

recorded and sent to the Academic Vascular Image Centre in Amsterdam for analysis.

The 5th, 10th, 25th, 50th, 75th, 90th, and 95th percentiles were estimated by age and sex, then adjusted using locally weighted scatterplot smoothing for the mean CIMT value of the common carotid artery (Table 1) and all carotid artery segments (common carotid artery, internal carotid artery, and carotid bulb) (Table 2) for the general population and the subsample without cardiovascular risk factors. Statistical analysis was performed using the R Statistical Package version 2.15.0 (R Foundation for Statistical Computing, Vienna, Austria).

In general, CIMT values found in the common segment and common carotid artery in individuals not exposed to cardiovascular risk factors were lower than in the general population. These differences were more accentuated the higher the percentile. Moreover, in some cases the CIMT values of the participants older than 80 years with no risk factors were higher than those in the general population. It is possible that the small number of older participants without risk factors decreased the reliability of the estimations. Furthermore, these findings could be subject to survival bias; despite the advanced age of this population and the fact that they had greater CIMT than the age-matched general population, they had not experienced coronary events.

The results of this analysis provide the reference ranges of CIMT in the general population and in the subsample without cardiovascular risk factors. Further cohort studies are needed to ascertain the additional predictive value of CIMT for the incidence of cardiovascular events.

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## Intravascular Diagnosis of Stent Fractures: Beyond X-ray Imaging

### Diagnóstico intravascular de fracturas de stents: más allá de la imagen radiológica

#### To the Editor,

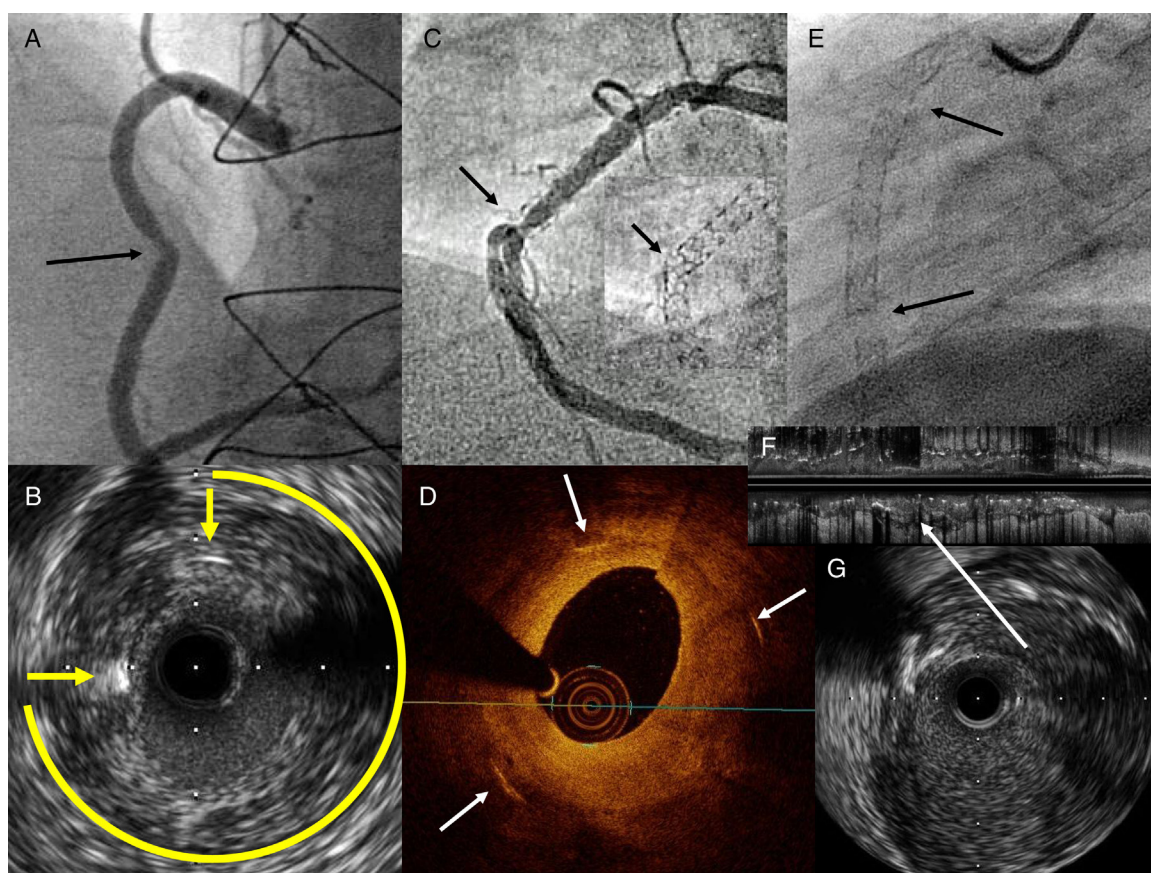
Drug-eluting stents (DES) have significantly reduced the rate of stent restenosis (SR) and the need for repeat interventional procedures. The presence of stent fractures (SF) with the appearance of SR and/or DES thrombosis, particularly with sirolimus-eluting DES (Cypher®), has recently been reported.<sup>1,2</sup> However, the actual incidence of SF is uncertain, and SFs can be hard to diagnose by angiography alone.

