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The influence of stent length on clinical and angiographic outcome in patients undergoing elective stenting for native coronary artery lesions

Final results of the Magic 5L Study

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Aims To prospectively evaluate the influence of stent length on 6 month clinical and angiographic outcome, in patients with native coronary lesions up to 45 mm in length, undergoing elective Magic Wallstent implantation.

Methods and Results On the basis of pre-procedural angiography, 276 patients (aged 61·3 ± 10·2 years; 78·6% male; 41·7% unstable angina) with a total of 302 lesions were prospectively assigned to one of five different length categories of Magic Wallstent. Angiography in multiple matched projections before and after implantation and at 6 months follow-up was analysed at the core laboratory. Primary end-points for the efficacy analysis were cumulative incidence of major adverse cardiac events and quantitative coronary angiography analysis 6 months after stent implantation. Magic Wallstent implantation was successful in 301 of 302 lesions and in 98·6% a residual stenosis <20% by online quantitative coronary angiography was achieved. At 30 days, 6·2% (1·8% subacute occlusion) of patients had experienced major adverse cardiac events, 27·5% at 6 months and 30·4% at 9 months. Angiographic restenosis occurred in 37%. Restenosis rates for the mini, extra-short, short, medium and long Wallstent groups were 25·9%, 25%, 22·6%, 36·2% and 67·5%, respectively. Multivariate analysis revealed stent length to be independently associated with greater angiographic restenosis and major adverse cardiac events.

Conclusions While shorter Magic Wallstents provided late outcomes comparable with short balloon-expandable stents, excessive restenosis with longer Wallstents should obviate their use in elective percutaneous intervention. Long coronary lesions provide a challenging substrate for emerging antirestenosis therapies, such as stent coatings and brachytherapy.

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Key Words: Long lesions, Magic Wallstent, restenosis, quantitative coronary angiography, multicentre trial.

Introduction

In 1986 the self-expanding Wallstent was the first stent to be implanted in human coronary arteries to treat acute vessel closure and late restenosis after angioplasty[1]. Over the past decade, it has been widely used in clinical practice, particularly for longer lesions and diseased bypass grafts[2–4]. A previous multicentre observational study with the second-generation 'less-shortening' Wallstent described favourable clinical and angiographic outcomes in a high-risk patient group, but showed that longer stents were associated with greater restenosis[5]. Since that study was not designed to evaluate the influence of stent length on outcome, the Magic 5L study was conceived to prospectively investigate the relationship between Wallstent length and late clinical and angiographic results. The safety and efficacy of the design could also be documented.

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Methods

The Magic Wallstent is a third generation stent, with a lowered profile (6 French compatible), higher radioopacity and an improved delivery system, to allow recapturing during deployment. It is available in five lengths, for lesions from 5–45 mm, and in four diameter derivations for vessels from 3·0–5·0 mm. The study was a prospective international multicentre registry using a unique design, whereby each of the five available stent lengths would be implanted in a minimum of 50 patients.

Eligible patients scheduled for percutaneous coronary intervention were assigned to the intended stent length on the basis of the pre-procedural angiogram. The study was centrally coordinated by an independent clinical coordinating centre and angiographic core laboratory (Cardialysis, Rotterdam, The Netherlands). Clinical follow-up was done at 1, 6 and 9 months after the procedure. Late restenosis was assessed at the 6 month angiography follow-up.

Exclusion criteria

Exclusion criteria included: intolerance or contra-indication to acetyl salicylic acid and/or ticlopidine, leukopenia, neutropenia, thrombocytopenia, peptic ulcer or upper gastrointestinal bleeding in the previous 6 months; acute myocardial infarction within 1 week prior to intervention, documented previous Q wave infarction in the territory supplied by the vessel to be stented and a large akinesia in this territory, an ejection fraction below 30%, cardiogenic shock, left bundle branch block or bifascicular block, severe hepatic disease; intended stenting of a left main coronary artery lesion, lesion at an important bifurcation, angiographic evidence of thrombus, or heavily calcified lesions, where full expansion of the pre-dilatation balloon could not be achieved.

