­Table 1. Associates of vascular calcification

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Author | PMID | Country | Time | CKD stages | sample | Findings | Data | Calcification | Ref |
| Ahmed *et al.* | 11382698 | USA | 2001 | 5D | 20 | Female more prevalent | Cases vs. control: 90% vs. 49.7% | Calciphylaxis (calcific uremic arteriolopathy) | (1) |
| 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 | (2) |
| Al-Rifai *et al.* | 22259897 | Lebanon | 2011 | 5D (HD) | 43 | Neutral | No association between VC and gender | Hand X-rays | (3) |
| Arjona Barrionuevo *et al.* | 20970624 | Spain | 2010 | 5T (awaiting transplant) | 356 | Female at risk | A positive correlation was observed between valve calcifications and female sex | Valvular calcification assessed with transthoracic echocardiography | (4) |
| Asci *et al.* | 20709740 | Turkey | 2010 | 5D (HD) | 207 | Male more severe | Male in patients with CACS 1–100 vs. 101–400 vs. >400: 38% vs. 72% vs. 61%, p = 0.005 | CACS calculated by summing the calcification score in the left main coronary artery, left anterior descending artery, left circumflex and right coronary artery on multislice CT. | (5) |
| Avramovski et al. | 31031374 | Macedonia | 2019 | 5D | 112 | Neutral | R = 0.127, p = 0.182 | AAC on lateral lumbar radiography in standing position | (6) |
| Bae *et al.* | 27709829 | Korea (multicenter) | 2016 | 5D (HD) | 423 | Male more severe | Median CAC score in male: 44.10 (0.00–258.70) vs. 5.15 (0.00–154.05) | CACS measured with L-spine  Radiography (Kauppila score) | (7) |
| Ballotta *et al.* | 14981445 | Italy | 2004 | 5D | 143 | Neutral | Male gender in patients with severe calcification vs. no calcification: 78% vs. 74%, p = 0.59 | Potential outflow artery chosen for the distal anastomosis classified during surgery as normal or as having mild-to-moderate uncalcified plaque, mild-to moderate calcification, or severe calcification | (8) |
| Bellasi *et al.* | 22630831 | US | 2012 | 5D (HD) | 141 | Neutral | Women in cardiovascular calcification index 0–2 vs. 3–4 vs. 5–7 vs. 8–11: 51% vs. 48% vs. 61% vs. 38%, p = 0.57 | Cardiovascular calcification index assessed with two-dimensional echocardiography | (9) |
| Bundy *et al.* | 31658949 | US (CRIC) | 2019 | 2-4 | 3404 | Neutral | Female in patients with quartiles 4 vs. 3 vs. 2 vs. 1 T50: 41% vs. 44% vs. 48% vs. 47%, ANOVA was not performed | T50 as the propensity of vascular calcification | (10) |
| Chandra *et al.* | 32129206 | India | 2020 | 5D | 90 | Neutral | Present vs. absent, male 67.5% vs. 62%, p = 0.59 | CAC or TAC assessed with computed tomography (Agatston score) | (12) |
| Chang *et al* | 22169112 | South Korea | 2012 | 5D (HD) | 289 | Neutral | Severe vs. modest calcification, male 41.8% vs. 44.7%, *p* = 0.066 | Lumbar spine lateral radiography | (13) |
| Chao *et al.* | 28522697 | Taiwan | 2017 | 5 | 88 | Neutral | Male in patients without vs. with AoAC 53) 51 (49) 0.65 | AoAC on radiography | (14) |
| Chao *et al.* | 32866261 | Taiwan | 2020 | 1-5? (ESRD and CKD) | 96 | Neutral | Male in patients without vs. with AoAC: 43% vs. 47%, p = 0.711 | AoAC measured with semi-quantitation on PA chest radiography | (15) |
| Charitaki *et al.* | 24473732 | UK | 2014 | 5D (HD) | 303 | Male at risk | Female Pearson r = -0.124, p = 0.031 | PWV | (16) |
| Chen *et al* | 28036114 | Sweden | 2017 | 5D, 5T | 240 | Neutral | Score > 100 vs. ≤ 100, male 68% vs. 57%, *p* = 0.052 | Coronary artery calcification (Agatston score) | (17) |
| 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 | (18) |
| Chiu *et al* | 20237457 | United States | 2010 | Proteinuric (1-5) | 225 | Neutral | Group 4 (severe) vs. 3 vs. 2 vs. 1, male 61% vs. 64% vs. 47% vs. 45%, *p* = 0.09 | Coronary artery calcification (Agatston score) | (19) |
| Choi *et al.* | 31048884 | Korea | 2019 | 5D (HD) | 97 | Male progresses more | AAC progression (+) vs. (-), male 50.9% vs. 29.5%, p = 0.033 | Lateral lumbar radiography (Kauppila score) | (20) |
| Chou *et al.* | 30594298 | Taiwan | 2018 | 5D | 49 | Neutral | Male in symptomatic secondary hyperparathyroidism compared with in control patients under hemodialysis:  34.7% vs. 38.5%, p = 1.0 | SSHT | (21) |
| Chue *et al.* | 22723973 | United Kingdom | 2012 | 3 | 120 | Male common | Male vs. Female, 67% vs. 43%, *p* = 0.01 | Lumbar spine lateral radiography | (22) |
| Claes KJ | 22143191 | Belgium | 2013 | 5T | 115 | Neutral | Male gender percentage in patients with below median vs. above median calcification: 59% vs. 62%, p = 0.5366 | AC assessed with lumbar X-ray | (23) |
| Claes KJ | 22143191 |  |  |  |  |  | With vs. without, male 72% vs. 55.4%, *p* = 0.16 | Lumbar spine lateral radiography |  |
| Coen *et al.* | 16557100 | Italy | 2006 | 5D (HD) | 132 | Male more prevalent | Log transform of cardiac score (score log) was correlated to age (p < 0.0001), serum calcium (p < 0.005), sex (p < 0.05), with prevalence of male sex, and inversely to serum cholesterol (p < 0.05) and HDL cholesterol (p < 0.01). | Cardiac calcification assessed with multislice CT (Agatston score) | (24) |
| Coll *et al.* | 20930091 | Spain | 2010 | 5D | 232 | Male more prevalent with calcification | With vs. without linear calcification: 65% vs 41% | Linear calcification assessed with carotid, femoral, or brachial ultrasound | (25) |
