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Case Report

Arterial repair after bare-metal stent implantation in peripheral arteries is delayed compared to that in coronary arteries: A case report of pathological evaluation

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ABSTRACT

Despite widespread use of endovascular therapy with bare-metal stent (BMS) implantation in patients with peripheral artery disease (PAD), arterial healing has not been well examined in this setting. An 84-year-old man with PAD received BMS implantation at the right external iliac artery (EIA, Epic 8.0 mm × 100 mm) and superficial femoral artery (SFA, SMART Control 8.0 mm × 150 mm). However, he died of lobar pneumonia 81 days later. Pathological evaluation was conducted at BMS implantation sites. At the distal part of Epic site in the EIA, neointimal formation was seldom observed. A small amount of fibrin deposition was seen around stent struts without apparent smooth muscle cell proliferation or surface endothelial cell coverage. In contrast, at the middle part of distal SMART site in the SFA, most of the stent struts were completely covered with moderate amount of neointima which was composed of a lot of smooth muscle cells and extracellular matrix on the plaque-free wall. However, on the contralateral calcified plaque site, a lot of fibrin components were still observed over the surface of thin neointima and only rough smooth muscle cells were scatteringly infiltrated. Furthermore, incomplete endothelial cell coverage was seen on the surface. Arterial repair after BMS implantation in peripheral arteries was extremely delayed.

<**Learning objective:** An 84-year-old man with peripheral artery disease received bare-metal stent (BMS) implantation in peripheral arteries. Pathological evaluation 81 days later showed heterogeneous neointimal coverage formation with incomplete coverage, especially at the vessel portions with significant plaque burden. In these portions, endothelial cell coverage was also incomplete. Moreover, some malapposed struts were observed. Arterial repair after BMS implantation in peripheral arteries was extremely delayed.>

Introduction

Endovascular therapy (EVT) with bare-metal stents (BMS) is widely used in patients with peripheral artery disease. In aortoiliac and femoropopliteal artery lesions, BMS implantation is associated with acceptable durability compared with traditional balloon angioplasty; however, arterial healing has not been well examined [1]. Thus, we report on pathological evaluation 81 days after BMS implantation in the external iliac artery (EIA) and superficial femoral artery (SFA). His bereaved family gave consent for the publication of his data.

Case report

An 84-year-old man was referred to our hospital with gangrene at his right second toe. His past medical history included diabetes mellitus, chronic kidney disease on hemodialysis for 31 months, and coronary artery disease which was treated by percutaneous coronary intervention. BMS was implanted at the right EIA (Epic 8.0 mm × 100 mm; Boston Scientific, Natick, MA, USA) and SFA (SMART Control 8.0 mm × 150 mm; Cordis, Miami Lakes, FL, USA). We measured the reference lumen diameter by intravascular ultrasound and evaluated ratio of stent size to reference lumen

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diameter. The ratios of Epic stent and SMART stent were 1.33 and 1.31, respectively. Dual antiplatelet therapy (DAPT) using aspirin and clopidogrel continued throughout his life. During the wound healing process after EVT, the patient died of lobar pneumonia despite intensive antibiotic treatment. With informed consent from his bereaved family, pathological evaluation of arterial healing was conducted at the EIA and SFA sites that had undergone BMS implantation 81 days before.

The sample was fixed in 10% buffered formalin, and film-based radiographs (high-resolution fixation images) were taken to determine the stented segments for analysis by comparison to angiograms (Fig. 1). The vessel was then embedded in Spurr resin, sectioned into 5-μm-thick slices, and stained with hematoxylin and eosin.

We evaluated four sections of the Epic stent and examined the percentage of uncovered struts of the each stent. In a total of 114 struts of Epic stent, 80 uncovered struts were observed and the percentage of uncovered struts was 70.1%. The distal part of the Epic implantation site in the EIA revealed an eccentric lesion with a lipid core plaque fringed with calcification (Fig. 2A). Stent struts were expanded to an almost round shape. Some struts were malapposed at the site where calcification distributed on the surface layer of the intima (Fig. 2B). Neointimal formation was seldom observed wholly. A small amount of fibrin deposition was seen around stent struts without apparent smooth muscle cell proliferation or surface endothelial cell coverage. Inflammatory cell infiltration was seldom observed (Fig. 2C and D).

We evaluated five sections of the SMART Control stent. In a total of 180 struts of SMART stent, 8 uncovered struts were observed and the percentage of uncovered struts was 4.4%. The middle part of the distal SMART implantation site in the SFA is shown in Fig. 3. The stent was implanted over an eccentric fibrocalcific plaque with severe spotty calcification and it expanded with an oval shape (Fig. 3A). Most of the stent struts were completely covered with moderate amount of neointima which was composed of a lot of smooth muscle cells and extracellular matrix on the plaque-free wall (Fig. 3B). However, on the contralateral calcified plaque site, a lot of fibrin components were observed over the surface of the thin neointima and only rough smooth muscle cells were scatteringly infiltrated. Furthermore, incomplete endothelial cell coverage was seen on the surface. Inflammatory cell infiltration was seldom observed (Fig. 3C and D).

