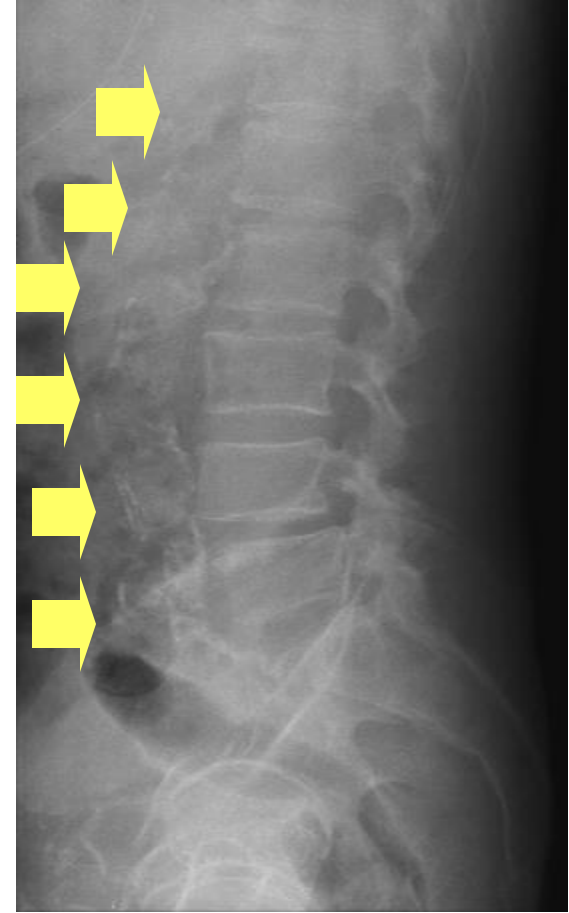
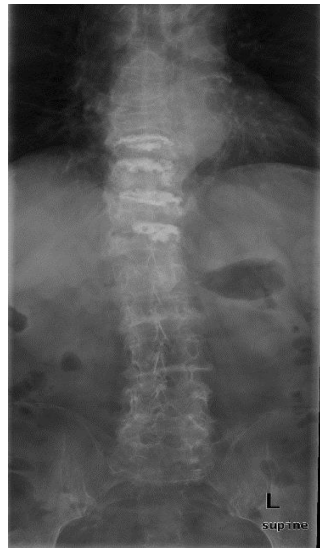
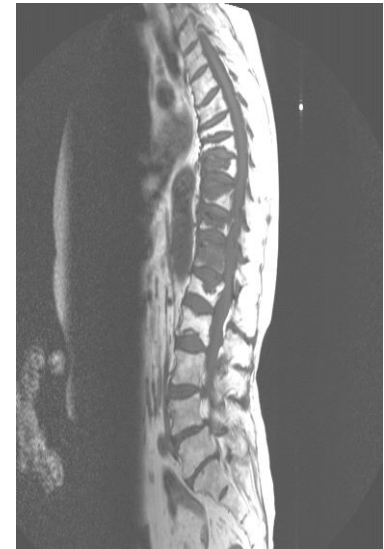
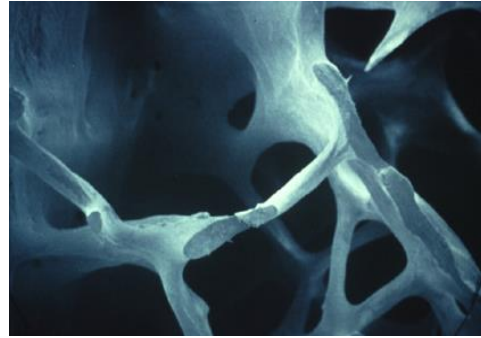
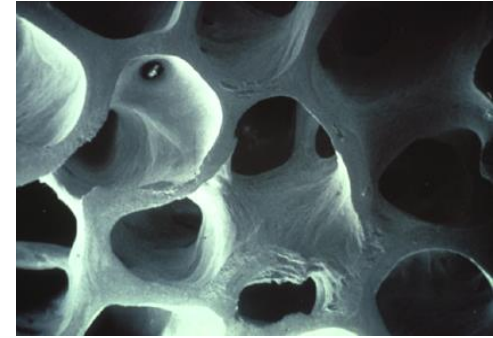


Is Osteoporosis linked with Cardiovascular Disease?

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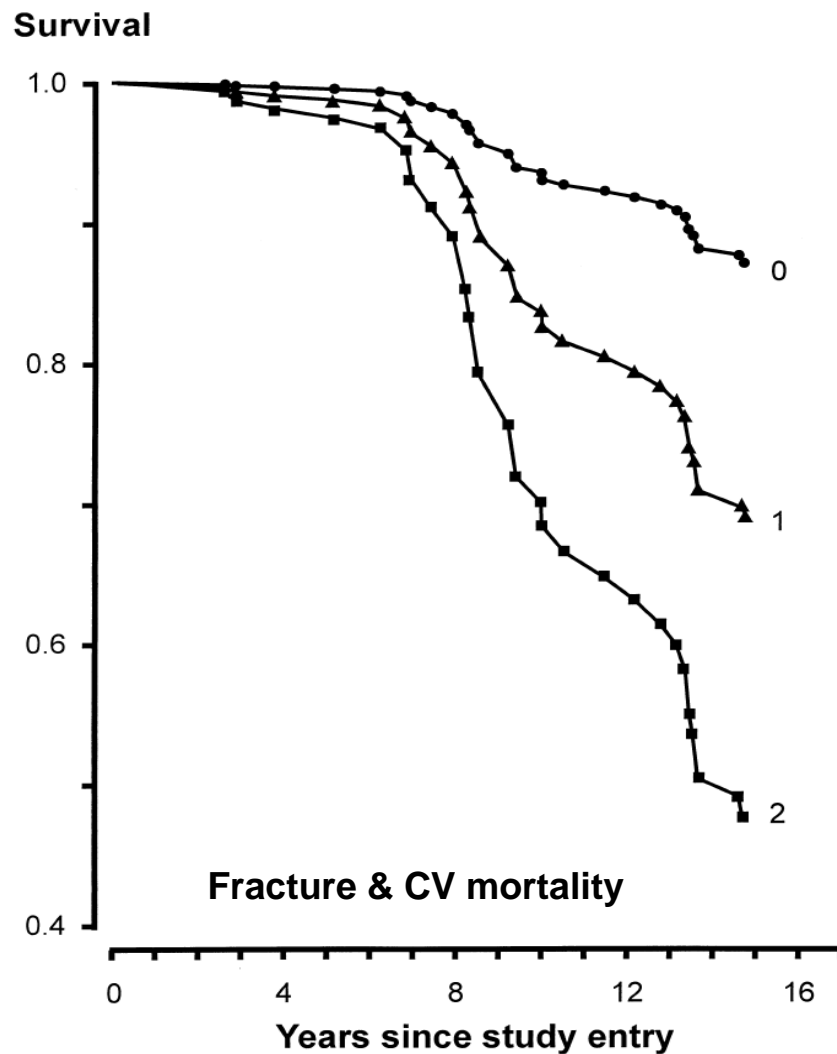
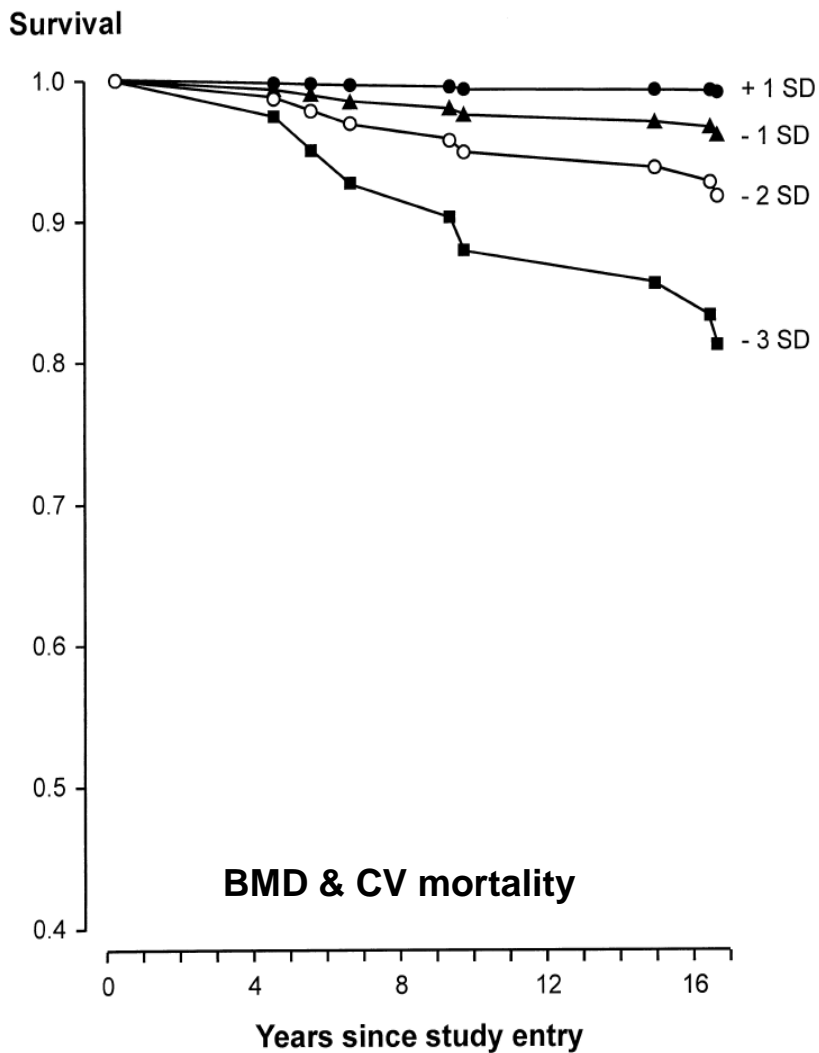
Osteoporosis vs Vascular calcification