End-points

Primary end-points

The primary clinical end-point for the efficacy and comparative analysis was the cumulative incidence of major adverse cardiac events at the 6 month follow-up, as defined previously[6]. The primary angiographic end-point was late restenosis outcome at 6 months, measured by off-line quantitative coronary angiography. Parameters to assess restenosis were minimal luminal diameter, diameter stenosis, categorical restenosis (defined as a diameter stenosis greater than 50%), late loss and loss index (late loss/acute gain).

Secondary end-points

The safety of Magic Wallstent implantation was evaluated on the basis of clinical status at 30 days post-procedure, including major adverse cardiac events, bleeding complications and subacute stent occlusion.

Stent implantation and angiographic procedure

There were five Wallstent length categories: mini, extra-short, short, medium and long and four diameter categories, 3·5, 4·0, 4·5 and 5·0; this diameter refers to the diameter the stent would achieve when completely expanded. Each unit carries a recommendation on the packing for vessel diameter and a length/diameter chart for reference. After adequate pre-dilatation, it was recommended to choose a Wallstent 0·5–1·0 mm larger than the maximal target reference diameter. In addition, the length chosen was recommended to be 4–8 mm longer than the lesion, to allow adequate anchoring of the stent proximal and distal, with the intention of covering the lesion with a single Magic Wallstent. Post-dilatation was recommended to achieve optimal stent expansion (diameter stenosis <20% by online quantitative coronary angiography in the worst angiographic view). If the lesion was not completely covered by the chosen Magic Wallstent, or if there was a significant edge dissection, a second Magic Wallstent could be implanted. Use of other stents was discouraged.

Coronary angiography was documented in at least two views after intracoronary injection of 0·1–0·3 mg nitroglycerin or 1–3 mg isosorbide dinitrate, at baseline and repeated post-procedure, after removal of the guidewire. Standardized procedures were followed to facilitate quantitative analysis at the core laboratory, as has been extensively described in the past[5–10]. Intravascular ultrasound was permitted according to operator's usual clinical practice.

Medication

All patients were pre-treated with aspirin 80–325 mg per day continuing indefinitely, ticlopidine (beginning pre-procedure with 1 g and continuing with 500 mg per day for a minimum of 2 weeks) and heparin bolus according to local practice, to maintain activated clotting time during the procedure >300 s. Platelet GP IIb/IIIa antagonists could be used before, during or after stenting, with documentation of timing and indication. Other medications were at the discretion of the treating physician.

Statistical analysis

Magic 5L is an observational, non-randomized clinical trial. Descriptive statistics were used. Continuous variables are presented as means with their 95% confidence interval, whenever appropriate, or as median and range. Categorical variables are presented as a rate with its 95% confidence interval. Analysis of variance was used to compare continuous outcome variables among the

