anterior descending circumflex arteries. Acute coronary syndrome stable coronary artery disease (CAD) were almost evenly split among the indications for coronary angiography. [21.

**Chronic Total Occlusion Coronary Intervention: Essential Principles for Indications Technique [10]**

| | |
|---|---|
| 1 | The primary goal of is to alleviate symptoms. |
| 2 | In every situation, it is recommended to do dual coronary a comprehensive, organized examination of the results. |
| 3 | To secure a guidewire, a micro-catheter is required. |
| 4 | escalation, retrograde dissection/reentry, escalation, retrograde escalation are the four CTO crossing techniques. |
| 5 | The efficiency success rate of the operation are both enhanced by switching up the tools methods used. |
| 6 | For to be successful to reduce or control problems, the center or doctor doing the procedure should have the right tools, knowledge, experience. |
| 7 | When doing CTO PCI, it is imperative to optimize stent placement by doing all possible things well, including making extensive use of intravascular imaging. |

The acronym PCI stands for coronary intervention, whereas CTO stands for chronic complete occlusion.

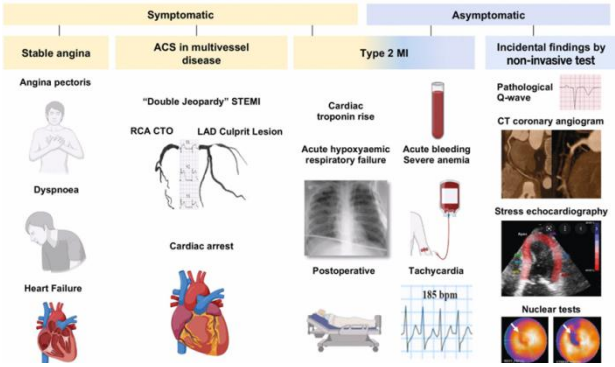
- **The CTO patient: characteristics clinical phenotypes**

Clinical settings in which CTOs are found vary greatly; some of these include acute coronary syndromes (ACS), evaluations of chest pain, documented ischaemia using various imaging modalities1, or, more rarely, as an incidental finding during a coronary workup prior to vascular or valve replacement surgery. A patient who presents without exertional symptoms (such as dyspnea or angina) requires a more thorough evaluation based on additional tests that the treating physician may not have access to when the patient presents (Figure 1) [14].

It is important to thoroughly assess the patient's age, fragility, any co-occurring conditions (such as major aortic aneurysms, concomitant valvular heart disease, non-cardiac limitations of functional capacity, cognitive deficits, ongoing cancer treatment) in both cases. To determine whether revascularization or OMT is more appropriate, in the case of revascularization, whether PCI or is more appropriate, these clinical factors should align with technical concerns. Notably, in comparison to individuals without CTO, those with the condition tend to be older, have a higher prevalence of diabetes, have a more impairment of ventricular ejection fraction (LVEF) [10].

In addition to elevation myocardial infarction (STEMI), other individuals may exhibit symptoms of acute coronary syndromes (ACS). When a plaque rupture or erosion occurs in the culprit artery that supplies collaterals to another coronary artery with a CTO in a type 1 myocardial infarction (MI), the prognosis is unfavorable because of the double injury caused by the interruption of collateral flow from the culprit artery to the CTO territory. Notably, a CTO is present in about one-third of individuals who undergo resuscitation after a cardiac arrest. Revascularization beyond the infarct-related

artery should be avoided in cases of cardiogenic shock caused by acute ischaemia. Subsequent studies disproved the SHOCK trial's original recommendation to try full revascularization in this context. In contrast, full revascularization for STEMI in the absence of cardiogenic shock multivessel disease is supported by strong evidence11. However, according to [15], patients with CTO in non-culprit arteries were not explicitly addressed in these studies.




**The many ways in which individuals with coronary CTO exhibit themselves clinically (Galassi et al., 2024).**

❖ **Symptom Improvement is the Primary Indication for CTO-PCI**

Two Post-symptom improvement has been shown in several observational studies randomized controlled trials. Three hundred ninety-six patients participated in the Euro-CTO multicenter study, with half given optimum medical treatment half given CTO-PCI. At 12 months, patients who were randomly allocated to showed more improvement in angina frequency quality of life, as measured by the Seattle Angina Questionnaire, compared to those who were randomly assigned to medical treatment alone.“[16]” states.

A total of ninety-four patients suffering with right coronary artery CTO were randomly randomized to either optimum medical treatment alone or in the single-center IMPACTOR-CTO experiment.Twelve months after CTO-PCI, patients compared to those receiving optimum medical treatment for their condition showed a considerable improvement in their quality of life, 6-minute walk distance, ischemia load on the Short Form-36 Health Survey. A number of observational studies meta-analyses have shown similar improvements in symptoms.In a 2018 study.