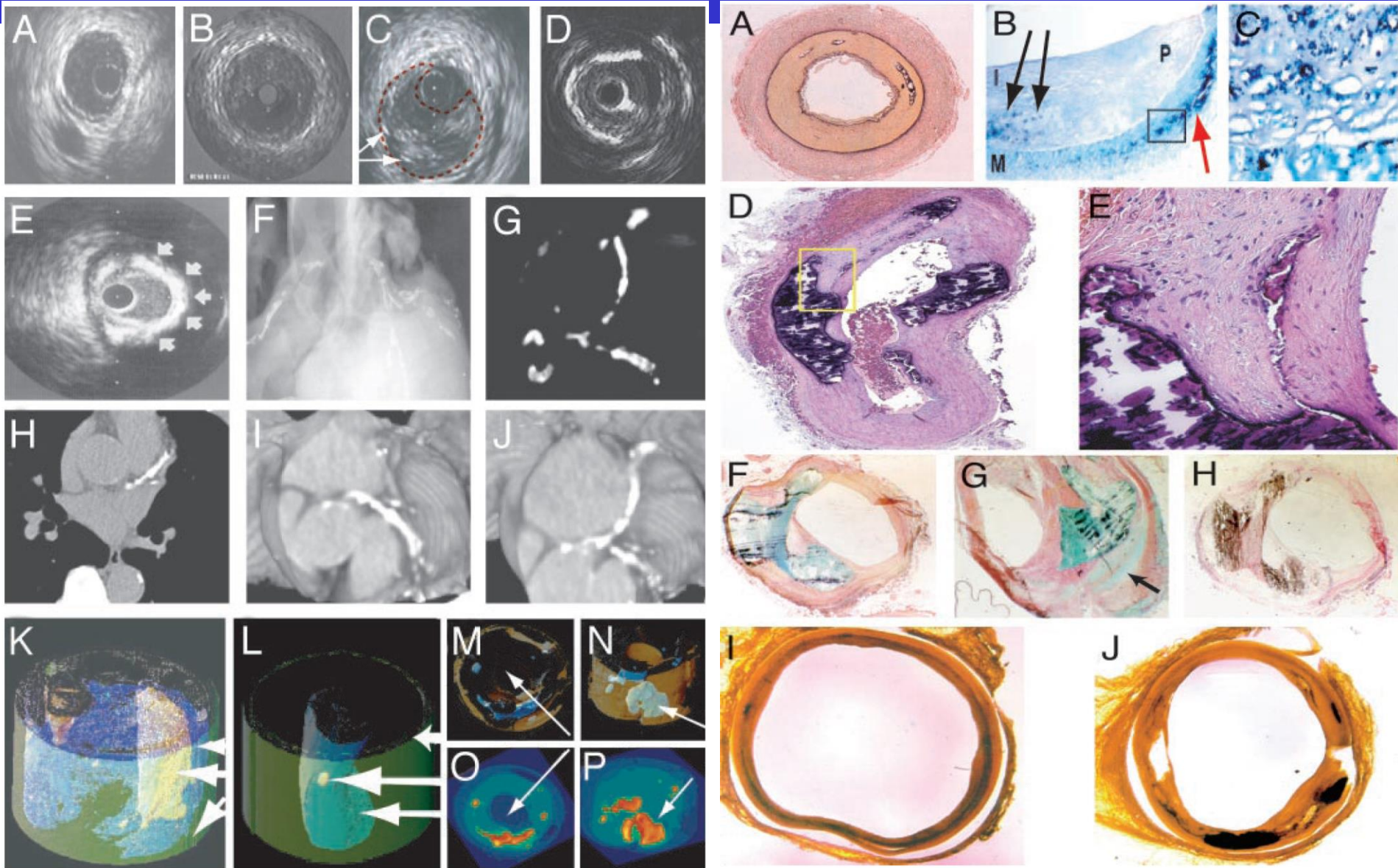
Osteoporosis

Vascular calcification

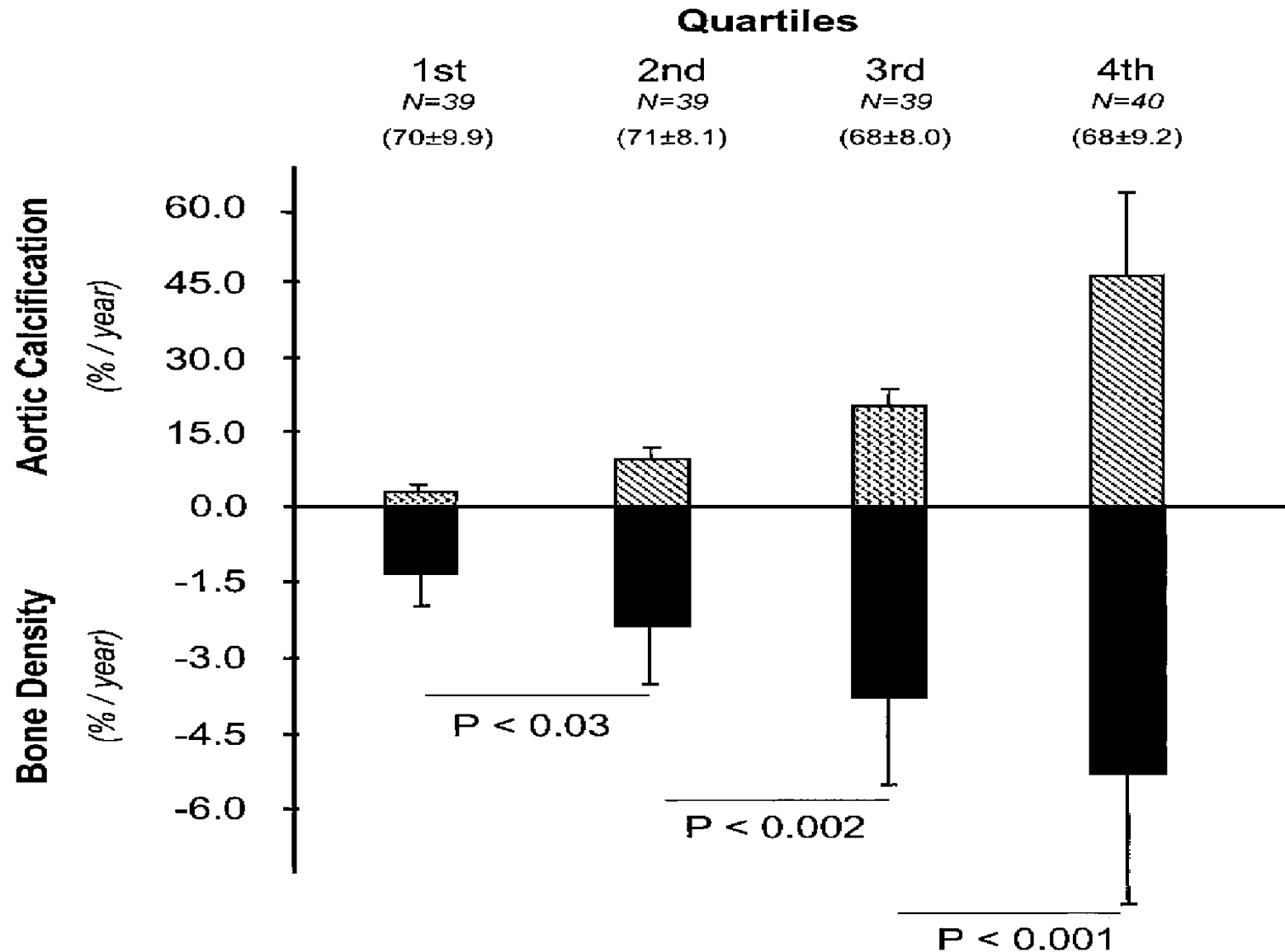
Association between Low Bone Mass and Cardiovascular Mortality



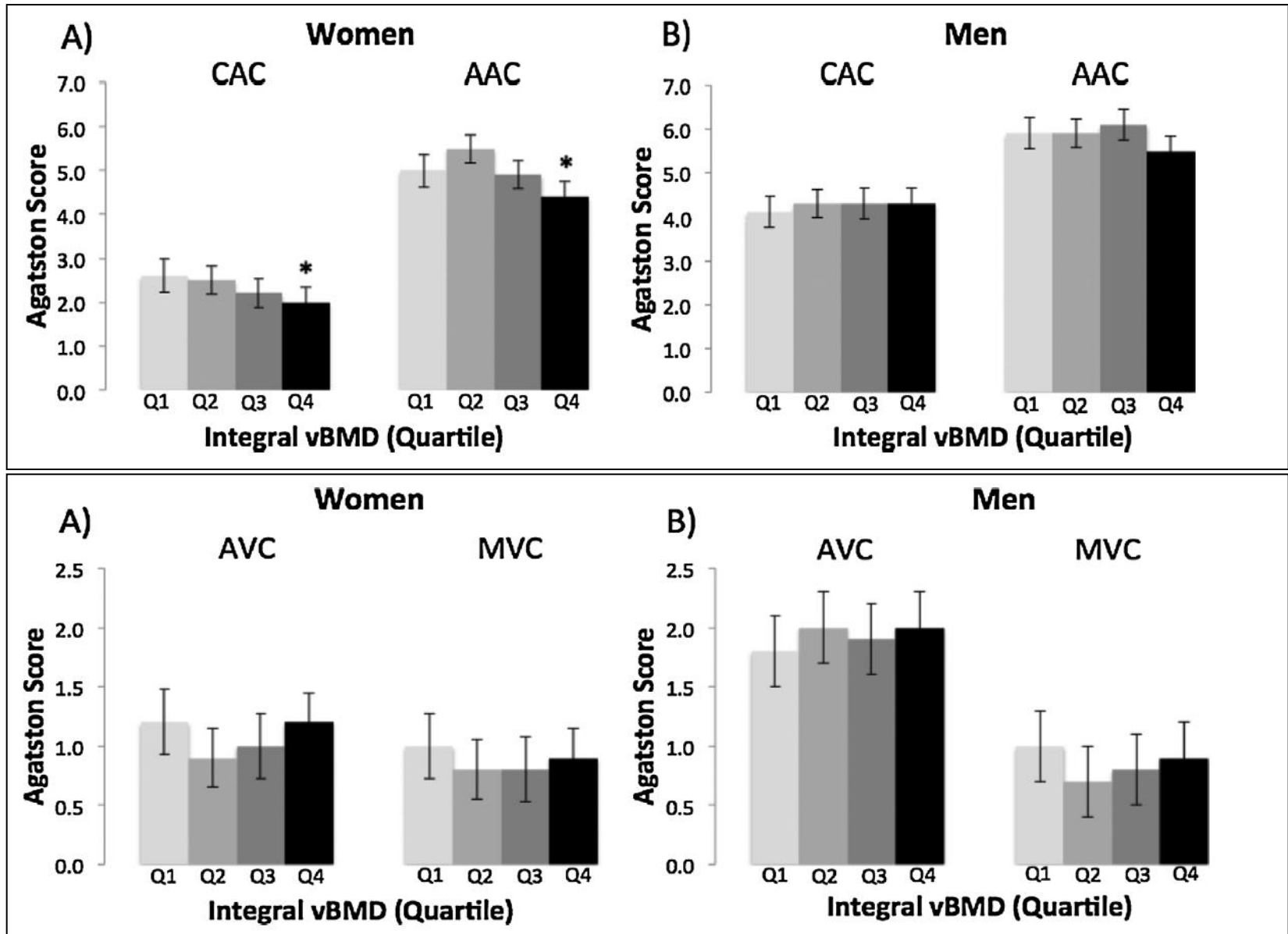
Vascular Calcification



Aortic Calcification & the Risk of Osteoporosis

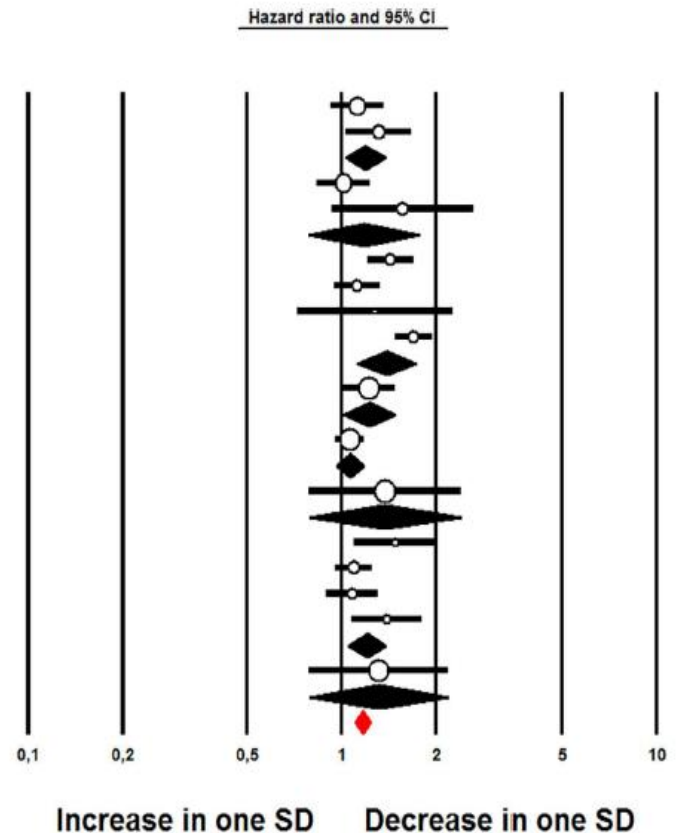


QCT Volumetric Bone Mineral Density & Vascular/Valvular Calcification (Framingham Study)

