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Review/Case Series

Optical coherence tomography following percutaneous coronary intervention with Excimer laser coronary atherectomy☆

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ABSTRACT

The indications for Excimer laser coronary atherectomy (ELCA) have been refined in modern interventional practice. With the expanding role for optical coherence tomography (OCT) providing high-resolution intra-coronary imaging, this article examines the appearance of the coronary lumen after ELCA. Each indication for ELCA is discussed and illustrated with a clinical case, followed by detailed analysis of the OCT imaging pre and post ELCA. The aim of the article is to provide information to interventional cardiologists to facilitate decision making during PCI, when ELCA has been used as part of the interventional strategy.

1. Introduction

Excimer laser coronary atherectomy (ELCA) has been applied in the treatment of arterial atheroma for over 20 years. Early results when compared with conventional percutaneous coronary intervention (PCI) techniques were disappointing resulting in limited uptake of the technology [1]. Advances in laser catheters and PCI technique has led to a resurgence of interest, reflected in recent literature [2–4]. Contemporary challenges in PCI include an ability to deal with calcified lesions and chronic total occlusions (CTO). Both are an approved indication for the use of ELCA.

Optical coherence tomography (OCT) is a recently developed intra-vascular imaging modality. It uses near-infrared light to provide high resolution (12–15 μm) images of the coronary vessel lumen and wall. It can clearly identify and differentiate intravascular thrombus, and provides a wealth of information on the effects of intervention on the coronary intima and media [5].

The aim of this article is to describe the coronary OCT appearance after ELCA, using case examples, to aid in PCI decision making. Each indication for ELCA is described, followed by a case description and analysis of the OCT images.

2. Indication 1: In-Stent Restenosis (ISR)

Despite significant advances in drug eluting stents (DES), target lesion revascularization (TLR) remains a limitation of PCI, with angiographic ISR of up to 10% in patients with DES [6].

ELCA is a safe and effective technique in the treatment of ISR. Lesions treated with ELCA, compared to balloon angioplasty (POBA), had a greater cross sectional area and luminal gain (on IVUS), with more intimal hyperplasia ablation [7]. However, these favorable angiographic criteria were not followed with a reduction in TLR at 6 months.

3. Case 1

A 57-year-old with previous multi-vessel PCI (using a 3.0x24mm sirolimus eluting stent) 3 years previously underwent angiography, identifying a severe fibrotic re-stenotic lesion in the proximal LAD (Fig. 1Ai). Due to the dense fibrotic restenosis, laser atherectomy was undertaken. This approach was adopted to maximize luminal gain in this large prognostic vessel.

A 1.4 mm concentric ELCA catheter using an energy of 60 mJ/mm^2 at a pulse repetition rate (PRF) of 40 Hz, delivered approximately 8000 pulses over 20 runs. The OCT appearance post ELCA (Fig. 1B) demonstrates a reduction in neo-intimal material, and creating a cleft/

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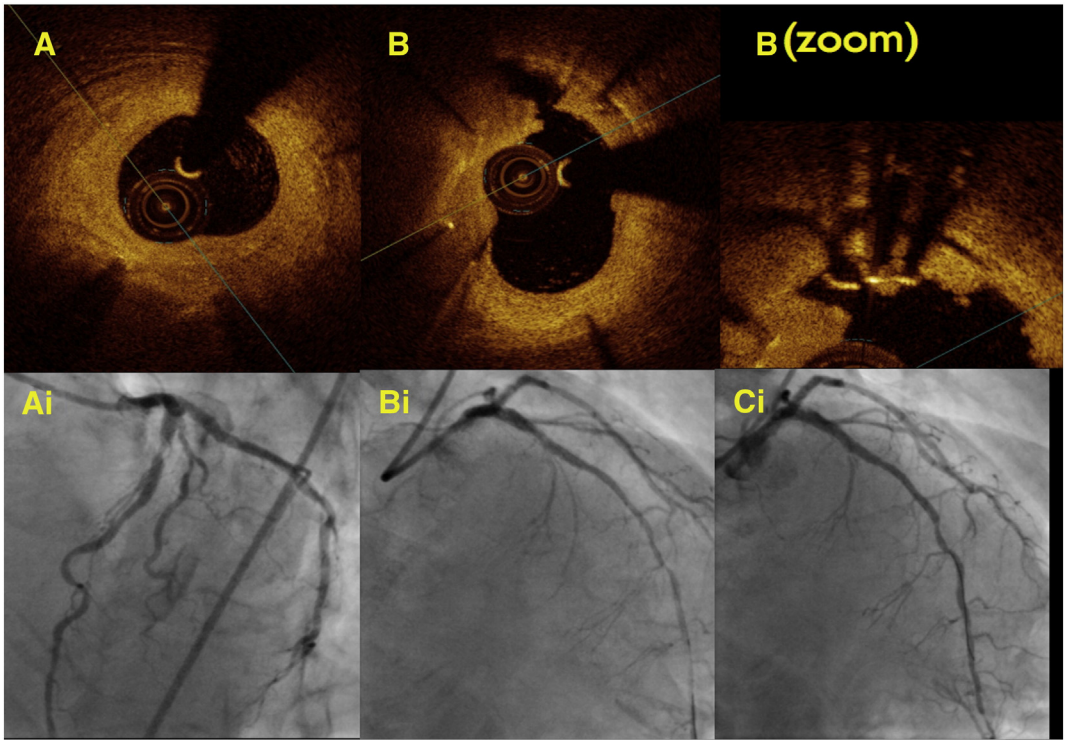

