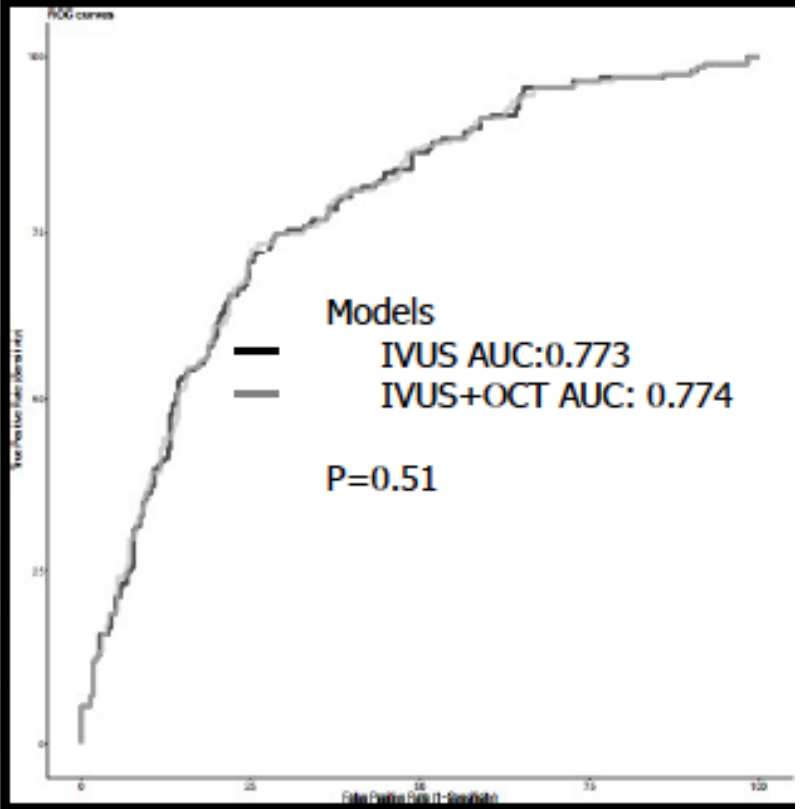
IBIS 4 – ESS sub-study

We define as disease progression as an increase in plaque area and reduction in lumen area

IVUS-based MV analysis of disease progression		
	OR	P
BL ESS per 1Pa increase	0.691	0.005
Plaque burden per 10% increase	0.038	0.003
Excessive expanding RM	1.671	0.057
Plaque burden per 10% increase	0.070	<0.001
IVUS and OCT-based MV analysis of disease progression		
	OR	P
BL ESS per 1Pa increase	0.692	0.005
Plaque burden per 10% increase	0.380	0.003
Excessive expanding RM	1.671	0.057
Macrophages	1.011	0.963
Neo-vessels	1.000	0.999



Conclusions: OCT-derived plaque micro-characteristics have little value in predicting more accurately than standalone IVUS and ESS segments that will to exhibit disease progression.

