Immediate and Six Months Clinical and Angiographic Results of Intra-Coronary Ephesos Stent Implantation

İNTRAKORONER EPHESOS STENT UYGULAMALARININ ERKEN DÖNEM VE ALTI AYLIK SONUÇLARI

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Özet

Amaç: Bu çalışmada semptomatik koroner arter hastalığında Ephesos stent uygulamalarının klinik ve anjiyografik sonuçlarını incelemek amaçlanmıştır. Ephesos stent, yeni, balon expandıbl, paslanmaz çelikten yapılmış ve multisellüler dizaynı olan bir stenttir.

Gereç ve Yöntemler: Ağustos-2001ve Şubat 2003 tarihleri arasında, kliniğimizde randomize 137 hastada Ephesos stent kullanılımı tercih edilmiş, 7 hastada kılavuz tel ile geçilemediği için stent yerleştirilememiştir. Takip döneminde 20 hastadan klinik ve anjiyografik veri elde edilememiş ve hastalar çalışma dışı bırakılmıştır. Bu çalışmada başarılı bir şekilde intrakoroner Ephesos stent yerleştirilen, klinik ve anjiyografik takiplerin yapılabildiği 110 hastanın 163 lezyonuna ait sonuçlar incelenmiştir. Hastaların çoğu kararsız angina pektoris (%63) tanısı ile yatırılmıştı. İncelenen lezyonların %36.7'si B ve C tipi idi. Hastalardan hiçbirisinde stentin yerleştirilememesi veya akut-subakut stent trombozu gibi bir problem izlenmedi. Hastalardan 2' sinde hastane içi dönemde non-Q MI gelişti.

Tartışma: 6 aylık olaysız yaşama oranı %77.3 olarak saptandı. Altı aylık takipte hastaların hiç birinde ölüm kaydedilmezken, 2 hastada non-Q MI, 3 hastada da Q-MI gözlendi. Bu hastalar anti-iskemik ve anti-agregan ilaçlarını kullanmamış ve terk ettikleri sigara alışkanlığına geri dönmüşlerdi. Yüzon hastaya kontrol koroner anjiyografi yapıldı. Anjiyografik restenoz oranı %18.1, klinik restenoz oranı %24,5 olarak saptandı. Toplam 25 hastada tekrar başarılı balon dilatasyon yapıldı.

Sonuçlar: Bu sonuçlar, yüksek riskli hastaları da içeren nativ koroner arter hastalığı tedavisinde, Ephesos stentin, restenoz oranı ve istenmeyen önemli kardiyak olay sıklığının düşük olması nedeniyle güvenle kullanılabileceğini göstermiştir.

Anahtar Kelimeler: Efesus stent, olaysız yaşam, restenoz

Abstract

Purpose: This study was conducted to evaluate the clinical and angiographic results of the Ephesos stent implantation in patients with symptomatic coronary artery disease. Ephesos stent is a new balloon-expandable, stainless steel, tubular stent with multicellular design.

Material and Methods: Between August 2001 and February 2003, Ephesos stent was selected for treatment of critical coronary artery disease in 137 patients. The lesions could not be passed through in 7 patients. The follow-up data of twenty patients were lost and these patients were excluded from the study. Study group was consisted of 110 patients with native coronary artery disease. The Ephesos was implanted in 110 patients with 163 de novo lesions.

Results: Most of the patients had unstable angina (%63.6), and 36.7% of lesions were type B and C. Mean lesion length was 12.7±4.7, and 62 % of lesions were < 3 mm in reference lumen diameter. Neither stent deployment failure nor acute-sub acute stent thrombosis occurred. 2 patients had non-Q-wave myocardial infarction during hospital stay. The 6-month event-free survival rate was 77.3%. No patients died during six months follow-up. 2 patients had non-Q MI and 3 patients had Q-MI within six months. Control angiographic data was obtained in 110 patients. Angiographic restenosis rate was 18.1%. Clinical restenosis rate was 24,5%. Twenty five patients had repeat target lesion balloon dilatation.

Conclusion: This results shows that Ephesos stent is a safe and effective choice with low incidence of major adverse cardiac event and restenosis rate within six months follow-up period for the prevention of restenosis in these relatively high-risk patients.