We describe the incidence of SF confirmed by intravascular imaging in a patient population angiographically assessed due to suspected SR. A total of 355 SR-type lesions were treated at our site between January 2007 and June 2012: 197 (55%) were conventional stents and 158 (45%) were DES. Intravascular ultrasound or optical coherence tomography was used in 169 (48%) lesions. The

incidence of SF confirmed by intravascular imaging was 3.6% (6 of 169 lesions). The characteristics of the SFs are shown in the Table.

SF was radiologically visible in only 1 of the 6 cases identified. In all others, it was suspected due to the presence of focal SR in a tortuous area or a hinge point. On occasion, the SR was not angiographically significant, but the intravascular ultrasound showed considerable focal hyperplasia and the absence of struts in an arch >270° (Figs. A and B). The intravascular image was analyzed frame by frame to identify suspected areas and to delimit the presence or absence of struts (Figs. C and D). All 6 patients underwent repeat percutaneous coronary intervention with stent implantation in the SR area. Further clinical follow-up and noninvasive tests showed no new events (median, 9 [3] months).

SF may be diagnosed by radiography (contrast-free imaging) or intravascular imaging, such as intravascular ultrasound or optical coherence tomography. Classifications have been described for both methods, based on the clear separation of struts or the absence of struts in one or more coronary segments.<sup>3,4</sup> Factors that favor the appearance of SF have also been reported, such as the presence of calcium, tortuous arteries, and the degree of artery torsion during the cardiac cycle.



**Figure.** A: Stent restenosis in the middle right coronary artery (arrow). B: Intravascular ultrasound image of A, with abundant concentric hyperplasia, only 2 visible struts (arrows), and a 270° arch with no struts. C: Radiologic image of overlapping stents in the right coronary, with focal restenosis in the angle area and broad image of stent distortion (arrow). D: Optical coherence tomography image of C; abundant concentric hyperplasia and only 3 struts (arrows) very far apart. E: Radiologic image of the right coronary artery; stents from the ostium to the distal segment by chronic occlusion; the arrows indicate 2 areas of complete fracture with physical separation of the struts. F: Longitudinal intravascular ultrasound image of E; the arrow indicates the fracture without struts. G: Transverse intravascular ultrasound image of E; absence of struts.

The actual incidence of SF is uncertain. Various studies report an incidence of 0.84% to 8.4%, and on many occasions SF is detected during investigations for SR.<sup>5</sup> SF can go unnoticed if not radiologically obvious or if the vessel is not investigated using intracoronary imaging. The most common intravascular findings are the absence of struts in a broad area of the vessel circumference and the presence of abundant hyperplasia in the same segment.<sup>6</sup> At times, it may be difficult to differentiate between incomplete SF and stent deformation (pronounced curves, postdilation of lateral branches, calcified lesions), which causes strut separation and asymmetry, but it is not difficult to detect the absence of struts. If the fracture is complete, total disappearance of struts is observed in various consecutive images (Figs. E-G).

The pathogenic mechanisms of SR or SF thrombosis are probably related to the lower amount of drug dispensed in the fracture area and to greater mechanical aggression from the fractured struts, as both of these factors cause smooth muscle cell proliferation and abnormal endothelialization.<sup>1,5</sup>

Some studies have shown that certain sirolimus-eluting DES (Cypher®) cause a greater number of SF because of their closed-cell design and the use of stainless steel, a material of lower flexibility and conformability than new cobalt, chromium, or platinum alloys. Right coronary or saphenous sites are more common, as are long stents, overlapping stents, and tortuous lesions or hinge points.<sup>5</sup> This series reviewed previous percutaneous coronary intervention procedures in cases of overlap, to rule out an actual separation

**Table**  
Characteristics of Lesions With Stent Fractures

Patients	Vessel	Stent	Imaging	Ostial	Overlap	Hinge	Tortuosity	Calcium	Fracture type	Time since PCI, months	New PCI with stent
1	ADA	Cypher	IVUS	No	Yes	No	Yes	Mild	Partial	22	Yes
2	RCA	Cypher	IVUS	No	Yes	Yes	Yes	No	Partial	9	Yes
3	RCA	Cypher	IVUS	No	Yes	Yes	Yes	Severe	Complete	8	Yes
4	RCA	Chrono	IVUS	Yes	No	No	No	Mild	Partial	13	Yes
5	RCA	Cypher	IVUS	No	Yes	Yes	Yes	Mild	Complete	29	Yes
6	RCA	Cypher	OCT	No	Yes	Yes	Yes	Mild	Partial	68	Yes

ADA, anterior descending artery; IVUS, intravascular ultrasound; OCT, optical coherence tomography; PCI, percutaneous coronary intervention; RCA, right coronary artery.

between stents, and confirmed correct stent position during release.