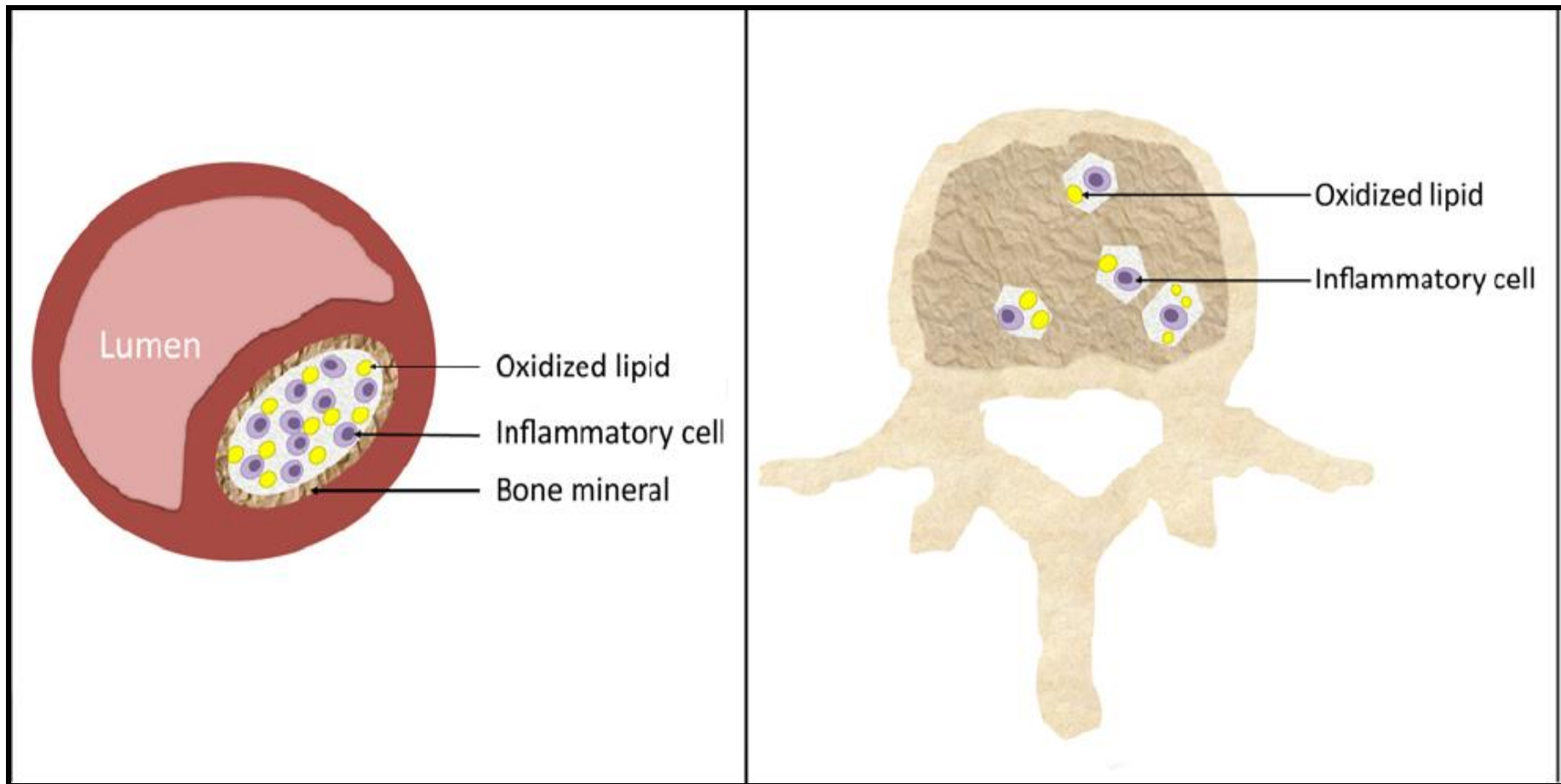


Bone mineral density & incident cardiovascular diseases

Group by Subgroup within study	Study name	Statistics for each study				
		Hazard ratio	Lower limit	Upper limit	Z-Value	p-Value
Calcaneus	Browner et al., 1991 (calcaneus)	1,120	0,930	1,349	1,192	0,233
Calcaneus	Browner et al., 1993 (calcaneus)	1,310	1,029	1,668	2,190	0,029
Calcaneus		1,188	1,024	1,378	2,268	0,023
Distal radius	Browner et al., 1991 (distal radius)	1,010	0,833	1,225	0,101	0,919
Distal radius	von der Recke et al., 1999	1,560	0,931	2,613	1,689	0,091
Distal radius		1,172	0,782	1,756	0,770	0,442
Femoral neck	Wiklund et al., 2012 (femoral neck)	1,430	1,214	1,685	4,272	0,000
Femoral neck	Farhat et al., 2007 (femoral neck)	1,120	0,947	1,325	1,320	0,187
Femoral neck	Pinheiro et al., 2006 (femoral neck)	1,280	0,725	2,260	0,851	0,395
Femoral neck	Zhou et al., 2015	1,690	1,480	1,930	7,745	0,000
Femoral neck		1,387	1,120	1,718	3,000	0,003
Proximal radius	Browner et al., 1991 (proximal radius)	1,220	1,011	1,472	2,077	0,038
Proximal radius		1,220	1,011	1,472	2,077	0,038
Radiographic absorptiometry of left hand	Mussolino et al., 2003	1,060	0,956	1,175	1,107	0,268
Radiographic absorptiometry of left hand		1,060	0,956	1,175	1,107	0,268
Spine	Pinheiro et al., 2006 (spine)	1,370	0,786	2,388	1,111	0,267
Spine		1,370	0,786	2,388	1,111	0,267
Total hip	Wiklund et al., 2012 (total hip)	1,480	1,098	1,996	2,571	0,010
Total hip	Farhat et al., 2007 (total hip)	1,090	0,958	1,240	1,310	0,190
Total hip	Mussolino et al., 2007	1,080	0,895	1,303	0,804	0,422
Total hip	Trivedi et al., 2001	1,390	1,080	1,789	2,555	0,011
Total hip		1,199	1,038	1,384	2,464	0,014
Trochanter	Pinheiro et al., 2006 (trochanter)	1,310	0,787	2,180	1,039	0,299
Trochanter		1,310	0,787	2,180	1,039	0,299
Overall		1,163	1,092	1,239	4,680	0,000

