­Table 1. Associates of vascular calcification

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Author | PMID | Country | Time | CKD stages | sample | Independent variable | Risk | Calcification | Ref |
| Chue CD | 22723973 | UK | 2012 | 3 | 120 | Male gender | +24% compared to no calcification | AAC | (1) |
| Renaud H | 3340252 | France | 1988 | 5D (HD) | 24 | Male gender | Simple covariance coefficient = 1.97, p < 0.01 | Linear calcifications of the abdominal aorta and of the iliac and femoral arteries | (2) |
| Al-Rifai | 22259897 | Lebanon | 2011 | 5D (HD) | 43 | Gender | No association between VC and gender | Hand X-rays | (3) |
| Tangvoraphonkchai K. | 31291619 | USA | 2019 | 5D (PD) | 24 | Male gender (%) | Stable PWV vs. increased PWV: 33% vs. 75% | Pulse wave velocity as surrogate | (4) |
| Jean G | 18852190 | France | 2008 | 5D (HD) | 161 | Male gender | Score 3 vs. score 0: 77% vs. 45% | diffuse VCs with aortic, iliac, femoral, popliteal and arm artery VCs | (5) |
| Disthabanchong S | 29236239 | Thailand | 2018 | 2-5T | 419 | Male gender (%) | AAC > 6 vs. ≤ 6: 44.4 vs. 62.6 (in CKD 2-5) | AAC | (6) |
| Cejka | 24709688 | Austria | 2014 | 5D (HD) | 66 | Male vs. female | Total score: 1535 [789–2281] vs. 514 [117–911], p = 0.01 | CAC score (Agatston) | (7) |
|  |  |  |  |  |  |  | Left main artery: 46 [6–86] vs. 6 [0–15], p = 0.035 |  |  |
|  |  |  |  |  |  |  | Left anterior descending: 630 [333–927] vs. 208 [68–349], p = 0.018 |  |  |
|  |  |  |  |  |  |  | Circumﬂex artery: 193 [2–384] vs. 57 [0–123], p = 0.24 |  |  |
|  |  |  |  |  |  |  | Right coronary artery: 667 [298–1035] vs. 242 [0–519], p = 0.017 |  |  |
|  |  |  |  |  |  | Male vs. female | Men CAC score <100 vs. CAC score ≥100 vs. Women CAC score <100 vs. CAC score ≥100: s289 vs. 241 vs. 228 vs. 189, p =0.03 | Total bone density (Dtot) |  |
|  |  |  |  |  |  |  | Men CAC score <100 vs. CAC score ≥100 vs. Women CAC score <100 vs. CAC score ≥100: 14 12 11 9, p = 0.03 | Bone volume (BV/TV) |  |
| Mazzaferro S | 17259697 | Italy | 2007 | 5D-5T | 100 | Male gender | Male-Dialysis (D) vs. Male-Transplant (Tx) vs. Female-D vs. Female-Tx: 1944 vs. 945 vs. 157 vs. 35, p < 0.02 | CACS (Agatston score) | (8) |
| He J | 22980963 | US (CRIC study) | 2012 | 2-4 | 2018 | Male gender | 0 vs. 0-100 vs. >100: 41.9% vs. 53.3% vs. 63.6%, p < 0.0001 | Total Agatston score | (9) |
| Lioufas NM | 32023606 | Multicenter (IMPROVE-CKD) | 2020 | 3b-4 | 278 | Male gender | 73% vs. 55% compared with no AAC | AAC (Agatston) | (10) |
| Ossareh S | 33277456 | Iran | 2020 | 5D (HD) | 143 | Male gender | 0.76 vs. 0.69, P < .05 | Common carotid intima media thickness (ccIMT) | (11) |
| Nemeth ZK | 26459001 | Hungary | 2015 | 5T | 993 | Male gender (%) | 1st (<3.20) vs. 2nd (3.20–4.39) vs. 3rd (>4.39): 63% vs. 58% vs. 52%, p = 0.02 | Serum OPG tertiles (pmol/L) | (12) |
| Buiten MS | 25495997 | Netherlands | 2014 | 5D | 127 | Female gender | <460 pg/mL vs. >460 pg/mL: 16% vs 31%, p < 0.05 | Klotho | (13) |
|  |  |  |  |  | 4275 | Male gender | <275 vs. 275–479 vs. ≥480: 40.0% vs. 46.9% vs. 51.0% | dp-ucMGP (/pmol/L) | (14) |
|  |  |  |  |  |  |  | Not CKD |  |  |
| Nigwekar SU | 27080977 | USA | 2016 | 5D (HD) | 3090 | Female gender | Central CUA vs. peripheral CUA: 73% vs. 61% | Calcific Uremic Arteriolopathy (CUA) | (15) |
|  |  |  |  |  |  |  | CUA has a predilection for white, female, diabetic, and obese patients and, especially in these patients, research and clinical attention should focus on avoiding additional CUA triggers such as vitamin K antagonism or deficiency, skin trauma, and mineral bone abnormalities. |  |  |
| Fusaro M | 23927679 | Italy | 2013 | 5D (HD) | 387 | Warfarin-treated male | 77.8 vs. 57.7%, p<0.04 compared to control male | Vertebral fractures | (16) |
|  |  |  |  |  |  |  | Compared with controls, warfarin-treated male patients had more vertebral fractures (77.8 vs. 57.7%, p<0.04), but not females (42.1% vs. 48.4%, p=0.6); |  |  |
| Gupta V | 33606319 | Hungary | 2021 | 5D (HD) | 982 | Male gender | Low (<3.20) vs. Med (3.20–4.39) vs. High (>4.39): 63% vs. 57% vs. 52% | OPG tertiles (pmol/L) | (17) |
| Ahmed S | 11382698 | USA | 2001 | 5D | 20 | Female gender | Cases vs. control: 90% vs. 49.7% | Calciphylaxis (calcific uremic arteriolopathy) | (18) |
| Charitaki E | 24473732 | UK | 2014 | 5D (HD) | 303 | Female vs. male | Pearson r = -0.124, p = 0.031 | PWV | (19) |
| Kahn *et al* | 27988970 | Austria | 2017 | 5T | 205 | Male gender vs. female | Total iliac: 1.00 (0.25-1.75) vs. 0.50 (0.13-1.13) | Vascular calcification score from native CT scan of the iliac region, containing right and left external iliac artery (REIA and LEIA), common iliac artery (RCIA and LCIA), distal aorta (AO) | (20) |
|  |  |  |  |  |  |  | LCIA: 1.00 (0.50-2.00) 1.00 (0.00-1.88) |  |  |
|  |  |  |  |  |  |  | REIA: 1.00 (0.00-1.50) 0.00 (0.00-0.50) |  |  |
|  |  |  |  |  |  |  | LEIA: 1.00 (0.00-1.50) 0.00 (0.00-0.50) |  |  |
| Ștefan *et al* | 31599199 | Romania | 2019 | 2-4 | 44 | Neutral | Male in RRI > 0.7 vs. RRI ≤ 0.7: 65% vs. 52%, p = 0.4 | Intrarenal resistance index (RRI) obtained from Doppler ultrasonography of interlobar  and arcuate arteries in the upper, middle, and lower  parts of the kidney. | (21) |
| Zhang *et al* | 31079116 | China | 2019 | 5D (HD) | 105 | Neutral | Male in ≤25th vs. 25-50th vs. 50-75th vs. ≥75th percentile:57.7% vs.48.1% vs. 46.2% vs. 65.4%, p = 0.473 | Serum s-Klotho level | (22) |
| Alayoud *et al* | 32127198 | France | 2020 | 5D (HD) | 28 | Male progress more | Male in progression vs. no progression: 36.4% (8M/14F) vs. 83.3% (5M/1F), p = 0.02 | Progression of CAC (Agatston score) measured with multi-slice ultra-fast CT | (23) |
| Chen *et al.* | 28329057 | US | 2017 | 1-4 | 1541 | Male more severe | Male in CAC score 0 vs. 0-100 vs. >100: 41.7% vs. 54.3% vs. 65.2%, p < 0.001 | CACS (Agatston score) measured with electron-beam or  multidetector CT | (24) |
| Wang *et al.* | 24876353 | China (Hong Kong) | 2014 | 3-5 | 300 | Male more severe | Male in CACS 0 vs. 1–99 vs. 100–399 vs. ≥400: 57.5% vs. 56.9% vs. 77.3%, p <0.001 | CACS (Agatston score) measured with CT | (25) |
| Etta *et al.* | 28748891 | India | 2017 | 4-5 | 95 | Neutral | Male in absent vs. present of calcification: 67.6% vs. 85.7%, p = 0.08 | Cardiac valvular calcification assessed with echocardiography | (26) |
|  |  |  |  |  |  |  | Male in absent vs. present of calcification: 71.8% vs. 70.0%, p = 0.58 | Abdominal aorta calcification assessed with lateral abdominal radiograph |  |
| Keyzer *et al.* | 25925688 | Netherlands | 2015 | 5T | 699 | Neutral | Male in tertile 1 vs. 2 vs. 3: 58% vs. 55% vs. 57% | Blood calcification propensity measured with Serum T50 | (27) |