Exercise capacity, anaerobic threshold, depression have all been shown to improve after CTO-PCI, which has alleviated regional ischemia in observational studies.The myocardium that may receive blood from a CTO is always in a state of partial ischemia.The effects of on various cardiovascular outcomes, including mortality, arrhythmia risk, ventricular ejection fraction, are yet unclear.In a 2017 study, Mashayekhi et al.

**Two angiographies**

Executing high-quality, concurrent dual coronary is the easiest most effective method for enhancing technical success decreasing problems of CTO-PCI. Procedure time expense are both minimally affected by the use of two catheters pressure monitoring equipment. For a more accurate assessment of the lesion's intricacy success rate, dual coronary is essential since it improves visibility comprehension of CTO architecture. [20].

For some circumstances when collateral circulation is only from ipsilateral vessels, such as CTOs situated in the dominant system, with a single guide may be done.To minimize contrast administration prevent the spread of ante-grade dissection zones, the second option involves injecting contrast selectively into the collateral donor branch using a micro-catheter. Guidemicro-catheter management is made simpler using the ping-pong procedure, which involves inserting two catheters into the major coronary artery. This is particularly true when a retrograde approach is used. As stated by Vo et al. in 2020.

Which crossing tactics are most likely to be effective safe will be determined by the CTO anatomy. Four features stout in an angiographic examination of a CTO's anatomy.Source: [34].

**Shape of the cap**

**Composition (e.g., calcium), occlusion duration, occlusion route.**

Assessing the distal vessel's medical merit.

Details of the collateral blood flow.

It is crucial to evaluate all lesions, not only CTOs, since doing so may affect clinical

decision-making lead to various revascularization procedures like CABG or pre-stenting of a donor artery.This is mentioned in the work of Wu et al. [30].

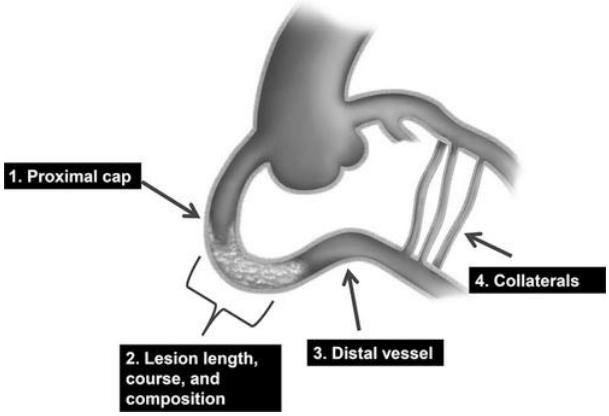



**Figure 2: The four critical angiographic characteristics that must be evaluated in order to design coronary intervention with chronic complete occlusion.Citation: Brilakis et al., 2019.**

**3. CTO scores**

To determine the level of complexity risk associated with a certain surgical procedure for different patient populations, ratings are developed by analyzing angiographical clinical data, including the patient's previous CABG or failure experiences. There is a gold standard for assessments, that is the J-CTO score. It was produced by the Multicenter CTO Registry of Japan. A minimum of one bend of more than 45° in the CTO entry or CTO body, an occlusion length more than 20 mm, calcification, a blunt stump, a history of failed efforts are the five criteria that are used to determine this. It may foretell the likelihood of a successful ante-grade guidecrossing within 30 minutes.The year 2018 was briefly mentioned by [4].

For patients with minor symptoms more complicated occlusions, medical treatment may be the best option. Dissection reentry retrograde crossing procedures need the expertise of highly trained operators for complex CTOs (those with a J-CTO score of 2 or above).[38]. is the source cited used.

Guidewire manipulation using a micro-catheter:

It is standard practice to use a micro-catheter to stabilize the coronary guide facilitate quick guide changeover while dealing with an or retrograde wires. Modifying the gap between the guidetip the micro-catheter may enhance the accuracy of rotational longitudinal guide motions in both fluid (blood-filled vessels) tissue (the occlusion itself). It is possible to dynamically stiffen the guidewires by positioning the micro-catheter near to the guidetip.In 2019, [12] conducted the current experiment.

In comparison to an over-the-balloon catheter, a micro-catheter has various benefits, such as a more streamlined design, a higher ratio of wire to lumen internal diameter, more leeway in terms of advancement, a marker at the distal tip that gives clear fluoroscopic feedback on its precise location. Contemporary cardiac micro-catheters have a copper braid to prevent the shaft from twisting, as opposed to a plastic balloon that covers the wire. Just as local accessibility, competence, CTO angiographic features influence guide choice, so do these same criteria influence micro-catheter choice. It is possible to reduce the complexity of CTO crossing by using a micro-catheter in combination with robust guide support, a coaxial guide position, other similar techniques.[11].