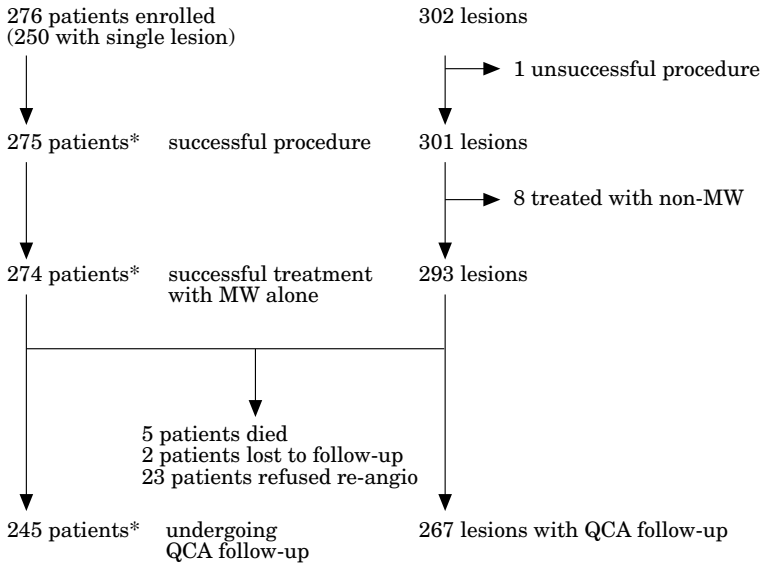

Figure 1 **Patient/lesion distribution. *Patients with multivessel disease could be included. MW=Magic Wallstent; QCA=quantitative coronary angiography; Note: A total of 216 patients undergoing successful implantation of a single Magic Wallstent in a single culprit lesion had complete quantitative coronary angiography follow-up according to the protocol.**

groups. Comparison of categorical variables was by chi-square test, dividing stent length into short (mini, extra-short and short) and long (medium and long). Logistic and linear multivariate regression techniques were used to investigate the independent influence of stent length on angiographic and clinical outcome. The analysis of clinical end-points was carried out with patients as units of measurement, analysis of angiographic end-points was carried out with the 'stented segment' as the unit of measurement, among patients treated with a single Magic Wallstent per lesion and with analysable angiograms at baseline and at 6 months. If a revascularization procedure involving the stented lesion was performed before the appointed time for the 6 month angiogram, the pre-procedural angiogram was used for angiographic end-point evaluation.

Results

Between 17 September 1997 and 23 October 1998, 15 European sites enrolled 276 patients with a total of 302 lesions, in 301 of which a Magic Wallstent was successfully implanted. Baseline demographic and lesion characteristics are listed in Fig. 1 and Table 1, respectively. The distribution of the different stent lengths used was 33 mini, 62 extra-short, 72 short, 52 medium and 45 long Magic Wallstents. (The study was curtailed at this time, as it appeared unlikely to reach 50 patients in the mini group within a reasonable time frame.) A total of 38 lesions were treated with an additional stent (12·6%) of which eight were non-Magic Wallstents. An optimal angiographic result was achieved in 98·6% of lesions. In-hospital major adverse cardiac events occurred in seven patients: two patients (0·7%) Q-wave myocardial infarction, three patients (1%) non-Q wave myocardial infarction and two patients (0·7%) re-PTCA. Mean hospital stay was $1{\cdot}9 \pm 3{\cdot}4$ days. Dissections post-procedure were noted in 36 patients (12·1%), approximately half of which (5·7%) were located within the stent.

Primary end-points

Overall clinical outcome

At 6 months follow-up, 76 patients (27·5%) had experienced major adverse cardiac events, of which five were fatal (1·8%). One patient died from previously undiagnosed prostate malignancy and four deaths were cardiac. Twelve patients (4·3%) experienced myocardial infarction of whom seven (2·5%) had a Q-wave and five (1·8%) a non-Q wave myocardial infarction. Five (1·8%) patients underwent CABG and 54 (19·6%) had re-PTCA for significant in-stent restenosis. At the 9 month follow-up, an additional eight patients (2·9%) had major adverse cardiac events, of whom two had undergone CABG and six re-PTCA, yielding 69·6% event-free survival.

Overall angiographic outcome

Serial matched quantitative coronary angiography data were complete in 83% of the patients (Table 2). Vessel size varied among five lesion groups; on average it was 3·01 mm, minimal luminal diameter post-procedure was $2{\cdot}61 \pm 0{\cdot}37$ mm, acute gain was 1·67 mm, with a residual

