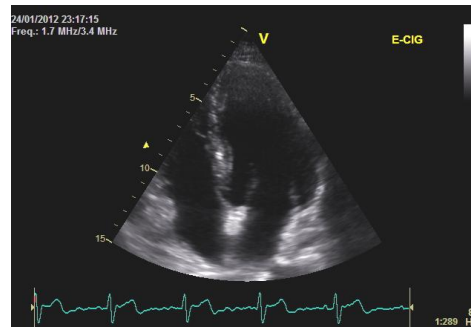




Vs.



## Acute effects of using an electronic nicotine-delivery device (e-cigarette) on myocardial function: comparison with the effects of regular cigarettes

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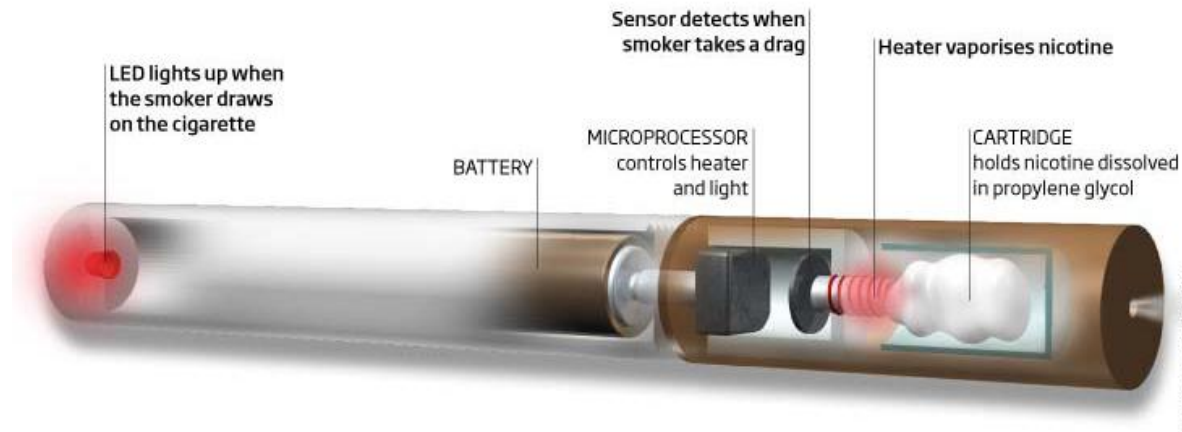


# Conflict of interest

All authors report no COI



# What is it?





# What is it?



## Liquid contents

- Glycerol
- Propylene glycol
- Flavorings
- Nicotine (optional)



# Why should we study it?

- Invented in 2003 by a Chinese pharmacist
- On the market for several years, as an alternative to cigarette smoking
- Several millions of people are using it
- Interesting characteristics: nicotine delivery, dealing with psychological addiction, no side-stream smoking
- Laboratory analysis showed that it contains no or traces of nitrosamines, no PAH
- WHO has asked for clinical studies to be performed, because these products should be regulated
- Regulation is imminent but no clinical studies to be based on

**CVD is an important cause of morbidity and mortality  
in smokers**



# Study protocol

## ◎ Background

Several studies have shown that acute smoking inhalation has adverse effects on myocardial function (Kyriakides et al, Eur Heart J 1992, Lichodziejewska et al, Chest 2007)

## ◎ Purpose

To study whether e-cigarette use has any immediate adverse effects on cardiac function compared to using tobacco cigarette.