Table 2. Causes of vascular calcification

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Author | PMID | Country | Time | CKD stages | sample | Independent variable | Risk | Calcification | Ref |
| Craver L | 24119158 | Spain | 2013 | 3-4 | 178 | Male sex | All patients: OR 4.218 (1.403-14.207)  eGFR < 30: OR 4.167 (1.050-20.178) | Abdominal aortic calcification (AAC) (Kauppila Index) | (28) |
|  |  |  |  |  |  |  | Lack of a FEP-FGF23 correlation in patients with severe AAC (KI > 5) suggested a role for an impaired phosphaturic response to FGF23 but not to PTH in AAC. Logistic and zero-inflated analysis confirmed the independent association of age, CKD stage, male gender and CP with AAC, and also identified a threshold FEP/FGF23 ratio of 1/3.9, below which the chances for a patient of presenting severe AAC increased by 3-fold. |  |  |
| Kirkpantur A | 19681840 | Turkey | 2009 | 5D (HD) | 102 | Male gender | HR 0.87 (0.56–0.91, p=0.87) | Coronary artery calcification score (CACS) | (29) |
| Pateinakis P | 23758931 | Greece | 2013 | 5D (HD) | 81 | Gender | β = -0.163 | Common carotid intima-media thickness (ccIMT) | (30) |
| Golembiewska E | 32033584 | Sweden | 2020 | 5-5D | 149 | Male gender | OR 4.4 (1.6–11.1) | Inferior epigastric artery & CACS | (31) |
|  |  |  |  |  |  |  | Male -x-> copeptin: β = −0.08 (0.31) |  |  |
| Chen Z | 28036114 | Sweden | 2017 | 5D-5T | 240 | Male gender | After adjustments for confounders by GLM (age, gender, BMI, diabetes, inflammation), only age, male gender, diabetes and statins remained significantly related to high CAC score. | CACS | (32) |
|  |  |  |  |  |  |  | Model with hsCRP: estimate = −0.38, se = 0.11, p = 0.005 |  |  |
|  |  |  |  |  |  |  | Model with IL-6: estimate = 0.40, se = 0.13, p = 0.002 |  |  |
|  |  |  |  |  |  |  | Model with TNF but without statins: estimate = 0.35, se = 0.13, p = 0.008 |  |  |
| Gelev S | 19259046 | Republic of Macedonia | 2008 | 5D (HD) | 150 | Male gender | +27% compared to female (80/91 vs. 36/59) | Arterial intimal & media calcification (AIC & AMC) | (33) |
|  |  |  |  |  |  |  | The present results suggest a few emerging risk factors for the occurrence of arterial  calcifications, especially of AIC in our HD patients, such as age older than 55, male gender, diabetes, as well as higher CRP (> 4.5 mg/L), blood leucocytes (> 6.5 × 109L), corrected total serum Ca (> 2.35 mmol/L), serum triglycerides (> 1.8 mmol/L), PP (> 60 mmHg) and BMI (> 23 kg/m2). |  |  |
|  |  |  |  |  |  |  | Our findings of significantly higher percentages of ACA in patients who were younger (under  55 yrs at inclusion and 45 yrs at the start of HD), predominantly female, without diabetes and with higher percentages of K/DOQI guideline recommended levels for serum Ca, are supportive of the previous reports [11, 15, 17]. |  |  |
| Capusa C |  | Romania | 2012 | 3-5 | 106 | Male gender | T ratio = 2.15, p = 0.04 | Aortic calcification score (ACS) | (34) |
| Maharem DA |  | Egypt | 2013 | 5-5T | 73 | Male gender |  | SVCS | (35) |
|  |  |  |  |  |  |  | VC was significantly associated with older age, male gender, longer HD duration, lower albumin, higher LDL-c, higher carotid plaques and lower BMD at the lumbar spine and the T-score value but had no significant association with the following parameters: duration of transplantation, blood pressure, total cholesterol, TG, Ca, PO4, Ca·PO4, iPTH, CRP, fetuin A, e-GFR and IMT. Also no significant association was seen between fetuin-A gene polymorphism and VC. Patients with VC had higher CRP than those without but did not reach a significant value. (Table 10). |  |  |
|  |  |  |  |  |  |  | P = 0.056 不應該相關，但是內文說相關 |  |  |
| Schlieper G |  | Germany? | 2015 | 5D (HD) | 220 | Gender? | HR 0.50 (0.28-0.87) | Adragao calcification scores | (36) |
|  |  |  |  |  |  |  |  |  |  |
| Schlieper G | 19468238 | Serbia | 2009 |  |  | Male gender | 2.75 (1.41–5.38) | Adragao calcification score | (37) |
|  |  |  |  |  |  |  | 2.32 (1.19–4.52) | Composite score |  |
| Sigrist M | 16263735 | UK | 2005 | 4-5D | 134 | Male gender | Calcification tertile 1/2/3: 18 (46%) / 28 (71%) / 39 (81%), P<0.001 | Multi-slice spiral CT scanning of a 5 cm standardized  segment of superficial femoral artery | (38) |
| Harada PHN | 25479288 | Brazil | 2014 | 2-5 | 117 | Male gender | OR 4.92 (2.07–11.70) | CACS | (39) |
|  |  |  |  |  |  | Pericardial fat | OR 1.85 (1.00-3.42) |  |  |
| Okamoto T | 29558928 | Japan | 2018 | 5D (HD) | 184 | Male gender | OR 3.29 (1.27–8.53) | Abdominal aortic calcification index | (40) |
| Vipattawat K | 24447254 | Thailand | 2014 | 5-5T | 261 | Male gender | Kidney transplant, univariate: OR 2.36 (1.13–4.91), p = 0.02\* | Total vascular calcification score | (41) |
|  |  |  |  |  |  |  | Kidney transplant, multivariate: OR 2.49 (0.87–7.14), p = 0.09 |  |  |
|  |  |  |  |  |  |  | CKD 5-5D, univariate: 1.44 (0.71–2.91), p = 0.32 |  |  |
|  |  |  |  |  |  |  | CKD 5-5D, multivariate: 2.02 (0.71–5.78), p = 0.19 |  |  |
| Evenpoel P | 26505822 | Belgium | 2015 | 5T | 268 | Male gender (F 1) | β = -0.64, t = 5.6, p = 0.0001 | Baseline CACS | (42) |
|  |  |  |  |  |  |  | β = -0.32, t = 2.3, p = 0.008 | Baseline aortic calcification |  |
|  |  |  |  |  |  | Male gender | P = 0.002 | Sclerostin |  |
|  |  |  |  |  |  |  | In multivariate regression analysis, higher age (P =.0001), **male gender (P =.002)**, lower eGFR (P =.002), lower PTH (P =.0001) and lower calcitriol levels (P =.05) were identified as independent determinants of higher levels of circulating **sclerostin**. |  |  |
| Jansson H | 31437840 | Sweden | 2019 | 3-4 | 84 | Male gender | β = 0.413, p = 0.030 | AAC volume | (43) |
| Nitta K | 30347400 | Japan | 2018 | 5D (HD) | 216 | Male gender | β = 0.221, 95%CI 0.124–0.319, p <0.0001 | AoAC score | (44) |
| Nishizawa Y | 15648030 | Japan | 2004 | 5D (HD) | 332 | Male gender | OR 3.380 (1.289-8.860) | Vascular calcification | (45) |
| Chiu Y-W | 20237457 | USA | 2010 | 1-5 | 225 | Male gender | Using multivariate linear regression analysis, increasing age  (P = 0.001), male gender (P = 0.01), and non-Latino whites (P = 0.003) were independently associated with a higher log-  transformed baseline CAC score. | CAC | (46) |
|  |  |  |  |  |  |  | 沒有列詳細數據 |  |  |
| Jankovic A | 28124305 | Serbia | 2017 | 5D (HD) | 90 | Female gender | OR 0.134 (0.04–0.45) | calcification in arteriovenous fistula (AVF)-blood vessels | (47) |
| Komatsu M | 25571879 | Japan | 2014 | 5D (HD) | 301 | Male gender (%) | Grade 0 vs. 1 vs. 2+3: 98/126 vs. 63/112 vs. 37/63, p = 0.0009 | AoAC | (48) |
| Jankovic A | 25823466 | Serbia | 2015 | 5D (HD) | 90 | Male gender | β = –0.432, p < 0.001 | overall calcification  score | (49) |
| Ishimura E | 12378387 | Japan | 2002 | 5D (HD) | 421 | Male gender | OR 3.380 (1.289-8.860) | Vascular calcification | (50) |
|  |  |  |  |  |  |  | 重複 |  |  |
| Turan MN | 26865177 | Turkey | 2016 | 5D (HD) | 224 | Male gender | RR 4.14 (2.01–8.51) | CACS | (51) |
| Claes KJ | 22143191 | Belgium | 2013 | 5T | 115 | Male gender (%) | PWV ≤ 7.35 m/s vs. > 7.35 m/s: 74 vs. 56, p = 0.05 | PWV | (52) |
| Manghat P | 21281749 | UK | 2011 | 1-4 | 145 | Male gender | β = 0.29, t =2.04, p =0.049 | Arterial Stiffness (SIDVP) | (53) |
| Qureshi AR | 26331407 | Sweden | 2015 | 5T | 89 | Male gender | RR 1.82 (1.03–1.16) | Vascular calcification | (54) |
| Jean G | 26890570 | France | 2016 | 5D (HD) | 227 | Female gender | OR 0.16 (0.075−0.362) | Serum sclerostin level | (55) |
| Sumida Y | 20420796 | Japan | 2010 |  |  | Male gender | Male gender was identified as an independent determinant for CAP. | Coronary artery plaque (CAP) | (56) |
| Raggi P | 11849871 | Multicenter (USA & Europe) | 2002 | 5D (HD) | 205 | Female gender | Parameter estimate = -0.587547, p = 0.0167 | Coronary artery calcification | (57) |
| Nishiura R | 18802328 | Japan | 2009 | 5D (HD) | 99 | Male gender | HR 3.034 (1.028–8.948) | OPG level | (58) |
| Beddhu S | 20630128 | HEMO Study | 2010 | 5D (HD) | 1827 | Male gender | The lower serum alkaline phosphatase group was associated with older age, **male gender**, non-black race and shorter dialysis years as well as higher serum calcium, higher serum calcium-phosphorus product and lower parathyroid hormone levels. | Lower alkaline phosphate | (59) |