| Craver *et al* | 24119158 | Spain | 2013 | 3-4 | 178 | Male more severe | Lumbar Kauppila score >5 vs. 1-5 vs. 0, male 83% vs. 80% vs. 70%, *p* = 0.017 | Lumbar spine lateral radiography | (26) |
| Davis *et al.* | 26797375 | US | 2016 | 5T | 131 | Neutral | Regression coefficient estimate of Length score of three readers: 0.051, p = 0.81; -0.070, p = 0.74; -0.16, p = 0.44  Circumference score in three readers: 0.060, p = 0.78; 0.012, p = 0.96; -0.089, p = 0.66  Morphology score in three readers: 0.12, p = 0.46; 0.029, p = 0.86; 0.047, p = 0.71 | Semiquantitative calcification scoring assessed with CT of bilateral common and external iliac arteries | (27) |
| DeLoach *et al.* | 19164320 | US | 2009 | 5T | 112 | Neutral | Calcification vs. no calcification: 68.4% vs. 58.1%, p = 0.29 | Aortic calcification measured with electron beam computed tomography (Agatston score) | (28) |
| Di Iorio *et al.* | 16940716 | Italy | 2006 | 4-5, 5D | 44 | Male more severe | Male in patients with TC score <400 vs. > 400: 42% vs. 75%, p = 0.05 | Calcification if if an area  > 1 mm2 displayed a density > 400 Hounsfield units (HU) on MSCT | (29) |
| Disthabanchong *et al.* | 29236239 | Thailand | 2018 | 2-5D, 5T | 419 | Female more severe (subgroup) | AAC score > 6 vs. ≤ 6 in CKD stage 2 -5, male 44.4% vs. 62.6, p < 0.05  In male with stage 5D, 50% vs. 50.5% (P > 0.05)  In male with stage 5T, 67.9% vs. 58.5% (p > 0.05) | Lumbar spine lateral radiography | (30) |
| El Amrani *et al.* | 25702239 | Morocco | 2015 | 5D (HD) | 49 | More male with CAC | Male in group with vs. without CAC: 64.7% vs. 26,6 %, p = 0.014 | CACS assessed with CT (Agatston score) | (31) |
| El Amrani *et al.* | 25702239 |  |  |  |  | Neutral | Male in group with vs. without valvular calcification: 45.8% vs. 60%, p = 0.321 | Valvular calcification assessed with echocardiography with hyperechoic lesion >1 mm thick was detected on the mitral or aortic valves |  |
| 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 | (32) |
| Etta *et al.* | 28748891 |  |  |  |  |  | Male in absent vs. present of calcification: 71.8% vs. 70.0%, p = 0.58 | Abdominal aorta calcification assessed with lateral abdominal radiograph |  |
| Fabbian *et al.* | 16013017 | Italy | 2005 | 5D (HD) | 132 | Neutral | On the contrary, sex, diabetes frequency, smoking habit, history of hypertension and hyperphosphatemia, cerebrovascular and ischemic heart disease (IHD), blood pressure (BP) and antihypertensive therapy, lipids, albumin, degree of anemia, calcium, phosphate and their product were no different between the two groups. | AoAC assessed with standard PA chest radiographs | (33) |
| Fayed *et al.* | 31170717 | Egypt | 2019 | 5 | 172 | Neutral | Male/Female in patients with intima vs. media vs. no calcification: 11/18 vs. 37/20 vs. 50/36, ANOVA was not performed | Arterial wall calcification through intraoperative arterial biopsy obtained during creation of arteriovenous vascular access for hemodialysis. | (34) |
| Fusaro *et al.* | 23927679 | Italy | 2013 | 5D (HD) | 387 | Warfarin-treated male | 77.8 vs. 57.7%, p<0.04 compared to control male | Vertebral fractures | (35) |
| Gunen Yilmaz *et al.* | 31464230 | Turkey | 2019 | 5D (HD) | 60 | Neutral | Female in patients with positive vs. negative CAC: 54.7% vs. 58.4%, p = 0.22 | CAC defined in panoramic radiography as heterogeneous nodular opacities in the soft tissue in the C3–C4 intervertebral area | (36) |
| Harada *et al* |  | Brazil | 2014 | 2-5 | 117 | Male more severe | Score >0 vs. score =0, male 78.7% vs. 42.9%, *p* < 0.001 | Coronary artery calcification (Agatston score) | (37) |
| He *et al.* | 22980963 | United States | 2012 | 2-4 | 2018 | Male more severe | Score >100 vs. 0-100 vs. 0, male 63.6% vs. 53.3% vs. 41.9%, *p* < 0.0001 | Coronary artery calcification (Agatston score) | (38) |
| He *et al.* | 29490308 | China | 2018 | 5D (HD) | 150 | Neutral | Male percentage in patients with vascular calcification vs. no calcification: 61.1% vs. 76.2%, p = 0.099 | AAC assessed with lateral lumbar radiography (Kauppila score) | (39) |
| Hou *et al* |  | Taiwan | 2019 | 5D (HD) | 120 | Neutral | High vs. low, male 52.8% vs. 47.8%, *p* = 0.851 | Pulse wave velocity | (40) |
| Humoud *et al.* | 16387073 | Kuwait | 2005 | 5D | 129 | Neutral | Male percentage in patients with vascular calcification vs. no calcification: 58.8% vs. 45.3%, p = 0.175 | Plain x-ray of the hands, including radial, palmar arterial arch, or palmar digital arteries | (41) |
| Jankovic *et al* |  | Serbia | 2017 | 5D (HD) | 90 | Male common | With vs. without calcification, male 66.1% vs. 35.3%, *p* = 0.008 | Forearm AVF plain radiography | (42) |
| Jansson *et al* |  | Sweden | 2019 | 3-4 | 84 | Neutral | With vs. without AAC, male 79% vs. 67%, *p* = 0.351 | Abdominal aortic calcification on computed tomography | (43) |
| Jean *et al* |  | France | 2016 | 5D (HD) | 227 | Neutral | Group 3 (severe) vs. 2 vs. 1, male 59.7% vs. 55.6% vs. 59.2%, *p* > 0.05 | Lumbar spine lateral radiography | (44) |
| Jean *et al* | 18852190 | France | 2009 | 5D (HD) | 161 | Male more severe | High VC score (3) vs. no VC (score 0), male 77% vs. 45%, *p* < 0.05 | Multi-site plain radiography involving pelvis, lumbar, knee, right hand, right arm, chest, skull, and orthopantomogram | (45) |