# Study protocol

## ◎ Design

### Inclusion criteria

All subjects healthy, no risk factors for CVD

Smokers:  $\geq 5$  years smoking history,  $\geq 15$  cig/d

e-cigarette users:  $\geq 1$  month use, quit smoking

### Exclusion criteria

Medications, recent infection, echocardiographic findings of hypertrophy, dilatation and more than mild valve regurgitation



# Study protocol

## ◎ Design

4h abstinence from caffeine, food and smoking/e-cigarette use

Echocardiography: GE VIVID 7, EchoPac

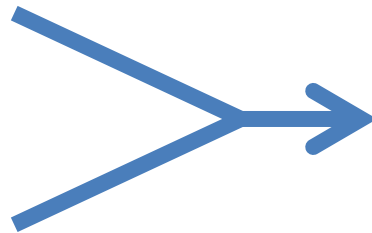
Cigarette used: 1mg nicotine, 10mg tar, 10mg CO

E-cigarette liquid used: 11mg/ml nicotine (**Nobacco**, USA MIX)

Smokers  
N=20

e-cigarette  
users  
N=22

(All had quit smoking for > 1 month)



Baseline  
echocardiogram

Second  
echocardiogram



- Smoking 1 cigarette (smokers)
- e-cigarette use for 7 minutes (e-cigarette users)

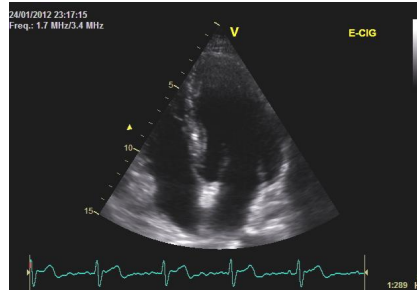




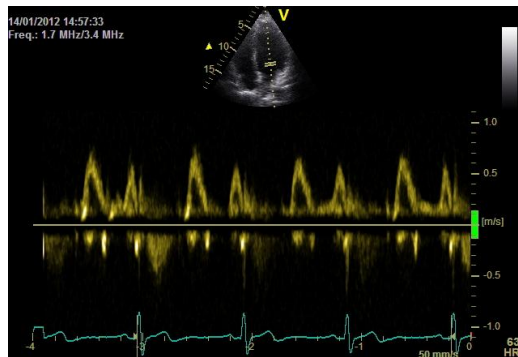


# Study protocol

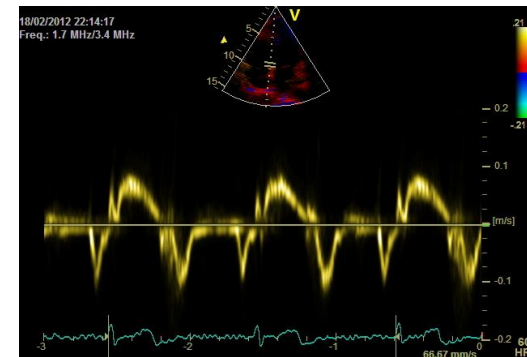
## Design



(LV volumes, LV mass, LA, LVEF)



(E, A, E/A, DT, IVRT, IVRTc)



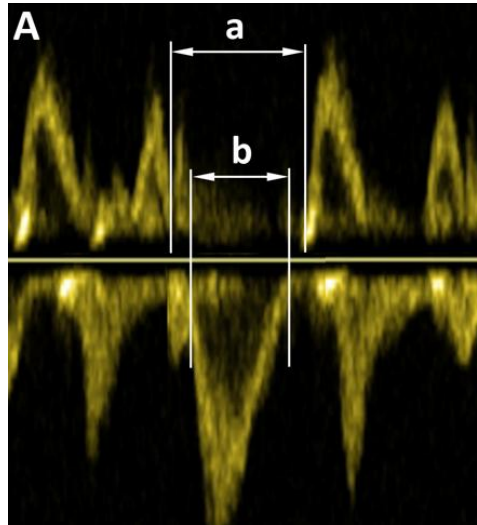
(Sm, Em, Am, Em/Am, E/Em)