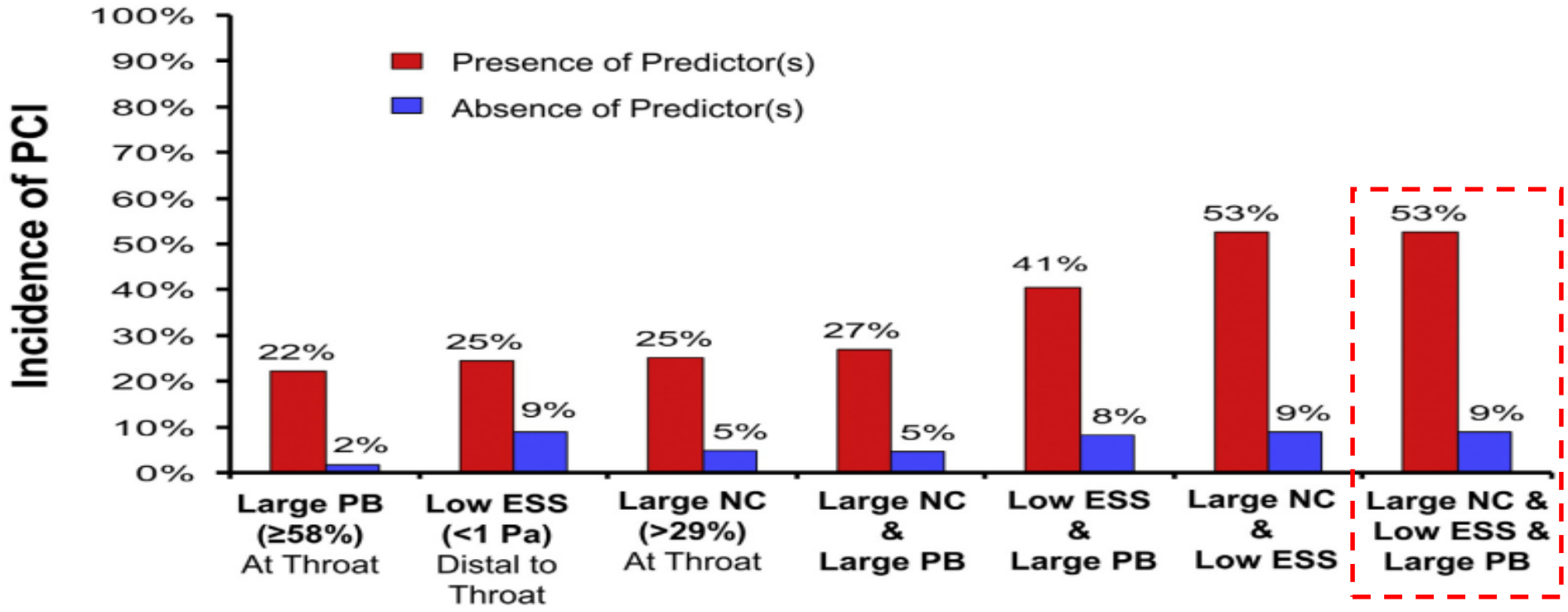
Shear stress analysis in multimodality imaging a sub-analysis of IBIS 4 study

Bourantas CV,[1,2] Raber L,[3] Sakellarios A,[4] Karagiannis A,[3] Kyohei Y,[3] Taniwaki M,[3] Radu M,[5] Moschovitis A,[3] Heg D,[3] Papafaklis MI,[4] Kalatzis F,[4] Naka KK,[4] Fotiadis DI,[4] Michalis LK,[4] Serruys PW,[6] Garcia-Garcia HM,[6] Windecker S[3](submitted)