|  |  |  |  |  |  |  | Alkaline phosphatase is typically considered as an innocent by-stander, but emerging data suggest that alkaline phosphatase might play a pathogenic role in vascular calcification and thus contribute to increased mortality in hemodialysis patients. |  |  |
| Mazzaferro S | 17259697 | Italy | 2007 | 5D-5T | 100 | Male gender | OR 10.5 (3.2–34.4) | CACS (Agatston) | (8) |
| Shu K-H | 22483469 | Taiwan | 2012 | 5T | 99 | Female gender | β = -1.61, p = 0.0021 | CACS | (60) |
| Schlieper G | 18800030 | Serbia | 2008 | 5D (HD) | 212 | Male gender | OR 5.08 (2.18–11.86) | Vascular access calcification | (61) |
| Morena M | 19574342 | France | 2009 | 1-5 | 133 | Male gender | OR 4.95 (2.36–10.37) | CACS ≥ 100 | (62) |
| Bellasi A | 17524408 | USA | 2008 | 5D | 142 | Male gender | Estimate = 735.82, p = 0.0366 | CACS (R-square 0.37) | (63) |
|  |  |  |  |  |  |  |  |  |  |
| Oprisiu R | 11774125 | France | 2002 | 5D (HD) | 24 | Male gender | Indeed, this observation is reminiscent of our own observation regarding the **extension of calcification** assessed prospectively on 3 years in 24 hemodialysis patients who never received vitamin D derivatives. The calcifications were measured on lateral and frontal X rays of lumbar spine and pelvis at the level of aorta, iliac, and femoral arteries.' This extension was exponential, and simple covariance analysis showed that the main significant risk factors for extension were **male gender**, age (only in male patients) | Extension of calcification | (64) |
| Evenpoel P | 26505822 | Belgium | 2015 | 5T | 268 | Male gender | β = -0.45, t = 4.01, p = 0.0001 | Annualized CACS change | (42) |
| Sigrist MK | 17928470 | UK | 2007 | 4-5D | 134 | Male gender | OR 8.82 (1.82 to 42.65) | Vascular calcification progression during 24 months | (65) |
| Tamei N | 21139318 | Japan | 2011 | 5D (HD) | 127 | Male gender | F-value = 5.092, β = 0.969, p = 0.0192 | AoACS progression (5 years) | (66) |
| Jung HH | 16554319 | Republic of Korea | 2006 | 5D (HD) | 40 | Male gender | B = 1.365, SE = 0.639, β = 0.317, p = 0.040 | annualized change of square root-transformed CAC  score | (67) |
| Scialla JJ | 21940840 | USA | 2011 | 1-5 | 351 | Female gender | Female -> Osteoprotegerin: 10.2% (0.2%– 21.3%) | OPG (percentage difference) | (68) |
| Kanbay M | 20576822 | Turkey | 2010 | 2-3 | 177 | Male gender | R = -0.181, p = 0.016 | Gensini score | (69) |
|  |  |  |  |  |  |  | The Gensini score values significantly correlated in univariate analysis with gender (R = -0.181, P = 0.016), presence of hyperension (R = 0.203, P = 0.007), HDL cholesterol level (R = -0.158, P = 0.047), eGFR (R = -0.315, P 0.001), iPTH (R = 0.152; P = 0.044), FGF 23 (R = 0.868; P = 0.001), and fetuin A levels (R = 0.491; P = 0.001) but not with the vitamin D values. |  |  |
| Jean G | 18721733 | France | 2008 | 5D (HD) | 253 | Female gender | Vitamin D (25D) deficient vs. sufficient: 53% vs. 28%, p < 0.05 | Vitamin D (25D) deficiency | (70) |
|  |  |  |  |  |  |  | Vitamin D deficiency was reported to be  associated with cardiovascular calcification, 5 |  |  |
| Hou J-S | 31122190 | Taiwan | 2019 | 5D (HD) | 120 | Female gender | OPG tertile 1/2/3: 62.5% / 55.0% / 32.%, p = 0.008\* | OPG | (71) |
|  |  |  |  |  |  |  | Bone loss -> OPG -> calcification |  |  |
| Flávia Letícia Carvalho Gonçalves | 25465028 | Brazil | 2014 | 5D (HD) | 91 | Gender (M/F) | Low vs High sclerostin: 24/22 vs. 31/14, p = 0.103 | Sclerostin | (72) |
| Chang JH | 22169112 | Republic of Korea | 2012 | 5D (HD) | 289 | Female gender | OR 3.892 (1.678–9.025) | Vitamin D (25D) deficiency | (73) |
| Zhang AH | 31079116 | China | 2019 | 5D (HD) | 105 | Male gender (male = 1, female = 2) | Correlation coefficient = -0.211, p = 0.03 | Interventricular septal thickness (IVST) | (22) |
|  |  |  |  |  |  |  | Lower A-Klotho -> higher IVST; Female thinner IVST |  |  |
| Block GA | 9531176 | USA | 1998 | 5D (HD) | 6407 | Male gender | OR 0.774, p = 0.0001 | Serum phosphorus > 6.5 mg/dL | (74) |
|  |  |  |  |  |  |  | Female -> higher serum phosphorus |  |  |
| Ho TY | 31477034 | Taiwan | 2019 | 5D | 61 | Male gender (female = 0, male = 1) | B = 1688.01, SE = 681.54,t = 2.48, p = 0.02 | CAC (Agatston) | (75) |
| Kuo TH | 31315601 | Taiwan | 2019 | 5D (PD) | 89 | Male gender | OR 2.882 (1.219–6.815) | above-median sclerostin levels | (76) |
| Fain ME | 29635270 | USA | 2018 | 5D (HD) | 37 | Male gender | Β ± SE = 2.23 ± 0.78, R2 = 0.090 | Carotid-femoral PWV | (77) |
|  |  |  |  |  |  |  | B ± SE = 4.16 ± 1.65, R2 = 0.121 | brachial artery flow-mediated dilation (FMD) |  |
| Claes KJ | 23788689 | Belgium | 2013 | 1-5 | 154 | Male gender | In multivariate regression analysis, older  age (P < .0001), male sex (P = .006), lower eGFR ( P =  .0008), the absence of calcification (P = .006), lower bsAP  levels (P = .03), and lower cholesterol levels (P = .03) were  identified as independent determinants of higher levels of  circulating sclerostin. | Circulating sclerostin | (78) |
| Baralić M | 30867641 | Serbia | 2018 | 5D (HD) | 56 | Sex (0? 1?) | B = -12.740, 95% CI = -23.967– -1.513, β = -0.273 | Index of left ventricular mass (iLVM) | (79) |
|  |  |  |  |  |  |  | B = -47.88, 95% CI = -95.3– -0.464, β = -0.296 | Relative wall thickness (RWT) |  |
| Porter CJ | 17617653 | UK | 2007 | 3-4 | 112 | Male gender | OR 43.713 (2.92–654.0) | CAC | (80) |
| Kanbay M | 22130958 | Turkey | 2011 | 2-3 | 88 | Male gender | In univariate analysis, the Gensini CAD  severity score correlated significantly with **male**  **gender**, eGFR, and serum levels of 25-OH-vitamin D,  iPTH, FGF-23, fetuin A, and calcitonin (R = 0.474,  P = 0.001 for the latter). | Gensini score | (81) |
| Fusaro M | 24897402 | Italy | 2014 | 5D (HD) | 387 | Male gender | OR 1.86 (CI 1.20–2.91) | Spine deformity index (SDI) > 1 | (82) |
| Nemeth ZK | 26459001 | Hungary | 2015 | 5T | 993 | Gender | B = −3.968, 95%CI −6.006– −1.930, β = −0.116, p < 0.001 | Pulse pressure | (12) |
| Chen HY | 23419133 | Taiwan | 2013 | 5D (HD) | 238 | Male gender | HR 0.92 (0.8–0.98) | Fetuin-A | (83) |
|  |  |  |  |  |  | Female gender | HR 0.87 (0.74–0.92) |  |  |
| Nitta K | 30347400 | Japan | 2018 | 5D (HD) | 389 | Female gender | β = 0.221, 95%CI 0.124–0.319, p < 0.0001 | AoAC | (44) |
| Floege J | 20110249 | Multicenter | 2010 | 5D (HD) | 360 | Male gender | Parameter estimate = 0.42599, SE = 0.42599, p = 0.0011 | CAC | (84) |
|  |  |  |  |  |  |  | Using multivariate analysis, factors shown to predict  CAC in the current study included older age, male gender,  longer dialysis vintage and diabetes, results consistent with  those reported previously. |  |  |
| González-Parra E | 26298279 | Spain | 2015 | 1-5? | 704 | Male gender | r = −0.084, 95% CI -0.155– -0.012, p = 0.0215 | Parathormone levels | (85) |
|  |  |  |  | 不確定是不是CKD cohort |  |  | r = −0.191, 95% CI -0.301– -0.080, p = 0.0007 | FGF-23 |  |
| Nakayama K | 24379691 | Japan | 2013 | 5D (HD) | 47 | Sex (male:0, female:1) | β = -0.41, t = -2.688, p = 0.014 in model with ΔP | Aortic calcification area index (ACAI) | (86) |
|  |  |  |  |  |  |  | β = -0.407, t = -2.608, p = 0.017 in model with ΔCa × P |  |  |
| Dai *et al* | 31823455 | Sweden | 2020 | 5 | 152 | Sex, male versus female | OR 6.67 (2.53–17.58) | coronary artery  calcification (CAC) score by computed tomography (CT) | (87) |
| Ramalho *et al* | 31368056 | Brazil | 2019 | 3-4 | 356 | Neutral | B = 0.10, 95% CI = -0.15–0.35, p = 0.45 | Urinary calcium excretions (UCE) | (88) |
| Bundy *et al* | 30935773 | USA | 2019 | 2-4 | 1274 | Neutral | Female sex in Quartiles 4 vs. 3 vs. 2 vs. 1 of T50: 46% vs. 45% vs. 49% vs. 47% | Serum calcification propensity quantified as transformation time | (89) |
| Wang *et al* | 30989586 | China | 2019 | 5D (HD) | 108 | Neutral | Female gender OR 0.56 (0.15–2.06), p = 0.38 | Severe AAC measured by abdomen lateral plain radiograph | (90) |
| Solbu *et al.* | 27798199 | Multicenter | 2016 | 5D (HD) | 2773 | Male at risk | HR 1.49 (1.21–1.83) | Atherosclerotic events including the first event of the following: non-fatal myocardial infarction, fatal coronary heart disease, non-fatal and fatal non-hemorrhagic stroke, coronary revascularization procedures and death from ischemic limb disease | (91) |
| Tanaka *et al.* | 20851632 | Japan | 2012 | 1-4 | 1198 | Neutral | OR 0.91, p = 0.72 | Carotid calcified plaque | (92) |

