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Review Article

Choice of Drug Eluting Stent: A Review

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Abstract: The development of stent has been a major achievement in treating obstructive coronary artery disease (OCAD). The main obstacle in the long term success of percutaneous coronary intervention (PCI) was the neo-intimal hyperplasia developed within the stent, which may leads to instent restenosis. The introduction of Drug-eluting stents (DES) shows steep decrease in angiographic restenosis when compared with bare metal stent. The ability of DES to prevent the restenosis after balloon angioplasty reduces the complications associated with sub acute stent thrombosis and late stent restenosis by decreasing the incidence of MI. The coating of bioabsorbable polymers on DES enhances antiproliferative drug release. This review article reveals various types of drug eluting stents and their comparison with bare metal stents.
Keywords: Bare-metal stents, Drug-eluting stents, Brachytherapy

INTRODUCTION

Drug-eluting stents (DES) introduced for the in stent restenosis after cardiac catheterization and coronary angiographic technology. The major drawback of coronary balloon angioplasty includes the risk of uncontrolled plaque disruption further lead to periprocedural coronary occlusion and MI. After introducing metallic mesh there is a significant progress in the prevention of restenosis after BA. The complications associated with sub acute stent thrombosis (SAT) and late instent restenosis (ISR) are encountered with bare metal stents. There is a remarkable progress in ISR with brachytherapy and the clinical trials also show a high successful rate on DES technique [1].

ROLE OF DRUG-ELUTING STENTS

The terms DES and BMS are coined with the hard outcomes of death or myocardial infarction (MI), both in the short- as well as the long-term (fig. 1). The primary role of DES is to reduce the restenosis rate by decreasing the clinically driven TLR rate, with less incidence of the risk of death or MI. This has been compared with a net clinical benefit of DES use and to BMS.

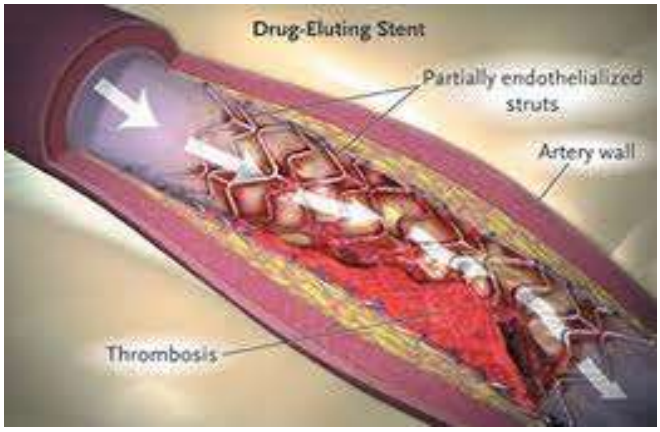

Fig.1: Drug eluting stent

IMPORTANCE OF RESTENOSIS

Acute coronary syndrome is the major presentation of restenosis, relatively only 25% present as chronic

stable angina. Percutaneous coronary intervention (PCI) outcomes for restenotic lesions are not as good as for de novo lesions. Concisely a lower overall risk of restenosis with the use of a DES produces improved PCI outcomes [2].

EFFICACY OF DRUG-ELUTING STENTS

Clinical trials have extensively evaluated: (1) DES versus BMS, (2) off-label versus on-label DES use, and (3) various DES in comparison to each other [3].

DRUG-ELUTING STENTS VERSUS BARE-METAL STENTS

Multiple randomized trials and 2 large meta-analyses have yielded a strong evidence of benefit with DES compared to BMS, in terms of reduction in clinically-driven TLR. The largest meta-analysis examined >18,000 patients from 38 randomized controlled trials (RCTs) having undergone onlabel PCI and follow- up for 4 years. A significant reduction in TLR with DES use was noted in comparison to BMS.

DRUG-ELUTING STENTS USE IN OFF-LABEL INDICATIONS

Off-label use includes patients with small vessels,long lesions, ostial lesions, restenotic lesions, left main artery lesions, and saphenous venous graft lesions. Studies have shown that DES are associated with higher MACE in off-label compared to on-label use. Data from DESs in patients in a real world setting (DEScover) and evaluation of DESs and ischemic events (EVENT) Registries suggest worst outcomes when DES are used for off-label use (figure 2). Thus, DES are less effective in off-label use but not worse and still better than BMS. It seems the reasons for poorer outcomes with DES use in off-label indications are more related to the patient, vessel or lesion characteristics, rather than the specific shortcomings of DES [4].