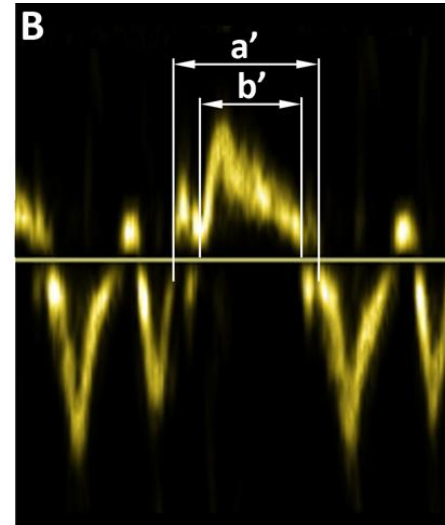
# Study protocol

## Design

$$\text{MPI} = (a-b)/b$$



$$\text{tMPI} = (a'-b')/b'$$



Myocardial Performance Index  
measured by Doppler flow (MPI) and  
tissue Doppler (tMPI)

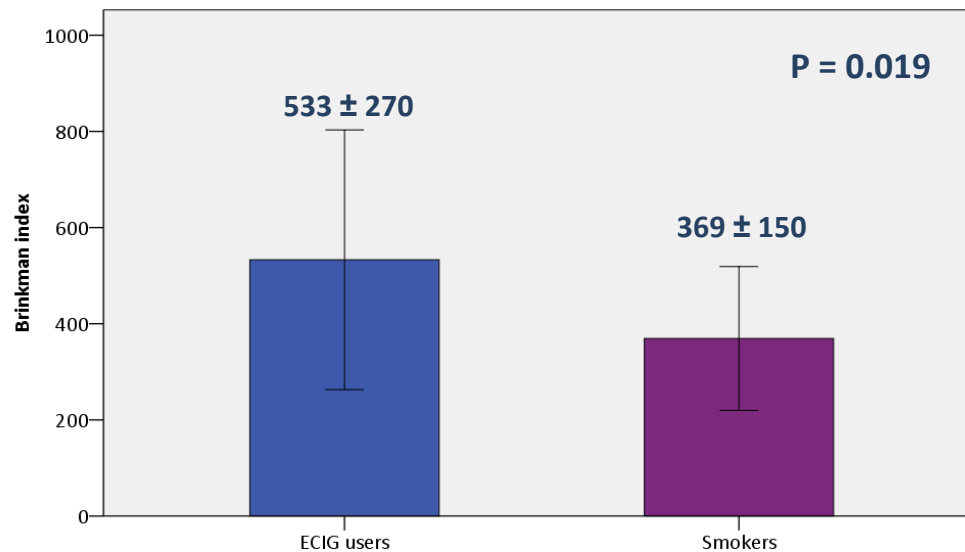


# Study protocol

## Results

Electronic cigarette users were previously heavy smokers ( $29 \pm 11$  vs.  $23 \pm 7$  cigs/d,  $P = 0.046$ )

They had quit smoking for  $93 \pm 65$  days, they were using the device for  $95 \pm 64$  days





# Study protocol

## Results

	Smokers (n=20)	ECIG users (n=22)	P-value
Age (years)	36 ± 5	36 ± 5	0.971
Body-mass index (kg/m <sup>2</sup> )	25.3 ± 2.5	26.5 ± 2.4	0.129
Body-surface area (m <sup>2</sup> )	2.02 ± 0.22	2.09 ± 0.15	0.292
Systolic BP (mmHg)	125 ± 10	127 ± 9	0.479
Diastolic BP (mmHg)	76 ± 6	77 ± 7	0.913
Heart rate (per minute)	67 ± 8	67 ± 9	0.915
LVEDV (ml)	115 ± 23	120 ± 22	0.459
LVESV (ml)	45 ± 8	47 ± 10	0.492
SV (ml)	70 ± 17	73 ± 14	0.497
Ejection fraction (%)	60 ± 4	61 ± 4	0.578
LAd	35 ± 4	34 ± 4	0.688
LAVi (ml/m <sup>2</sup> )	22 ± 5	20 ± 5	0.122
LVMi (g/m <sup>2</sup> )	63 ± 10	68 ± 13	0.154