Table 3. Modifiers of vascular calcification

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Author | PMID | Country | Time | CKD stages | sample | Independent variable | Risk | Calcification | Ref |
| Kirkpantur A | 19681840 | Turkey | 2009 | 5D (HD) | 102 | HD vintage | HR 0.85 (0.58–0.95)  Independent of other influencing factors, HD vintage and serum PTH levels were significant determinants of low bone mass and T-scores in all anatomical sites whereas fetuin-A was an independent predictor in proximal radius, femoral neck, and trochanter | CACS | (29) |
|  |  |  |  |  |  | Serum PTH | Standard regression coefficient -0.21– -0.33 | Bone mineral densities (BMD) |  |
|  |  |  |  |  |  | Fetuin-A | Standard regression coefficient -0.29– -0.41 | BMD |  |
| Kahn J | 27988970 | Austria | 2017 | 5T | 205 | Older than 55 yrs | 1.25 (0.50-2.00) vs. 0.50 (0.00-1.16) | Total iliac calcification (without distal aortic segment) | (20) |
|  |  |  |  |  |  |  | Median total calcification score was 3 (2.2-3) in the patients declined for renal  transplantation, with similar results in the different regions of the iliac arteries. |  |  |
| Golembiewska E | 32033584 | Sweden | 2020 | 5-5D | 149 | Copeptin (1-SD increase) | OR 1.6 (1.1–2.6) | Inferior epigastric artery & CACS | (31) |
|  |  |  |  |  |  |  | Mechanisms of vascular calcification in CKD. In the setting of uraemic milieu, activation of renin-angiotensin and vasopressin systems,  upregulation of sodium-dependent phosphate transporter Pit-1 promotes osteochondrocytic transformation and apoptosis of vascular smooth muscle cell (VSMC) and, in consequence, accelerated vascular calcification |  |  |
|  |  |  |  |  |  | Higher Age (1-SD increase) | OR 2.5 (1.5–4.1) |  |  |
|  |  |  |  |  |  | Diabetes | OR 23.2 (2.5–210.5) |  |  |
| Chen Z | 28036114 | Sweden | 2017 | 5D-5T | 240 | Statins | Model with hsCRP: estimate = 0.29, se = 0.11, p = 0.009 | CACS | (32) |
|  |  |  |  |  |  |  | Model with IL-6: estimate = 0.44, se = 0.14, p = 0.001 |  |  |
| Scialla JJ | 21940840 | USA | 2011 | 1-5 | 351 | Osteoprotegerin (OPG) | Reference | Ratio of aortic pulse wave velocity | (68) |
|  |  |  |  |  |  |  | Tertile 2 (5.05 to 7.45 pmol/L): 1.06 (0.97– 1.15) |  |  |
|  |  |  |  |  |  |  | Tertile 3 (7.46 to 22.31 pmol/L): 1.10 (1.01– 1.20) |  |  |
| Chen Z | 30777028 | Sweden | 2019 | 5 | 174 | Total body bone mineral density (tBMD) in female | β = −0.27, se = 0.12, p = 0.03 | CACS | (93) |
|  |  |  |  |  |  | BMD at legs in female | β = −0.28, se = 0.12, p = 0.02 |  |  |
|  |  |  |  |  |  |  | Multivariate generalized linear model  (GLM) analysis adjusted for age, diabetes and hsCRP showed that in females per SD higher CAC score (1057 AUs) was  predicted by either per SD (0.13 g/cm2) lower tBMD or per SD (0.17 g/cm2) lower BMD at legs. **No such associations were found in male** **ESRD patients**. |  |  |
| Evenpoel P | 26505822 | Belgium | 2015 | 5T | 268 | Lower Sclerostin | Remarkably, **a lower circulating sclerostin** **level** was identified as independent determinant of a higher baseline AoC score in the final regression model, ie, **after adjustment** for traditional (older age, male gender, high BMI, presence of  diabetes, hypertension) and nontraditional (inflammation, high PTH, low calcidiol, long dialysis vintage) risk factors | baseline aortic calcification score | (42) |
| Turan MN | 26865177 | Turkey | 2016 | 5D (HD) | 224 | FGF-23 (per 50 pg/ml) | RR 1.17 (1.05–1.30) | CACS | (51) |
| Qureshi AR | 26331407 | Sweden | 2015 | 5T | 89 | Sclerostin | middle+high sclerostin tertiles vs. low sclerostin tertile: RR 3.67 (1.23–11.02) | Vascular calcification | (54) |
| Morena M | 19574342 | France | 2009 | 1-5 | 133 | Osteoprotegerin | 769.26–1063.62 pg/mL: OR 7.57 (2.06–27.85) | CACS ≥ 100 | (62) |
|  |  |  |  |  |  |  | ≥1063.62 pg/mL: OR 8.54 (2.14–34.11) |  |  |
|  |  |  |  |  |  |  | ROC -> cutoff 757.7 pg/mL |  |  |
| Chen Z | 28036114 | Sweden | 2017 | 5D-5T | 240 | Statins | 0 (0-531) AUs to 273 (0-1256) AUs after 1.5 years of RRT | CACS | (32) |
| Chang JH | 22169112 | Republic of Korea | 2012 | 5D (HD) | 289 | 25D level | r = −0.170, P = 0.004 | Vascular calcification score (Kauppila index) | (73) |
|  |  |  |  |  |  |  | 25D serum levels and VCS (r = −0.170, P = 0.004) at the end of the summer, but not at the end of the winter (r = −0.114, P = 0.054; Fig. 2). Therefore, we analyzed the data to reveal the association of serum 25D level with vascular calciﬁcation at the end of the summer, when vitamin D levels were found to peak. |  |  |
| Sumida Y | 20420796 | Japan | 2010 | 5D (HD) | 135 | Carotid artery plaque | OR 13.89 (4.08 – 47.29) | Carotid artery calcification | (56) |
| Peyro-Shabani A | 30510649 | Iran | 2018 | 5D (HD) | 84 | Female gender | ACI score 0-40 vs. 41-80 vs. 81-120: 3.48±1.18 vs. 4.54±0.93 vs. 3.80±1.04, p = 0.01 | P (mg/dL)(mean ± SD) | (94) |
|  |  |  |  |  |  | Male gender | ACI score 0-40 vs. 41-80 vs. 81-120: 298(68-2630) vs. 287(166-892) vs. 540(391-698), p = 0.02 | Alkaline phosphate (U/L)(median (min-max)) |  |
| Wang *et al.* | 24876353 | China (Hong Kong) | 2014 | 3-5 | 300 | Male gender negatively correlated | Partial correlation coefficient = -0.14, p = 0.02 | Tissue advanced glycation end products (reflected by skin autofluorescence) | (25) |
|  |  |  |  |  |  |  |  |  |  |

Table 4. Adjusted risk of complications of vascular calcification or gender difference

