Does the Stent Implantation Increase Perivascular and Vascular Inflammatory Responses?: Case Report

Stent İmplantasyonu Perivasküler ve Vasküler İnflamasyonu Arttırır mı?

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ABSTRACT Coronary stenting appears to cause a severe arterial injury and an intense inflammatory response within the vessel wall. We report case of a 50 year old female patient with two bare metal stents implants on left anterior descending coronary artery who developed ischemic cardiomyopathy and eventually underwent an orthotopic heart transplantation. After the transplantation microscopic evaluation of the samples obtained from the native heart revealed dominance of lymphocytes within the mononuclear inflammatory cells in the proximal part of the left anterior descending artery (LAD) (which included the stent) and dominance of plasma cells within the mononuclear inflammatory cells in the middle third of the LAD.

Key Words: Cardiomyopathies; inflammation; transplants

ÖZET Koroner stent işleminin ciddi arteryel yaralanmaya, arteriyel damar duvarı içinde ve çevresinde inflamatuar yanıt oluşumuna sebep olduğu görülmüştür. Elli yaşında kadın hastaya akut anterior miyokard infarktüsü sonrası sol ön inen koroner arterine (LAD) iki adet metal stent işlemi uygulanmış ancak sonrasında iskemik kardiyomiyopati gelişmiş olan hastaya hastanemizde ortotopik kalp nakli yapılmıştır. Bu hastadan elde ettiğimiz örnekleri olgu sunumu olarak raporlaştırdık. Transplantasyon sonrasında nativ kalp dokusundan elde ettiğimiz örneklerin mikroskobik değerlendirmesinde, LAD'nin proksimal kısmında (stentin uygulandığı segment) dominant olarak mononükleer inflamatuar hücreler ve ağırlıklı lenfosit hücrelerinin bulunduğunu, LAD'nin orta ve distal kısmında (stentin bulunmadığı kısım) ise başlıca mononükleer hücreler içinde plasma hücreleri bulunduğunu tespit ettik.

Anahtar Kelimeler: Kardiyomiyopatiler; inflamasyon; transplantlar

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Over the years use of coronary stents has rapidly increased and is now used worldwide for treatment of coronary artery disease. Since their introduction in 1987, intracoronary stents have been used almost routinely in percutaneous coronary revascularization.[1] After the advent of percutaneous coronary intervention (PCI), increased stent performance has also encouraged a more aggressive treatment in patients with diffuse lesions and multivessel disease.[2] The presence of these intracoronary foreign bodies might induce an inflammatory reaction and have possible functional and structural repercussions for the coronary artery and surrounding cardiac muscle.

CASE REPORT

A 50 year old female patient with a positive family history of cardiac disease and smoking was admitted to our hospital with a diagnosis of acute anterior myocardial infarction. Two bare metal stents (3x22 mm and 3x12 mm) were implanted into the proximal part of the LAD (Figure 1). No occlusions were identified in any of the other coronary arteries (Figures 1, 2). Three months postoperatively, the patient presented with complaints of dyspnea, orthopnea and swelling of the legs. Echocardiography revealed an ejection fraction of 20%, second degree mitral insufficiency, second-third degree tricuspid insufficiency and pulmonary hypertension of 45 mmHg. Following revision of her drug treatment, the patient underwent implantable cardioverter defibrillator (ICD) implantation. A decision for orthotopic heart transplantation was made at the cardiology-cardiovascular surgery multidisciplinary meeting, and successfully performed three months later.

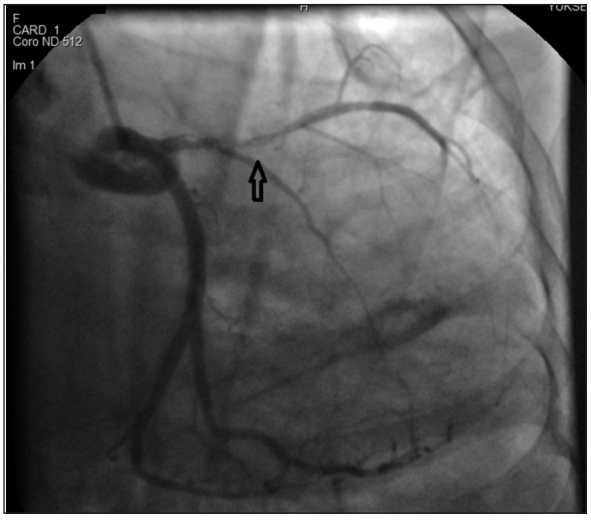

FIGURE 1: Angiographic view of the LAD and Cx. Arrow shows atherosclerotic segment of the LAD.