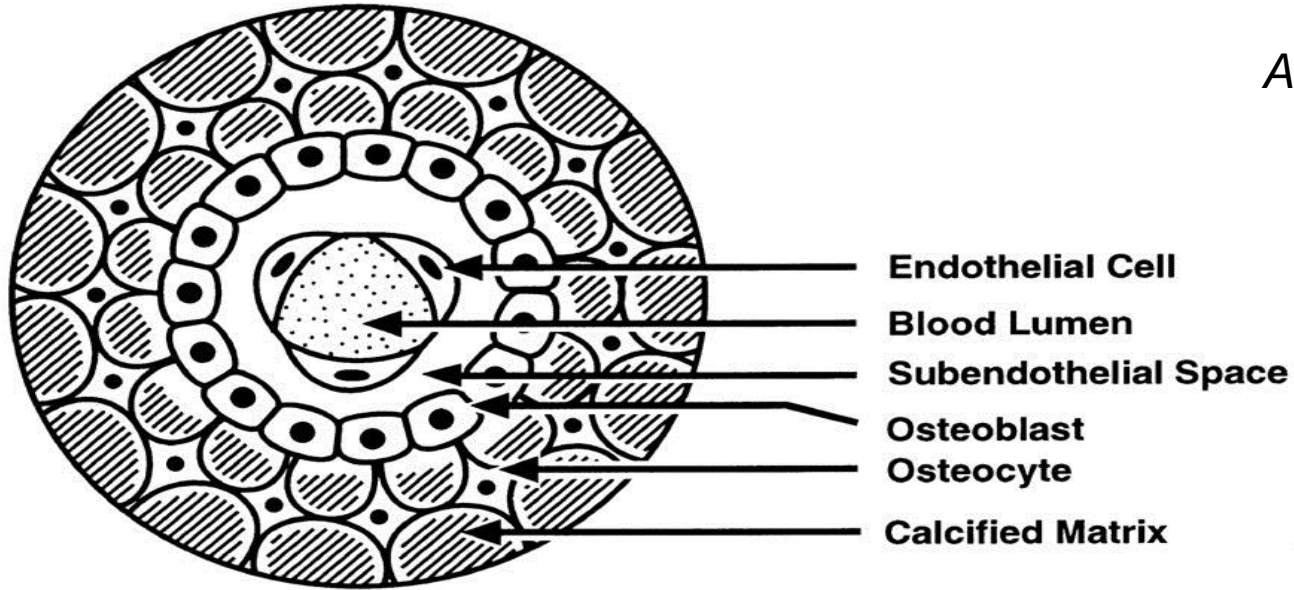


Atherosclerosis & bone mineralization

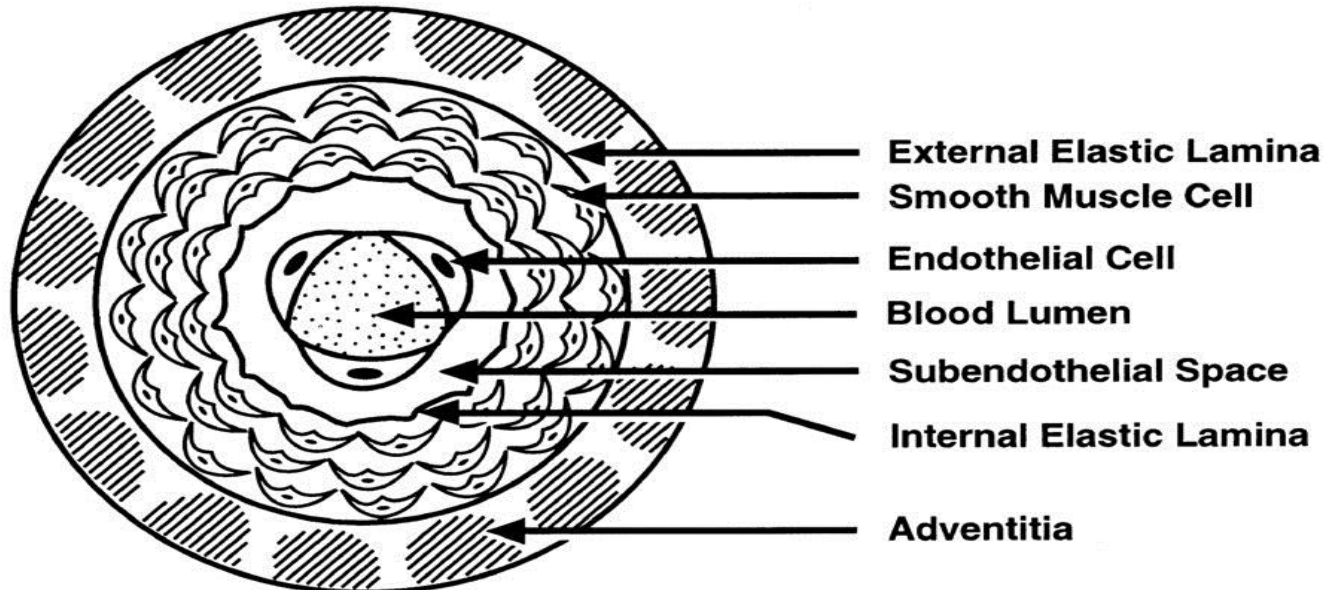


Osteon

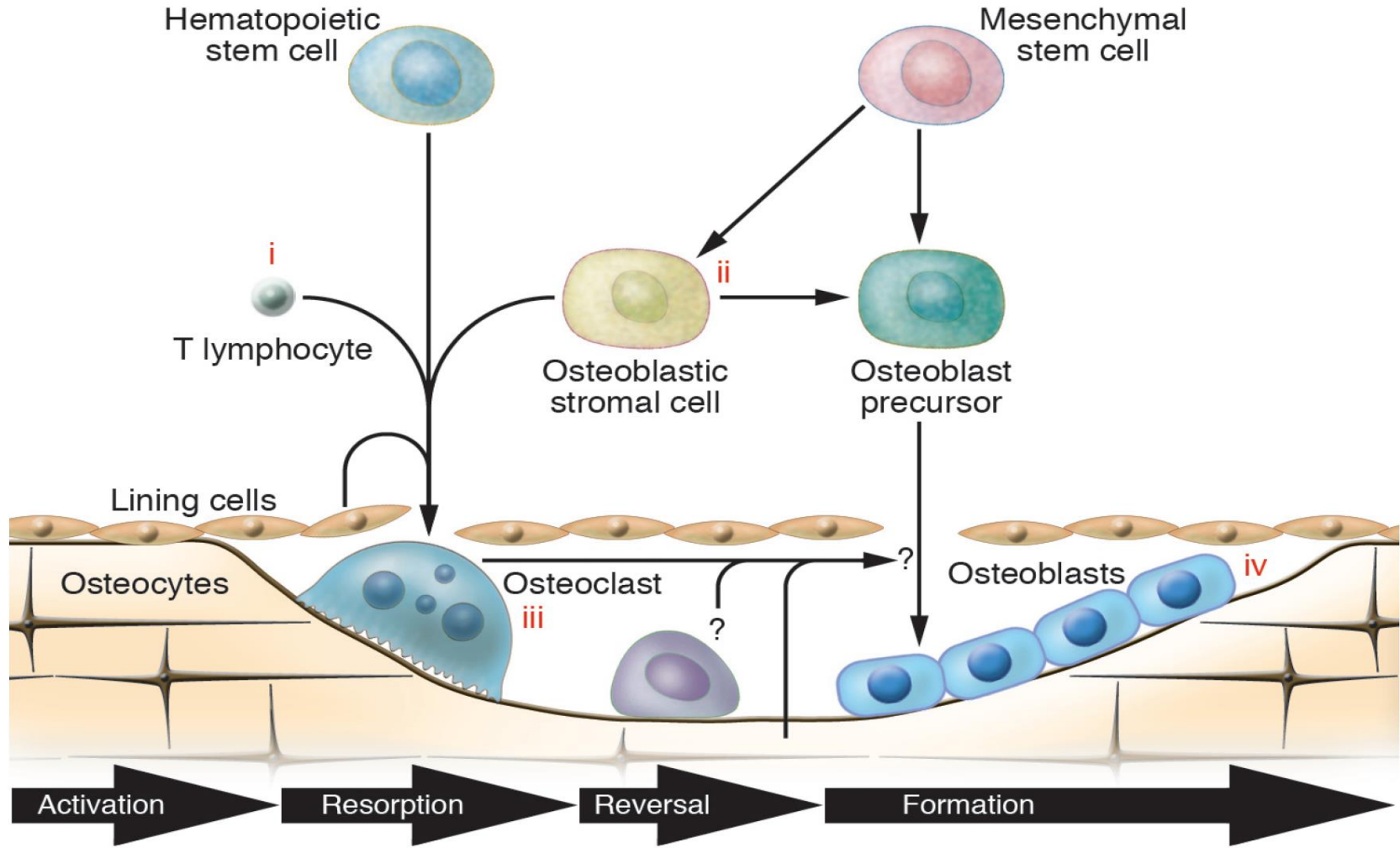
ATVB 1997;17:680-687



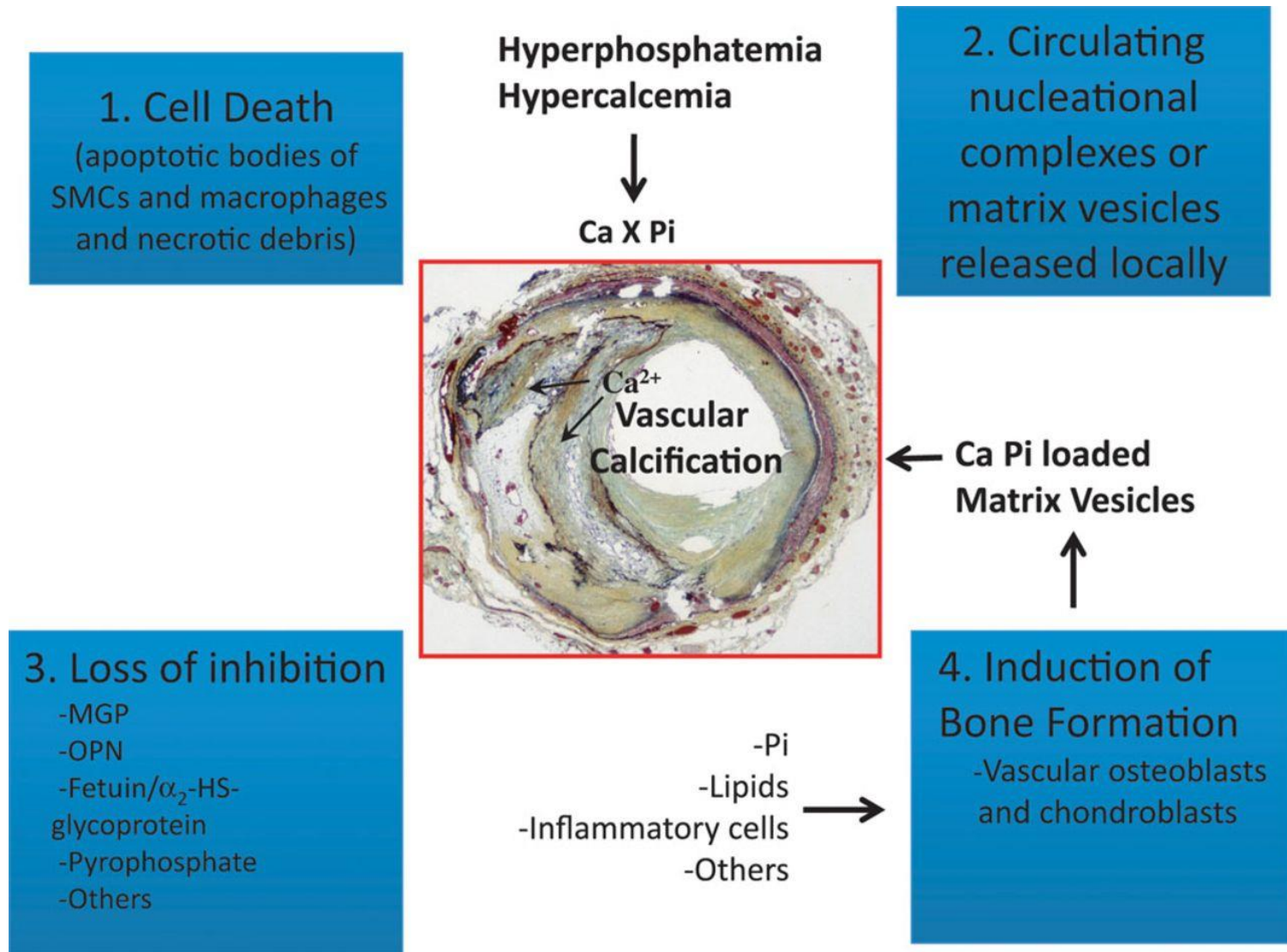
Artery Wall



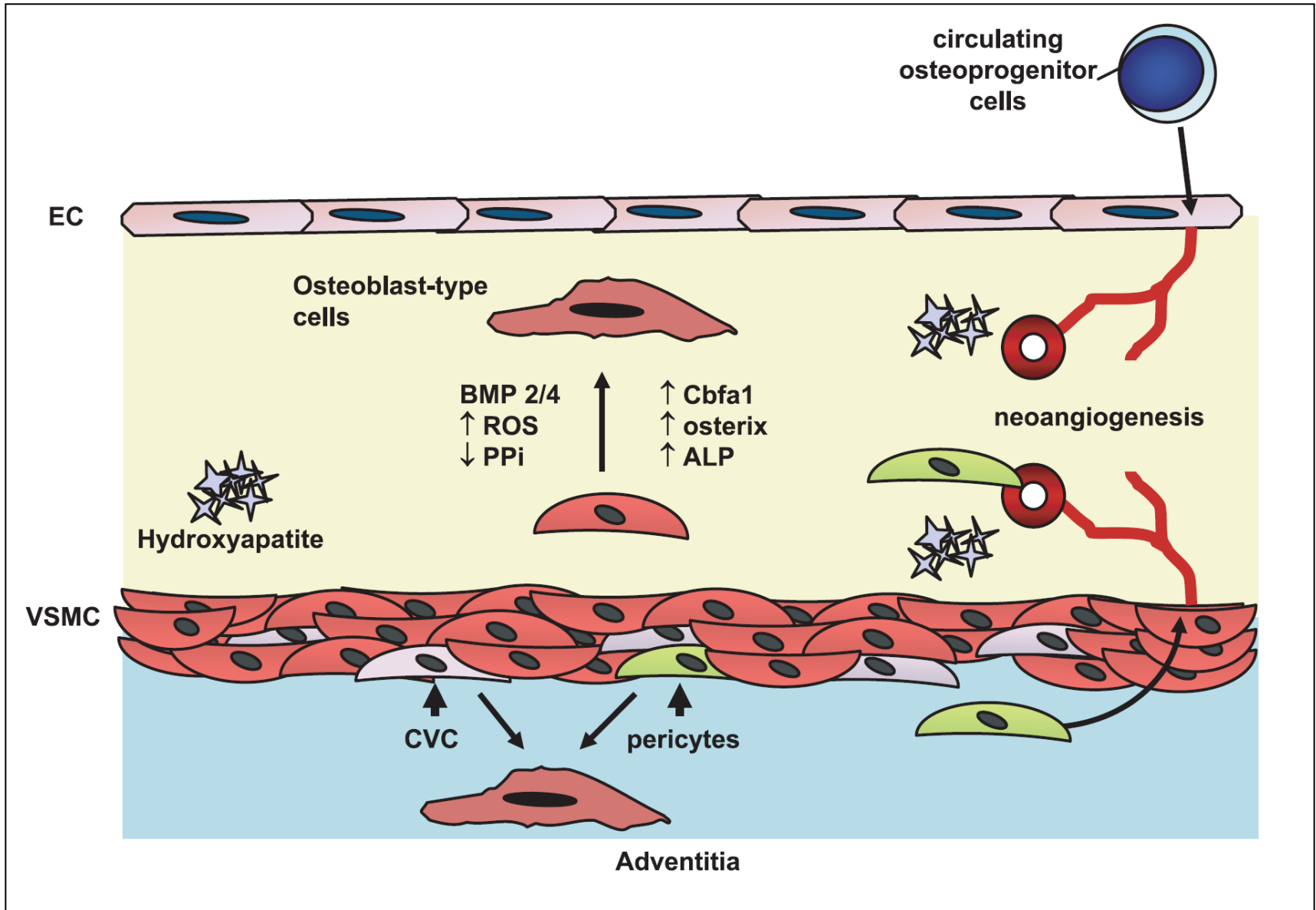