| Jiménez Villodres *et al.* | 30429202 | Spain | 2018 | 3 | 139 | Male more severe (AACS) | Pathological vs. normal AACS, male 80% vs. 63%, p < 0.05  Abnormal vs. normal KI, male 69% vs. 72%, p > 0.05 | AACS on lateral abdominal X-ray (Agatston score) and KI a low-grade CT of the abdomen | (46) |
| Kahn *et al* | 27988970 | Austria | 2017 | 5T | 205 | Male more severe, segment-specific | Aorta: male vs. female, 2.0 vs. 1.5, *p* = 0.511  Right common iliac artery: male vs. female, 1.0 vs. 1.0, *p* = 0.139  Total iliac artery: male vs. female, 1.00 vs. 0.50, *p* = 0.003  External iliac artery: male vs. female, 1.0 vs. 0.0, *p* <0.001 | Pelvic computed tomography | (47) |
| 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 | (48) |
| Kim *et al.* | 22111814 | Korea | 2011 | 5D | 184 | Neutral | AoACS progression (+) vs. (-): 47.8% vs. 44.5%, p = 0.657 | AoAC on chest radiography | (49) |
| Kim *et al.* | 30769062 | Korea | 2019 | 5D | 47 | Neutral | Calcification vs. noncalcification, female 16.7% vs. 31.0%, p = 0.324 | Calcification in the  arterial media within 5 cm of the planned anastomosis area in preoperative duplex ultrasound | (50) |
| Kimura *et al.* | 10412787 | Japan | 1999 | 5D (HD) | 137 | Male more severe | A comparison of the ACAI of men in their 40s (17.7 ± 10.3%, N = 8) was significantly higher than that of women in the same age group (4.0 ± 3.7%, N = 10, P < 0.01), indicating that abdominal aortic calcification develops earlier in men than women. | ACAI (aortic calcification area index) assessed with CT over the area above the bifurcation of the common iliac artery | (51) |
| Komatsu *et al* |  | Japan | 2014 | 5D (HD) | 301 | Female common | Grade 2+3 vs. 1 vs. no calcification, male 58.7% vs. 56.3% vs. 77.8%, *p* = 0.0009 | Aortic arch calcification on chest radiography | (52) |
| Lee e*t al* |  | Taiwan | 2014 | 5D (HD) | 712 | Neutral | Group 3 (severe) vs. 2 vs. 1 vs. none, male 38.1% vs. 42.2% vs. 45.7% vs. 43.8%, *p* = 0.606 | Aortic arch calcification on chest radiography | (53) |
| Lee *et al.* | 27884313 | Korea | 2006 | 2-5 | 1078 | Male more prevalent | Male in patients with CAC vs. without CAC: 73.7% vs. 54.4%, p < 0.001 | CACS determined by MSCT (Agatston score) | (54) |
| Lee *et al.* | 31144545 | Taiwan | 2019 | 5D (HD) | 61 | Male more severe | No vs. Severe vascular calcification, male 37% vs. 52%, p = 0.240 | AAC | (55) |
| Lioufas *et al.* | 32023606 | Multicenter (IMPROVE-CKD) | 2020 | 3b-4 | 278 | Male gender | 73% vs. 55% compared with no AAC | AAC (Agatston) | (56) |
| Liu *et al.* | 27156072 | China | 2016 | 5D | 41 | Neutral | Male vs. female in non-VC: 59.38% vs. 40.63%  Male vs. female in VC: 66.67% vs. 33.33%  P = 0.993 | VC, the degree of calcium salt deposition assessed with immunohistochemical analysis of radial arteries | (57) |
| Lockhart *et al.* | 15280525 | US | 2004 | 5D (HD) | 32 | Neutral | Male in patients with high vs. low calcification score: 67% vs. 42%, p = 0.28 | Vascular calcifications on CT of the distal aorta, common iliac, external iliac and common  femoral arteries on a semi-quantitative 5-point scale. | (58) |
| London *et al.* | 23343541 | France | 2013 | 5D (HD) | 155 | Neutral | Gender ratio in CCA calcified vs. CCA non-calcified: 1.38±0.48 vs. 1.44±0.49, p > 0.05 | Common carotid artery (CCA) calcification assessed with ultrasonography | (59) |
| Maharem *et al* |  | Egypt | 2013 | 5, 5D, 5T | 73 | Neutral | VC presence vs. absence, male 57.9% vs. 31.6%, *p* = 0.056 | Pelvic and hand plain radiography | (60) |
| Mazzaferro *et al.* | 17259697 | Italy | 2007 | 5D, 5T | 100 | Male more severe | Male dialysis vs. male transplant (Tx) vs. female dialysis vs. female transplant, 1944 vs. 945 vs. 157 vs. 35, *p* < 0.02 | Coronary artery calcification (Agatston score) | (61) |
| Merjanian *et al.* | 12787418 | US | 2003 | Nondialyzed DAD | 32 | Loss of CAC prevalence in male DKD vs. control | Male 92% vs. 67%, p > 0.05  Female 95% vs. 54%, p < 0.05 | CAC measured with electron beam CT (Agatston and volumetric method) | (62) |
| Merjanian *et al.* | 12787418 |  |  |  |  | Male prone to increased severity of CAC | Male 619 vs. 18, p < 0.05  Female 232 vs. 6, p < 0.001 | CAC measured with electron beam CT (Agatston and volumetric method) |  |
| Miyatake *et al.* | 31945100 | Japan | 2020 | 5T | 50 | Neutral | Male vs. female 1.72 (0.00–1.55) vs. 0.00 (0.00–1.26) | Aortic calcification area index | (63) |
| Mizuiri *et al.* | 28703899 | Japan | 2018 | 2-5 | 145 | Neutral | CACS quartile 1 vs. 2 vs. 3 vs. 4, male 63.9% vs. 54.1% vs. 64.9% vs. 62.9%, p > 0.05  IACS quartile 1 vs. 2 vs. 3 vs. 4, male 52.8% vs. 68.6% vs. 65.8% vs. 58.3% | CACS (Agatston score) and IACS using thoracicoabdominal multi-detector computed tomography. | (64) |
| Moorehead *et al.* | 4434140 | UK | 1974 | 5D (HD) | 150 | Male at risk | Female sex may possibly confer some advantage with respect to erosions in the age range 20-59 years (women v. men: 2-2 % v. 12-2 %; P < 0-04). | Erosions | (65) |
| Morena *et al* |  | France | 2009 | 1-5 | 133 | Male common | Severe vs. minor, 73.6% vs. 36.1%, *p* < 0.0001 | Coronary artery calcification (Agatston score) | (66) |
| Munguia *et al.* | 26518929 | Spain | 2015 | 5T | 119 | Neutral | Without VC vs. with VC: 62.3% vs. 70%, p = 0.384 | AAC assessed with lateral lumbar radiography of L4-S1 (KauppiIa index) | (67) |