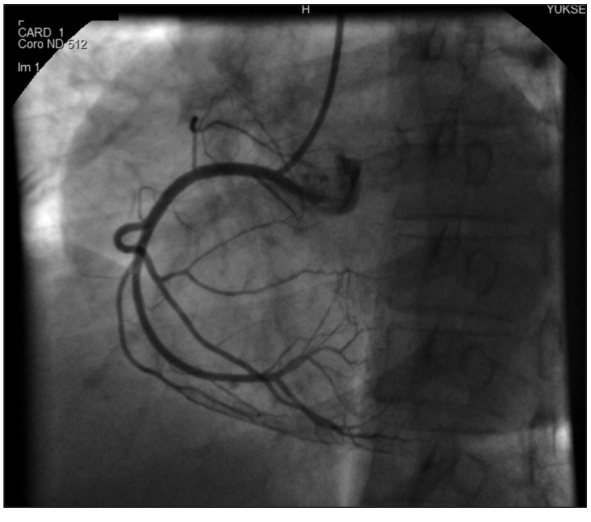

FIGURE 2: Angiographic view of the right coronary artery.

Written consent for pathological investigation of the native heart was obtained from the patient and her relatives. Following extraction of the native heart, the LAD, circumflex and the right coronary artery along with the surrounding epicardium, plus some myocardial and fat tissue were excised. The LAD was divided into 3 segments; proximal, middle and distal. The stent was removed within the proximal segment. The other coronary arteries were divided into 2 segments and the specimens sent to the pathology department.

The samples obtained from the patient were sent to the pathology laboratory conserved in formaldehyde solution. The samples were prepared using hematoxylin-eosin dye. Microscopic evaluation revealed dominance of lymphocytes within the mononuclear inflammatory cells in the proximal part of the LAD (which included the stent) in each magnified field (Figure 3) and dominance of plasma cells within the mononuclear inflammatory cells in the middle third of the LAD (Figure 4). Inflammatory cells were not seen in the samples prepared from the distal part of the LAD, circumflex and right coronary arteries (Figure 5).

DISCUSSION

Coronary stenting appears to cause a more severe arterial injury and a more intense inflammatory response within the vessel wall than other modalities of percutaneous interventions.[3,4] Balloon and stent placement causes arterial over distension and vascular injury. This acts as a potent stimulus for proliferation of smooth muscle cells and neointimal hyperplasia.[5] However, the vascular injury caused by placement of a coronary stent is more aggressive. The rate and duration of cellular proli-

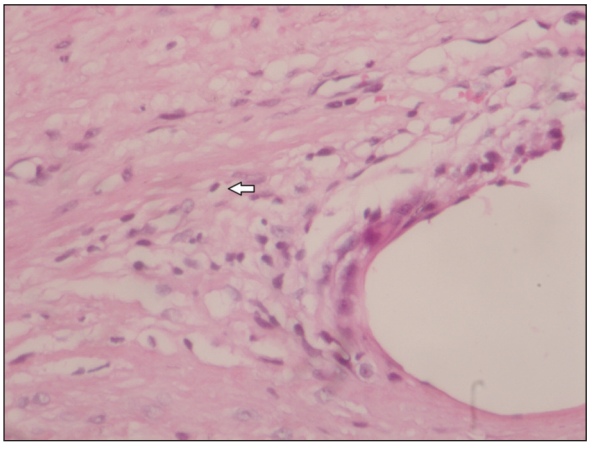

FIGURE 3: Microscopic views of the samples obtained from the proximal part of the LAD. Arrow shows mononucleer inflamatuar cells.
(See color figure at
http://www.turkiyeklinikleri.com/journal/cardiovascular-sciences/1306-7656/)

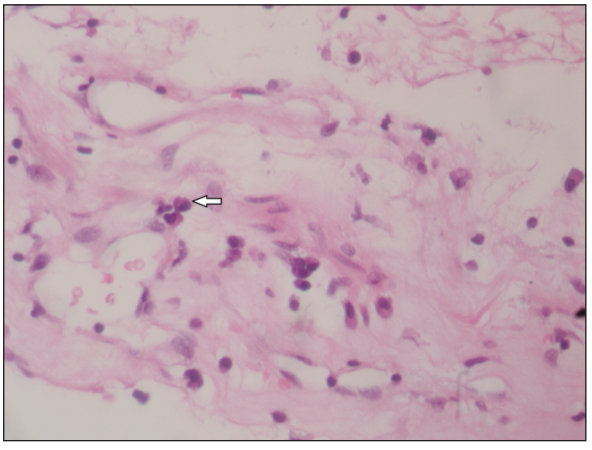

FIGURE 4: Microscopic views of the sample obtained from the middle part of the LAD. Arrow shows mononucleer inflamatuar cells.
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feration following stenting exceeds those of balloon angioplasty as the stent struts cause focal deep vascular trauma. The stent applies prolonged mechanical strain on the coronary artery wall, thus further potentiating cellular proliferation. The effects of residual foreign material after stenting includes chronic inflammation.[6]