IVUS-based Tissue Characterization and ESS: PREDICTION of events

combined ESS, necrotic core and plaque burden

prediction of clinically-relevant events

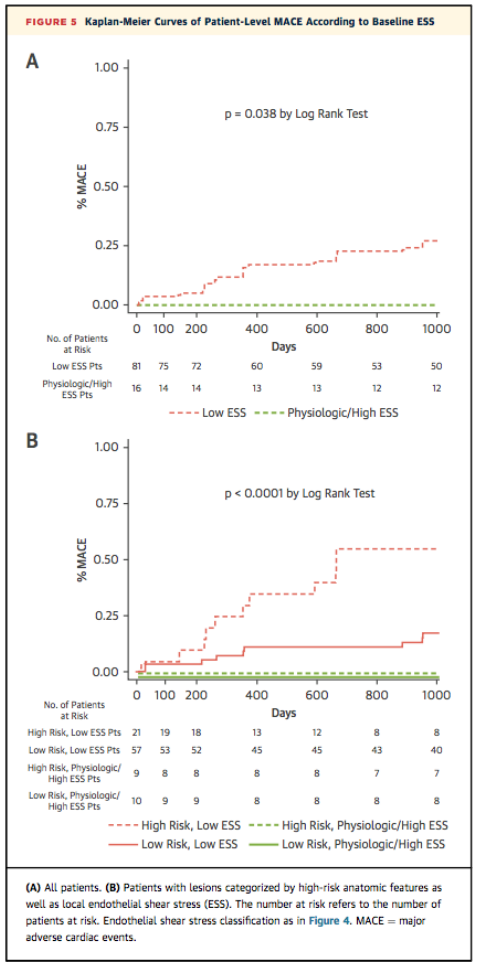


Diagn.Accuracy	59%	77%	70%	72%	85%	88%	88%
Sensitivity	94%	42%	74%	74%	42%	32%	32%
Specificity	54%	82%	69%	72%	91%	96%	96%
Positive PV	22%	25%	25%	27%	41%	53%	53%
Negative PV	98%	91%	95%	95%	92%	91%	91%
Prevalence	22%	10%	16%	15%	6%	4%	4%

Papafaklis et al. Int J Cardiol 2016

PROSPECT Study.

Role of low endothelial shear stress and plaque characteristics in the prediction of nunculprit major adverse cardiac events.



CONCLUSIONS

Local low ESS provides incremental risk stratification of untreated coronary lesions in high-risk patients, beyond measures of PB, MLA, and morphology.

Lesion with normal SS regardless of their characteristis (PB, MLA or lesion phenotype did not develop MACE at follow-up

Low ESS regardless the characteristics of the lesions: 22% possibility of developing MACE

Lesions of high risk and Low ESS: 58% possibility of developing MACE

Role of Low Endothelial Shear Stress and Plaque Characteristics in the Prediction of Nonculprit Major Adverse Cardiac Events The PROSPECT Study

Peter H. Stone, MD, Akiko Maehara, MD, Ahmet Umit Coskun, PHD, Charles C. Maynard, PHD, Marina Zaromitydou, MD, PHD, Gerasimos Siasos, MD, PHD, Ioannis Andreou, MD, PHD, Dimitris Fotiadis, PHD, Kostas Stefanou, PHD, Michail Papafaklis, MD, PHD, Lampros Michalis, MD, PHD, Alexandra J. Lansky, MD, Gary S. Mintz, MD, Patrick W. Serruys, MD, PHD, Charles L. Feldman, SCD, Gregg W. Stone, MD

JACC: CARDIOVASCULAR IMAGING VOL. -, NO. -, 2017

Conclusion

Which is the accuracy of prediction future events:

- FFR: 18%
- IVUS anatomic characteristics + Virtual Histology: 18%
- IVUS anatomic characteristics + ESS: 50%
- IVUS anatomic characteristics + Virtual Histology + ESS: 52% -58%

Intravascular Imaging coupled with physiology vs FFR

Intravascular Imaging coupled with Physiology is a new tool which possibly predicts new events better than FFR

However we need more studies in order to prove it.

We have the tools which can couple Intravascular Imaging with Physiology reliably and quickly enough.

Can we use CTCA in a similar fashion with IVUS + physiology? PROSPECT –MSCT Study.

Summary:

The present analysis for the first time investigated the potential value of MSCT-derived plaque characteristics in identifying lesions that are likely to progress at 3-year follow-up.

We found that:

1) low ESS and increased baseline lumen area were predictors of lumen decrease at follow-up;

2) decreased plaque area and burden were independently associated with an increase in plaque area at follow-up;

3) low ESS and decreased plaque area and burden and increased calcific tissue component were independently related with an increase in plaque burden at follow-up; and

4) a low plaque area and burden and an increased fibrofatty and fibrous tissue component were independently related to an increase in the necrotic core at follow-up.