Table 1 Baseline demographic and clinical data

	N	%
Age (years)	61·3 ± 10·2	
Male gender	217	78·6
Days in hospital	1·9 ± 3·4	
Angina	276	
Unstable (Braunwald Class)	115	41·7
1B	32	11·6
2B	59	21·4
3B	3	1·1
1C	5	1·8
2C	15	5·4
3C	1	0·4
Stable	142	51·4
CCS1	22	8·0
CCS2	83	30·1
CCS3	35	12·7
CCS4	2	0·7
Silent ischaemia	19	6·9
History of		
MI		
Q wave	53	19·2
Non-Q wave	62	22·5
CABG	12	4·3
PTCA	58	21·0
Stroke	8	2·9
Peripheral vascular disease	17	6·2
Family history	104	37·7
Risk factors		
Diabetes mellitus — insulin dependent	9	3·3
Diabetes mellitus — non-insulin dependent	29	10·5
Hypertension	108	39·1
Hypercholesterolaemia	173	62·7
Previous smoker	115	41·8
Current smoker	71	25·8

CCS=Canadian Cardiovascular Society; CABG=coronary artery bypass graft; PTCA=percutaneous transluminal coronary angiography.

Table 2 Pre-procedural anatomical and functional characteristics

	N	%
Lesion location (n=276)		
RCA	192	69·6
LM	4	1·4
LAD	132	47·8
CFX	89	32·2
ACC/AHA lesion type (n=301)		
A	18	6·0
B1	69	22·9
B2	163	54·2
C	51	16·9
Calcification (n=286)		
Moderate to heavy calcification	55	19·2
Lesion length (n=279)		
<10 mm	158	56·6
10–20 mm	76	27·2
>20 mm	45	16·1

RCA=right coronary artery; LM=left main; LAD=left anterior descending coronary artery; CFX=circumflex artery; ACC/AHA=American College of Cardiology/American Heart Association.

diameter stenosis of 17·9%. At the 6-month follow-up, the minimal luminal diameter was 1·60 ± 0·73 mm with a mean diameter stenosis of 45·9%, a restenosis rate of 37% and a mean loss index of 0·64.

Outcome comparisons between the five groups

For valid inter-group comparisons, patients with more than one lesion treated and those with more than a single Magic Wallstent were excluded. Tables 3 and 4 and Fig. 1 show angiographic and clinical outcome data among the five patient groups. Variations in vessel size are appreciated. It is also worth mentioning that the restenosis rate was similar for the three shorter stent groups, being lowest in the short stent group, so that up to a mean stent length of 20 mm, no significant change in restenosis rate was observed. Making a categorical distinction between shorter (mini, extra-short and short) and longer stents (medium and long), it is apparent that the post-procedural result was superior in the shorter stent groups, 16% vs 20% diameter stenosis. At follow-up, all outcome parameters were superior in the shorter stent groups: % diameter stenosis, minimal luminal diameter at follow-up, restenosis rate, late lumen loss, loss index, as well as the cumulative frequency of major adverse cardiac events (Fig. 2), particularly target lesion revascularization (23·8% vs 33·7%, $P=0·048$).

Multivariate analyses were performed, including all known clinical procedural and angiographic variables known or thought to have an influence on the occurrence of major adverse cardiac events or on angiographic restenosis or minimal luminal diameter at follow-up (including stent length and multiple and overlapping stents). Stent length was the only variable to be retained in each of the three models, being significantly independently predictive of a smaller minimal luminal diameter at follow-up ($P=0·0001$) and a higher incidence of angiographic restenosis ($P=0·0001$) and major adverse cardiac events ($P=0·0001$). A larger post-procedural diameter ($P=0·0001$), age ($P=0·008$) and prior PTCA ($P=0·03$) were predictors of a larger minimal luminal diameter at follow-up and a larger post-procedural minimal luminal diameter was also predictive of a lower restenosis rate ($P=0·002$).

Secondary end-points

Safety, acute/subacute occlusion, bleeding complications

Safety evaluation was at 30 days, by which time 6·2% of patients had experienced major adverse cardiac events, with one death (0·4%), nine myocardial infarctions (four Q and five non-Q) (3·3%), one CABG (0·4%) and six re-PTCAs (2·2%).