| Nigwekar *et al.* | 27080977 | USA | 2016 | 5D (HD) | 3090 | Female gender | Central CUA vs. peripheral CUA: 73% vs. 61% | Calcific Uremic Arteriolopathy (CUA) | (68) |
| Nitta *et al* |  | Japan | 2018 | 5D (HD) | 216 | Female more severe | Group 3 (severe) vs. 2 vs. no calcification, female 47.5% vs. 40.9% vs. 23.1%, *p* < 0.0001 | Aortic arch calcification on chest radiography | (69) |
| Niu *et al.* | 31339604 | China | 2019 | 5D | 56 | Neutral | Male in patients with progression score <100 vs. 100–500 vs. > 500: 59.3% vs. 73.7% vs. 70.7%, p = 0.572 | CAC measured with MSCT (Agatston score) | (70) |
| Niu *et al.* | 31791277 | China | 2019 | 5D (PD) | 150 | Neutral | Male in patients with presence vs. absence of AAC: 51.65% vs. 49.15%, p = 0.765 | AAC assessed with lateral abdominal plain film, frontal pelvic radiograph and both hands radiograph over the abdominal aorta, iliac artery, femoral artery, radial artery,  and finger arteries | (71) |
| Oh *et al.* | 12093777 | Germany | 2002 | 5 | 39 | Female more prevalent in childhood-onset CRF aged 19-39 | Compared with healthy control subjects, median calcium scores exceeded the age-specific 95th normal percentiles on average 10-fold in male and 17-fold in female patients (Figures 2 and 3). | Coronary artery calcification burden was assessed by CT scan with ECG gating (Agatston score) | (72) |
| Oh *et al.* | 16224161 | Korea | 2005 | 5D (PD) | 50 | Neutral | Male in patients with vs. without calcified plaques: 64.3% vs. 83.3%, p > 0.05 | Calcified plaques measured with B-mode ultrasound observations of plaques | (73) |
| Okamoto *et al* |  | Japan | 2018 | 5D (HD) | 184 | Male more likely to worsen | Annual progression rapid vs. slow, male 53% vs. 27%, *p* = 0.008 | Abdominal aorta calcification on computed tomography | (74) |
| Ossareh *et al.* | 33277456 | Iran | 2020 | 5D (HD) | 143 | Male gender | 0.76 vs. 0.69, P < .05 | Common carotid intima media thickness (ccIMT) | (75) |
| Petrovic *et al.* | 32872092 | Serbia | 2020 | 5D (HD) | 80 | Neutral | Male in patients with PWV ≤ 8.8 m/s vs. > 8.8 m/s: 14% vs. 20%, p = 0.119 | PWV | (76) |
| Qureshi *et al* |  | Sweden | 2015 | 5T | 89 | Male more severe | Moderate-severe vs. non-minimal, male 76% vs. 54%, *p* = 0.04 | Biopsy-verified calcification in epigastric arteries | (77) |
| Raggi *et al.* | 21700824 | US | 2011 | 5D (HD) | 144 | Neutral | Female gender in patients with 1 vs. 2 vs. 3 calcified valves: 54.1 vs. 55.3 vs. 38.9, p = 0.19 | Valvular calcification assessed with electron-beam CT | (78) |
| Renaud *et al.* | 3340252 | France | 1988 | 5D (HD) | 24 | Male increase more rapid | Correlation coefficient for male vs. annual calcification increase = 1.97, *p* < 0.01 | Lumbosacral radiography for linear calcifications involving the abdominal aorta, iliac and femoral arteries | (79) |
| Ribeiro *et al.* | 9719161 | Portugal | 1998 | 5D (HD) | 92 | Neutral | 58.5% vs. 56.7%, p > 0.05 | Mitral valve calcification determined in B-mode echocardiograph | (80) |
| Ribeiro *et al.* | 9719161 |  |  |  |  |  | 62.5% vs. 52.3%, p > 0.05 | Aortic valve calcification determined in B-mode echocardiograph |  |
| Roca-Tey *et al.* | 19554054 | Spain | 2009 | 5D (HD) | 45 | Neutral | Male in patients with vs. without AVF calcification: 81.5% vs. 55.6%, p = 0.09 | Radial or brachial AVF calcification on spiral CT | (81) |
| Schlieper *et al* |  | Serbia | 2008 | 5D (HD) | 212 | Male common | With vs. without, male 78% vs. 47%, *p* < 0.0001 | Vascular access calcification on plain radiography | (82) |
| Shu *et al* |  | Taiwan | 2012 | 5T | 99 | Male more severe | Group 5 (severe) vs. 4 vs. 3 vs. 2 vs. 1, male 66.7% vs. 53.3% vs. 63.6% vs. 65.0 vs. 29.3%, *p* = 0.027 | Coronary artery calcification (Agatston score) | (83) |
| Sigrist *et al.* | 17928470 | United Kingdom | 2006 | 4-5D | 134 | Male common | Calcification tertiles 3rd vs. 2nd vs. 1st, male 81% vs. 71% vs. 46%, *p* < 0.001 | Superficial femoral artery in computed tomography | (84) |
| 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. | (85) |
| Strózecki *et al.* | 16350826 | Poland | 2005 | 5D (HD) | 65 | Neutral | 48.5% vs. 43.7%, p > 0.05 | Echocardiographic  criteria of dense echoes in mitral vascular calcification  (MVC) or aortal vascular calcification (AVC) valve  leaflets or annulus. | (86) |
| Tangvoraphonkchai *et al.* | 31291619 | USA | 2019 | 5D (PD) | 24 | Male gender (%) | Stable PWV vs. increased PWV, male 33% vs. 75% | Pulse wave velocity as surrogate | (87) |
| Tomiyama *et al.* | 19594321 | Brazil | 2010 | 2-4 | 50 | Male more prevalent | Male in patients without vs. with calcification: 47% vs. 79%, p = 0.02 | CACS using MSCT (Agatston score) | (88) |
| Turan *et al* |  | Turkey | 2016 | 5D (HD) | 224 | Male more severe | Group 4 (severe) vs. 3. vs. 2 vs. no calcification, male 56% vs. 59% vs. 38% vs. 41%, *p* = 0.003 | Coronary artery calcification (Agatston score) | (89) |
| Wang *et al.* | 12506148 | Hong Kong | 2003 | 5D (PD) | 192 | Neutral | Male in patients with vs. without valvular calcification: 50.0% vs. 51.5%, p = 0.842 | Valvular calcification on ultrasound of the aortic valve or mitral valve or mitral annulus | (90) |