# Study protocol

## Results

### Haemodynamic changes

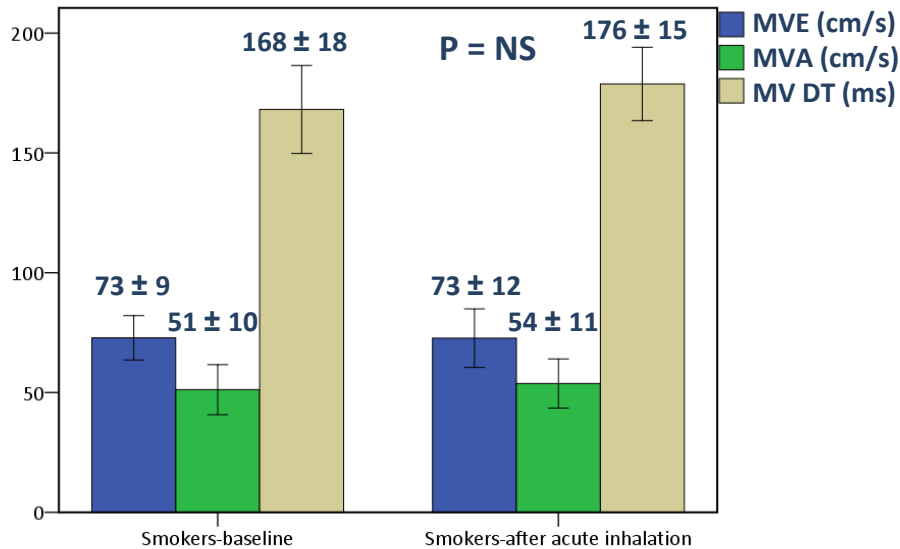
	Smokers (n=20)	ECIG users (n=22)	P-value (smokers intra-group)	P-value (ECIG users intra- group)	P-value (inter- group after inhalation)
SBP (mmHg)	135 ± 7	128 ± 10	< 0.001	0.433	0.028
DBP (mmHg)	80 ± 7	81 ± 6	< 0.001	0.001	0.57
HR bpm	74 ± 8	68 ± 10	< 0.001	0.245	0.055
Ejection fraction (%)	60 ± 4	62 ± 4	0.317	0.224	0.571

- Smoking increased SBP by 7.6%, DBP by 6.3% and HR by 10.4%
- ECIG use increased DBP by 4.4%

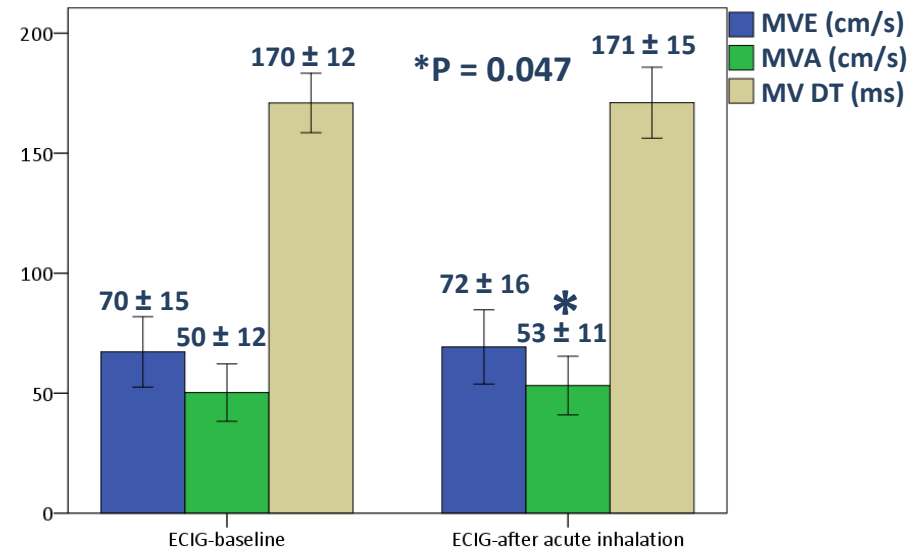


# Study protocol

## Results



$E/A = 1.48 \pm 0.35 \rightarrow E/A = 1.38 \pm 0.31$   
( $P = 0.026$ )