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Ref | Time | doi | PMID | Country | Relation | Variable |  | Gender | Calcification | Complications | CKD stages | sample |
| (95) | 2017 | 10.1186/s12882-017-0480-2 | 28253835 | Netherlands | complications | AAC score | OR 1.19 (1.07–1.30) | v | AAC | Coronary artery disease | 5D | 90 |
|  |  |  |  |  |  | Male gender | Univariate: 2.59 (1.00–6.68)  Multivariate: 2.73 (0.95–7.82) |  |  |  |  |  |
| **(1)** | 2012 | 10.1371/journal.pone.0039241 | 22723973 | UK | complications | Male gender (Μ = 0, F = 1) | Β = -0.34 (-13.45– -4.48) | v | AAC | Left ventricular mass index | 3 | 120 |
|  |  |  |  |  |  | Mean femoral Z-score | B = -0.23 (-4.75– -0.85) |  |  |  |  |  |
| (96) | 2021 | 10.1186/s12882-021-02251-y | 33541279 | Finland | complications | Male gender | B = 31.0 | v |  | Maximal ergometry workload (WMAX) | 4-5 | 174 |
|  |  |  |  |  |  | AAC score | B = -1.44 |  | AAC | WMAX% < 50% |  |  |
|  |  |  |  |  |  |  | AAC and TnT showed fair predictive power for WMAX% less than 50% of the expected value with AUCs of 0.70 and 0.75, respectively. |  |  |  |  |  |
| (97) | 2014 | 10.1159/000360230 | 24847332 | Taiwan | complications | Male gender | HR 2.354 (1.371 – 4.042) | v | AAC | Cardiovascular mortality | 5D (HD) | 712 |
|  |  |  |  |  |  | AAC Grade 3 | HR 2.497 (1.237 – 5.043) |  |  | Cardiovascular mortality |  |  |
|  |  |  |  |  |  |  | HR 1.604 (1.058 – 2.431) |  |  | All-cause mortality |  |  |
| (32) | 2017 | 10.1111/eci.12718 | 28036114 | Sweden | Complications | CACS | HR 1.52 (1.12-2.06) | v | CACS | Mortality | 5D-5T | 240 |
| (98) | 2015 | 10.3109/0886022X.2015.1077316 | 26336882 | Portugal? | complications | Simple  vascular calcification score (SVCS) | https://www.tandfonline.com/na101/home/literatum/publisher/tandf/journals/content/irnf20/2015/irnf20.v037.i09/0886022x.2015.1077316/20151009/images/medium/irnf_a_1077316_f0002_c.jpg | v | SVCS | Vascular access flow (DU-Qa) | 5D (HD) | 50 |
|  |  |  |  |  |  | Male gender | P = 0.575 |  |  |  |  |  |
| (99) | 2008 | 10.1111/j.1365-2362.2008.02032.x | 19021697 | Sweden | complications | Low fetuin-A | HR 2.2 (1.4–3.5) | x | Fetuin-A inhibits vascular calcification | Mortality | 5D (HD) | 222 |
|  |  |  |  |  |  |  | Patients with low fetuin-A levels (< median) had higher mortality (Hazard ratio ‘HR’ 2·2; CI 1·4–3·5, P< 0·001), but this association was lost after adjustment for age, gender, comorbidities score, dialysis vintage and inflammation (CRP > median). In inflamed patients with low fetuin a significantly independent association with mortality (HR 2·3; CI 1·2–4·5, P= 0·01) was observed compared to non-inflamed patients with high fetuin-A, after adjusting for the same variables. |  |  |  |  |  |
| (100) | 2016 | 10.15386/cjmed-515 | 27004031 | Romania | complications | male gender | HR 14.96 (2.09-106.98) | v | vascular or  other soft tissue calcifications (VC) by plain film | all-cause mortality | 5D (HD) | 92 |
|  |  |  |  |  |  | VC score | HR 1.30 (1.05-1.59) |  |  |  |  |  |
|  |  |  |  |  |  |  | HR 1.387 (1.095-1.757) |  | Cardiovascular mortality |  |  |  |
|  |  |  |  |  |  |  | Multivariable Cox analysis of CdV mortality used  as covariates age, gender, HD vintage, presence of DM,  VC score, presence of ROD, Ca in dialysis solution, oral  Ca salts, vitamin D treatment, serum Ca, P, iPTH, ALP,  creatinine, Hb, cholesterol, trygliceride, CRP, albumin,  ferritin levels, URR, spKt/V baseline renal disease, initial  CdV disease. The method was Forward LR stepwise.  VC score (HR=1.387; 95.0% CI 1.095-1.757; p=0.007)  and URR (HR=0.942; 95.0% CI 0.888-0.999; p=0.046)  remained in the ecuation. **Increased VC score and decreased**  **URR represent risk factors for CDV mortality.** |  |  |  |  |  |
| (101) | 2014 | 10.1007/s00223-013-9811-x | 24193439 | China | complications | Male gender | HR 0.225 (0.100-0.509) | ? |  | All-cause mortality | 5D | 120 |
|  |  |  |  |  |  |  | HR 0.043 (0.008-0.241) |  |  | cardiocerebrovascular  mortality |  |  |
| (102) | 2013 | 10.1186/1471-2369-14-263 | 24289833 | Canada | complications | Aortic arch calcification score (AoAC) | Score 1 1.52 [0.99, 2.34] 0.06 | x | AoAC | Mortality | 5D (HD) | 824 |
|  |  |  |  |  |  |  | Score 2 1.22 [0.72, 2.05] 0.47 |  |  |  |  |  |
|  |  |  |  |  |  |  | Score 3 2.49 [1.28, 4.82] 0.01 |  |  |  |  |  |
| (72) | 2014 | 10.1186/1471-2369-15-190 | 25465028 | Brazil | Complications? | Male sex (versus  female) | HR 0.82 (0.39-1.75), p = 0.620 | x |  | Mortality | 5D (HD) | 91 |
|  |  |  |  |  |  | Sclerostin | HR 2.18 (1.41-3.38) |  |  |  |  |  |
| (103) | 2018 | 10.1080/0886022X.2018.1455588 | 29619867 | Lithuania | Complications | Male gender | HR 2.89, p = 0.357 | x | aortic arch calcification | Cardiovascular event | 5T | 37 |
|  |  |  |  |  |  |  | Multivariate linear regression revealed that **donor age, donor gender, and recipient eGFRdischarge (R-squared 0.65, p = 0.002)** better predict eGFR1year than AoAC combined with recipient eGFRdischarge (R-squared 0.35, p = 0.006). During 1-year follow-up, four (10.81%) patients experienced **cardiovascular events**, which were predicted by **PWV ratio** (HR 7.549, p = 0.045), but **not related to AoAC score** (HR 1.044, p = 0.158). |  |  |  |  |  |
| (48) | 2014 | 10.1159/000368476 | 25571879 | Japan | Complications | Male gender | Univariate: HR 1.502 (0.624-4.163), p = 0.3772 |  |  | Cardiovascular mortality | 5D (HD) | 301 |
|  |  |  |  |  |  |  | Univariate: HR 1.485 (0.746-3.215), p = 0.2690 |  |  | All-cause mortality |  |  |
|  |  |  |  |  |  | AoAC Grade 1 | Univariate: HR 2.838 (1.053-8.920), p = 0.0390 |  |  | Cardiovascular mortality |  |  |
|  |  |  |  |  |  |  | Multivariate: HR 1.731 (0.616-5.623), p = 0.3065 |  |  |  |  |  |
|  |  |  |  |  |  | AoAC Grade 2+3 | Univariate: HR 4.636 (2.794-9.149), p = 0.0011 |  |  |  |  |  |
|  |  |  |  |  |  |  | Multivariate: HR 2.629 (1.455-5.124), p = 0.016 |  |  |  |  |  |
|  |  |  |  |  |  | AoAC Grade 2+3 | Univariate: HR 3.409 (2.015-5.781), p = 0.0261 |  |  | All-cause mortality |  |  |
|  |  |  |  |  |  |  | Multivariate: HR 1.699 (1.052-2.680), p = 0.0222 |  |  |  |  |  |
| (104) | 2011 | 10.1093/ndt/gfr089 | 21414968 | The Netherlands | Complications | Female gender | B = 3.14, β = 0.23, 95% CI -0.05–6.32, p = 0.05 | v |  | Capillary recruitment | 5D | 35 |
|  |  |  |  |  |  |  | Male -> rarefaction |  |  |  |  |  |
| (52) | 2013 | 10.1159/000334597 | 22143191 | Belgium | complications | Gender | Parameter estimate = 1.07001, p = 0.0182, HR 2.915 (1.2–7.08) |  |  | Cardiovascular events | 5T | 115 |
|  |  |  |  |  |  | AC present | Parameter estimate = 3.07957, p = 0.0024, HR 21.749 (2.97–159.4) |  | Aortic calcification |  |  |  |
|  |  |  |  |  |  | AC score | Parameter estimate = 0.16250, p <0.0001, HR 1.176 (1.11–1.244) |  |  |  |  |  |
| (105) | 2012 | 10.1159/000334597 | 22143191 | Belgium | complications | Female gender | Univariate: Parameter estimate = –7.9, p = 0.05, R2 = 0.014 | v |  | Prolonged corrected QT interval | 5T | 193 |
|  |  |  |  |  |  | Aortic calcification score | Univariate: Parameter estimate = 1.12, p= 0.0017, R2 = 0.045 |  | Aortic calcification score |  |  |  |
|  |  |  |  |  |  |  | In multivariate linear regression analysis, female gender, a higher aortic calcification score, hematocrit and PTH levels and lower calcium and potassium levels were found to be independently  associated with QTc. These variables explain 21% of the variability of QTc. Similar associations were found for JTc. |  |  |  |  |  |
| **(6)** | 2018 | 10.1007/s11255-017-1758-9 | 29236239 | Thailand | Complications | Male gender | CKD 2-5: HR 2.35 (0.93–5.91) |  |  | Mortality | 2-5T | 419 |
|  |  |  |  |  |  |  | CKD 5D: 1.14 (0.49–2.65) |  |  |  |  |  |
|  |  |  |  |  |  |  | KT: 1.36 (0.41–4.52) |  |  |  |  |  |
|  |  |  |  |  |  | AAC > 6 | CKD 2-5: HR 2.35 (1.05–5.25)\* |  | AAC |  |  |  |
|  |  |  |  |  |  |  | CKD 5D: HR 1.84 (0.77–4.39) |  |  |  |  |  |
|  |  |  |  |  |  |  | KT: HR 2.93 (0.9–9.22) |  |  |  |  |  |
|  |  |  |  |  |  | pelvic arterial calcification (PAC) > 1 | CKD 2-5: HR 3.04 (1.33–6.96)\*\* |  | PAC |  |  |  |
|  |  |  |  |  |  |  | CKD 5D: HR 2.64 (1.14–6.08)\* |  |  |  |  |  |
|  |  |  |  |  |  |  | KT: HR 13.9 (3.74–51.3)\*\* |  |  |  |  |  |
| (106) | 2006 | 10.1159/000095362 | 16940716 | Italy | Complications | Male gender | RR 0.85 (0.81–0.76), coefficient = –2.01, p = 0.001 | v |  | QT dispersion (QTd) | 4-5D (HD) | 46 |
|  |  |  |  |  |  | TC score ??? | RR 11.2 (8.22–16.7), coefficient = 1.571, p = 0.0001 |  |  |  |  |  |
|  |  |  |  |  |  |  | TC score到底是甚麼? |  |  |  |  |  |
| (107) | 2014 | 10.1007/s11255-013-0620-y | 24318369 | Japan | Complications | CS | OR 9.9759x1030 (12.528–7.9429x1060) |  | Calcification score |  | 5D (HD) | 49 |
|  |  |  |  |  |  | Male gender | OR 23.194 (1.452–370.372) |  |  |  |  |  |
| (108) | 2013 | 10.1093/ndt/gft039 | 23605174 | Belgium | complications | Male gender | HR 0.55 (0.25–1.19), p = 0.13 |  |  | All-cause mortality | 5D (HD) | 100 |
|  |  |  |  |  |  | Sclerostin | HR 0.33 (0.15–0.73) |  |  |  |  |  |
| (109) | 2016 | 10.1016/j.bone.2016.08.007 | 27519971 | Sweden | complications | CAC (>100 vs. ≤100 AUs) | RR 2.86 (1.26–6.45) 0.01 |  |  | Low Vertebral bone density (VBD) | 5 | 231 |
|  |  |  |  |  |  | Male gender | RR 1.22 (0.62–2.39), p = 0.57 |  |  |  |  |  |
| (110) | 2009 | 10.1093/ndt/gfp253 | 19491380 | UK | complications | Male gender | OR 8.06 (1.34–48.450) |  |  | All-cause mortality | 4-5D | 134 |
|  |  |  |  |  |  | OPG >25 pmol/L | OR 5.31(1.35–20.88) |  |  |  |  |  |
| (111) | 2005 | 10.1111/j.1523-1755.2005.00345.x | 15882283 | Sweden | Complications | Male gender | RR 1.30 (0.83-2.02), NS |  |  | All-cause mortality | 5 | 258 |
|  |  |  |  |  |  |  | RR 1.32 (0.77–2.25), NS |  |  | Cardiovascular mortality |  |  |
|  |  |  |  |  |  | Low Fetuin-A | 2.58 (1.64–4.07) |  |  | All-cause mortality |  |  |
|  |  |  |  |  |  |  | 2.63 (1.51–4.59) |  |  | Cardiovascular mortality |  |  |
| (112) | 2005 | 10.1111/j.1523-1755.2005.00233.x | 15780108 | France | Complications | Male = 1, female = -1 | β = −0.48, HR 0.62, p = 0.0043 |  |  | First fatal or nonfatal cardiovascular event | 5D (HD) | 179 |
|  |  |  |  |  |  | Log (calciﬁcation score) | β = 0.90, HR 2.46, p <0.0001 |  |  |  |  |  |
|  |  |  |  |  |  |  | 18% of variance explained. |  |  |  |  |  |
| (113) | 2016 | 10.5301/jva.5000591 | 27516144 | Singapore | Complications | Male gender | OR 1.99, SD = 0.22 |  |  | Arteriovenous fistula secondary patency | 5D | 436 |
|  |  |  |  |  |  | Calcified radial artery | Secondary patency vs. primary failure: 12% vs. 25%, p = 0.002 |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |

1. Chue CD, Wall NA, Crabtree NJ, Zehnder D, Moody WE, Edwards NC, et al. Aortic calcification and femoral bone density are independently associated with left ventricular mass in patients with chronic kidney disease. PLoS One [Internet]. 2012;7(6). Available from: http://www.embase.com/search/results?subaction=viewrecord&from=export&id=L365024006

2. Renaud H, Atik A, Herve M, Moriniere P, Hocine C, Belbrik S, et al. Evaluation of vascular calcinosis risk factors in patients on chronic hemodialysis: lack of influence of calcium carbonate. Nephron. 1988;48(1):28–32.

3. Al-Rifai R, Arabi A, Masrouji R, Daouk M. Prevalence of peripheral vascular calcifications in patients on chronic hemodialysis at a tertiary care center in Beirut: A pilot study. J Med Liban [Internet]. 2011;59(3):117–21. Available from: http://search.ebscohost.com/login.aspx?direct=true&db=cmedm&AN=22259897&site=ehost-live&scope=site

4. K. T, A. D, Tangvoraphonkchai K, Davenport A. Reduction in Aortic Pulse Wave Velocity Is Associated with a Short-Term Reduction in Dual-Energy X-Ray Absorptiometry Lumbar Spine Bone Mineral Density T Score. Blood Purif [Internet]. 2019;1–5. Available from: http://www.embase.com/search/results?subaction=viewrecord&from=export&id=L628687376

5. Jean G, Bresson E, Terrat J-C, Vanel T, Hurot J-M, Lorriaux C, et al. Peripheral vascular calcification in long-haemodialysis patients: associated factors and survival consequences. Nephrol Dial Transplant [Internet]. 2009;24(3):948–55. Available from: http://www.embase.com/search/results?subaction=viewrecord&from=export&id=L354216091

6. Disthabanchong S, Vipattawat K, Phakdeekitcharoen B, Kitiyakara C, Sumethkul V. Abdominal aorta and pelvic artery calcifications on plain radiographs may predict mortality in chronic kidney disease, hemodialysis and renal transplantation. Int Urol Nephrol [Internet]. 2018;50(2):355–64. Available from: http://www.embase.com/search/results?subaction=viewrecord&from=export&id=L619734828

7. Cejka D, Weber M, Diarra D, Reiter T, Kainberger F, Haas M. Inverse association between bone microarchitecture assessed by HR-pQCT and coronary artery calcification in patients with end-stage renal disease. Bone. 2014;64:33–8.

8. Mazzaferro S, Pasquali M, Pugliese F, Barresi G, Carbone I, Francone M, et al. Serum levels of calcification inhibition proteins and coronary artery calcium score: Comparison between transplantation and dialysis. Am J Nephrol [Internet]. 2007;27(1):75–83. Available from: http://www.embase.com/search/results?subaction=viewrecord&from=export&id=L46364544

9. He J, Reilly M, Yang W, Chen J, Go AS, Lash JP, et al. Risk factors for coronary artery calcium among patients with chronic kidney disease (from the Chronic Renal Insufficiency Cohort Study). Am J Cardiol. 2012;110(12):1735–41.

10. Lioufas NM, Pedagogos E, Hawley CM, Pascoe EM, Elder GJ, Badve S V, et al. Aortic Calcification and Arterial Stiffness Burden in a Chronic Kidney Disease Cohort with High Cardiovascular Risk: Baseline Characteristics of the Impact of Phosphate Reduction On Vascular End-Points in Chronic Kidney Disease Trial. Am J Nephrol. 2020;51(3):201–15.

11. Ossareh S, Rayatnia M, Vahedi M, Jafari H, Zebarjadi M. Association of Serum Fetuin-A with Vascular Calcification in Hemodialysis Patients and Its’ Impact on 3-year Mortality. Iran J Kidney Dis. 2020 Dec;14(6):500–9.