| 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 | (91) |
| Wu *et al.* | 27497908 | Taiwan | 2017 | 5D (PD) | 190 | Neutral | Grade 0 vs. 1 vs. 2 vs. 3: 43.8% vs. 40.4% vs. 58.3% vs. 37.0%, p = 0.293 | AoAC detected with chest X-ray | (92) |
| Yoshikawa *et al.* | 23504408 | Japan | 2013 | 5D (HD) | 134 | Male at risk | β = -0.20, p = 0.008 | Abdominal aortic calcium volume score (AACVS) | (93) |
| Zhou *et al.* | 30309449 | Sweden | 2018 | 1-5 | 151 | More male had AAC | Male vs. female: 76% vs. 69% | AAC evaluated with lateral lumbar X-ray (Kauppila score) | (94) |
| Zhou *et al.* | 30309449 |  |  |  |  |  | More men (76%) had AAC than women (69%). 沒有p-value |  |  |
| Jean *et al.* | 22584463 | France | 2012 | 5D (HD) | 85 | Neutral | Progressors vs. non-progressors, female 44% vs. 52% | VC measured with semiquantitative score on plain radiological films (front pelvis, profile lumbar and knee, right hand and arm, chest, skull, and orthopantomogram) | (95) |

Table 2. Causes of vascular calcification

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Author | PMID | Country | Time | CKD stages | sample | Findings | Data | Calcification | Ref |
| Abd Alamir *et al.* | 26188533 | US | 2015 | 2-3 | 2070 | Neutral | OR 1.21 (0.94–1.56) | Mitral annular calcification (MAC) assessed with coronary calcium scanning (Agatston score) | (96) |
| Adragao *et al.* | 15034154 | Portugal | 2004 | 5D (HD) | 123 | Male gender at risk | Vascular calcification score ≥ 3: OR 7.47 (2.9–19.1) | Simple vascular calcification score based on plain  radiographic films of pelvis and hands (Adragao) | (97) |
| Adragao *et al.* | 15034154 |  |  |  |  |  | Iliac score > 0: OR 3.5 (1.5–8.3) |  |  |
| Baralić *et al.* | 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) | (98) |
| Baralić *et al.* | 30867641 |  |  |  |  |  | B = -47.88, 95% CI = -95.3– -0.464, β = -0.296 | Relative wall thickness (RWT) |  |
| Bellasi *et al* |  | United States | 2008 | 5D | 142 | Male more severe (subgroup) | For coronary artery, male β = 735.82, p = 0.0366  For thoracic aorta, gender *p* > 0.05 | Coronary artery calcification (Agatston score) and thoracic aorta calcification | (100) |
| Blacher *et al.* | 9555858 | France | 1998 | 5D (HD) | 74 | Male at risk (male = 1, female = 2) | β = -0.25, p = 0.0074 | LV mass calculated according to the Penn convention | (101) |
| Block et al. | 9531176 | USA | 1998 | 5D (HD) | 6407 | Male gender | OR 0.774, p = 0.0001 | Serum phosphorus > 6.5 mg/dL | (102) |
| Block et al. | 9531176 |  |  |  |  |  | Female -> higher serum phosphorus |  |  |
| Budoff *et al.* | 21783289 | US (CRIC) | 2011 | 2-3A | 1908 | Male at risk | Women as independent variable for overall CAC: OR 0.43 (0.35-0.53) | CAC detected using CT (Agatston score) | (103) |
| Budoff *et al.* | 21783289 |  |  |  |  |  | Women as independent variable for CAC in patients without CVD: 0.36 (0.28-0.45) |  |  |
| Budoff *et al.* | 21783289 |  |  |  |  |  | Women as independent variable for CAC in patients with CVD: 0.67 (0.45-1.00) |  |  |
| 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 | (104) |
| Chae *et al.* | 30595681 | Korea | 2018 | 1-5 | 1832 | Female milder | Female in quartile 1 vs. 2 vs. 3 vs. 4: 44.3% vs. 41.3% vs. 37.0% vs. 38.1%, p = 0.101, p for trend = 0.025 | Brachial ankle PWV (baPWV) | (106) |
| Chae *et al.* | 30595681 |  |  |  |  |  | P = 0.101但是p for trend = 0.025 |  |  |
| Chang et al. | 22169112 | Republic of Korea | 2012 | 5D (HD) | 289 | Female gender | OR 3.892 (1.678–9.025) | Vitamin D (25D) deficiency | (13) |
| Chen *et al.* | 23419133 | Taiwan | 2013 | 5D (HD) | 238 | Male gender | HR 0.92 (0.8–0.98) | Fetuin-A | (107) |
| Chen *et al.* | 23419133 |  |  |  |  | Female gender | HR 0.87 (0.74–0.92) |  |  |
| Chen *et al.* | 28036114 | Sweden | 2017 | 5D, 5T | 240 | Male at risk | β = 0.35, *p* = 0.008 | Coronary artery calcification (Agatston score) | (17) |
| Chiu *et al.* | 20237457 | United States | 2010 | Proteinuric (1-5) | 225 | Male at risk | Male with significantly higher probability of more severe VC (*p* = 0.01) | Coronary artery calcification (Agatston score) | (19) |
| Chue *et al* |  | United Kingdom | 2012 | 3 | 120 | Male at risk | Female β = -0.34 (-13.45– -4.48) | Lumbar spine lateral radiography | (22) |
| Claes *et al.* | 22143191 | Belgium | 2013 | 5T | 115 | Male gender (%) | PWV ≤ 7.35 m/s vs. > 7.35 m/s: 74 vs. 56, p = 0.05 | PWV | (23) |
| Claes et al. | 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 | (108) |
| Coll *et al.* | 20930091 | Spain | 2010 | 5D | 232 | Neutral | OR 1.57 (0.69–3.55), p = 0.27 | Linear calcification assessed with carotid, femoral, or brachial ultrasound | (25) |
| Craver *et al.* | 24119158 | Spain | 2013 | 3-4 | 178 | Male sex | For AAC severity, male β = 1.237 (0.058-2.417), *p* = 0.04  For severe AAC, in all patients, male OR 4.218 (1.403-14.207), p = 0.014  For severe AAC, in eGFR < 30: OR 4.167 (1.050-20.178) | Abdominal aortic calcification (AAC) (Kauppila Index) | (26) |
| 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) | (109) |
| Evenpoel *et al.* | 26505822 | Belgium | 2015 | 5T | 268 | Male gender (F 1) | For coronary calcification, female β = -0.64, *p* < 0.0001  For thoracic aortic calcification, female β = -0.32, *p* = 0.008 | Coronary artery calcification (Agatston score) and thoracic aortic calcification | (110) |