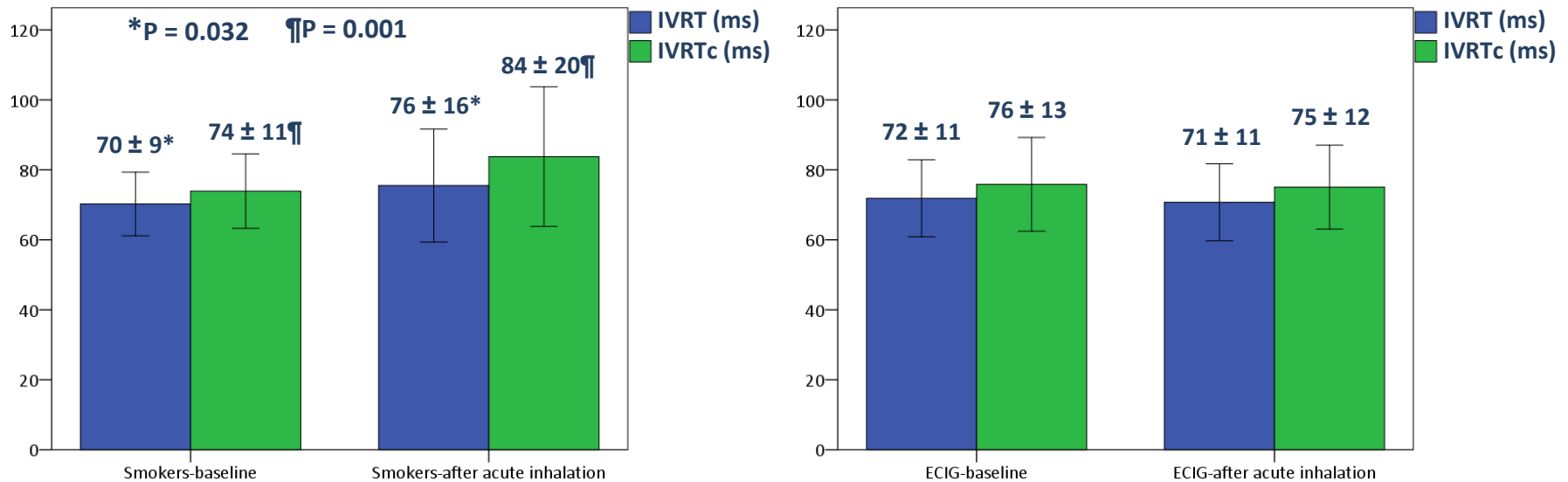
$E/A = 1.44 \pm 0.34 \rightarrow E/A = 1.38 \pm 0.31$   
( $P = 0.054$ )