12. Nemeth ZK, Mardare NG, Czira ME, Deak G, Kiss I, Mathe Z, et al. Serum osteoprotegerin is associated with pulse pressure in kidney transplant recipients. Sci Rep. 2015 Oct;5:14518.

13. Buiten MS, de Bie MK, Bouma-de Krijger A, van Dam B, Dekker FW, Jukema JW, et al. Soluble Klotho is not independently associated with cardiovascular disease in a population of dialysis patients. BMC Nephrol. 2014 Dec;15:197.

14. Riphagen IJ, Keyzer CA, Drummen NEA, de Borst MH, Beulens JWJ, Gansevoort RT, et al. Prevalence and Effects of Functional Vitamin K Insufficiency: The PREVEND Study. Nutrients. 2017 Dec;9(12).

15. Nigwekar SU, Zhao S, Wenger J, Hymes JL, Maddux FW, Thadhani RI, et al. A Nationally Representative Study of Calcific Uremic Arteriolopathy Risk Factors. J Am Soc Nephrol. 2016;27(11):3421–9.

16. Fusaro M, Tripepi G, Noale M, Plebani M, Zaninotto M, Piccoli A, et al. Prevalence of Vertebral Fractures, Vascular Calcifications, and Mortality in Warfarin Treated Hemodialysis Patients. Curr Vasc Pharmacol [Internet]. 2015;13(2):248–58. Available from: http://www.embase.com/search/results?subaction=viewrecord&from=export&id=L604512509

17. Gupta V, Ekundayo O, Nemeth ZK, Yang Y, Covic A, Mathe Z, et al. Association between serum osteoprotegerin level and mortality in kidney transplant recipients. Transpl Int Off J Eur Soc Organ Transplant. 2021 Feb;

18. Ahmed S, O’Neill KD, Hood AF, Evan AP, Moe SM. Calciphylaxis is associated with hyperphosphatemia and increased osteopontin expression by vascular smooth muscle cells. Am J kidney Dis Off J Natl Kidney Found. 2001 Jun;37(6):1267–76.

19. Charitaki E, Davenport A. Aortic pulse wave velocity in haemodialysis patients is associated with the prescription of active vitamin D analogues. J Nephrol. 2014 Aug;27(4):431–7.

20. Kahn J, Ram LM, Eberhard K, Groselj-Strele A, Obermayer-Pietsch B, Mueller H. Calcification score evaluation in patients listed for renal transplantation. Clin Transplant. 2017;31(3).

21. Ștefan G, Florescu C, Sabo A-A, Stancu S, Mircescu G. Intrarenal resistive index conundrum: systemic atherosclerosis versus renal arteriolosclerosis. Ren Fail [Internet]. 2019 Nov;41(1):930–6. Available from: http://search.ebscohost.com/login.aspx?direct=true&db=cmedm&AN=31599199&site=ehost-live&scope=site

22. Zhang A-H, Guo W-K, Yu L, Liu W-H. Relationship of Serum Soluble Klotho Levels and Echocardiographic Parameters in Patients on Maintenance Hemodialysis. Kidney Blood Press Res. 2019;44(3):396–404.

23. Alayoud A, El Amrani M, Belarbi M, El Kharras A, Chtioui M, Elfilali K. Risk factors for progression of coronary artery calcification over 5 years in hemodialysis patients. Ann Cardiol Angeiol (Paris). 2020 Apr;69(2):81–5.

24. Chen J, Budoff MJ, Reilly MP, Yang W, Rosas SE, Rahman M, et al. Coronary Artery Calcification and Risk of Cardiovascular Disease and Death Among Patients With Chronic Kidney Disease. JAMA Cardiol. 2017;2(6):635–43.

25. Wang AY-M, Wong C-K, Yau Y-Y, Wong S, Chan IH-S, Lam CW-K. Skin autofluorescence associates with vascular calcification in chronic kidney disease. Arterioscler Thromb Vasc Biol. 2014;34(8):1784–90.

26. Etta PK, Sharma RK, Gupta A. Study of chronic kidney disease-mineral bone disorders in newly detected advanced renal failure patients: A Hospital-based cross-sectional study. Saudi J Kidney Dis Transplant An Off Publ Saudi Cent Organ Transplantation, Saudi Arab [Internet]. 2017;28(4):874–85. Available from: http://search.ebscohost.com/login.aspx?direct=true&db=cmedm&AN=28748891&site=ehost-live&scope=site

27. Keyzer CA, de Borst MH, van den Berg E, Jahnen-Dechent W, Arampatzis S, Farese S, et al. Calcification Propensity and Survival among Renal Transplant Recipients. J Am Soc Nephrol. 2016 Jan;27(1):239–48.

28. Craver L, Dusso A, Martinez-Alonso M, Sarro F, Valdivielso JMJMJM, Fernandez E, et al. A low fractional excretion of Phosphate/Fgf23 ratio is associated with severe abdominal Aortic calcification in stage 3 and 4 kidney disease patients. BMC Nephrol [Internet]. 2013;14(1). Available from: http://www.embase.com/search/results?subaction=viewrecord&from=export&id=L52814371

29. Kirkpantur A, Altun B, Hazirolan T, Akata D, Arici M, Kirazli S, et al. Association Among Serum Fetuin-A Level, Coronary Artery Calcification, and Bone Mineral Densitometry in Maintenance Hemodialysis Patients. Artif Organs. 2009;33(10):844–54.

30. Pateinakis P, Papagianni A, Douma S, Efstratiadis G, Memmos D. Associations of fetuin-A and osteoprotegerin with arterial stiffness and early atherosclerosis in chronic hemodialysis patients. BMC Nephrol. 2013;14.

31. Golembiewska E, Qureshi AR, Dai L, Lindholm B, Heimbürger O, Söderberg M, et al. Copeptin is independently associated with vascular calcification in chronic kidney disease stage 5. BMC Nephrol [Internet]. 2020 Feb 7;21(1):43. Available from: http://search.ebscohost.com/login.aspx?direct=true&db=cmedm&AN=32033584&site=ehost-live&scope=site

32. Chen Z, Qureshi AR, Parini P, Hurt-Camejo E, Ripsweden J, Brismar TB, et al. Does statins promote vascular calcification in chronic kidney disease? Eur J Clin Invest [Internet]. 2017;47(2):137–48. Available from: http://www.embase.com/search/results?subaction=viewrecord&from=export&id=L614236354

33. Gelev S, Spasovski G, Trajkovski Z, Damjanovski G, Amitov V, Selim G, et al. Factors associated with various arterial calcifications in haemodialysis patients. Prilozi [Internet]. 2008;29(2):185–99. Available from: http://search.ebscohost.com/login.aspx?direct=true&db=cmedm&AN=19259046&site=ehost-live&scope=site

34. Capusa C, Stancu S, Barsan L, Ilyes A, Dorobantu N, Petrescu L, et al. Are mineral metabolism abnormalities predictors of vascular calcifications in non-dialysis chronic kidney disease? Nephrol Dial Transplant [Internet]. 2012;27:ii152. Available from: https://www.embase.com/search/results?subaction=viewrecord&id=L70765735&from=export

35. Maharem DA, Gomaa SH, El Ghandor MK, Mohamed EI, Matrawy KA, Zaytoun SS, et al. Association of serum fetuin-A and fetuin-A gene polymorphism in relation to mineral and bone disorders in patients with chronic kidney disease. Egypt J Med Hum Genet [Internet]. 2013;14(4):337–52. Available from: http://www.embase.com/search/results?subaction=viewrecord&from=export&id=L369999530

36. Schlieper G, Frisch B, Djuric Z, Dimkovic N, Floege J. Sp711Comprehensive Comparison of Cardiovascular Imaging Tools and Biomarkers for Risk Prediction in Hd Patients: Imt Beets Them All. Nephrol Dial Transplant. 2015;30(suppl\_3):iii613–4.

37. Schlieper G, Brandenburg V, Djuric Z, Damjanovic T, Markovic N, Schurgers L, et al. Risk factors for cardiovascular calcifications in non-diabetic Caucasian haemodialysis patients. Kidney Blood Press Res [Internet]. 2009;32(3):161–8. Available from: http://www.embase.com/search/results?subaction=viewrecord&from=export&id=L50530012

38. Sigrist M, Bungay P, Taal MW, McIntyre CW. Vascular calcification and cardiovascular function in chronic kidney disease. Nephrol Dial Transplant [Internet]. 2006;21(3):707–14. Available from: http://www.ncbi.nlm.nih.gov/pubmed/16263735

39. Harada PHN, Canziani ME, Lima LM, Kamimura M, Rochitte CE, Lemos MM, et al. Pericardial fat is associated with coronary artery calcification in non-dialysis dependent chronic kidney disease patients. PLoS One [Internet]. 2014;9(12):e114358–e114358. Available from: http://search.ebscohost.com/login.aspx?direct=true&db=cmedm&AN=25479288&site=ehost-live&scope=site

40. Okamoto T, Hatakeyama S, Kodama H, Horiguchi H, Kubota Y, Kido K, et al. The relationship between poor nutritional status and progression of aortic calcification in patients on maintenance hemodialysis. BMC Nephrol. 2018;19.

41. Vipattawat K, Kitiyakara C, Phakdeekitcharoen B, Kantachuvesiri S, Sumethkul V, Jirasiritham S, et al. Vascular calcification in long-term kidney transplantation. Nephrology [Internet]. 2014;19(4):251–6. Available from: http://www.embase.com/search/results?subaction=viewrecord&from=export&id=L372702733

42. Evenepoel P, Goffin E, Meijers B, Kanaan N, Bammens B, Coche E, et al. Sclerostin serum levels and vascular calcification progression in prevalent renal transplant recipients. J Clin Endocrinol Metab [Internet]. 2015;100(12):4669–76. Available from: http://search.ebscohost.com/login.aspx?direct=true&db=cin20&AN=113977572&site=ehost-live&scope=site

43. Jansson H, Saeed A, Svensson MK, Finnved K, Hellström M, Guron G. Impact of Abdominal Aortic Calcification on Central Haemodynamics and Decline of Glomerular Filtration Rate in Patients with Chronic Kidney Disease Stages 3 and 4. Kidney Blood Press Res [Internet]. 2019;44(5):950–60. Available from: http://www.embase.com/search/results?subaction=viewrecord&from=export&id=L629160945

44. Nitta K, Hanafusa N, Okazaki M, Komatsu M, Kawaguchi H, Tsuchiya K. Association Between Risk Factors Including Bone-Derived Biomarkers and Aortic Arch Calcification in Maintenance Hemodialysis Patients. Kidney Blood Press Res [Internet]. 2018;43(5):1554–62. Available from: http://www.embase.com/search/results?subaction=viewrecord&from=export&id=L624716127

45. Nishizawa Y, Jono S, Ishimura E, Shioi A. Hyperphosphatemia and vascular calcification in end-stage renal disease. J Ren Nutr [Internet]. 2005;15(1):178–82. Available from: http://www.embase.com/search/results?subaction=viewrecord&from=export&id=L40093705

46. Chiu Y-W, Adler SG, Budoff MJ, Takasu J, Ashai J, Mehrotra R, et al. Coronary artery calcification and mortality in diabetic patients with proteinuria. Kidney Int [Internet]. 2010;77(12):1107–14. Available from: http://search.ebscohost.com/login.aspx?direct=true&db=cin20&AN=105217265&site=ehost-live&scope=site

47. Jankovic A, Damjanovic T, Djuric Z, Marinkovic J, Schlieper G, Djuric P, et al. Calcification in arteriovenous fistula blood vessels may predict arteriovenous fistula failure: a 5-year follow-up study. Int Urol Nephrol [Internet]. 2017;49(5):881–7. Available from: http://www.embase.com/search/results?subaction=viewrecord&from=export&id=L614230135

48. Komatsu M, Okazaki M, Tsuchiya K, Kawaguchi H, Nitta K. Aortic Arch Calcification Predicts Cardiovascular and All-Cause Mortality in Maintenance Hemodialysis Patients. Kidney Blood Press Res. 2014;39(6):658–67.