Bone remodeling process



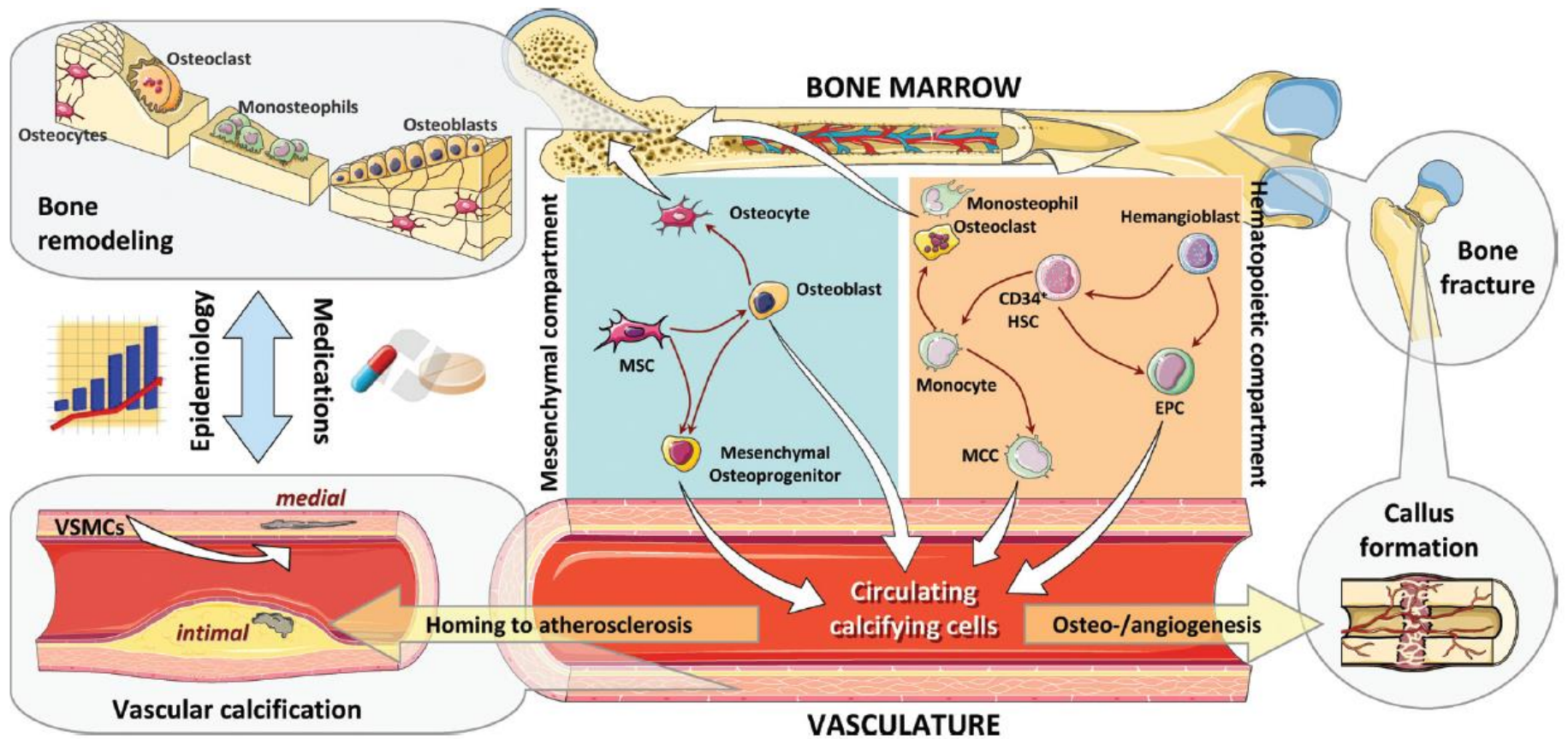
Theories for vascular calcification



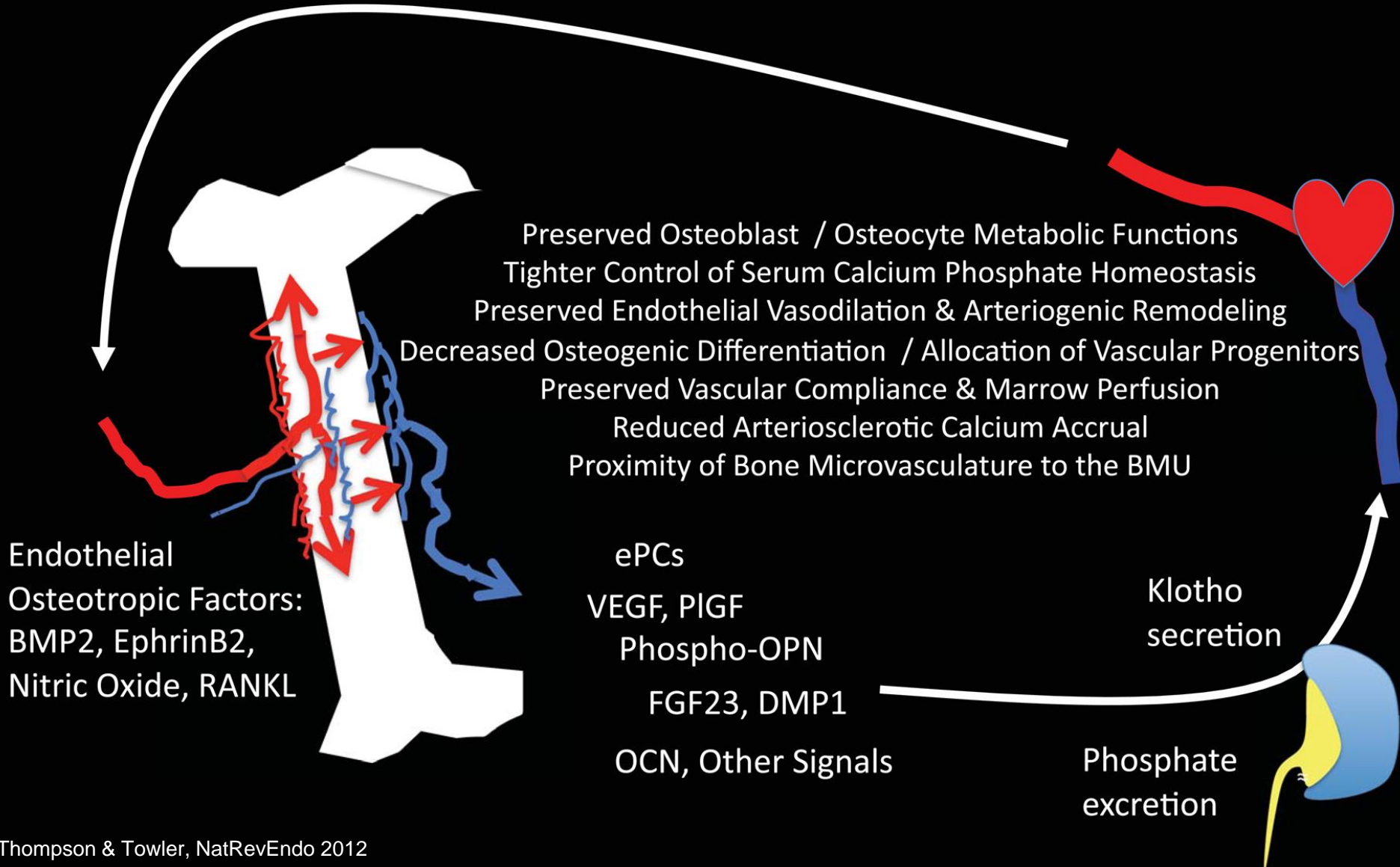
Origin of osteoblast-type cells



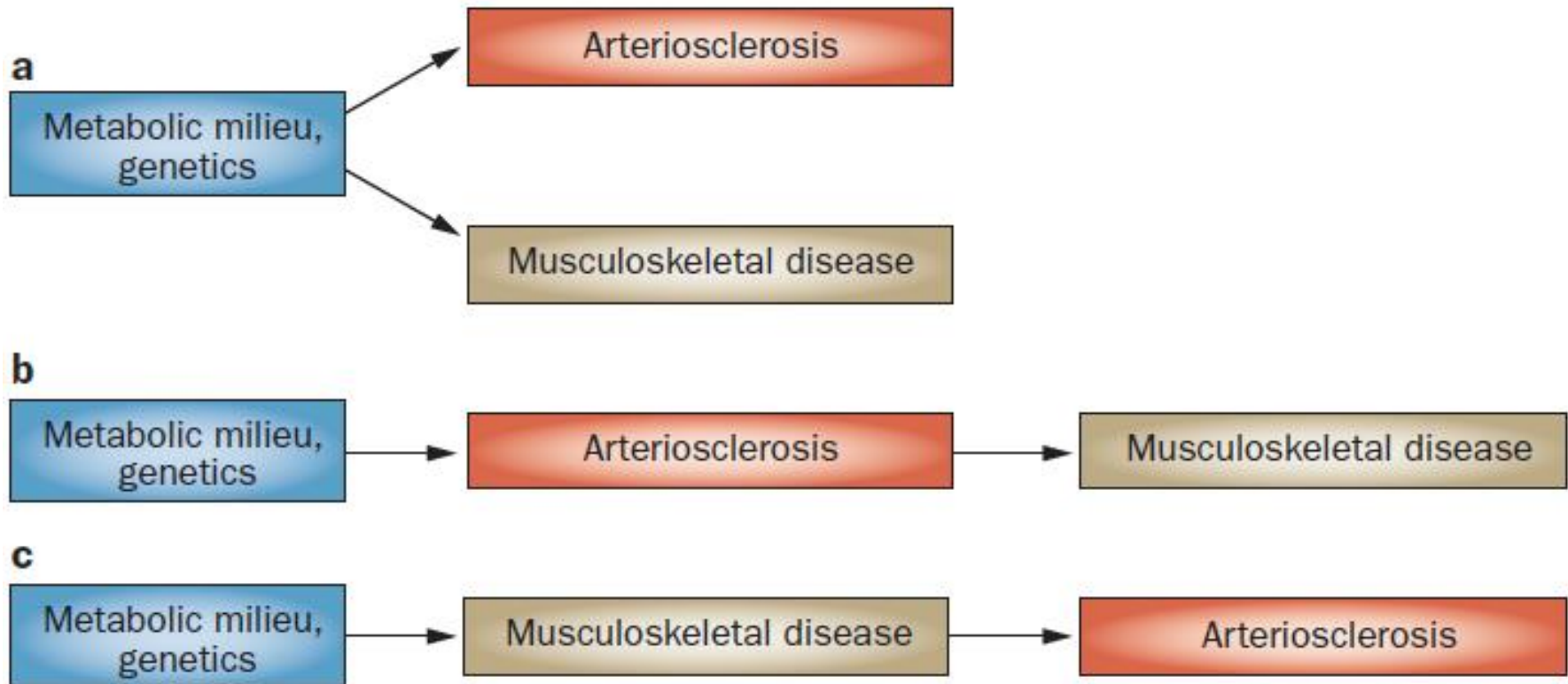
Role of circulating calcifying cell (CVC) in bone-vascular axis