Table 3 Angiographic results

Variable	Mini n=27	Extra-short n=56	Short n=62	Medium n=47	Long n=40	Overall n=267
Lesion length* (mm)	7·56 ± 2·66	8·79 ± 3·10	10·49 ± 3·54	13·89 ± 6·24	18·79 ± 12·30	12·31 ± 8·55
Stent length post (mm)	8·95 ± 1·38	13·85 ± 2·87	19·98 ± 2·62	27·12 ± 3·10	43·12 ± 4·18	24·37 ± 13·81
Stent length f-up (mm)	8·88 ± 1·38	13·76 ± 2·47	19·82 ± 2·51	26·93 ± 3·42	41·62 ± 4·57	23·18 ± 12·49
Ref diam pre (mm)	2·84 ± 0·38	2·96 ± 0·44	3·14 ± 0·64	3·13 ± 0·41	2·86 ± 0·47	3·01 ± 0·54
Ref diam post (mm)	2·94 ± 0·34	3·11 ± 0·37	3·28 ± 0·50	3·35 ± 0·39	3·21 ± 0·41	3·19 ± 0·44
Ref diam f-up (mm)	2·80 ± 0·35	2·88 ± 0·51	3·06 ± 0·62	3·07 ± 0·59	2·75 ± 0·50	2·91 ± 0·57
MLD pre (mm)	1·01 ± 0·20	0·95 ± 0·41	1·02 ± 0·33	0·96 ± 0·37	0·78 ± 0·44	0·94 ± 0·39
MLD post (mm)	2·47 ± 0·30	2·61 ± 0·27	2·74 ± 0·45	2·65 ± 0·36	2·56 ± 0·34	2·61 ± 0·37
MLD f-up (mm)	1·75 ± 0·64	1·74 ± 0·56	1·82 ± 0·76	1·67 ± 0·78	1·21 ± 0·58	1·60 ± 0·73
% diam stenosis pre	64 ± 8	68 ± 12	67 ± 10	69 ± 11	73 ± 15	69 ± 12
% diam stenosis post	16 ± 5	16 ± 6	16 ± 6	21 ± 7	20 ± 6	18 ± 6
% diam stenosis f-up	38 ± 19	40 ± 16	41 ± 17	46 ± 21	56 ± 18	46 ± 20
Absolute gain (mm)	1·46 ± 0·32	1·66 ± 0·38	1·72 ± 0·50	1·69 ± 0·52	1·79 ± 0·57	1·67 ± 0·47
Absolute loss (mm)	0·72 ± 0·61	0·87 ± 0·55	0·91 ± 0·65	0·98 ± 0·69	1·35 ± 0·60	1·01 ± 0·67
Loss index	0·50 ± 0·44	0·54 ± 0·34	0·56 ± 0·38	0·64 ± 0·50	0·77 ± 0·33	0·64 ± 0·44
Restenosis rate (%)	25·9	25·0	22·6	36·2	67·5	37·1

Pre=pre-procedure; post=post-procedure; f-up=follow up; Ref diam=reference diameter; MLD=minimal luminal diameter; % diam=percent diameter. Loss index is calculated as loss/gain. Notice that the column 'Overall' is the total count of the five different stent length groups including the analysed lesions treated with more then one magic Wallstent.
*By automated quantitative coronary angiography.

Table 4 Major adverse cardiac events (n=7260). Clinical outcome (worst major adverse cardiac events per patient, ranking)

	Up to discharge		Up to 31 days		Up to 210 days		Up to 300 days	
	%	n	%	n	%	n	%	n
Death	0	0	1	0·4	5	1·8	5	1·8
MI	9	3·3	9	3·3	12	4·3	12	4·3
Q wave MI	4	1·4	4	1·4	7	2·5	7	2·5
Q wave MI	5	1·8	5	1·8	5	1·8	5	1·8
CABG	0	0	1	0·4	5	1·8	7	2·5
Re-PTCA	5	1·8	6	2·2	54	19·6	60	21·7
No MACE	262	94·9	259	93·8	200	72·5	192	69·6
All	276	100	276	100	276	100	276	100

MI=myocardial infarction; MACE=major adverse cardiac events. For abbreviations, see Table 1.