Transmitral flow



# Study protocol

## Results

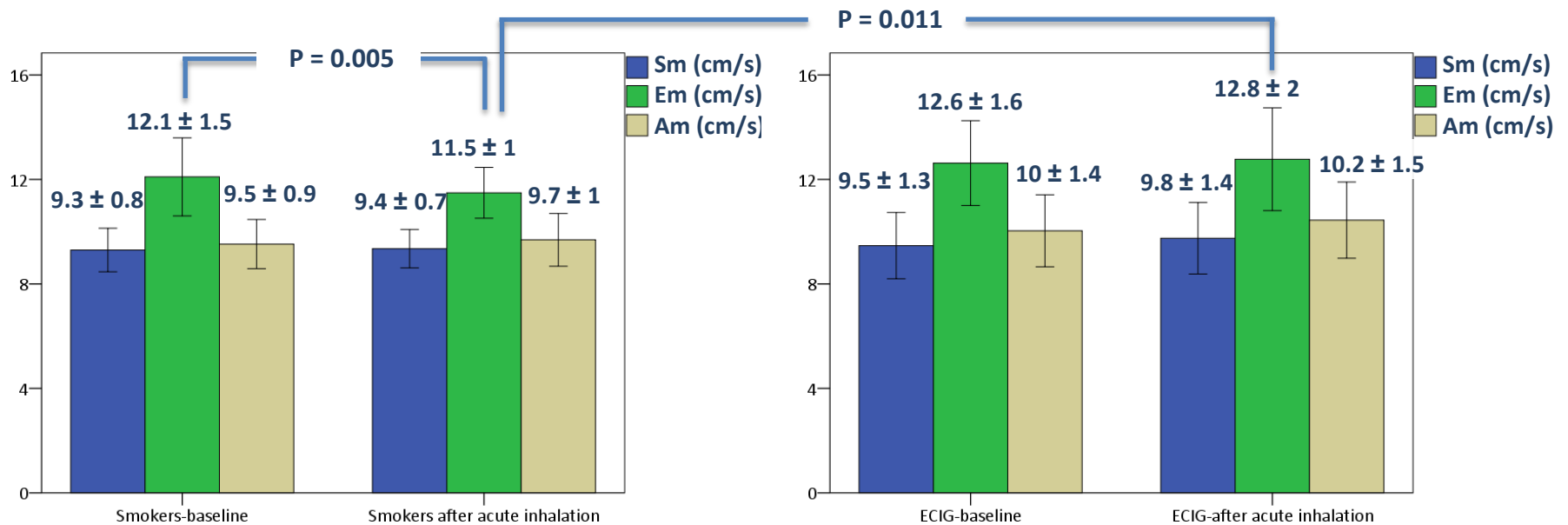


IVRT, IVTRc



# Study protocol

## Results



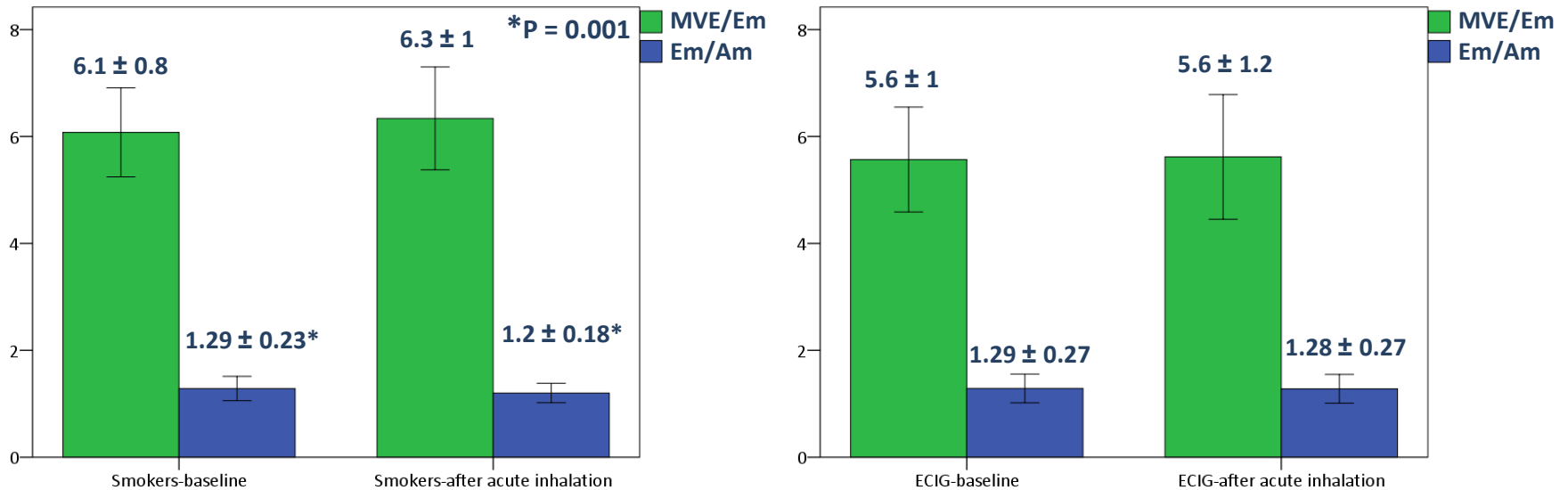
Mitral annulus velocities





# Study protocol

## Results

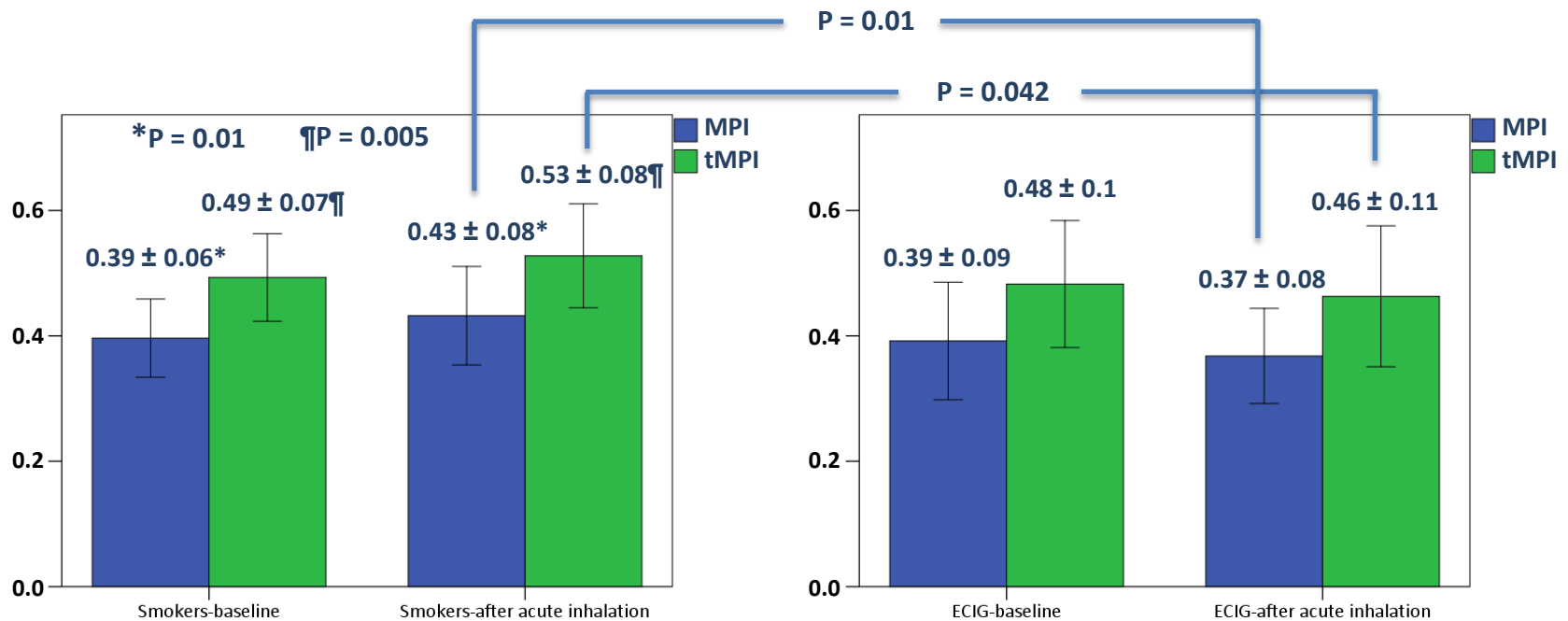


E/Em, Em/Am



# Study protocol

## Results



MPI, tMPI



# Smoking vs electronic cigarette

## ◎ Conclusions

Haemodynamics: greater elevation in BP and HR from smoking compared to ECIG, although we used liquid with nicotine concentration of 11mg/ml

Cardiac function: diastolic function acutely impaired in smokers, in accordance to previous studies

No difference in diastolic function observed in experienced ECIG users

### Potential mechanisms

Less nicotine absorbed (Bullen et al, Tob Control 2010)

Absence of combustion and different chemical composition, leading to less free radicals created and absorbed.

*THANK YOU*