| Evenpoel *et al.* | 26505822 | Belgium | 2015 | 5T | 268 | Male gender | β = -0.45, t = 4.01, p = 0.0001 | Annualized CACS change | (110) |
| Fain et al. | 29635270 | USA | 2018 | 5D (HD) | 37 | Male gender | Β ± SE = 2.23 ± 0.78, R2 = 0.090 | Carotid-femoral PWV | (111) |
| Fain et al. | 29635270 |  |  |  |  |  | B ± SE = 4.16 ± 1.65, R2 = 0.121 | brachial artery flow-mediated dilation (FMD) |  |
| Fayed *et al.* | 31464238 | Egypt | 2019 | 5D (HD) | 81 | Neutral | β = 0.022, p = 0.695 | AAC measured with spiral CT of the last 10 cuts of the abdominal aorta before its division into the two common iliac arteries | (112) |
| Filgueira *et al.* | 21617086 | Brazil | 2011 | 2-4 | 72 | Neutral | Female as a factor: Coefficient = 0.149, SEM = 0.663, p = 0.82 | CACS (Agatston score) measured with computed tomography | (113) |
| Flávia Letícia et al. | 25465028 | Brazil | 2014 | 5D (HD) | 91 | Gender (M/F) | Low vs High sclerostin: 24/22 vs. 31/14, p = 0.103 | Sclerostin | (114) |
| Floege *et al.* | 20110249 | Multicenter | 2010 | 5D (HD) | 360 | Male gender | Parameter estimate = 0.42599, SE = 0.42599, p = 0.0011 | CAC | (115) |
| Floege *et al.* | 20110249 |  |  |  |  |  | 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. |  |  |
| Fusaro *et al.* | 24897402 | Italy | 2014 | 5D (HD) | 387 | Male gender | OR 1.86 (CI 1.20–2.91) | Spine deformity index (SDI) > 1 | (116) |
| Fusaro *et al.* | 26493621 | Italy | 2015 | 5D (HD) | 314 | Neutral | OR 1.52 (0.87–2.66), p = 0.1 | Vascular calcification assessed with radiograph of the thoracic and lumbar  regions of the spinal column in the latero-lateral view according to Witteman et al (117). | (118) |
| Gelev *et al.* | 19259046 | Macedonia | 2008 | 5D (HD) | 150 | Male common | VC prevalence: male vs. female, 87.9% vs. 61.0%, *p* < 0.03  Intimal VC prevalence: male vs. female, 53.8% vs. 32.2%, *p* < 0.02  Medial VC prevalence: male vs. female, 34.1% vs. 28.8%, *p* > 0.05 | Pelvic antero-posterior radiography | (119) |
| Gelev *et al.* | 19259046 |  |  |  |  |  | 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). |  |  |
| Gelev *et al.* | 19259046 |  |  |  |  |  | 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]. |  |  |
| Golembiewska *et al.* | 32033584 | Sweden | 2020 | 5, 5D | 149 | Male at risk | Male OR 4.4 (1.6–11.1), *p* = 0.003 | Inferior epigastric artery histopathology calcification grading | (120) |
| Golembiewska *et al.* | 32033584 |  |  |  |  |  | Male -x-> copeptin: β = −0.08 (0.31) |  |  |
| González-Parra E *et al.* | 26298279 | Spain | 2015 | 1-5? | 704 | Male gender | r = −0.084, 95% CI -0.155– -0.012, p = 0.0215 | Parathormone levels | (121) |
| González-Parra E *et al.* | 26298279 |  |  | 不確定是不是CKD cohort |  |  | r = −0.191, 95% CI -0.301– -0.080, p = 0.0007 | FGF-23 |  |
| Gross *et al.* | 17699396 | German | 2006 | 3-5, 5D | 23 | Neutral | Media thickness β = 0.068, 95% CI 0.009 to 0.071, p = 0.666  Intima thickness β = 0.041, 95% CI 0.303 to 0.233, p = 0.792  Media area β = 0.084, 95% CI 0.609 to 0.346, p = 0.581  Intima area β = 0.1, 95% CI 0.609 to 0.346, p = 0.524  Plaque area β = 0.075, 95% CI 0.216 to 0.37, p = 0.598  Lumen area β = 0.035, 95% CI 1.437 to 1.827, p = 0.811  Lumen area/lumen + intima β = 0.055, 95% CI 0.077 to 0.111, p = 0.715  CRP intima β = 0.019, 95% CI 0.299 to 0.265, p = 0.904  CRP media β = 0.127, 95% CI 0.275 to 0.108, p = 0.385  PTX3 intima β = 0.417, 95% CI 0.441 to -0.085, p = 0.005  PTX3 media β = 0.0, 95% CI 0.175 to 0.175, p = 1  Fetuin A intima β = 0.122, 95% CI 0.691 to 0.291, p = 0.416  Fetuin A media β = 0.171, 95% CI 0.770 to 0.203, p = 0.246  HIF-1 intima β = 0.091, 95% CI 0.411 to 0.218, p = 0.541  HIF-1 media β = 0.035, 95% CI 0.23 to 0.291, p = 0.814  C5b-9 intima β = 0.004, 95% CI 0.605 to 0.622, p = 0.978  C5b-9 media β = 0.09, 95% CI 0.31 to 0.558, p = 0.567  Collagen IV intima β = 0.195, 95% CI 0.36 to 0.081, p = 0.208  Collagen IV media β = 0.044, 95% CI 0.221 to 0.167, p = 0.78  TGF-β intima β = 0.007, 95% CI 0.215 to 0.225, p = 0.963  TGF-β media β = 0.011, 95% CI 0.25 to 0.233, p = 0.943  ET-1 intima β = 0.033, 95% CI 0.254 to 0.204, p = 0.829  ET-1 media β = 0.012, 95% CI 0.265 to 0.286, p = 0.937  vWF intima β = 0.051, 95% CI 0.367 to 0.52, p = 0.729  vWF media β = 0.034, 95% CI 0.492 to 0.392, p = 0.822  eNOS intima β = 0.039, 95% CI 0.136 to 0.104, p = 0.789  eNOS media β = 0.09, 95% CI 0.193 to 0.105, p = 0.556  Glycophorin A intima β = 0.083, 95% CI 1.852 to 1.054, p = 0.582  CD68 intima β = 0.148, 95% CI 0.909 to 2.518, p = 0.349  CD68 media β = 0.046, 95% CI 7.923 to 5.835, p = 0.761  Intima calcium β = 0.033, 95% CI 5.526 to 6.727, p = 0.844  Intima phosphorus β = 0.057, 95% CI 2.774 to 3.918, p = 0.731  Media calcium β = 0.215, 95% CI 9.173 to 1.793, p = 0.181  Media phosphorus β = 0.118, 95% CI 2.185 to 1.046, p = 0.479  CRP in situ hybridization intima β = 0.184, 95% CI 0.246 to 1.049, p = 0.216  CRP in situ hybridization media β = 0.072, 95% CI 0.246 to 1.049, p = 0.630 | Coronary calcification parameters | (122) |
| Gruppen *et al.* | 12631088 | Dutch | 2003 | 5D | 140 | Male gender at risk | β = 0.21, p = 0.009 | LVMI | (123) |
| Gruppen *et al.* | 12631088 |  |  |  |  | Neutral | β = 0.17, p = 0.05 | Aortic valve calcification |  |