Key Words: Ephesos stent, event-free survival, restenosis

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The development and widespread use of coronary stents has probably been the single most significant advance in the field of interventional cardiology over the last 10 years. The use of a stent at the time of coronary artery dilatation is now carried out in more than 70% of all intra-coronary angioplasty procedures and so, in many ways,

coronary angioplasty has become coronary stenting. Despite this achievement, coronary stenting is still perceived as a relatively immature technology. There is still very significant and important debate concerning its exact role. Stent designs, stent technologies and stent coatings continue to challenge the interventional cardiologist to try and utilize them to their best ability. The increased cost of stenting represents financial challenges that have been taken up to a greater or lesser extent in different health-care systems and countries (1).

The Ephesos stent (Nemed Corporation, Istanbul, Turkey) is a new balloon-expandable, stainless-steel, tubular stent. We evaluate the immediate and long-term clinical and angiographic results following Ephesos stent implantation in patients with native coronary artery disease.

Material and Methods

Patients

Patients were consecutively selected for enrolment if there was symptomatic coronary artery disease or positive functional testing, and angiographic evidence of single- or multi-vessel disease with a target lesion stenosis of ≥75% in a ≥2.5 mm vessel. Patients were excluded if there was left main disease (≥50%), recent myocardial infarction (MI) (≤7days), contraindications to anti-platelet therapy, or ≥ 3 stents needed for 1 target site. The protocol of the study was approved by the Ethical Committee of Scientific Research Programmes of Abant İzzet Baysal University Düzce Medical School. An informed consent form was read and signed by every patient.

Stent description and implantation

The Ephesos stent is a variable size long, stainless-steel, laser-cut, tubular, slotted-tube multicellular device mounted on a customized, non-compliant, polyethylene terephthalate (PET), non-tapered balloon with a short balloon overhang (0.5mm). In the unexpended state, the crossing profile is 0.048". All of the stents used were first generation type.

Procedures were performed using standart angioplasty tecnique with an 8 French (Fr) guiding catheter via the femoral artery approach. A bolus of 100 IU/kg of heparin was administered intra-arterially after insertion of the vascular access sheath. Target lesions were initially treated with appropriate balloon dilatation. The reference diameter of target vessel was estimated visually, and stent size was determined based on a stent-to-artery ratio of 1.1:1 to 1.2:1. The stents were deployed at 8-14 atmospheres (atm.) and high-pressure balloon inflation (to 14 atm.) was then applied with a non-compliant short balloon to avoid distal dissection.

Post-procedure medication protocol and medication and follow-up

After successful stent implantation, heparin was not routinely administered unless there was a clinical indication, such as a large residual dissection. Femoral sheaths were removed 4-6 hours after the procedure. Aspirin 100-300 mg once daily and ticlopidine 250 mg twice daily were continued for 4 weeks and aspirin was there after 100-300 mg once daily indefinitely. Electrocardiograms (ECG) were recorded immediately post-procedure, then daily before discharge. If the patient had recurrent chest pain post-procedure CK-MB level was measured and additional ECG was performed. The majority of patients were discharged 2 days post-procedure. Follow-up coronary angiography was performed at 6 months, or earlier if clinically indicated.

Angiographic analysis

Quantitative coronary angiographic analysis was performed at Angiographic Laboratory of Cardiology Department of Duzce Medical Faculty of Abant izzet Baysal University using the quantitative coronary analysis system (AET-med S.P.A., Italy). Angiographic measurements were obtained during end-diastole using the image that showed the greatest narrowing, without overlap and with the least degree of foreshortening. Intra-coronary nitroglycerin was administered at baseline and final angiography. Measurements of the reference vessel diameter, minimal lumen diameter (MLD)

and percent diameter stenosis were determined by average of 2 orthogonal views. The index reference diameter was the average of proximal and distal reference vessel diameters. Lesion length was measured on the baseline angiography using the "shoulder-to-shoulder" definition. Lesions were characterized according to the modified American College of Cardiology/American Heart Association (ACC/AHA) classification. Changes in MLD were expressed as acute gain (post-procedural MLD minus pre-procedural MLD), late loss (post-procedural MLD minus 6-month follow-up MLD), net gain (acute gain minus late loss), and loss index (late loss/acute gain). Angiographic restenosis was defined as re-narrowing of target lesion > 50% based on a single worst view. Clinical restenosis rate was defined as the major adverse coronary events (acute coronary syndrome, AMI, stroke and revascularisation need) seen during the follow-up period. Q-wave myocardial infarction was defined as the development of new abnormal Q-waves not present at the baseline in association with CK-MB enzyme elevation of three times the upper normal limit and non-Q wave myocardial infarction was defined as CK and CK-MB elevation of three times the upper normal limit.