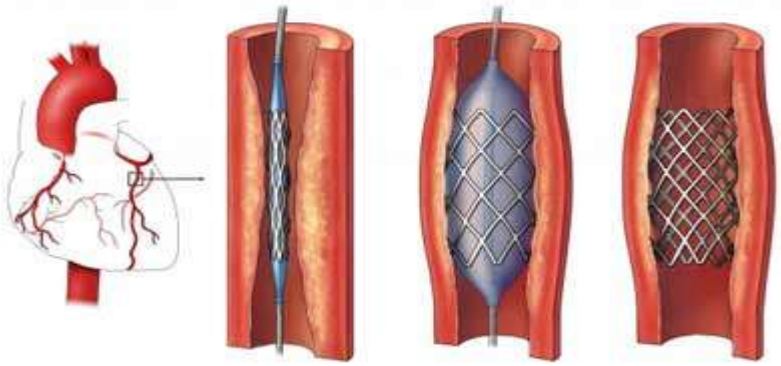

Figure 2: DES inside the arteries

COMPARISONS AMONG DES—FIRST GENERATION STENTS

The first two DES approved were Sirolimus-eluting stents (SES) and paclitaxel-eluting stents (PES). The advantage of SES in preventing restenosis is documented in the Randomized study with the sirolimus-eluting VElocity balloon-expandable stent in treating patients with de novo native coronary artery lesions (RAVEL), SIRIUS,and Stenting Coronary Arteries in Non-Stress/Benestent Disease (SCANDSTENT) trials and the Rapamycin-eluting Stent Evaluated at Rotterdam Cardiology Hospital (RESEARCH) registry.

SIROLIMUS-ELUTING STENTS VERSUS PACLITAXEL-ELUTING STENTS

Comparison of SES and PES have illustrated lower restenosis rates and late lumen loss with SES in randomized clinical trials (RCTs) like REALITY (a prospective, randomized, multicenter comparison of the Cypher sirolimus-eluting and the Taxus PES systems) and SIRTAX (randomized comparison of a sirolimus-versus a paclitaxel-eluting (Taxus) stent for coronary revascularization) . The most recent and largest comparative trials of SES and PES are the SORT-OUT II trial involving 2098 real world patients. It found no statistically significant difference between the SES and PES groups in the primary risk of death or MI. The nondiabetic population has clearly lower TLR rates with SES especially in group of patients with higher risk for restenosis like small vessels, long lesions, etc. [5, 6].

SECOND GENERATION STENTS

The zotarolimus-eluting (Endeavor) and the everolimus-eluting stents (EES) (Xience/Promus) approved in 2008 and are often called the second generation DES. These stents have a cobalt chromium platform; and are thinner and more flexible than the first generation stents. Biocompatible polymers offers reduced inflammatory response than the first generation durable polymer (DP) stents.

ZOTAROLIMUS-ELUTING STENTS (ZES)

The ENDEAVOR program compared ZES with BMS, PES, and SES. Overall assessment emerged that ZES was superior to BMS and inferior to SES and PES with respect to the angiographic LL. In terms of clinical outcomes however, ZES is comparable to PES and appears to have similar or improved safety but higher TLR rates. The trial showed that ZES was prior to EES for the primary endpoint of target vessel failure (TVF)

and also late lumen loss. There were similar rates of MACE and TLR for 2yrs in the 2 groups. Stent thrombosis rates were not significantly different in the two stents.

NEWER DRUG-ELUTING STENTS

The second generation EES and ZES have a DP remaining on the stent after the drug is eluted. A risk of late stent thrombosis leads to the presence of polymer has been linked to vascular inflammation or delayed endothelialization and healing. Reducing the duration of vessel exposure to the polymer in order to minimize the risk of stent thrombus has given rise to the concept of bioabsorbable polymers. Optimal stenting techniques are essential so as not to lose the benefit of DES [7-9].

BIOABSORBABLE POLYMERS

The biocompatible polymer coatings on the first and second generation DES enhances antiproliferative drug release.it is thought that the more biodegradable polymers on the second generation stents offer less inflammation and greater degree of re-endotheliaztion compared to the first generation DES [10].

PRACTICAL CONSIDERATION IN DES USE DRUG-ELUTING STENTS OR BMS

Balloon angioplasty or BMS should be used in patients with high bleeding risk, inability to comply with 12 months of DAPT, or anticipated invasive or surgical procedures within the next 12 months, during which time DAPT may be interrupted. Risk benefit profile is most favorable for DES over BMS when the risk of restenosis or its consequences with BMS are unacceptably high (left main disease, small vessels, in-stent restenosis, bifurcations, diabetes, long lesions, multiple lesions, saphenous vein grafts) [11].

DRUG-ELUTING STENTS COST CONSIDERATIONS

The cost issues are also relevant in this context. Any of the rigorously tested DES which has a good efficacy and safety data if it is significantly lower in cost should be preferred over a BMS if there are no compelling indications like inability to take DAPT for long-term. In this context there is a place for some of the indigenously produced DES like the sirolimuseluting, supralimus-stent from Sahjanand Technologies and Yukon Choice from IVT. It would be however desirable to have better clinical long term data so that the claims of safety and efficacy are established [12].

CONCLUSION

The introduction of DES in PCI is an important achievement in interventional cardiology. DES drastically reduces the ISR rate in all patients in controlled clinical trials and real clinical practice. Advancements in drug delivery stent technologies exhibited gradual reduction in cost outcome in therapy of coronary artery disease.

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