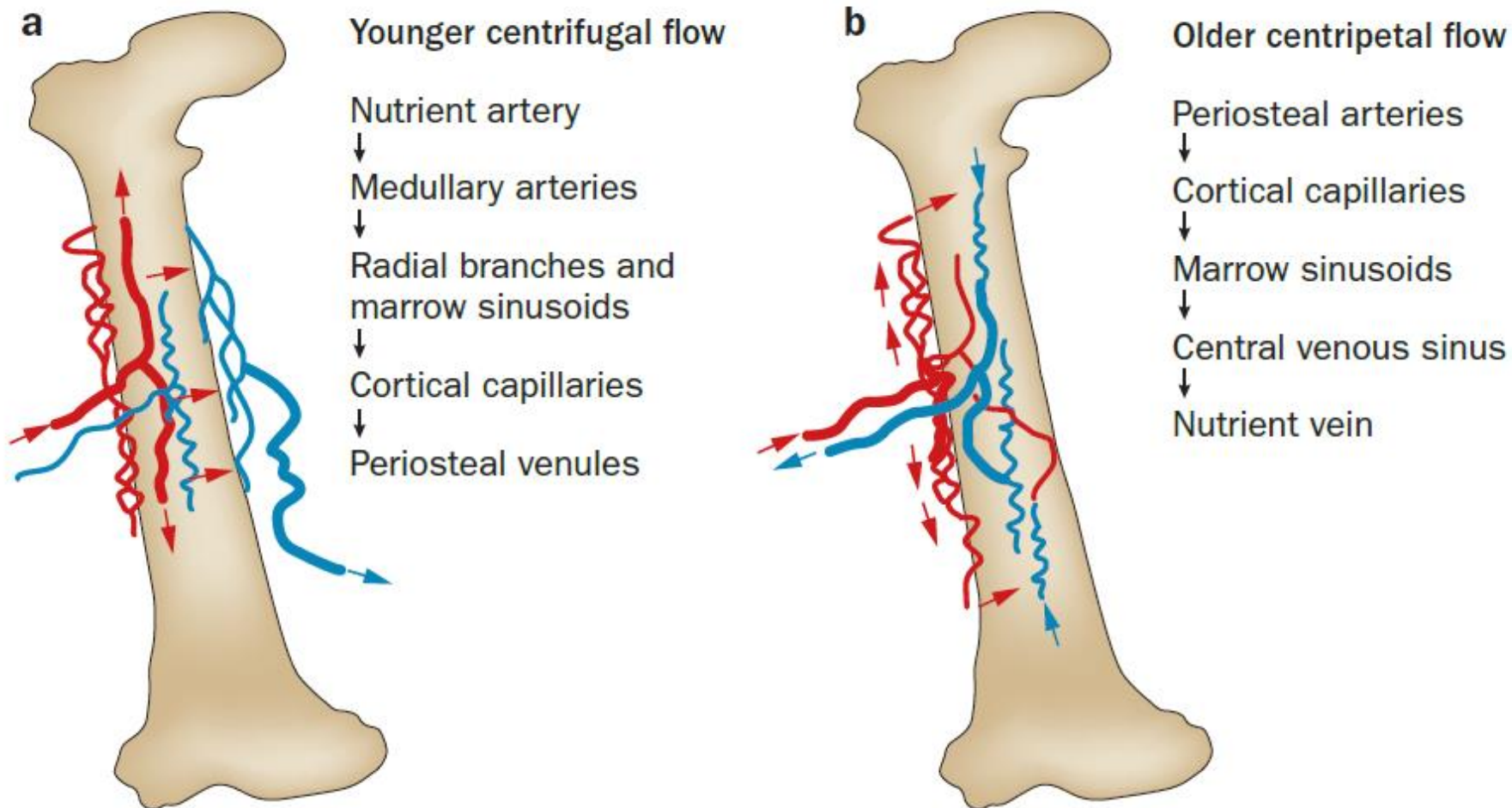
Emerging Bone-Vascular Interactions



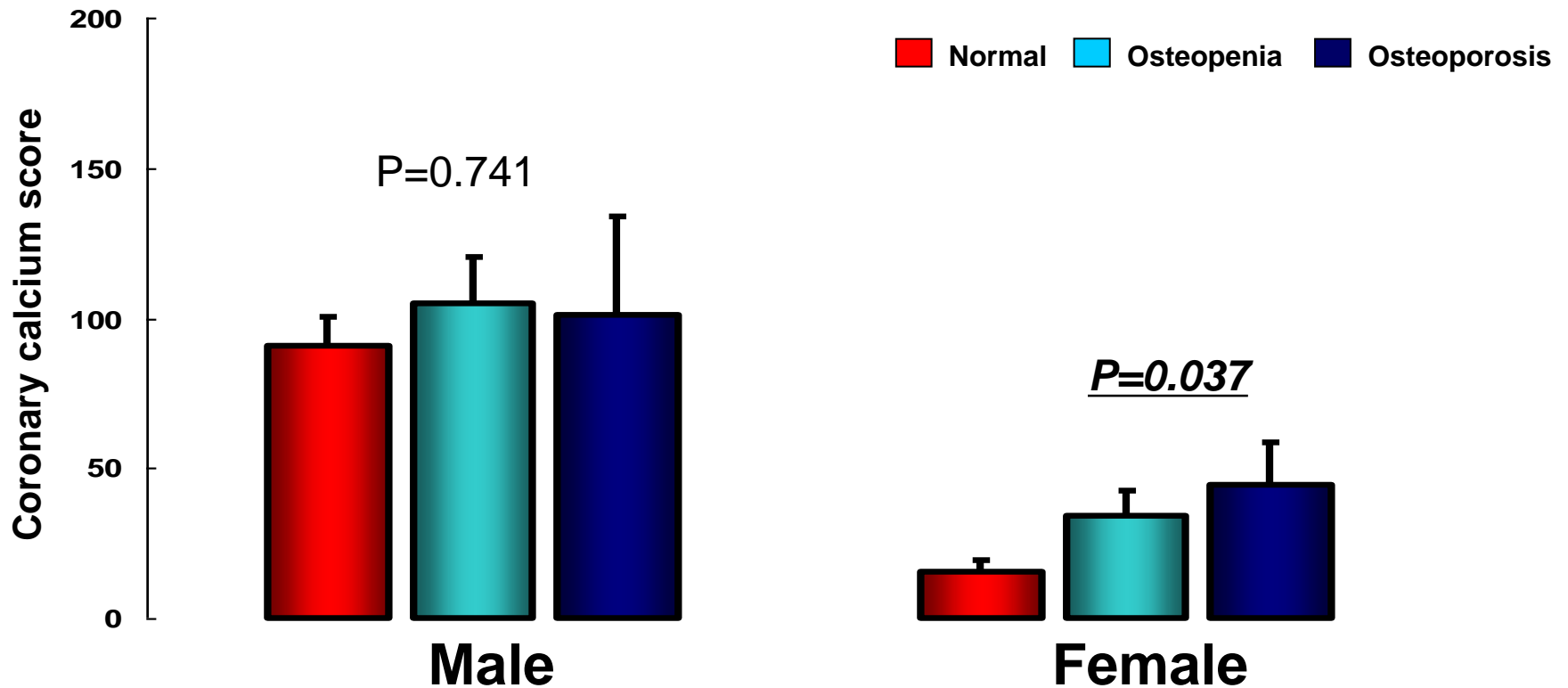
Relationships between the metabolic milieu, genetics, arteriosclerosis & musculoskeletal disease



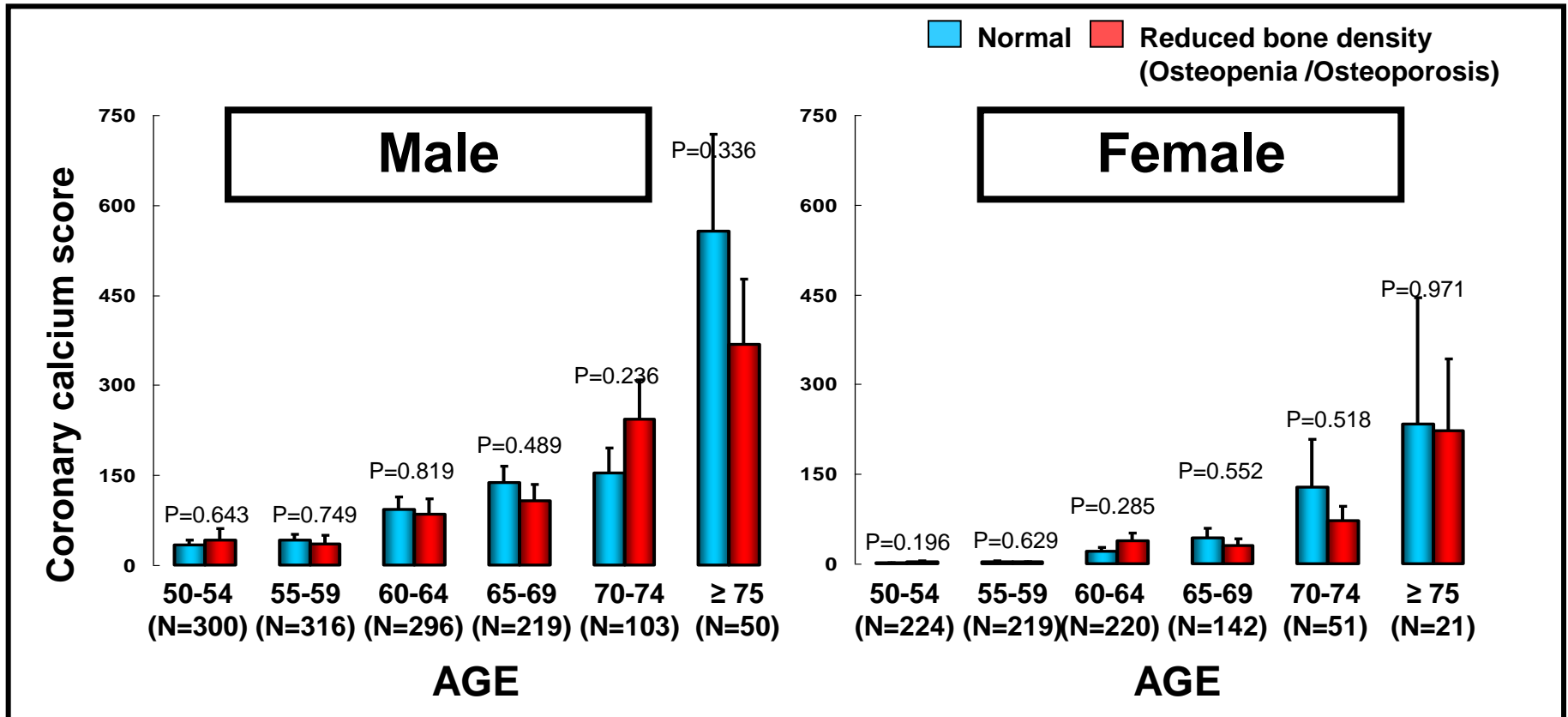
Age-dependent changes in cortical blood flow of long bones



Coronary calcium score & bone mineral density



Coronary calcium score & age according to the bone mineral density



Unadjusted and adjusted odds ratio for presence of any coronary artery calcium (CACs > 0) with reduced bone mineral density (osteopenia and osteoporosis)

Male>

	Odds ratio	P value	95% Confidence interval
Model (1)	1.124	0.349	0.880 ~ 1.434
Model (2)	0.985	0.910	0.764 ~ 1.271
Model (3)	1.097	0.532	0.821 ~ 1.466