The overlapping site of two SMART Control stents is shown in the supplementary data. They were implanted in the eccentric lesion with crescent lipid core plaque including calcification. Both stents revealed good expansion (Suppl. A). Mild-to-moderate neointimal formation was observed on the plaque-free wall with partial endothelial cell coverage. While randomly arranged smooth muscle cells and the accumulation of proteoglycan were mainly detected around struts, small smooth muscle cells were arranged in a concentric circle and collagen fiber tended to be increased on the surface. Fibrin deposition was mainly seen and the smooth muscle cell proliferation was poor on the contralateral plaque site (Suppl. B–D).

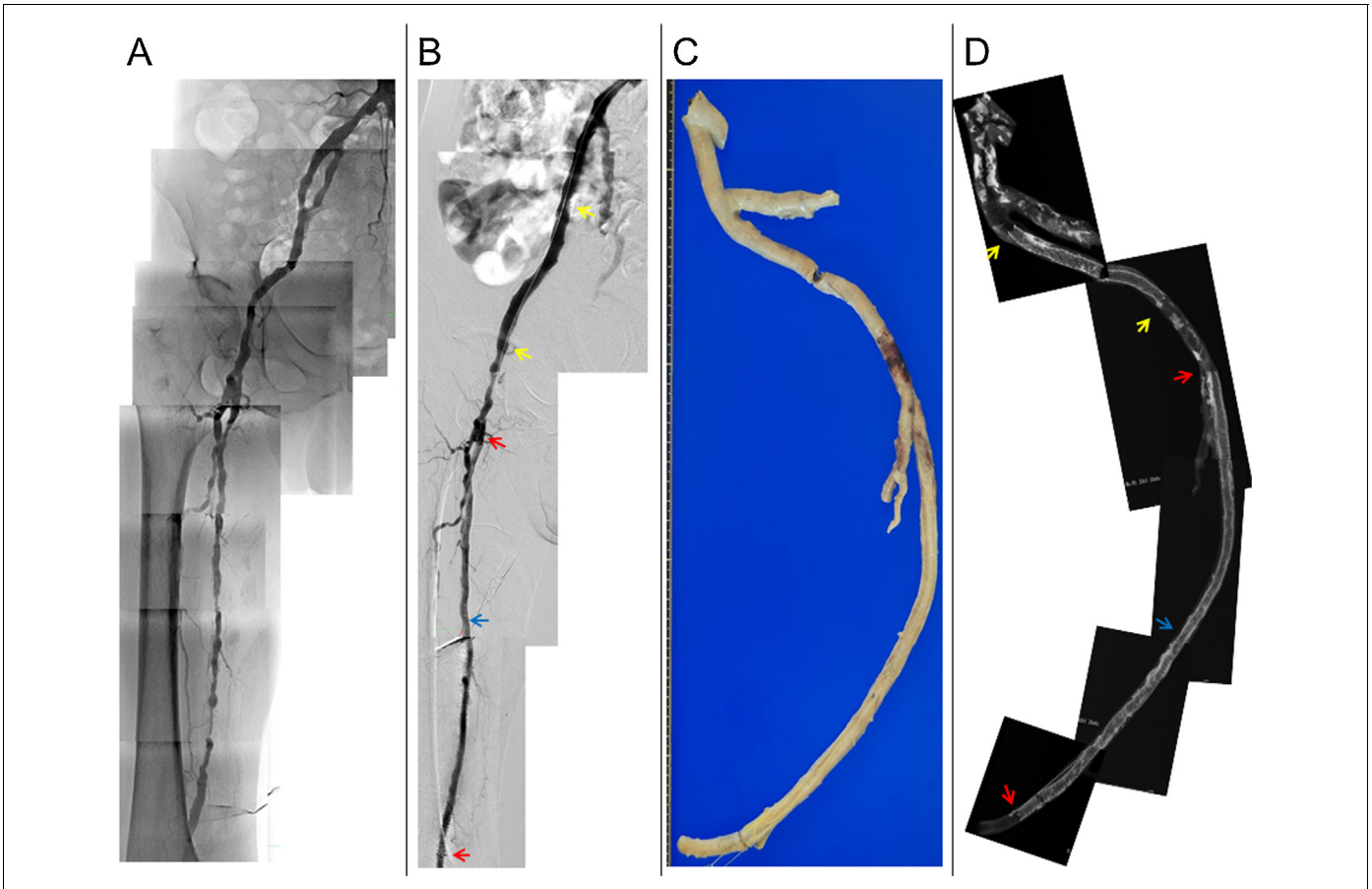

Fig. 1. Images of peripheral artery pre- and post-endovascular therapy (EVT) and postmortem Images 81 days after implantation. (A) Aortic angiography (AOG) pre-intervention. AOG revealed severe stenosis of the right external iliac artery (EIA) and superficial femoral artery (SFA). (B) AOG post-intervention. Two bare-metal stents (BMS) (SMART Control 8.0 mm × 150 mm) were implanted in the right SFA (between red arrows, blue arrow: overlapping site) and a BMS in the right EIA (Epic 8.0 mm × 100 mm, between yellow arrows). (C) Macroscopic postmortem image of right peripheral artery 81 days after EVT. (D) Soft X-ray image of the right peripheral artery 81 days after EVT (between yellow arrows, Epic stent; between red arrows, two SMART stents; blue arrow, overlapping site).

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