Data collection and statistics

Demographic, clinical and technical data were prospectively entered into a computerized database. All patients were interviewed and examined monthly. Follow-up coronary angiography was performed 6 months after the procedure. If a revascularization procedure involving the target site had been performed before the 6-month angiography, the findings of the most recent angiography (≥ 2 months after the initial procedure) were used as data for follow-up angiography.

Statistical analysis was performed with SPSS 8.0 for Windows (Statistical Package for Social Sciences). Continuous variables are expressed as mean±SD. Restenosis was considered as a categorical variable and categorical variables were compared using the chi-square test (diabetes mellitus, hyperlipidemia, lesion complexity, and stent size of 3.5 mm or more vs. smaller stents).

Results

From August 2001 to February 2003, 137 patients were selected as non-randomised fashion to intracoronary Ephesos stent implantation. Stent was not successfully implanted for 7 patients because of the inability to pass through the lesion by the guide wire. Successfully clinical and angiographic follow-up data were achieved about patients with Ephesos stent in 110 patients for 163 different lesions. Baseline clinical and angiographic data of the patients are summarised in Table 1. There was a high proportion of patients with hypertension (40%) and unstable angina (63,3%). Prevalence of patients with diabetes mellitus was 21,8%. 36,9% of patients had type B and C lesions according to ACC/AHA classification (Table 1). Angiographic characteristics of the study group are shown in Table 2.

Mean reference lumen diameter was 2,74±0,42 mm and overall 62% of the lesions were under 3 mm in diameter. In 7 cases the lesions could not be passed through with the guide wire among 137 patients. Procedural success rate was 94.8%. No stent deployment failure occurred (device success rate was 100%). The mean pressure used for stent deployment was 11,4±2,6 atm. The acute gain was 1,43±0,48 mm. Direct stenting was feasible in 52 (40%) patients and predilatation of lesions were performed in 60% of patients using undersized balloons (2 mm in diameter and 20 mm in length) by an average pressure of 8 atm for 60

Table 1. Baseline clinical characteristics (n=110)

Characteristics	Number (%)
Age (years)	57.8±11.4
Male	85 (62.5)
Hypertension	44 (40)
Diabetes Mellitus	24 (21.8)
Hyperlipidemia	36 (32.7)
Current smokers	32 (29)
Prior myocardial infarction	34 (30.9)
Prior coronary angioplasty	10 (9)
Prior coronary artery bypass grafting	8 (7.2)
Unstable angina	70 (63.6)
Multivessel disease	32 (29)

Table 2. Baseline angiographic characterics in 110 patients (n=163 lesions)

Characteristics	Number (%)
Target coronary artery	
Left anterior decending artery (LAD) only	63 (38.6)
Left circumflex artery (CX) only	24 (14.7)
Right coronary artery (RCA) only	44 (26.9)
LAD+RCA	8 (4.9)
LAD+CX	13 (7.9)
CX+RCA	6 (3.6)
LAD+CX+RCA	5 (3)
Lesion morphology	
Eccentricity	94 (57.6)
Irregularity	34 (20.8)
Calcification	23 (14.1)
Angulation	18 (11)
Tortuosity	10 (6.1)
Bifurcation	4 (2.4)
Total occlusion	0 (0)
Lesion complexity (ACC/AHA)	
A	103 (63.1)
B1	48 (29.4)
B2	9 (5.5)
C	3 (1.8)

seconds. Any events such as stent lost, stent dislocation or balloon burst before optimal deployment, acute or sub-acute stent thrombosis did not occur. Six months control angiography could be performed in 84.6% of the patients. (Quantitative angiographic follow-up data were obtained in 110 patients at an average of 180±23 days). The binary restenosis rate (≥50% stenosis at six months follow-up) was 18,1%. The analysis of restenosis rate according to the lesion type revealed that, restenosis in type A, B and C lesions were 10,6% (11/110), 12,3% (7/57) and 66% (2/3), respectively. Data demonstrated a 1,84±0,46 mm maximum lumen diameter at the end of the study (Table 3).

Early and late clinical outcomes of the patients are shown in Table 4. None of the patients were lost during the procedure and all of them were alive at the end of the six-month follow-up period. Two patients had acute MI (one Q-wave and one non-Q-wave) in hospital stay after the procedure. They were treated by urgent balloon angioplasty. In late follow-up time 2 patients had non-Q MI and 3 patients had Q-wave MI. The patients with non-Q wave MI and one patient with Q wave MI had repeated balloon angioplasty. 2 patients with Q wave MI could not be performed angioplasty due to late admission. All other patients were major cardiac event-free during the overall follow-up time. 25 (22.7%) of the patients were undergone target vessel revascularisation at the end of six month. Angiographic restenosis rate was (20/110) 18,1% and clinical restenosis rate was (27/110) 24,5%.