**Connecting the antegrade:**

The most common method for crossing CTOs is ante-grade wiring, which is also known as ante-grade escalation.The ante-grade direction, or the first blood flow path, is followed by a number of guidewires. Guideselection is influenced by the properties of the CTO. When dealing with a functional occlusion that has a visible channel or a tapered cap, it is recommended to start with a polymer-jacketed, low penetration force, tapered guidewire. If necessary, you may then escalate to or high penetration force guidewires. It is common practice to begin ante-grade wiring using a composite core guideor an penetration force polymer-jacketed guidein cases when the cap is blunt. As stated by Vo et al. in 2020.

Before microcatheters, balloons, or stents are advanced over a guidewire, it must be removed realigned if it leaves the vascular structure. You can try rerouting the guideif it gets stuck in the sub intimal space, but if that doesn't work, you can leave it in there to help direct another guideinto the distal true lumen (the parallel-technique). A dual-lumen micro catheter or intravascular ultrasound can make

this process easier.In a 2017 study, Suzuki et al.

Introduction into the subintimal space, subintimal crossing of the CTO, reentry into the distal real lumen are the steps that make up ante-grade dissection reentry. It's possible for ante grade wiring efforts to cause purposeful or inadvertent entrance dissection. The STAR method was the first of its kind to be invented; it included an unintended uncontrolled entrance into the distal lumen during dissection.This sometimes required stenting lengthy lengths of the coronary arteries, which blocked off several side branches caused significant vascular damage. The rates of restenosis re-occlusion inside the stent were also high.In a 2016 study, [13].

This is why the STAR method has changed into a rescue plan that doesn't include stent placement after ballooning; instead, it's all about getting ready for another effort, which is also called a "investment procedure" or sub intimal plaque remodeling.Because they reduce the risk of vascular injury, shorten the dissection stent lengths, improve the chances of side branch preservation, limited dissection/reentry techniques (using dedicated reentry systems or wire-based strategies) are a significant improvement.Positive clinical results have been linked to these methods.[15].

In contrast to the method, which involves advancing the guidein the same direction as the blood flow, the retrograde method involves approaching the blockage from the distal artery.After a collateral channel or bypass graft is used to push a guideinto the artery distal to the blockage, a tiny catheter is inserted at the distal CTO cap. If the distal cap is tapered or the occlusion is brief, the next step is to try crossing the CTO retrogradely utilizing retrograde wiring or retrograde dissection/reentry procedures.[21]

One of the most common methods for retrograde crossing is reverse controlled ante grade retrograde tracking, which involves inflating a balloon over the ante grade guidewire and then advancing the retrograde guide into the space that the balloon has created. Intravascular ultrasonography has the potential to provide light on the reasons behind the failure of some reverse controlled antegrade retrograde tracking operations, allowing clinicians to better equip themselves for these challenging cases.By using guide catheter extensions, it is also feasible to control the retrograde tracking in the opposite direction.Researchers .

Choice of crossing strategy:

It is important to consider the features of the CTO lesion as well as the availability skill of local equipment when choosing the first subsequent crossing procedures. The hybrid, Asia Pacific, Euro-CTO algorithms are just a few of the many that have been created to help in crossing strategy selection. The increased likelihood of problems with the retrograde technique the ongoing need to prepare lesions even when the retrograde approach is ultimately necessary make crossing the preferable first crossing strategy over retrograde crossing.The study was conducted by Galassi et al. in 2019.

However, efforts to cross grades before the procedure might lead to retrograde problems. Particularly in more complicated CTOs, the retrograde strategy is essential for high success rates has been linked to positive long-term results. It is common practice to use a main retrograde method when dealing with CTOs that have flush aorto-ostial or cap uncertainty.As stated by [16].

Alteration to the approach to crossing:

The efficacy, safety, effectiveness of depend on its adaptability. the guidetip angulation or changing the guideare examples of small adjustments that can be made based on pre-procedural planning if the initial or subsequent crossing strategy fails to achieve progress. A more significant change would be to convert from an ante grade to a retrograde approach.Staying out of a failure mode, where time, contrast, radiation are wasted trying the same technique over over again with no results, increases the risk of complications prevents the use of alternative strategies.Source: [18].