49. Jankovic A, Damjanovic T, Djuric Z, Marinkovic J, Schlieper G, Tosic-Dragovic J, et al. Impact of Vascular Calcifications on Arteriovenous Fistula Survival in Hemodialysis Patients: A Five-Year Follow-Up. Nephron. 2015;129(4):247–52.

50. Ishimura E, Okuno S, Kitatani K, Kim M, Shoji T, Nakatani T, et al. Different risk factors for peripheral vascular calcification between diabetic and non-diabetic haemodialysis patientsn - Importance of glycaemic control. Diabetologia [Internet]. 2002;45(10):1446–8. Available from: http://www.embase.com/search/results?subaction=viewrecord&from=export&id=L35244899

51. Turan MN, Kircelli F, Yaprak M, Sisman AR, Gungor O, Bayraktaroglu S, et al. FGF-23 levels are associated with vascular calcification, but not with atherosclerosis, in hemodialysis patients. Int Urol Nephrol. 2016;48(4):609–17.

52. Claes KJ, Heye S, Bammens B, Kuypers DR, Meijers B, Naesens M, et al. Aortic calcifications and arterial stiffness as predictors of cardiovascular events in incident renal transplant recipients. Transpl Int [Internet]. 2013;26(10):973–81. Available from: http://www.embase.com/search/results?subaction=viewrecord&from=export&id=L52694576

53. Manghat P, Souleimanova I, Cheung J, Wierzbicki AS, Harrington DJ, Shearer MJ, et al. Association of bone turnover markers and arterial stiffness in pre-dialysis chronic kidney disease (CKD). Bone [Internet]. 2011 May 1;48(5):1127–32. Available from: http://search.ebscohost.com/login.aspx?direct=true&db=cmedm&AN=21281749&site=ehost-live&scope=site

54. Qureshi AR, Olauson H, Witasp A, Haarhaus M, Brandenburg V, Wernerson A, et al. Increased circulating sclerostin levels in end-stage renal disease predict biopsy-verified vascular medial calcification and coronary artery calcification. KIDNEY Int. 2015;88(6):1356–64.

55. Jean G, Chazot C, Bresson E, Zaoui E, Cavalier E. High Serum Sclerostin Levels Are Associated with a Better Outcome in Haemodialysis Patients. Nephron. 2016;132(3):181–90.

56. Sumida Y, Nakayama M, Nagata M, Nakashita S, Suehiro T, Kaizu Y, et al. Carotid artery calcification and atherosclerosis at the initiation of hemodialysis in patients with end-stage renal disease. Clin Nephrol [Internet]. 2010;73(5):360–9. Available from: http://www.embase.com/search/results?subaction=viewrecord&from=export&id=L358729373

57. Raggi P, Boulay A, Chasan-Taber S, Amin N, Dillon M, Burke SK, et al. Cardiac calcification in adult hemodialysis patients: A link between end-stage renal disease and cardiovascular disease? J Am Coll Cardiol [Internet]. 2002;39(4):695–701. Available from: http://www.embase.com/search/results?subaction=viewrecord&from=export&id=L34158168

58. Nishiura R, Fujimoto S, Sato Y, Yamada K, Hisanaga S, Hara S, et al. Elevated Osteoprotegerin Levels Predict Cardiovascular Events in New Hemodialysis Patients. Am J Nephrol. 2009;29(3):257–63.

59. Beddhu S, Baird B, Ma X, Cheung AK, Greene T. Serum alkaline phosphatase and mortality in hemodialysis patients. Clin Nephrol. 2010;74(2):91–6.

60. Shu K-H, Tsai I-C, Ho H-C, Wu M-J, Chen C-H, Cheng C-H, et al. Coronary artery calcification in kidney transplant recipients with long-term follow-up. Transplant Proc [Internet]. 2012;44(3):687–90. Available from: http://search.ebscohost.com/login.aspx?direct=true&db=cmedm&AN=22483469&site=ehost-live&scope=site

61. Schlieper G, Krüger T, Djuric Z, Damjanovic T, Markovic N, Schurgers LJ, et al. Vascular access calcification predicts mortality in hemodialysis patients. Kidney Int [Internet]. 2008;74(12):1582–7. Available from: http://search.ebscohost.com/login.aspx?direct=true&db=cin20&AN=105591391&site=ehost-live&scope=site

62. M. M, A.-M. D, I. J, H. V, G. G, K. K, et al. A cut-off value of plasma osteoprotegerin level may predict the presence of coronary artery calcifications in chronic kidney disease patients. Nephrol Dial Transplant [Internet]. 2009;24(11):3389–97. Available from: http://www.embase.com/search/results?subaction=viewrecord&from=export&id=L358385284

63. Bellasi A, Veledar E, Ferramosca E, Ratti C, Block G, Raggi P, et al. Markers of vascular disease do not differ in black and white hemodialysis patients despite a different risk profile. Atherosclerosis [Internet]. 2008;197(1):242–9. Available from: http://www.embase.com/search/results?subaction=viewrecord&from=export&id=L351273245

64. Oprisiu R, Bunea D, Tarek S, Hedi B, Fournier A. Progression of vascular calcification and dyslipidemia in patients on chronic hemodialysis [Internet]. Vol. 39, American Journal of Kidney Diseases. 2002. p. 209. Available from: https://linkinghub.elsevier.com/retrieve/pii/S0272638614700988

65. Sigrist MK, Taal MW, Bungay P, McIntyre CW. Progressive vascular calcification over 2 years is associated with arterial stiffening and increased mortality in patients with stages 4 and 5 chronic kidney disease. Clin J Am Soc Nephrol. 2007;2(6):1241–8.

66. Tamei N, Ogawa T, Ishida H, Ando Y, Nitta K. Serum Fibroblast Growth Factor-23 Levels and Progression of Aortic Arch Calcification in Non-Diabetic Patients on Chronic Hemodialysis. J Atheroscler Thromb. 2011;18(3):217–23.

67. Jung HH, Kim S-W, Han H. Inflammation, mineral metabolism and progressive coronary artery calcification in patients on haemodialysis. Nephrol Dial Transplant. 2006;21(7):1915–20.

68. Scialla JJ, Leonard MB, Townsend RR, Appel L, Wolf M, Budoff MJ, et al. Correlates of osteoprotegerin and association with aortic pulse wave velocity in patients with chronic kidney disease. Clin J Am Soc Nephrol [Internet]. 2011;6(11):2612–9. Available from: http://www.embase.com/search/results?subaction=viewrecord&from=export&id=L362887921

69. Kanbay M, Nicoleta M, Selcoki Y, Ikizek M, Aydin M, Eryonucu B, et al. Fibroblast Growth Factor 23 and Fetuin A are Independent Predictors for the Coronary Artery Disease Extent in Mild Chronic Kidney Disease. Clin J Am Soc Nephrol [Internet]. 2010;5(10):1780–6. Available from: http://www.embase.com/search/results?subaction=viewrecord&from=export&id=L70484166

70. Jean G, Charra B, Chazot C. Vitamin D Deficiency and Associated Factors in Hemodialysis Patients. J Ren Nutr [Internet]. 2008;18(5):395–9. Available from: http://search.ebscohost.com/login.aspx?direct=true&db=cin20&AN=105677388&site=ehost-live&scope=site

71. Hou J-S, Lin Y-L, Wang C-H, Lai Y-H, Kuo C-H, Subeq Y-M, et al. Serum osteoprotegerin is an independent marker of central arterial stiffness as assessed using carotid-femoral pulse wave velocity in hemodialysis patients: a cross sectional study. BMC Nephrol [Internet]. 2019;20(1):N.PAG-N.PAG. Available from: http://search.ebscohost.com/login.aspx?direct=true&db=cin20&AN=136621379&site=ehost-live&scope=site

72. F.L.C. G, R.M. E, L.M. DR, F.G. G, F.G. Z, R.B. O, et al. Serum sclerostin is an independent predictor of mortality in hemodialysis patients. BMC Nephrol [Internet]. 2014;15(1):190. Available from: http://search.ebscohost.com/login.aspx?direct=true&db=cmedm&AN=25465028&site=ehost-live&scope=site

73. Chang JH, Ro H, Kim S, Lee HH, Chung W, Jung JY. Study on the relationship between serum 25-hydroxyvitamin D levels and vascular calcification in hemodialysis patients with consideration of seasonal variation in vitamin D levels. Atherosclerosis. 2012;220(2):563–8.

74. Block GA, Hulbert-Shearon TE, Levin NW, Port FK. Association of serum phosphorus and calcium x phosphate product with mortality risk in chronic hemodialysis patients: a national study. Am J kidney Dis Off J Natl Kidney Found. 1998 Apr;31(4):607–17.

75. Ho T-Y, Chen N-C, Hsu C-Y, Huang C-W, Lee P-T, Chou K-J, et al. Evaluation of the association of Wnt signaling with coronary artery calcification in patients on dialysis with severe secondary hyperparathyroidism. BMC Nephrol. 2019;20(1):345.

76. Kuo T-H, Lin W-H, Chao J-Y, Wu A-B, Tseng C-C, Chang Y-T, et al. Serum sclerostin levels are positively related to bone mineral density in peritoneal dialysis patients: a cross-sectional study. BMC Nephrol. 2019;20(1):266.

77. Janda K, Krzanowski M, Chowaniec E, Kuśnierz-Cabala B, Dumnicka P, Kraśniak A, et al. Osteoprotegerin as a marker of cardiovascular risk in patients on peritoneal dialysis. Pol Arch Med Wewn. 2013;123(4):149–55.

78. Claes KJ, Viaene L, Heye S, Meijers B, d’Haese P, Evenepoel P. Sclerostin: Another Vascular Calcification Inhibitor? J Clin Endocrinol Metab. 2013;98(8):3221–8.

79. Baralić M, Brković V, Stojanov V, Stanković S, Lalić N, Durić P, et al. Dual roles of the mineral metabolism disorders biomarkers in prevalent hemodilysis patients: In renal bone disease and in vascular calcification. J Med Biochem. 2019;38(2):134–44.