Table 3. Peri-procedural and 6-month angiographic characteristics (n= 163 lesions)

Characteristics	Pre-procedure	Post-procedure	6-month
Reference lumen diameter (mm)	2.74±0.42	2.85±0.28	2.70±0.34
Reference diameter < 3mm (%)	62	60	76
Minimum lumen diameter (mm)	1.02±0.46	2.42±0.33	1.84±0.46
Percent diameter stenosis (%)	82±16	16±4	34±14
Lesion length (mm)	12.7±4.7	--------	----------
Maximum inflation pressure (atm)	----------	11.4±2.6	-------
Binary restenosis (>50%)	----------	---------	20(%18.1)
Pattern of restenosis (%)			
Focal (<10mm in length)	-----	---------	12(60%)
Diffuse (≥10mm in length)	---------	--------	8(40%)
Acute gain (mm)	-------	1.43±0.48	----------
Late loss (mm)	----------	----------	0.72±0.44
Loss index			0.46±0.34

Table 4. Clinical outcomes for patients (n=110)

Events	Number (%)
Early	
Composite primary endpoint	
Death	0
Non-Q wave MI	1(0.9%)
Q-wave MI	1(0.9%)
Target vessel revascularization	2(1.8%)
Late (31-180 days)	
Composite primary endpoint	
Death	0
Non-Q wave MI	2(1.8%)
Q-wave MI	3(2.7%)
Target vessel revascularization	20(18,1%)
All (0-180 days)	
Composite primary endpoint	
Death	0
Non-Q wave MI	2(1.8%)
Q-wave MI	3(2.7%)
Target vessel revascularization	25(22.7%)
Angiographic restenosis rate	20(18,1%)
Clinical restenosis rate	27(24,5%)

Discussion

The search for a better stent continues since randomised trials demonstrated that stents were able to reduce restenosis rates with respect to percutaneous transluminal angioplasty (1). Beyond application of new technologies in stent production such as drug-elution, self-expansion or biodegradable product usage; newer conventional stent generation goes on. Ephesos is one of these and it is available for clinical practice for about four years in Turkey. To our knowledge, there is only one single centre experience with this stent in the literature but it is not English language. Batyraliev et al. evaluated Ephesos stent in 168 patients with 198 lesions and reported the restenosis rate as 12% and target vessel revascularisation as 12.1% at six month's follow-up (6). Niiazova-Karben et al. from the same centre evaluated the usage of Epheos stent in 23 patients with acute myocardial infarction complicated with cardiogenic shock and stents were deployed successfully in all patients (7).

In our patient group, neither stent deployment failure nor acute-subacute stent thrombosis occurred. 2 patients had non-Q-wave myocardial infarction during hospital stay.

The 6-month event-free survival rate was 77.3%. No patients died during six months follow-up. 2 patients had non-Q MI and 3 patients had Q-MI within six months. Control angiographic data was obtained in 110 patients. The loss index was 0.46±0.34. Angiographic restenosis rate was 18.1%. Twenty five patients with restenosis had repeat target lesion revascularization.

Many different stents were evaluated by the investigators and the results were published in the last decade. Our results; device and procedural success rates, lesion length, diameter and complexity were comparable with these data (2-10). During the follow-up period, 22.7% of the patients had re-revascularisation of the target vessel, which is moderately high, possibly because of the differences in the patient's cohort with respect to lesion characteristics. Angiographic restenosis rates were also compatible with the previous data (5-10).The angiographic restenosis rates reported in BENESTENT 2 and MIAMI trials were 16% and 22%, respectively (8-10). This is especially important when the baseline characteristics of the patients were concerned, in which 21,8% of them had DM and 62% had a reference lumen diameter of <3 mm. The results of this study indicate a potential benefit of Ephesos stent for the prevention of stent thrombosis and restenosis in these relatively high-risk patients.

Study limitations: This study is an open, non-randomised, single-centre; prospective trial and we conclude that Ephesos stent is a safe and effective choice with low incidence of major adverse cardiac event and restenosis rate within six months follow-up period. Other limitations are absence of comparison with reference stents such as Palmaz-Shatz stent and absence of intravascular ultrasound analysis. But, our results should be compared with larger-scale, randomised studies with other stent types.

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