Acute occlusion occurred in one patient due to vessel perforation, with emergency CABG and death on day 8 due to cerebrovascular accident. Subacute occlusion occurred pre-discharge in four patients (1·4%) and in another patient 5 days post-discharge. In three cases the occlusion could be successfully treated by re-PTCA and in one myocardial infarction occurred followed 3 days later by CABG. Two patients experienced major bleeding (0·7%) in the interval between discharge and 30-day follow-up.

Discussion

Long lesions are known to be associated with higher restenosis rates after balloon angioplasty[9,10], and use of adjunctive devices such as Rotablator[11] and excimer laser[12], although initially facilitating acute success, did not lead to improvement in late outcome. Stent implantation is now widely practised for all lesion subsets, although strictly speaking, only of proven benefit for short lesions, proximal left anterior descending coronary artery lesions, chronic total occlusions and saphenous vein graft lesions[7,13–16]. Empirical use of stenting for long lesions is, at this time, not supported by published results from a randomized clinical trial. In this study we sought to evaluate the influence of stent length on late clinical and angiographic outcome using the Magic Wallstent, which was available in a range of lengths suitable for revascularization of lesions from 5–45 mm in length. Although implantation was safe and acutely effective in the short term in this comparatively high risk

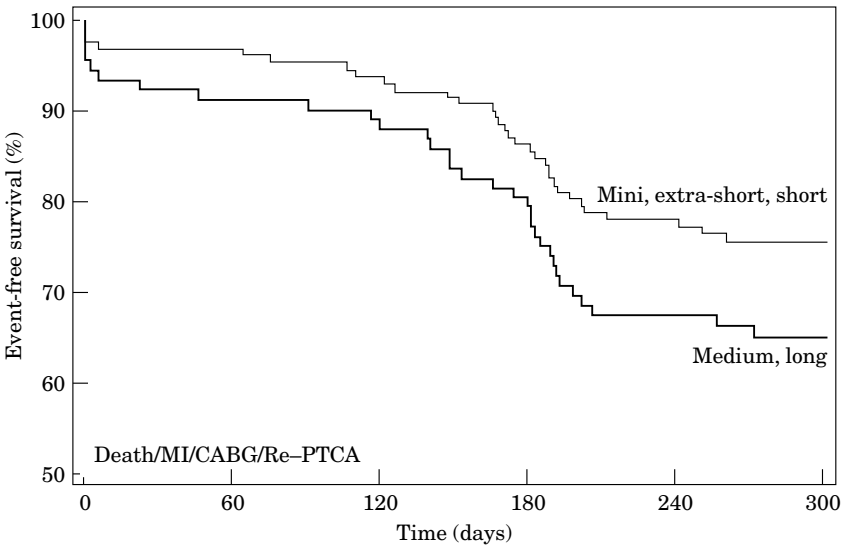

Figure 2 **Kaplan–Meier curves illustrating freedom from major adverse cardiac events during scheduled follow-up for the five patient groups, categorized into two groups, namely shorter stents (mini, extra-short and short) and longer stents (medium and long). The considerably lower event-free survival of the longer stent group is noteworthy, beginning from the early post-procedural period. Of additional note is the steep descent in the curves beginning at about 150 days, as a consequence of restenosis and of re-PTCA at the time of repeat angiography.**

heterogeneous patient group, elective implantation of medium and long Magic Wallstents was associated with unacceptably high angiographic restenosis and an increased frequency of major adverse cardiac events and for this reason cannot be recommended. Implantation of multiple stents per lesion was not found to be associated with adverse outcome, presumably because the stent length parameter was such a strong predictor and also since multiple stents were only required in 12% of patients, mainly in the shorter stent groups.