80. Porter CJ, Stavroulopoulos A, Roe SD, Pointon K, Cassidy MJD. Detection of coronary and peripheral artery calcification in patients with chronic kidney disease stages 3 and 4, with and without diabetes. Nephrol Dial Transplant. 2007;22(11):3208–13.

81. Kanbay M, Wolf M, Selcoki Y, Solak Y, Ikizek M, Uysal S, et al. Association of serum calcitonin with coronary artery disease in individuals with and without chronic kidney disease. Int Urol Nephrol [Internet]. 2012;44(4):1169–75. Available from: http://www.embase.com/search/results?subaction=viewrecord&from=export&id=L365913496

82. Fusaro M, Gallieni M, Noale M, Tripepi G, Miozzo D, Plebani M, et al. The relationship between the Spine Deformity Index, biochemical parameters of bone metabolism and vascular calcifications: results from the Epidemiological VERtebral FRACtures iTalian Study (EVERFRACT) in dialysis patients. Clin Chem Lab Med. 2014;52(11):1595–603.

83. Chen H-Y, Chiu Y-L, Hsu S-P, Pai M-F, Yang J-Y, Peng Y-S. Low serum fetuin A levels and incident stroke in patients with maintenance haemodialysis. Eur J Clin Invest. 2013 Apr;43(4):387–96.

84. Floege J, Raggi P, Block GA, Torres PU, Csiky B, Naso A, et al. Study design and subject baseline characteristics in the ADVANCE Study: effects of cinacalcet on vascular calcification in haemodialysis patients. Nephrol Dial Transplant. 2010;25(6):1916–23.

85. González-Parra E, Aceña Á, Lorenzo Ó, Tarín N, González-Casaus ML, Cristóbal C, et al. Important abnormalities of bone mineral metabolism are present in patients with coronary artery disease with a mild decrease of the estimated glomerular filtration rate. J Bone Miner Metab. 2016 Sep;34(5):587–98.

86. Nakayama K, Nakao K, Takatori Y, Inoue J, Kojo S, Akagi S, et al. Long-term effect of cinacalcet hydrochloride on abdominal aortic calcification in patients on hemodialysis with secondary hyperparathyroidism. Int J Nephrol Renovasc Dis. 2013;7:25–33.

87. Dai L, Debowska M, Lukaszuk T, Bobrowski L, Barany P, Söderberg M, et al. Phenotypic features of vascular calcification in chronic kidney disease. J Intern Med. 2020 Apr;287(4):422–34.

88. Ramalho J, Petrillo EM, Takeichi APM, Moyses RMA, Titan SM. Calcitriol and FGF-23, but neither PTH nor sclerostin, are associated with calciuria in CKD. Int Urol Nephrol. 2019 Oct;51(10):1823–9.

89. Bundy JD, Cai X, Scialla JJ, Dobre MA, Chen J, Hsu C-Y, et al. Serum Calcification Propensity and Coronary Artery Calcification Among Patients With CKD: The CRIC (Chronic Renal Insufficiency Cohort) Study. Am J kidney Dis Off J Natl Kidney Found. 2019 Jun;73(6):806–14.

90. Wang Y, Miao Y, Gong K, Cheng X, Chen Y, Zhao M-H. Plasma Complement Protein C3a Level Was Associated with Abdominal Aortic Calcification in Patients on Hemodialysis. J Cardiovasc Transl Res. 2019;

91. Solbu MD, Mjoen G, Mark PB, Holdaas H, Fellstrom B, Schmieder RE, et al. Predictors of atherosclerotic events in patients on haemodialysis: post hoc analyses from the AURORA study. Nephrol Dial Transplant. 2018;33(1):102–12.

92. Tanaka M, Abe Y, Furukado S, Miwa K, Sakaguchi M, Sakoda S, et al. Chronic kidney disease and carotid atherosclerosis. J Stroke Cerebrovasc Dis. 2012;21(1):47–51.

93. Chen Z, Qureshi AR, Brismar TB, Ripsweden J, Haarhaus M, Barany P, et al. Differences in association of lower bone mineral density with higher coronary calcification in female and male end-stage renal disease patients. BMC Nephrol. 2019;20.

94. Peyro-Shabani A, Nabahati M, Saber-Sadeghdoust M-A, Soleymani MJ, Oliaei F. Risk factors associated with aortic calcification in hemodialysis patients. Casp J Intern Med. 2018;9(4):347–52.

95. de Bie MK, Buiten MS, Rotmans JI, Hogenbirk M, Schalij MJ, Rabelink TJ, et al. Abdominal aortic calcification on a plain X-ray and the relation with significant coronary artery disease in asymptomatic chronic dialysis patients. BMC Nephrol [Internet]. 2017;18(1):82. Available from: http://search.ebscohost.com/login.aspx?direct=true&db=cmedm&AN=28253835&site=ehost-live&scope=site

96. Lankinen R, Hakamäki M, Metsärinne K, Koivuviita N, Pärkkä JP, Saarenhovi M, et al. Association of maximal stress ergometry performance with troponin T and abdominal aortic calcification score in advanced chronic kidney disease. BMC Nephrol [Internet]. 2021 Feb 4;22(1):50. Available from: http://search.ebscohost.com/login.aspx?direct=true&db=cmedm&AN=33541279&site=ehost-live&scope=site

97. Lee C Te, Huang CC, Hsu CY, Chiou TTY, Ng HY, Wu CH, et al. Calcification of the aortic arch predicts cardiovascular and all-cause mortality in chronic hemodialysis patients. CardioRenal Med [Internet]. 2014;4(1):34–42. Available from: http://www.embase.com/search/results?subaction=viewrecord&from=export&id=L603943439

98. Guedes Marques M, Botelho C, Maia P, Ibeas J, Ponce P. Doppler ultrasound and calcification score: Improving vascular access surveillance. Ren Fail [Internet]. 2015;37(9):1425–9. Available from: http://www.embase.com/search/results?subaction=viewrecord&from=export&id=L605893428

99. Metry G, Stenvinkel P, Qureshi AR, Carrero JJ, Yilmaz MI, Bárány P, et al. Low serum fetuin-A concentration predicts poor outcome only in the presence of inflammation in prevalent haemodialysis patients. Eur J Clin Invest [Internet]. 2008;38(11):804–11. Available from: http://www.embase.com/search/results?subaction=viewrecord&from=export&id=L352548873

100. Moldovan D, Rusu C, Kacso IM, Potra A, Patiu IM, Gherman-Caprioara M. Mineral and bone disorders, morbidity and mortality in end-stage renal failure patients on chronic dialysis. Clujul Med [Internet]. 2016;89(1):94–103. Available from: http://search.ebscohost.com/login.aspx?direct=true&db=cmedm&AN=27004031&site=ehost-live&scope=site

101. Zhang DL, Wang LY, Sun F, Zhou YL, Duan XF, Liu S, et al. Is the dialysate calcium concentration of 1.75 mmol/L suitable for Chinese patients on maintenance hemodialysis? Calcif Tissue Int. 2014;94(3):301–10.

102. Bohn E, Tangri N, Gali B, Henderson B, Sood MM, Komenda P, et al. Predicting risk of mortality in dialysis patients: a retrospective cohort study evaluating the prognostic value of a simple chest X-ray. BMC Nephrol [Internet]. 2013;14(1):263. Available from: http://search.ebscohost.com/login.aspx?direct=true&db=cin20&AN=104122812&site=ehost-live&scope=site

103. Laucyte-Cibulskiene A, Boreikaite E, Aucina G, Gudynaite M, Rudminiene I, Anisko S, et al. Usefulness of pretransplant aortic arch calcification evaluation for kidney transplant outcome prediction in one year follow-up. Ren Fail. 2018;40(1):201–8.

104. Thang OHD, Serne EH, Grooteman MPC, Smulders YM, ter Wee PM, Tangelder G-J, et al. Capillary rarefaction in advanced chronic kidney disease is associated with high phosphorus and bicarbonate levels. Nephrol Dial Transplant. 2011;26(11):3529–36.

105. Claes KJ, Heye S, Nuyens D, Bammens B, Kuypers DR, Vanrenterghem Y, et al. Impact of vascular calcification on corrected QT interval at the time of renal transplantation. Am J Nephrol [Internet]. 2012;35(1):24–30. Available from: http://search.ebscohost.com/login.aspx?direct=true&db=cin20&AN=108148330&site=ehost-live&scope=site

106. Di Iorio BR, Bortone S, Piscopo C, Grimaldi P, Cucciniello E, D’Avanzo E, et al. Cardiac vascular calcification and QT interval in ESRD patients: Is there a link? Blood Purif [Internet]. 2006;24(5–6):451–9. Available from: http://www.embase.com/search/results?subaction=viewrecord&from=export&id=L46030087

107. Kamiura N, Yamamoto K, Okada S, Sakai M, Fujimori A, N. K, et al. Calcification of the thoracic aorta determined by three-dimensional computed tomography predicts cardiovascular complications in patients undergoing hemodialysis. Int Urol Nephrol [Internet]. 2014;46(5):993–8. Available from: http://www.embase.com/search/results?subaction=viewrecord&from=export&id=L52905826

108. Viaene L, Behets GJ, Claes K, Meijers B, Blocki F, Brandenburg V, et al. Sclerostin: another bone-related protein related to all-cause mortality in haemodialysis? Nephrol Dial Transplant. 2013;28(12):3024–30.

109. Chen Z, Qureshi AR, Ripsweden J, Wennberg L, Heimburger O, Lindholm B, et al. Vertebral bone density associates with coronary artery calcification and is an independent predictor of poor outcome in end-stage renal disease patients. Bone. 2016;92:50–7.

110. Sigrist MK, Levin A, Er L, McIntyre CW. Elevated osteoprotegerin is associated with all-cause mortality in CKD stage 4 and 5 patients in addition to vascular calcification. Nephrol Dial Transplant. 2009;24(10):3157–62.

111. Stenvinkel P, Wang K, Qureshi AR, Axelsson J, Pecoits-Filho R, Gao P, et al. Low fetuin-A levels are associated with cardiovascular death: Impact of variations in the gene encoding fetuin. Kidney Int [Internet]. 2005;67(6):2383–92. Available from: http://www.embase.com/search/results?subaction=viewrecord&from=export&id=L41623401

112. K.F. H, J.J. C, G.M. L, Huybrechts KF, Caro JJ, London GM. Modeling the implications of changes in vascular calcification in patients on hemodialysis. Kidney Int [Internet]. 2005;67(4):1532–8. Available from: http://www.embase.com/search/results?subaction=viewrecord&from=export&id=L40463132

113. Joseph Lo Z, Tay WM, Lee Q, Chua JL, Tan GWL, Chandrasekar S, et al. Predictors of radio-cephalic arteriovenous fistulae patency in an Asian population. J Vasc Access [Internet]. 2016;17(5):411–6. Available from: http://search.ebscohost.com/login.aspx?direct=true&db=cmedm&AN=27516144&site=ehost-live&scope=site