| Harada *et al.* | 25479288 | Brazil | 2014 | 2-5 | 117 | Male at risk | Male OR 4.92 (2.07–11.70), *p* < 0.01 | Coronary artery calcification (Agatston score) | (37) |
| Ho et al. | 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) | (124) |
| Hou *et al.* | 31122190 | Taiwan | 2019 | 5D (HD) | 120 | Female gender | OPG tertile 1/2/3: 62.5% / 55.0% / 32.%, p = 0.008\* | OPG | (125) |
| Hou *et al.* | 31122190 |  |  |  |  |  | Bone loss -> OPG -> calcification |  |  |
| Ishimura *et al.* | 12378387 | Japan | 2002 | 5D (HD) | 421 | Male at risk (subgroup) | In diabetics, male OR 3.38 (1.289-8.860), *p* = 0.0019  In non-diabetics, male OR 1.328 (0.252-6.997), *p* = 0.7376 | Digital artery on hand radiography | (126) |
| Ishimura *et al.* | 15490400 | Japan | 2004 | 5D (HD) | 594 | Male at risk | OR 2.339 (1.466–3.732), p = 0.0004 | Aortic calcification | (127) |
| Ishimura *et al.* | 15490400 |  |  |  |  |  | OR 1.857 (1.043–3.306), p = 0.0355 | Hand arteries calcification |  |
| Jankovic *et al.* | 25823466 | Serbia | 2015 | 5D (HD) | 90 | Male gender | β = -0.432, p < 0.001 | overall calcification  score | (128) |
| Jankovic *et al.* | 28124305 | Serbia | 2017 | 5D (HD) | 90 | Male at risk and more severe | For VC risk, female OR 0.134 (0.04–0.45), *p* = 0.001  For VC severity relation, female β = –0.432 (-4.41– -1.86), *p* < 0.001 | Forearm AVF plain radiography | (42) |
| Jansson *et al.* | 31437840 | Sweden | 2019 | 3-4 | 84 | Neutral but  male more severe | Among total cohort, male not associated with AAC  Among those with AAC, male β = 0.413, *p* = 0.03 | Abdominal aortic calcification on computed tomography | (43) |
| Jean *et al* |  | France | 2009 | 5D (HD) | 161 | Neutral | Female OR 0.79 (0.3 – 1.8), *p* = 0.5 | Multi-site plain radiography involving pelvis, lumbar, knee, right hand, right arm, chest, skull, and orthopantomogram | (45) |
| Jean *et al.* | 18721733 | France | 2008 | 5D (HD) | 253 | Female gender | Vitamin D (25D) deficient vs. sufficient: 53% vs. 28%, p < 0.05 | Vitamin D (25D) deficiency | (129) |
| Jean *et al.* | 18721733 |  |  |  |  |  | Vitamin D deficiency was reported to be  associated with cardiovascular calcification, 5 |  |  |
| Jean *et al.* | 26890570 | France | 2016 | 5D (HD) | 227 | Female gender | OR 0.16 (0.075−0.362) | Serum sclerostin level | (44) |
| Jung *et al.* | 16554319 | South Korea | 2006 | 5D (HD) | 40 | Male deteriorate rapidly | For calcification progression at 5-yr, male β = 1.365, *p* = 0.04 | Coronary artery calcification (Agatston score) | (130) |
| Kanbay *et al.* | 20576822 | Turkey | 2010 | 2-3 | 177 | Male gender | R = -0.181, p = 0.016 | Gensini score | (131) |
| Kanbay *et al.* | 20576822 |  |  |  |  |  | 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. |  |  |
| Kanbay *et al.* | 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 | (132) |
| Kestenbaum *et al.* | 19692998 | US (MESA study) | 2009 | 3-5 | 562 | Male gender at risk | IRR 2.27 (1.26–4.09) | CACS measured with electron beam CT or  multidetector row helical CT | (133) |
| Kestenbaum *et al.* | 19692998 |  |  |  |  | Neutral | IRR 1.10 (0.84–1.42), p = 0.50 | Progression of CAC |  |
| Kirkpantur *et al.* | 19681840 | Turkey | 2009 | 5D (HD) | 102 | Neutral | Male HR 0.87 (0.56–0.91, p=0.87) | Coronary artery calcification score (CACS) | (134) |
| Komatsu *et al.* | 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 | (52) |
|  |  |  |  |  |  |  |  |  |  |
| Maharem *et al.* |  | Egypt | 2013 | 5-5T | 73 | Male gender |  | SVCS | (60) |
| Maharem *et al.* |  |  |  |  |  |  | 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). |  |  |
| Maharem *et al.* |  |  |  |  |  |  | P = 0.056 不應該相關，但是內文說相關 |  |  |
| Maia *et al.* | 29880286 | Brazil | 2018 | 5D (HD) | 309 | Female more prevalent | Prevalence ratio 2.004 (1.012 –3.966) | CAC assessed with panoramic radiographs | (136) |
| Manghat *et al.* | 21281749 | UK | 2011 | 1-4 | 145 | Male at risk (subgroup) | General, male β = 0.06, p =0.54  In in CKD stage 4, male β = 0.29, t =2.04, p =0.049 | Arterial Stiffness (SIDVP) | (137) |
| Maréchal *et al.* | 21944666 | Belgium | 2012 | 5T | 197 | Women less at risk | Annualized progression of CACS: regression coefficient = -0.09, SE = 0.04, 95%CI -0.17– -0.01, p = 0.03 | CACS (Agatston score) | (138) |
| Mazzaferro *et al.* | 17259697 | Italy | 2007 | 5D, 5T | 100 | Male at risk | Male OR 10.5 (3.2–34.4), *p* < 0.0001 | Coronary artery calcification (Agatston score) | (61) |
| Miyatake *et al.* | 31945100 | Japan | 2020 | 5T | 50 | Neutral | Female β = -0.051, p = 0.741 | Aortic calcification area index | (63) |
| Moldovan *et al.* | 20862543 | Romania | 2010 | 5D (HD) | 81 | Male gender at risk of progression | OR 7.226 (1.138–45.882) | Vascular calcification on hands and pelvis bone radiographs | (139) |
| Morena *et al.* | 19574342 | France | 2009 | 1-5 | 133 | Male more severe | Male OR 4.95 (2.36–10.37), *p* < 0.0001 | Coronary artery calcification (Agatston score) | (66) |
| Muntner *et al.* | 17050630 | US | 2006 | 5D (HD) | 148 | Neutral | Prevalence rate ratio 1.37 (0.72–2.62) | CACS ≥ 100 assessed with cardiac CT | (140) |
| Nakayama *et al.* | 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) | (141) |
| Nakayama *et al.* | 24379691 |  |  |  |  |  | β = -0.407, t = -2.608, p = 0.017 in model with ΔCa × P |  |  |