The overall event-free survival rate at the 6 month follow-up of 72·5% is comparable with the data from the Wellstent native study (75·2%)[5], but somewhat lower than published results of trials using balloon expandable stents, such as BENESTENT[7] and STRESS[13]. These studies restricted inclusion to stable patients with short lesions in larger vessels, whereas Magic 5L included a heterogeneous group of patients with a high prevalence of unstable angina and considerably longer lesions. The angiographic and clinical outcomes among patients receiving shorter Magic Wallstents in this study compare favourably with BENESTENT and STRESS trials, even though the mean stent length in this study is actually somewhat longer (Table 3). Thus, it must be concluded that the Magic Wallstent itself is inherently an adequate device for elective coronary revascularization, but implantation of longer stents is associated with poorer results.

Previous large retrospective studies in single centres have described similarly disappointing results with elective stenting of long lesions[17] and lesion length has been identified as an independent risk factor for in-stent restenosis and adverse cardiac events[18]. The ADVANCE trial was initiated to specifically address the issue of the additional value of stenting long lesions after achieving a satisfactory balloon angioplasty result (defined as diameter stenosis <30% by on-line quantitative coronary angiography). After 34% of lesions had required 'bail-out' stenting, because of unacceptable or occlusive dissection or diameter stenosis >50%, despite repeat inflations, the remaining patients were randomly assigned to additional stenting or acceptance of the result. Interim analysis revealed inferior clinical results at 6 months in the additional stenting group, whereas the power calculation for the study had been based on an assumption of a 30% reduction in major adverse cardiac events by stenting[19]. Accordingly, the study was terminated with the conclusion that a strategy of 'provisional stenting'[20] was appropriate for percutaneous revascularization of long lesions.

Since all of these studies have employed a variety of stent types, it seems that the adverse outcomes are independent of the stent design, although the Wallstent has historically tended to be linked with poorer outcomes, without objective evidence to prove this. Escaned *et al.*[21], investigated the influence of stent design on late outcome and reported a higher loss index for the self-expanding Wallstent ($0{\cdot}60 \pm 0{\cdot}41$) compared to multicellular ($0{\cdot}27 \pm 0{\cdot}26$) and slotted tube ($0{\cdot}33 \pm 0{\cdot}40$) stent designs. However, the length of the stented segment (a predictor of restenosis in that study also) was significantly higher in the self-expanding

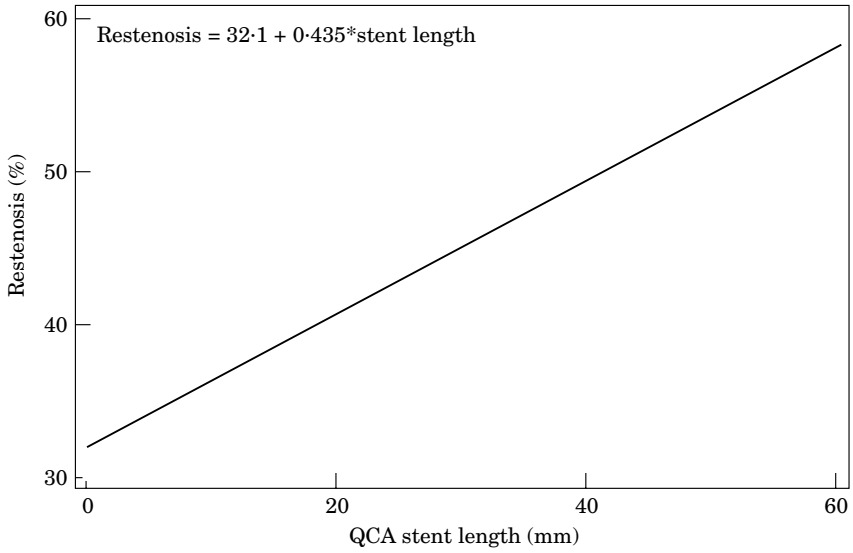

Figure 3 **Linear regression analysis of the relationship between Magic Wallstent length and late angiographic restenosis, as measured by core laboratory quantitative angiography. A direct linear relationship is evident, with increasing chance of restenosis predicted by implantation of longer Magic Wallstent.**