Farb and colleagues demonstrated that fibrin, platelets, and acute inflammatory cells were mostly present in association with stent struts eleven days after stenting. Chronic inflammation was also commonly observed adjacent to the struts, especially more than 12 days after stenting.[7] Our case revealed dominance of inflammatory cells in the proximal part of the LAD, containing the stent, and middle third of the LAD. However, inflammatory cells were not seen in the distal part of the LAD, circumflex and right coronary arteries.

Gomes et al. studied arterial specimens obtained from 6 patients who had previously undergone stent implantation. All the specimens revealed an inflammatory process with leucocyte infiltration of the intimal and medial layers. The authors concluded that the vessel wall structure of those patients who had previously undergone stent implantation was visibly weaker and more fragile.[2]

A striking implication of stent inflammatory reaction is related to endothelial function. Caramori and associates studied patients treated with coronary intervention for isolated proximal left anterior descending stenosis at least 6 months previously, and found no evidence of restenosis. They showed that severe coronary endothelial dysfunction occurred long-term after stenting as compared with balloon angioplasty or atherectomy. This suggests that significant acceleration of coronary artery disease can be seen distal to the stent.[8]

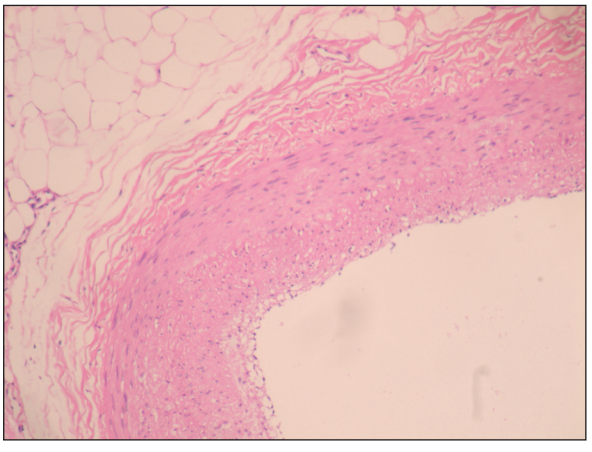

FIGURE 5: Microscopic views of the samples obtained from the distal part of the LAD, right coronary artery and circumflex.
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In conclusion, the presence of an intracoronary stent induces an acute and chronic inflamma-

tory reaction, with involvement of the distal coronary artery and surrounding myocardium. Further studies are necessary to assess the extent of the inflammatory process and its consequences. Furthermore, based on these findings, the operative technique used may require modification.

REFERENCES

1. Sigwart U, Puel J, Mirkovitch V, Joffre F, Kappenberger L. Intravascular stents to prevent occlusion and restenosis after transluminal angioplasty. N Engl J Med 1987;316(12):701-6.
2. Gomes WJ, Giannotti-Filho O, Paez RP, Hossne NA Jr, Catani R, Buffolo E. Coronary artery and myocardial inflammatory reaction induced by intracoronary stent. Ann Thorac Surg 2003;76(5):1528-32.
3. Kollum M, Kaiser S, Kinscherf R, Metz J, Kübler W, Hehrlein C. Apoptosis after stent implantation compared with balloon angioplasty in rabbits. Role of macrophages. Arterioscler Thromb Vasc Biol 1997;17(11):2383-8.
4. Hofma SH, Whelan DM, van Beusekom HM, Verdouw PD, van der Giessen WJ. Increasing arterial wall injury after long-term implantation of two types of stent in a porcine coronary model. Eur Heart J 1998;19(4):601-9.
5. Karas SP, Gravanis MB, Santoian EC, Robinson KA, Anderberg KA, King SB 3rd. Coronary intimal proliferation after balloon injury and stenting in swine: an animal model of restenosis. J Am Coll Cardiol 1992;20(2):467-74.
6. Orford JL, Selwyn AP, Ganz P, Popma JJ, Rogers C. The comparative pathobiology of atherosclerosis and restenosis. Am J Cardiol 2000;86(4B):6H-11H.
7. Farb A, Sangiorgi G, Carter AJ, Walley VM, Edwards WD, Schwartz RS, et al. Pathology of acute and chronic coronary stenting in humans. Circulation 1999;99(1):44-52.
8. Caramori PR, Lima VC, Seidelin PH, Newton GE, Parker JD, Adelman AG. Long-term endothelial dysfunction after coronary artery stenting. J Am Coll Cardiol 1999;34(6):1675-9.