Fig. 1. Severe concentric fibrotic In-stent restenosis in the proximal LAD DES on angiography (panel Ai) and the corresponding OCT (panel A). Post ELCA, a cleft/dissection plane is evident (panel B), extending to the true intimal layer (panel B-zoom). This was subsequently treated with sequential non-compliant and paclitaxel eluting balloon inflations with an excellent final angiographic result (panel Ci).

dissection plane having, extending to the media (Fig. 1B (zoom)). Stent expansion was achieved with sequential non-compliant (NC) and Paclitaxel eluting balloon inflations (Fig. 1C).

ELCA proved effective in debulking the lesion, an effect that is not a consequence of thermal injury [8], as in-vivo models have demonstrated acceptable temperature changes within stented porcine arteries.

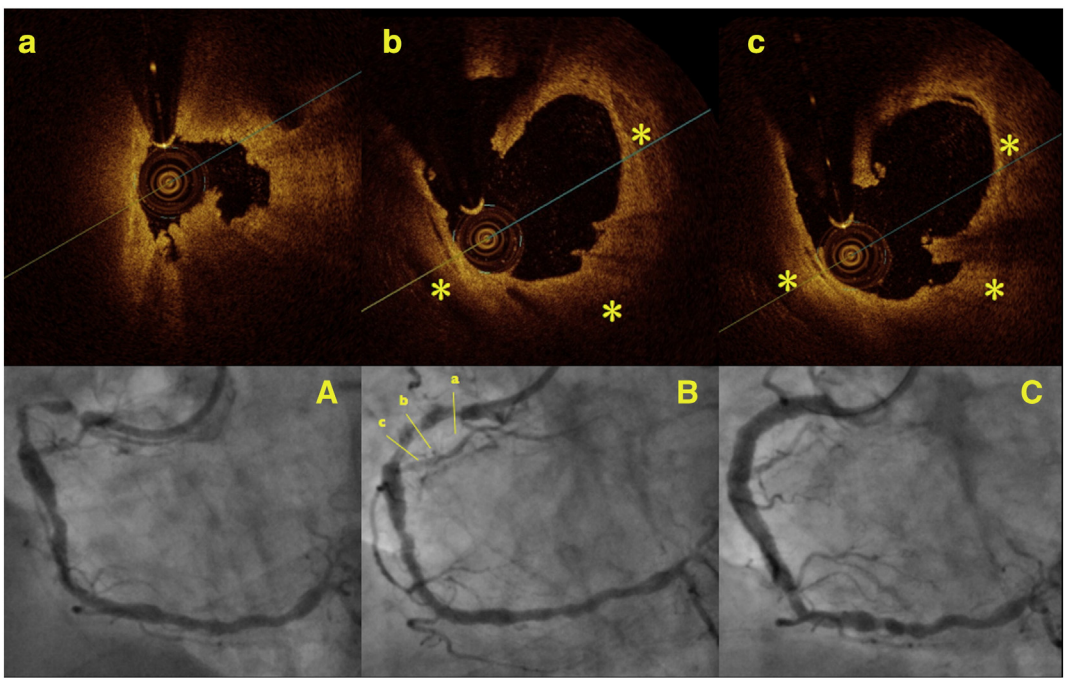

Fig. 2. Panel A demonstrates a severe calcific lesion in the proximal RCA. This proved uncrossable. ELCA was undertaken, and the OCT taken post-ELCA is shown in panels a-c, with the position in the RCA indicated on panel B. A variegated fibro-thrombotic lesion in seen in the proximal artery with the appearance of white thrombus on the inferior border (a). Extensive media calcification is evident, but little involving the intima directly (shown with *in panel b & c) Multiple dissection planes are evident distally, within the diseased intimal layer, not extending into the calcific media (panel b & c), and not apparent angiographically (panel B). The lesion was now easily crossable with an NC balloon. After pre-dilatation, the case was completed with 2 DES, with the final angiographic appearance shown in panel C.