stent group. The loss index in the Magic 5L study was $0{\cdot}64 \pm 0{\cdot}44$ increasing with increasing stent lengths (from $0{\cdot}50 \pm 0{\cdot}44$ for the mini — similar to that reported by Kuntz *et al.* for all coronary devices[22] — up to $0{\cdot}77 \pm 0{\cdot}33$ for the long Magic Wallstent). Even though the loss index for the mini, extra-short and short stents is higher than that of the slotted tube and multicellular stents reported by Escaned *et al.*[21], this does not in fact translate into higher restenosis rates. As an explanation of greater intimal hyperplasia associated with Wallstent use, strut overlap and chronic outward expansion were proposed by Von Birgelen *et al.*[23], in a three dimensional intravascular ultrasound study; however, inherently longer stent length was overlooked. Thus it seems likely that the adverse results until now associated with the Wallstent may be a consequence of the fact that the stent length being used was significantly longer than the average length of balloon-expandable stents used in comparative studies and clinical practice.

Clinical implications and future directions

For practical purposes, it would be useful to define a cut-off point for lesion length beyond which the results of stenting become unacceptable. As there is in fact a continuous relationship between stented segment length and late restenosis (Fig. 3), there is no practically applicable cut-off point and since multiple other factors including vessel diameter, lesion location, anginal status, diabetic status and extent of vessel disease also play important determining roles[8–10,18,21,22] individual cases need to be judged as such and the combination of risk factors taken into account when deciding on alternative therapies.

The place of so-called 'spot stenting' and of a policy of 'provisional stenting' in long lesions[20], as well as new rotablation techniques[24] needs to be objectively evaluated. Furthermore, the optimal methods of judging and guiding acute outcome (i.e. the place of fractional flow reserve, coronary flow reserve and intravascular ultrasound) need to be established. New adjunctive therapies, which may reduce restenosis and improve late clinical outcome, need to be urgently evaluated in this high-risk lesion subset. For example, if stent coating with antiproliferative compounds, such as rapamycin[25], or catheter-based brachytherapy[26] can reduce restenosis after stenting of long lesions into the range of 'short' lesions, then perhaps elective stenting of long lesions would be an acceptable therapy.

Limitations

This was a non-randomized clinical trial and therefore lacks a 'conventional' control group. A direct comparison with balloon angioplasty in long coronary lesions may have been more objective, but the purpose was to comparatively evaluate Magic Wallstent results in short and long lesions, since shorter Wallstents had not previously been critically evaluated. It was intended to recruit 50 patients per group, but after the ordained study period, there was insufficient in the mini group and the sponsor requested closing the study after 276 patients had been recruited. It would have been ideal to

have limited inclusion to a single lesion per patient so as to couple clinical and angiographic outcomes with stent length category, but investigators believed recruitment would be too low if multilesion intervention was not allowed. As is usual for Wallstent studies, target lesion distribution shows a higher prevalence of the right coronary artery lesions, compared to traditional interventional studies and daily clinical practice. Since left anterior descending coronary artery location has a higher restenosis propensity[8,22], this imbalance could produce more favourable results compared with other trials, although left anterior descending coronary artery location itself was not an independent predictor of poor outcome in this study.

Conclusions

This was the first prospective multicentre study to compare different lengths of the same stent type in order to assess the influence of stent length on clinical and angiographic outcomes. The safety and feasibility of the Magic Wallstent was excellent. While the shorter versions of the Magic Wallstent proved to be equipotent tools with balloon-expandable stents, longer stents were shown to be associated with significantly increased restenosis and clinical events (mainly target lesion revascularization). Elective stenting of long coronary lesions thus appears ill advised and while optimal therapy remains to be established, there is a necessity for urgent evaluation of promising adjunctive therapies such as stent coatings and catheter-based brachytherapy.

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