TABLE 1 Univariate and Multivariate Analysis of the Variables Associated With Atherosclerotic Disease Progression

	Univariate Analysis			Multivariate Model	
	Associated Factor	β (95% CI)	p Value	β (95% CI)	p Value
Increase in lumen area (per 1 mm^2)	Presence of low endothelial shear stress at baseline	−1.06 −(−1.34 to −0.78)	<0.001	−0.47 (−0.78 to −0.16)	<0.001
	Baseline lumen area (per 1-mm^2 increase)	−0.28 (−0.33 to −0.23)	<0.001	−0.22 (−0.28 to −0.16)	<0.001
	Baseline outer vessel wall area (per 1-mm^2 increase)	−0.13 (−0.16 to −0.09)	<0.001	–	–
	Baseline plaque area (per 1-mm^2 increase)	0.08 (0.01 to 0.15)	0.029	–	–
	Baseline plaque burden (per 10% increase)	1.08 (0.88 to 1.28)	<0.001	–	–
	Presence of expanding remodeling at baseline	−1.04 (−1.38 to −0.70)	<0.001	−0.21 (−0.58 to 0.17)	0.277
Increase in plaque area (per 1 mm^2)	Baseline lumen area (per 1-mm^2 increase)	−0.04 (−0.9 to 0.01)	0.083	–	–
	Baseline outer vessel wall area (per 1-mm^2 increase)	−0.14 (−0.17 to −0.10)	<0.001	–	–
	Baseline plaque area (per 1mm^2 increase)	−0.42 (−0.48 to −0.37)	<0.001	−0.40 (−0.46 to 0.33)	<0.001
	Baseline plaque burden (per 10% increase)	−0.66 (−0.84 to 0.48)	<0.001	−0.23 (−0.41 to 0.05)	0.014
	Baseline % fibrofatty tissue (per 10% increase)	0.30 (0.05 to 0.55)	0.017	−0.07 (−0.29 to 0.16)	0.569
	Baseline % calcific tissue (per 10% increase)	−0.21 (−0.44 to 0.03)	0.081	–	–
Increase in plaque burden (per 10%)	Presence of low endothelial shear stress at baseline	0.28 (0.18 to 0.37)	<0.001	0.11 (0.02 to −0.21)	0.018
	Baseline lumen area (per 1-mm^2 increase)	0.05 (0.03 to 0.06)	<0.001	–	–
	Baseline plaque area (per 1-mm^2 increase)	−0.12 (−0.14 to 0.10)	<0.001	−0.10 (−0.12 to −0.07)	<0.001
	Baseline plaque burden (per 10% increase)	−0.46 (−0.53 to −0.40)	<0.001	−0.40 (−0.48 to −0.32)	<0.001
	Baseline % necrotic tissue (per 10% increase)	0.05 (0.01 to 0.09)	0.044	−0.03 (−0.08 to 0.01)	0.154
	Baseline % calcific tissue (per 10% increase)	−0.10 (−0.19 to −0.01)	0.035	0.22 (0.13 to 0.31)	<0.001
	Presence of expanding remodeling at baseline	0.20 (0.09 to 0.31)	<0.001	−0.04 (−0.15 to 0.07)	0.506
Increase in necrotic core (per 1 mm^2)	Presence of low wall shear stress at baseline	0.13 (−0.02 to 0.27)	0.097	0.01 (−0.14 to 0.17)	0.872
	Baseline plaque area (per 1-mm^2 increase)	−0.05 (−0.08 to −0.01)	0.017	−0.08 (−0.12 to −0.04)	<0.001
	Baseline plaque burden (per 10% increase)	−0.17 (−0.27 to −0.07)	0.001	−0.14 (0.25 to 0.03)	0.016
	Baseline % necrotic tissue (per 10% increase)	−0.25 (−0.31 to −0.18)	<0.001	–	–
	Baseline % fibrofatty tissue (per 10% increase)	0.16 (0.02 to 0.31)	0.028	0.17 (0.03 to 0.31)	0.016
	Baseline % fibrous tissue (per 10% increase)	0.22 (0.16 to 0.28)	<0.001	0.29 (0.23 to 0.36)	<0.001

JACC Cardiovasc Imaging. 2016 Aug;9(8):1009-11. doi: 10.1016/j.jcmg.2015.07.005. Epub 2015 Sep 9.

