

Left main bifurcation stenting: the impact of strut thickness on long-term outcomes

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Over the latest years, both randomized controlled trials (RCTs) and observational studies have provided solid basis for percutaneous coronary intervention as a treatment option for unprotected left main (LM) bifurcation coronary artery disease. A recent meta-analysis comparing the long-term outcome between LM bifurcation disease one-stent technique versus two-stent technique, the study has demonstrated that one-stent strategy resulted associated with both major adverse cardiac events and target lesion revascularizations (TLRs) lower rates but resulted equivalent to two-stent strategy in terms of cardiovascular mortality, target lesion failure and stent thrombosis (ST) even at one-year and three-year follow-up.^[1] However, previous analyses have mainly focused on the type of double stent strategy adopted, as well as bifurcation geometrical properties (*i.e.*, bifurcation angle, side branch length, and *etc*) or different biodegradable polymer. On the contrary, the impact of stents strut thickness has been generally neglected in current literature.

Cochrane Library, Embase, PubMed and Google Scholar were queried to locate RCTs comparing provisional versus up-front two-stent strategies for LM bifurcations lesions published between January 2004 and November 2020, including only studies clearly defining the type of stent used were included in the analysis. From a total of 287 articles, after excluding duplicates, 92 articles were eligible for review. After comprehensive full-text articles evaluation, three articles were included into our final review.^[2–4]

From our analysis, globally 602 patients (755 males, mean age: 65.3 years) received a dual stenting approach for the treatment of unprotected LM bifurcation lesions, with different technique. Stents struts thickness varied from 140 to 81 μm . At 30 days, only the EXCEL trial^[4] showed a cardiovascular death of 2.7%, while the DK crush V^[3] and CACTUS trial^[2] reported no events in the same follow-up period (Table 1). As showed in the Figure 1A, ST rate decreased with the decreasing of stent struts thickness among the three investigations. Similarly, the rate of TLR, which were available with the same definition in two of three, confirmed a decrease of events using thinner struts (Figure 1B). Notably, both the DK crush V^[3] and EXCEL trial^[4] also presented an analysis based on three-year follow-up: ST rate remained lower when using thin or ultrathin struts (0.4% vs. 1.6% for the DK crush V and EXCEL trial, respectively) compared when thicker struts stents were used.

The results of published CRTs on the treatment of LM bifurcation lesions seems to enforce the concept that leaving a scarce amount of metal layers at the carina of LM bifurcation after double stenting techniques may result in a more favourable short-term and long-term outcomes.^[5] This concept has been recently confirmed by different fluid dynamic analysis, which demonstrated that leaving the few metal at bifurcation significantly improved the rheological properties of the whole LM bifurcation after stenting.^[6] It is obvious that from a purely biomechanical and physiologic point of view, a thick strut impairs blood flow rheology much more than a thin strut in-

Table 1 Summary of the characteristics of the selected studies.

Trial	Year	Stent used, strut thickness	Mean age, yrs	Males	Double stenting techniques	Technique used	Cardiovascular death	Target lesion revascularization	Stent thrombosis
CACTUS trial ^[2]	2009	Cypher	65 ± 10	142 (80.2%)	177	Crush	0	1.7%	1.7%
DK crush V ^[3]	2017	Xience V, Endeavor Resolute, Firebird II	65 ± 9	199 (82.9%)	240	DK crush	0	0.4%	0.4%
EXCEL trial ^[4]	2018	Xience V	66.8 ± 9.3	141 (76.2%)	185	T, TAP, Culotte, Reverse crush	2.7%	NR	1.6%

Data are presented as means ± SD or *n* (%).

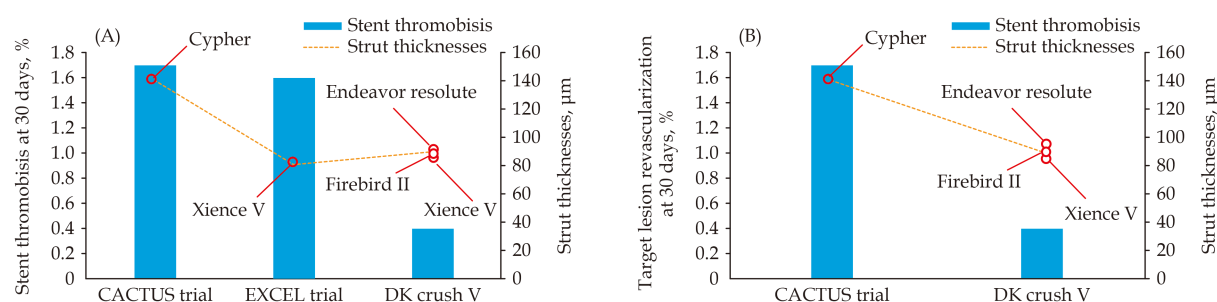


Figure 1 Histogram representation of the stent thrombosis (A) and target lesion revascularization (B) based on strut thicknesses.

independently from stent shape and design,^[7,8] inducing turbulences of the blood stream, thus increasing the chances of particle recirculation and favoring a nidus for thrombus allocation.^[9] These phenomena are intuitively amplified if long segments of metal layer are crushed or overlapped such as in culotte technique or classical crush or DK crush.^[10]

Obviously, different confounders may have a major impact on outcomes and remains difficult to assess the specific contribution of stent thickness, complex stenting techniques and length of the dual antiplatelet therapy in particular on mid-term and long-term target lesion failure and mortality.

However, our observations may represent an additional stimulus to keep open the debate on this issue, evidencing the need of further sub-analysis on existing and future trials in terms of stent struts, to assess the specific contribution of different stenting approaches in these patients.

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