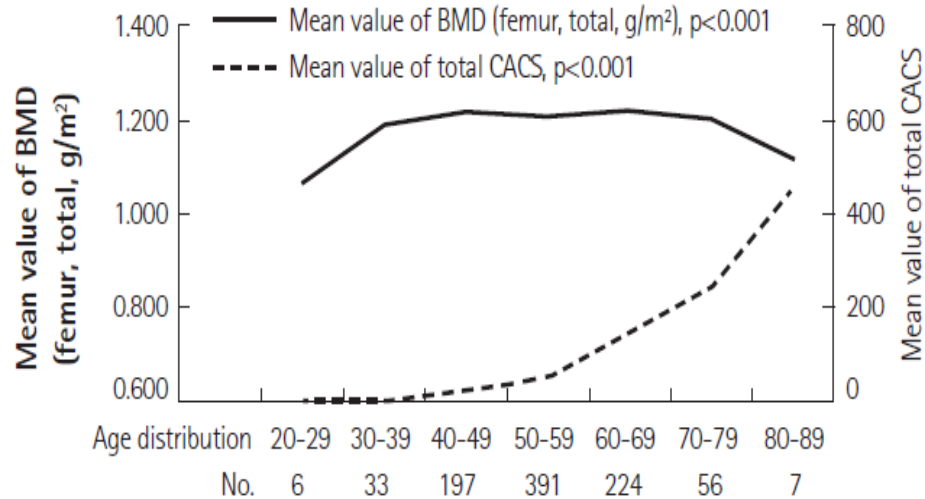
Female>

	Odds ratio	P value	95% Confidence interval
Model (1)	1.925	< 0.001	1.383 ~ 2.679
Model (2)	1.148	0.460	0.797 ~ 1.176
Model (3)	1.292	0.223	0.856 ~ 1.950

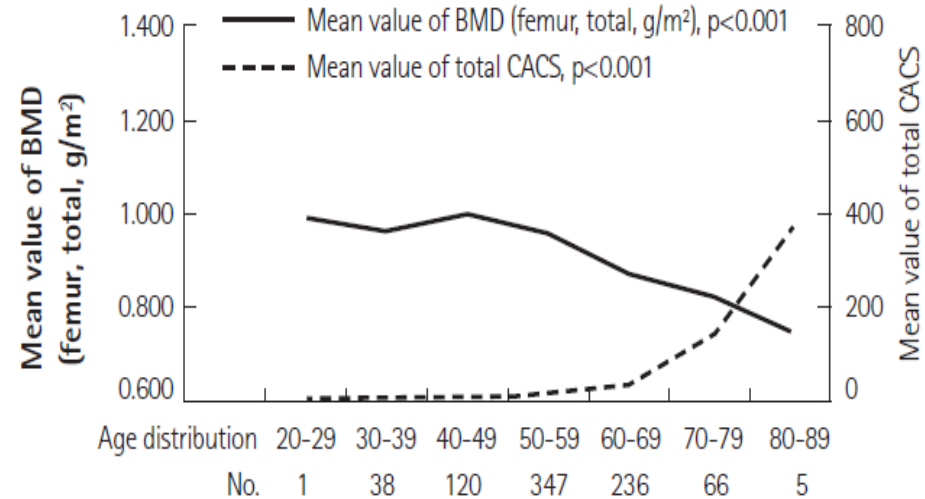
Model (1); unadjusted, Model (2); age-adjusted, Model (3); age & risk factors (hypertension, diabetes mellitus, dyslipidemia, obesity, and smoking) adjusted

Gender Difference in Bone Loss & Vascular Calcification

Male (n=914)



Female (n=813)



Articles

Inhibitors of hydroxymethylglutaryl-coenzyme A reductase and risk of fracture among older women

Lancet 2000; 355: 2185–88

	Cases (n=928)	Controls (n=2747)	Odds ratio (95% CI)		
			Unadjusted	Multiple regression model I*	Multiple regression model II†
Statins					
No dispensing	853 (91.9%)	2490 (90.6%)	1.00	1.00	1.00
1–6 dispensings	24 (2.6%)	85 (3.1%)	0.73 (0.43–1.26)	0.62 (0.35–1.10)	0.73 (0.41–1.31)
7–12 dispensings	28 (3.0%)	86 (3.1%)	0.99 (0.58–1.71)	0.81 (0.46–1.44)	0.95 (0.53–1.70)
≥13 dispensings	23 (2.5%)	86 (3.1%)	0.54 (0.32–0.91)	0.48 (0.27–0.83)	0.52 (0.29–0.91)
Non-statin lipid-lowering drugs					
No dispensing	897 (96.7%)	2677 (97.5%)	1.00	1.00	1.00
1–6 dispensings	15 (1.6%)	39 (1.4%)	1.06 (0.50–2.26)	1.22 (0.55–2.69)	1.02 (0.45–2.29)
7–12 dispensings	10 (1.1%)	14 (0.5%)	2.00 (0.68–5.85)	2.37 (0.76–7.39)	2.26 (0.74–6.95)
≥13 dispensings	6 (0.6%)	17 (0.6%)	0.67 (0.24–1.88)	0.81 (0.28–2.36)	0.90 (0.30–2.66)

*Adjusted for age, chronic disease score, and hospital admissions during the previous year in conditional logistic regression model. Use of statins and non-statin lipid-lowering drugs included in the same model. †Adjusted for age, hospital admissions during the previous year, use of antipsychotic, long-acting hypnotic, or antidepressant drugs during the previous 30 days, and use of thiazide diuretics, hypoglycaemic agents, and systemic steroids during the previous 2 years in conditional logistic regression model. Use of statins and non-statin lipid-lowering drugs included in the same model.

Table 2: Association between fracture risk and dispensing of statins and non-statin lipid-lowering drugs

Original Investigation

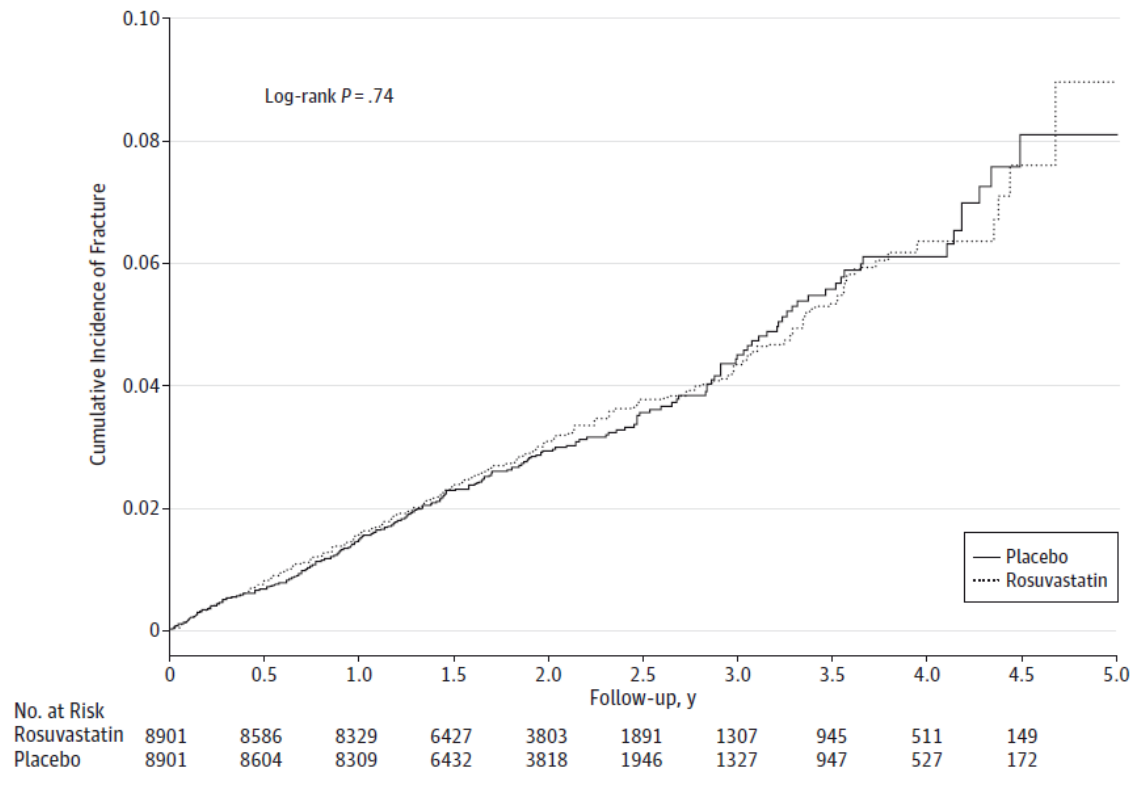
Statin Therapy and Risk of Fracture

Results From the JUPITER Randomized Clinical Trial

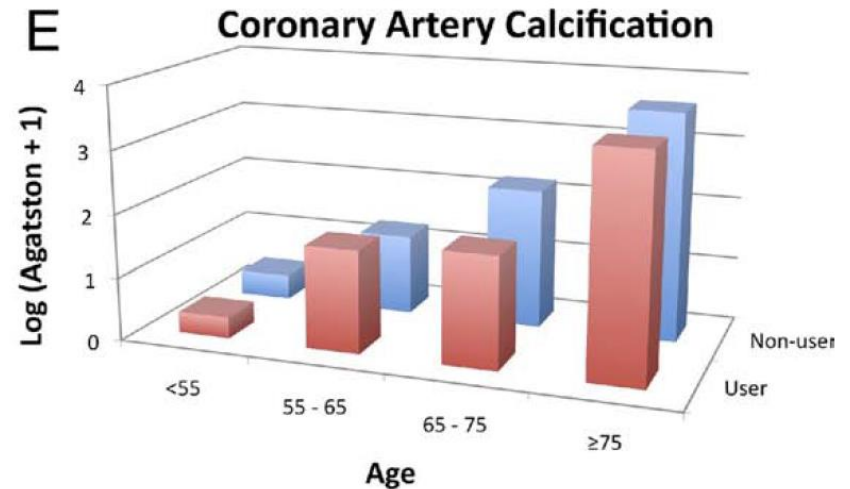
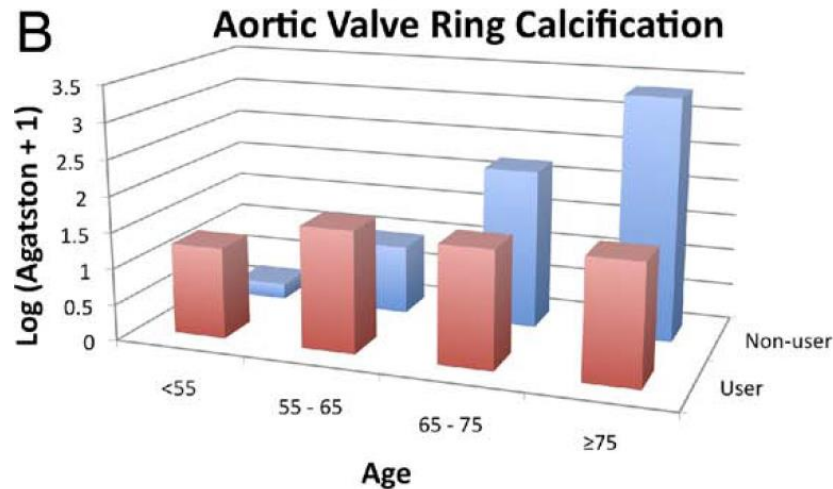
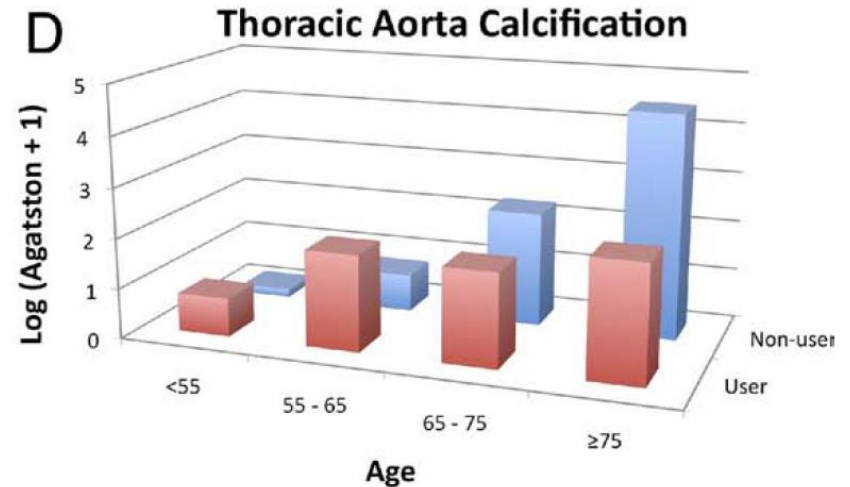
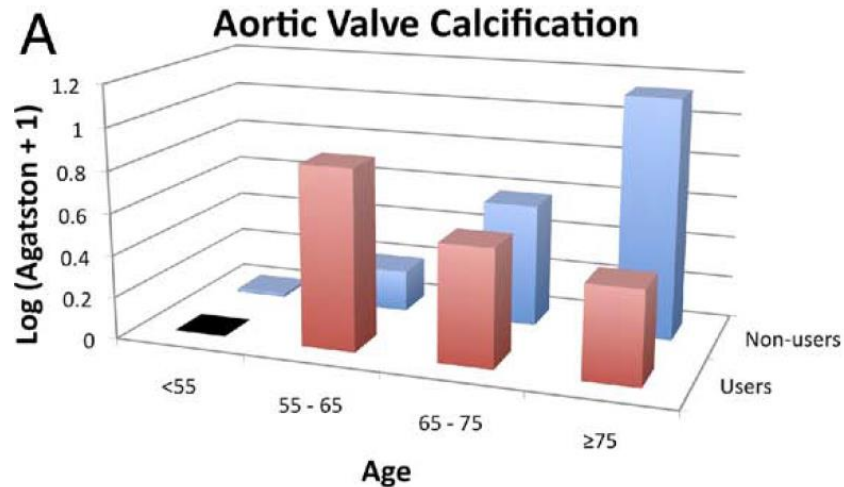
Jessica M. Peña, MD, MPH; Sara Aspberg, MD, PhD; Jean MacFadyen, BA; Robert J. Glynn, ScD; Daniel H. Solomon, MD, MPH; Paul M Ridker, MD, MPH