Noninvasive Prediction of Atherosclerotic Progression: The PROSPECT-MSCT Study.

Bourantas CV, Papadopoulou SL, Serruys PW, Sakellarios A, Kitslaar PH, Bizopoulos P, Girasis C, Zhang YJ, de Vries T, Boersma E, Papafaklis MI, Naka KK, Fotiadis DI, Stone GW, Reiber JH, Michalis LK, de Feyter PJ, Garcia-Garcia HM.

Can we measure ESS from 3D QCA reliably?

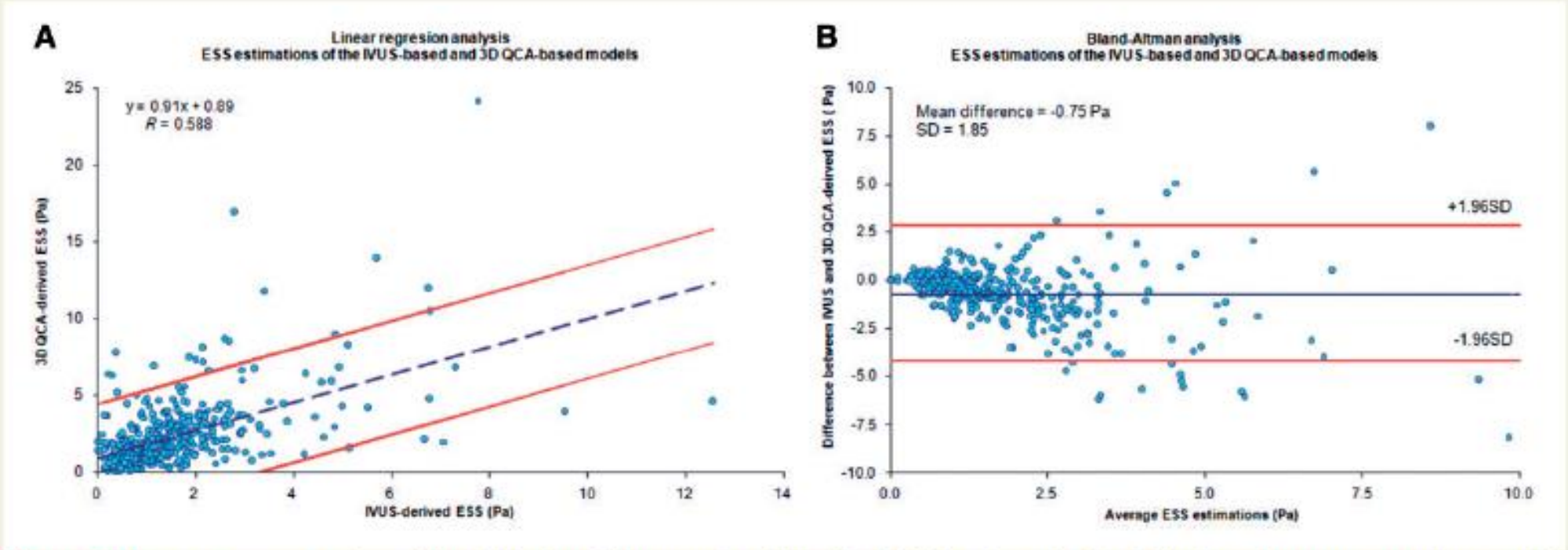


Figure 2 Linear regression analysis (*A*) and Bland and Altman analysis (*B*) of the IVUS-based vs. the 3D QCA-derived minimum predominant ESS values estimated in the 470 3 mm segments included in the present analysis.

Mpourantas, …., Michalis et al: European J CardioVasc Imag, 2018

FINAL CONCLUSION

- We are moving towards a new era

- The whole concept is accurate as possible prediction of new events in order to establish pre-emptive treatments
- It seems that we can predict up to 58% from 18% who is the accepted value till now
- It seems that we will be able to get this results non-invasively

Thank you for your attention