This observational register has several limitations. Angiographic follow-up was carried out only in patients with suspected SR based on clinical symptoms compatible with this diagnosis or ischemia observed in noninvasive tests. Intravascular ultrasound or optical coherence tomography was used in half the patients, and thus the number of undiagnosed SF could have been even higher. Furthermore, optical coherence tomography is still used infrequently, although its imaging resolution is better able to identify struts than intravascular ultrasound.

In conclusion, SF diagnosis using intravascular imaging techniques is extremely accurate and is superior to diagnosis by radiologic imaging alone. This finding has prognostic implications, because SF increases the risk of SR and thrombosis. Some sirolimus-eluting DES (Cypher®) have a higher incidence of SF than other DES.

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## Emotional Regulation and Heart Rate Variability in Healthy Male Managers

### Regulación emocional y variabilidad de la frecuencia cardiaca en directivos varones sanos

#### To the Editor,

Cardiovascular diseases are the main cause of death in Spain, and numerous preventative policies are currently being applied all around the world.<sup>1</sup> Analysis of heart rate variability (HRV) is a reliable means of evaluating health, because low values are directly related to age, an increased incidence of cardiovascular disease, and mortality.

Variables such as optimism and positive emotionality favor cardiovascular health in adults. In contrast, poor control of negative emotions predicts the appearance of cardiovascular disease.<sup>2</sup> Emotional regulation (ER) is a central skill in emotional intelligence, defined as an individual's ability to regulate his or her emotions and those of others to foster emotional and intellectual growth. This skill facilitates the development of strategies that are effective in reducing the impact of negative emotions. Hence, it functions as a protector against challenging situations and even produces more adaptive physiological responses.<sup>3</sup>

Managers assigned high levels of responsibility, especially male managers in Spain, are exposed to continual professional demands that can cause psychological burnout and clinical symptoms. The objective of the present study was to determine whether ER is related to a reliable HRV indicator such as the low frequency/high frequency (LF/HF) ratio and whether ER moderates the negative effect of age on managers' HRV.

The sample included 101 Spanish managers aged between 30 and 63 years (mean, 43.15 [6.90] years) holding managerial positions in private companies, randomly selected during a team-building course. The course was financed by the company, and was attended voluntarily. Managers with cardiovascular disease and/or

electrocardiographic abnormalities were excluded and therefore all participants were healthy and all gave their consent to being included in this study. We assessed self-perception of ER skills using items taken from the Spanish version of the Trait Meta-Mood Scale,<sup>4</sup> the most frequently used, Spanish-language, self-report emotional intelligence scale, which has an alpha reliability coefficient of 0.86. This scale correlates with multiple criterion variables and demonstrates adequate test-retest reliability in the Spanish population.<sup>4</sup> ER levels in our sample ranged from 14 to 40 points (29.35 [5.66]). HRV was determined with a Polar chest band linked to a Promis Body Monitor signal analysis unit, following established short-duration measure standards. The parameter used in this study was the LF/HF ratio, an index that relates low with high frequencies and has a negative association with HRV, ie, the higher the LF/HF ratio, the lower the HRV, and vice versa.<sup>5</sup> The LF/HF values in the sample ranged from 0.5 to 5.5 (1.20 [0.91]). As covariable, we included perceived stress measured with the Spanish version of the Perceived Stress Scale. In addition, a specialist physician assessed smoking habits, alcohol intake, physical activity and body mass index. Levels of perceived stress ranged from 0 to 27 points (13.50 [5.59] points); the mean values for alcohol intake and the number of cigarettes smoked per day were 0.64 (0.48) L and 4.56 (10.22) cigarettes, respectively. Physical activity was classified as sedentary (0 h/week), light (1–3 h/week) and moderate (>3 h/week), with 45%, 36%, and 19% of managers, respectively, in each category. Body mass index ranged from 22.09 to 39.63 (27.11 [3.30]).

As a function of ER level, managers were divided into 3 groups following the recommendations established by the authors<sup>4</sup>: low (8–24), middle (24–35), and high (35–40). We also divided the sample into 2 groups by median age ≤41 and >41 years. We performed ANCOVA analysis to examine the effect of low, middle and high ER and the 2 age groups on the LF/HF indicator. Analyses were adjusted for perceived stress level, alcohol and tobacco consumption, physical activity, and body mass index, which were included as control covariables on the