JAMA Intern Med. 2015;175(2):171-177

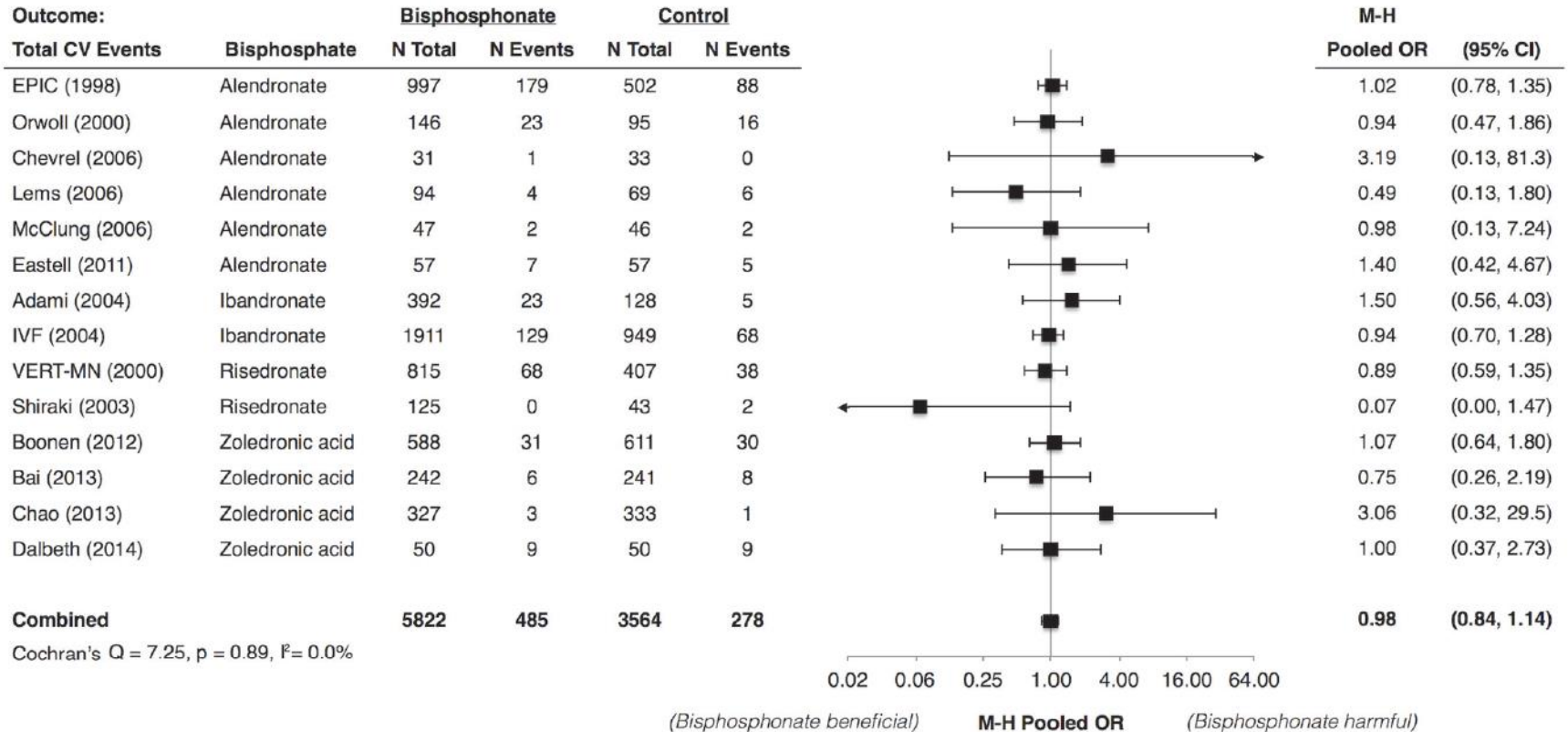
Figure 1. Cumulative Incidence of Fracture According to Treatment Assignment



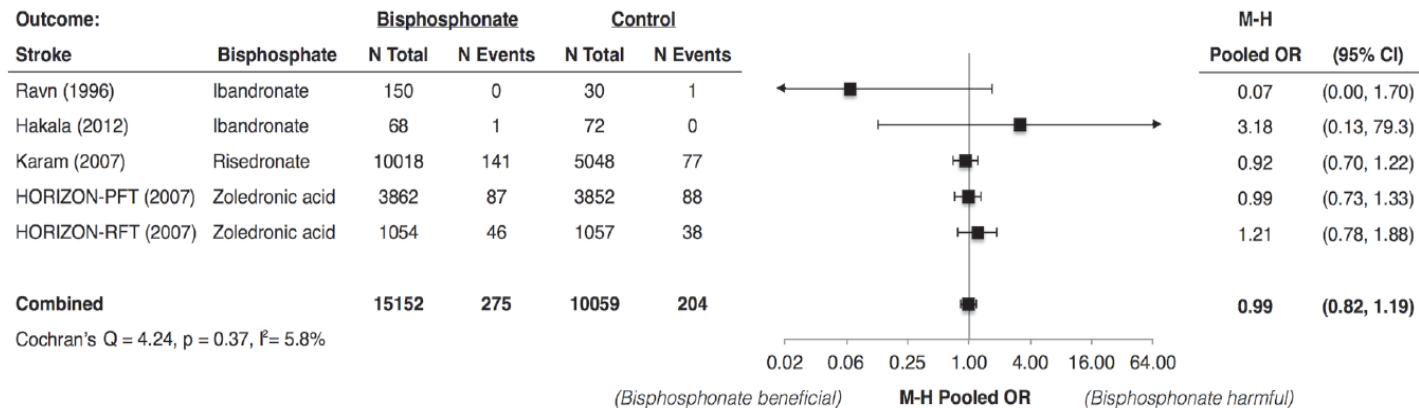
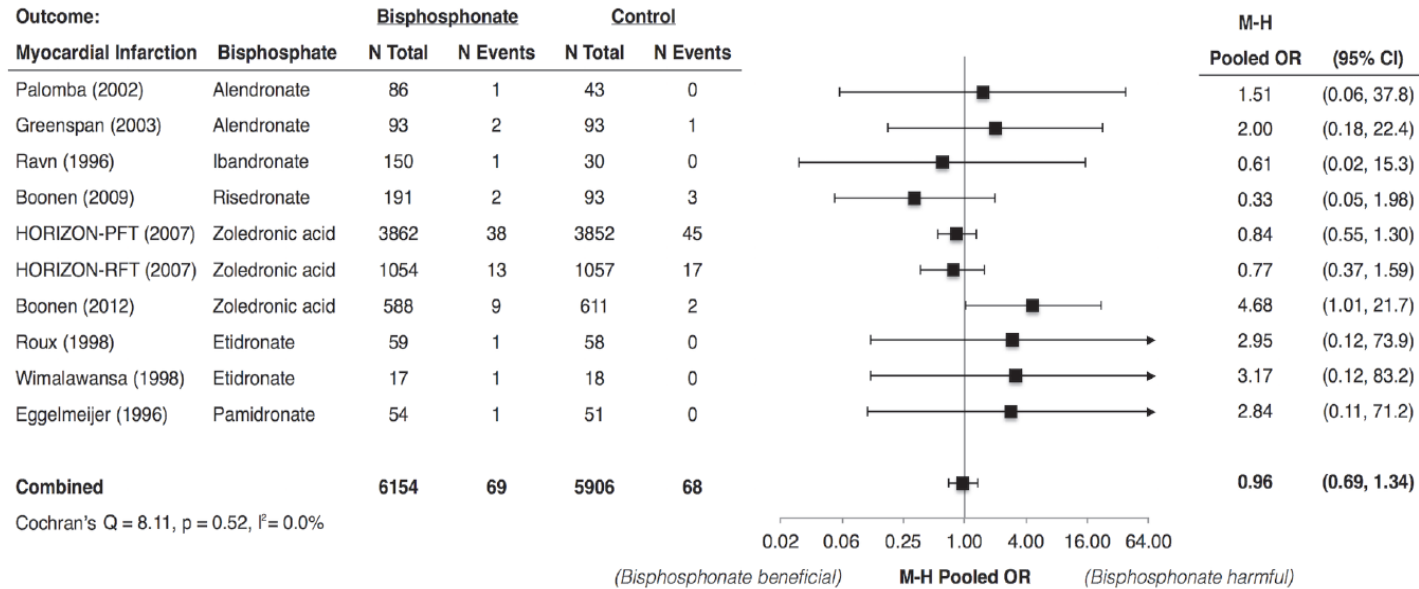
Bisphosphonate Use and Prevalence of Valvular/Vascular Calcification in Women



Bisphosphonates & Risk of Cardiovascular Events



Myocardial Infarction & Stroke with Use of Bisphosphonates



Summary

- **Epidemiological studies verified a link between osteoporosis and cardiovascular disease.**
 - Patients with osteoporosis are at higher risk for ischemic heart disease and stroke and, on the other hand, patients with peripheral arterial disease or ischemic heart disease have a higher risk of osteoporotic fractures.
- **However, further studies are required to investigate the underlying mechanisms between osteoporosis and cardiovascular disease.**