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Risk of sudden cardiac death: Are coronary chronic total occlusions an additional risk factor?

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Abstract

Sudden arrhythmic cardiac death remains a significant, potentially reversible, cardiological challenge in terms of creating accurate risk prediction models. The current guidelines for implantable cardioverter defibrillator (ICD) therapy are mainly based on left ventricular ejection fraction despite its low sensitivity and specificity in predicting sudden cardiac death (SCD). Chronic total occlusions have been associated with increased mortality but further research is required to clarify if they should be incorporated in a risk model predicting SCD aiming to identify patients that would benefit from ICD therapy even with preserved ejection fraction.

Key words: Sudden cardiac death; Chronic total occlusion; Left ventricular ejection fraction; Implantable cardioverter defibrillator

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Core tip: Further research is necessary in order to clarify if chronic total occlusion can be incorporated in a risk prediction model of sudden cardiac death aiming to identify patients that would benefit from implantable cardioverter defibrillator.

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INTRODUCTION

Even though death from cardiac causes has been decreasing over the last two decades in the western world, approximately 20% of all deaths and 50% of cardiovascular deaths are due to sudden cardiac death (SCD)^[1,2]. Coronary chronic total occlusions (CTO) occur in about 16% of patients with significant ischaemic heart disease and they have been associated with increased mortality in a large prospective observational study^[3]. However, currently it is not well known to what extent CTO increase SCD and if these patients would benefit from implantable cardioverter defibrillator (ICD) therapy.

In this Editorial, we focus on a recent article by Chi *et al*^[4] published in JACC Clinical Electrophysiology as we feel it provides a new insight into the role of CTO in relation to prognosis and identifies gaps in knowledge that warrant further research. In this study the authors aimed to understand the relationship between CTO and the occurrence of ventricular tachycardia/fibrillation (VT/VF) or appropriate ICD therapy. They performed a meta-analysis including a total of 17 studies involving almost 55 thousand patients. They found that the presence of CTO was associated with higher risk of VT/VF or appropriate ICD therapy; however it was not associated with a difference in cardiac mortality or in all-cause mortality. The higher risk of VT/VF or appropriate ICD therapy was confirmed on both univariate and multivariate analysis (in only two studies), while the risk of cardiac mortality was significantly higher on univariate but not on multivariate analysis and the risk of all-cause mortality was not significantly higher in either univariate or multivariate analysis^[4].

Comparing patients with infarct-related and non-infarct related CTOs, they concluded that the former had a higher risk of VT/VF or appropriate ICD therapy, cardiac mortality and higher all-cause mortality. The higher risk of VT/VF or appropriate ICD therapy of patients with infarct-related CTOs was confirmed on univariate but not multivariate analysis while the higher risk of cardiac mortality was only significant on multivariate analysis and the higher risk of all-cause mortality was significant on both univariate and multivariate analysis. Finally, non-revascularization of CTO was associated with higher risk of all-cause mortality but this did not reach statistical significance. The authors reached the conclusion that ICD implantation for primary or secondary prevention should be considered in patients who have infarct-related CTOs^[4].

According to American Heart Association/American College of Cardiology/ Heart Rhythm Society (AHA/ACC/HRS) 2017, European Society of Cardiology (ESC) 2015 and United Kingdom National Institute for Health and Clinical Excellence (NICE) 2014 guidelines, an ICD is indicated for secondary prevention in survivors of cardiac arrest provided there is no reversible cause^[5-7]. The decision for primary prevention ICD therapy varies slightly according to the various guidelines however, in general it depends on the left ventricular ejection fraction (LVEF), QRS duration and New York Heart Association (NYHA) class. The AHA/ACC/HRS 2017 guidelines recommend ICD if LVEF < 35% and NYHA II-III or LVEF < 30% and NYHA I. The ESC 2015 guidelines recommend ICD if LVEF < 35% and NYHA II-III^[5]. According to NICE 2014 guidelines, primary prevention ICD therapy is indicated if LVEF < 35%, NYHA I-III and QRS duration > 120 ms. For patients who fulfil the first two criteria but QRS is < 120 ms, ICD is recommended if there is a high risk of SCD^[7] and in this situation the current research^[4] would perhaps suggest that presence of CTO can be a qualifying criterion for "high risk"^[7].

Even though LVEF has a central role in the algorithm for recommending primary prevention ICD therapy, it has both low specificity and sensitivity for predicting SCD. It is established that low LVEF predicts not only SCD but also other modes of cardiovascular death as well^[8]. In addition, only a minority of patients who suffer cardiac arrest will have LVEF < 35%. It is estimated that 40% of patients who suffer SCD have known heart disease with LVEF > 40%, while only 13% of patients who suffer SCD have known heart disease and LVEF < 40%^[2]. It has also been shown that myocardial scar > 5% is an independent risk factor for all-cause mortality and appropriate ICD therapy, irrespective of LVEF^[9]. In addition, looking at other pathologies for example dilated cardiomyopathy^[10] and aortic stenosis^[11], other

parameters such as presence of myocardial fibrosis have been shown to have additional prognostic impact over and above LVEF.

CONCLUSION

Chi *et al*^[4] have analysed 17 studies that had included patients with severely reduced LVEF but also patients with only mildly reduced or even normal LVEF. It remains to be seen whether CTO can be regarded as an independent factor for malignant arrhythmias over and above the information we get from LVEF, but this study certainly suggests that this should be investigated. In addition, further research can identify whether patients who have viable myocardium with evidence of reversible ischaemia in the presence of some myocardial scar in the CTO territory should also be considered for an ICD even after successful revascularisation. Even though we do not feel that definitive conclusions can be drawn from this analysis, it is an important study as it indicates that further research is needed in order to clarify the relationship of infarct-related CTO and non-infarct related CTO with SCD both in patients with reduced and preserved LVEF. It is well appreciated that the risk of SCD is continuous rather than dichotomous and no single parameter can adequately discriminate to dichotomise the risk^[2]. Therefore, clarification if CTO is a high risk variable for SCD in patients with preserved LVEF (introducing a new term for such patients, the CTOpEF patients) or mid-range EF (CTOmrEF patients) or in patients with LVEF < 35% and narrow QRS would be very clinically relevant.

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