Score for CHA2DS2-VASc

Patients with non-valvular atrial fibrillation may have their cardio-embolic risk estimated using the CHA2DS2-VASc score, which is a straightforward, validated, repeatable scoring method. Hypertension, old age, diabetes mellitus are among the elements that make up the CHA2DS2-VASc scoring system. These conditions are known to increase the likelihood of atherosclerosis, vascular spasm, micro-vascular dysfunction, common outcomes like no-reflow stroke. Even in individuals who do not have atrial fibrillation, the CHA2DS2-VASc score has the potential to be an effective predictor of unfavorable vascular events.“[29].

If a patient has atrial fibrillation without valvular atrial fibrillation, the CHA2DS2-VASc score should be used to assess the risk of thromboembolic complications. People at high risk who could benefit from anticoagulant therapy can be identified using the CHA2DS2-VASc score. Thromboembolism is more likely in those with preexisting cardiovascular illness, a history of myocardial infarction,

peripheral arterial disease, aortic plague, those who are over the age of 65, hypertension, diabetes mellitus (DM), female gender, and congestive heart failure (CHF).[33] states that.

The CHA2DS2-VASc score incorporates the risk factors for atherosclerotic inflammation-induced CAD, which increases the incidence of thromboembolism. A hypothesis was put up regarding a potential correlation between the CHA2DS2-VASc score and the SYNTAX score, which quantifies the intricacy and severity of coronary artery disease.As per the colleagues at Tanircan.

The CHA2DS2-VASc score is calculated in the following way: For this purpose, we have incorporated the following criteria: congestive heart failure (1 point), hypertension (1 point), age 75 or older (2 points), diabetes mellitus (1 point), history of stroke or transient ischemic attack (2 points), vascular disease (1 point), age 65–75 (1 point), and gender (1 point). When employing the CHA2DS2-VASc, a maximum of nine points may be calculated. Aortic plaque, peripheral artery disease, myocardial infarction, or any history of these conditions was deemed vascular disease. If non-coronary arteries had a stenosis of 50% or more, it was considered PAD. Cardiology patients with congestive heart failure had an LVEF of 40% or below. Those that smoke now have done so regularly for over a year.Participants in the Okubo study [22].

Patients with non-valvular atrial fibrillation may utilize the CHA2DS2-VASc score, a dependable, straightforward, and user-friendly scoring system, to anticipate the likelihood of cardio-embolic consequences. Patients with ischemic stroke atrial fibrillation and a CHA2DS2-VASc score before to admission had a correlation with the 90-day endpoint. A high CHA2DS2-VASc score is associated with increased platelet activity, according to the evidence. It also predicts that patients with STEMI will have acute stent thrombosis after a primary PCI and that ACS will develop in cases where blocked arteries do not have reflow.Given the findings of the study carried out by Asher et al. in the year 2021.

Poor outcomes, including ACS and CAD, are more common in those with diabetes mellitus compared to those without the illness. The quantity of thrombi is often greater in patients with ACS and hypertension. There was a correlation between Total Occlusion and the CHA2DS2-VASc score, which accounts for DM HT.In 2018, Davutoğlu made a publication.

The CHA2DS2-VASc score was shown to be an accurate predictor of Total Occlusion in patients with NSTEMI. Consequently, this score might be useful for early detection of NSTEMI patients who could benefit from invasive procedures. [22].

Identifying patients at risk for no-reflow prior to coronary intervention (PCI) may be useful from a prophylactic perspective. Patients undergoing coronary intervention (PCI) who have non-ST-elevation myocardial infarction (NSTEMI) may be independently predicted to have poor blood flow using the CHA2DS2-VASc score.Based on research done in 2020 by Barman and colleagues.

Female patients (65–74 years old), those with hypertension, diabetes mellitus, a history of stroke or vascular disease, and those without valvular atrial fibrillation were the target population for the development of the CHA2DS2-VASC score, which was used to determine the likelihood of thromboembolic events and the necessity of oral anti-coagulant medication [38]. [17]. found that it was useful for predicting the severity of coronary artery disease mortality due to the inclusion of certain common risk variables.

Patients undergoing cardiac resynchronization due to congestive heart failure may also find it useful for predicting mortality and morbidity [14].

In patients with supraventricular arrhythmia or atrial fibrillation, it may be able to forecast the development of thrombus embolism, according to researchers [16].

The reported occurrence of CIN varies substantially among categories, falling anywhere from 7% to 25%, depending on the presence of risk factors. [33] states that in order to determine the appropriate amount of preventive for people at high risk, risk categorization is essential.

## 4. Conclusions:

Recent reports have shown that the CHA2DS2-VASC score, which is used to stratify embolic risk in atrial fibrillation, may predict worse clinical outcomes in patients with coronary artery disease. In patients undergoing coronary intervention (PCI) for non-ST elevation myocardial infarction (NSTEMI), we looked at the association between the CHA2DS2-VASC score contrast-induced nephropathy (CIN).

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