| Nemeth *et al.* | 26459001 | Hungary | 2015 | 5T | 993 | Gender | B = −3.968, 95%CI −6.006– −1.930, β = −0.116, p < 0.001 | Pulse pressure | (142) |
| Nishiura *et al.* | 18802328 | Japan | 2009 | 5D (HD) | 99 | Male gender | HR 3.034 (1.028–8.948) | OPG level | (143) |
| Nishizawa *et al.* | 15648030 | Japan | 2004 | 5D (HD) | 332 | Male at risk | Male OR 3.380 (1.289-8.860), *p* = 0.0019 | Digital artery on hand radiography | (144) |
| Nishizawa *et al.* | 25805429 | Japan | 2015 | 5D (HD) | 207 | Neutral | β = -0.095, p = 0.174 | CACS (Agatston score) using multidetector computed tomography | (145) |
| Nitta *et al.* | 30347400 | Japan | 2018 | 5D (HD) | 216 | Female more severe | Female β = 0.221 (0.124–0.319), p <0.0001 | Aortic arch calcification on chest radiography | (69) |
| Nitta *et al.* | 30347400 | Japan | 2018 | 5D (HD) | 389 | Female gender | β = 0.221, 95%CI 0.124–0.319, p < 0.0001 | AoAC | (69) |
| Okamoto *et al.* | 29558928 | Japan | 2018 | 5D (HD) | 184 | Male deteriorate rapidly | OR 3.29 (1.27–8.53), p = 0.014 | Abdominal aortic calcification index | (74) |
| Oprisiu *et al.* | 11774125 | France | 2002 | 5D (HD) | 24 | Male more likely to progress | Male significant correlation with calcification extension | Pelvic and lumbar lateral radiography | (146) |
| Pateinakis *et al.* | 23758931 | Greece | 2013 | 5D (HD) | 81 | Gender | β = -0.163, p = 0.025 | Common carotid intima-media thickness (ccIMT) | (147) |
| Pateinakis *et al.* | 23758931 |  |  |  |  | Neutral | β = −0.128, p = 0.15 | Pulse wave velocity |  |
| Porter *et al.* | 17617653 | UK | 2007 | 3-4 | 112 | Male gender | OR 43.713 (2.92–654.0) | CAC | (148) |
| Qureshi *et al.* | 26331407 | Sweden | 2015 | 5T | 89 | Male at risk of medial VC, not CAC | For epigastric artery, male RR 1.82 (1.03–1.16), *p* = 0.03  For coronary artery, male RR 0.83 (0.38-1.81), *p* = 0.63 | Biopsy-verified calcification in epigastric arteries and coronary artery calcification (Agatston score) | (77) |
| Raggi *et al.* | 11849871 | United States and Europe | 2002 | 5D (HD) | 205 | Male at risk | Female β = -0.587547, p = 0.0167 | Coronary artery calcification | (149) |
| Raggi *et al.* | 11849871 |  |  |  |  | Neutral | Female as independent variable: parameter estimate = -0.044508, p = 0.9036 | Aortic calcification (Agatston score) |  |
| 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) | (150) |
| Schlieper *et al* |  | Serbia | 2008 | 5D (HD) | 212 | Male at risk | Male OR 3.95 (1.89–8.27), *p* = 0.0001 | Vascular access calcification on plain radiography | (82) |
| Schlieper *et al.* |  |  |  |  |  |  |  |  |  |
| Schlieper *et al.* | 18800030 | Serbia | 2008 | 5D (HD) | 212 | Male gender | OR 5.08 (2.18–11.86) | Vascular access calcification | (82) |
| Schlieper *et al.* | 19468238 | Serbia | 2009 | 5D (HD) | 194 | Male at risk | For composite score, male OR 2.32 (1.19–4.52), *p* = 0.014  For Adragao score, male OR 2.75 (1.41–5.38), *p* = 0.003 | Pelvic, hand, arm plain radiography and echocardiography | (152) |
| Scialla *et al.* | 21940840 | USA | 2011 | 1-5 | 351 | Female gender | Female -> Osteoprotegerin: 10.2% (0.2%– 21.3%) | OPG (percentage difference) | (153) |
| Sharma *et al.* | 16647710 | UK | 2007 | 5 (for renal transplant evaluation) | 140 | Neutral | OR 0.45 (0.16–0.81), p = 0.53 | MAC assessed with echocardiography | (154) |
| Shu *et al.* | 22483469 | Taiwan | 2012 | 5T | 99 | Male more severe | Female β = -1.61, p = 0.0021 | Coronary artery calcification (Agatston score) | (83) |
| Sigrist *et al* |  | United Kingdom | 2007 | 4-5D | 134 | Male deteriorate rapidly | For calcification progression at 2-yr, male OR 8.82 (1.82 to 42.65), *p* = 0.007 | Superficial femoral artery calcification on computed tomography | (84) |
| Sigrist et al. | 16263735 | United Kingdom | 2006 | 4-5D | 134 | Male at risk | Female β = -2.108, *p* < 0.001 | Superficial femoral artery in computed tomography | (155) |
| 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 | (156) |
| Stavroulopoulos *et al.* | 21224493 | UK | 2011 | 3-4 | 112 | Male at risk | OR 27.808 (1.625–475.97) | CAC on multi-slice CT scanning of the thorax measured with Agatston / Janowitz scoring system | (157) |
| Stavroulopoulos *et al.* | 21224493 |  |  |  |  | Neutral in CKD patients with diabetes | within the diabetes group females progressed the same as males, 9/18 females (50% of females with diabetes and CKD), the same proportion as male with diabetes (Figure 3b). This was in sharp contrast to the group without diabetes, where 11/12 of the progressors were men compared to only one female progressor |  |  |
| Sumida *et al.* |  | Japan | 2010 | 5D | 135 | Neutral | Gender not associated with calcification | Carotid artery calcification on computed tomography | (158) |
| Sumida *et al.* | 20420796 | Japan | 2010 |  |  | Male gender | Male gender was identified as an independent determinant for CAP. | Coronary artery plaque (CAP) | (158) |
| Tamei *et al.* | 21139318 | Japan | 2011 | 5D (HD) | 127 | Male deteriorate rapidly | For calcification progression at 5-yr, male β = 0.969, *p* = 0.0192 | Aortic arch calcification on chest radiography | (159) |
| Tanaka *et al.* | 20851632 | Japan | 2012 | 1-4 | 1198 | Neutral | OR 0.91, p = 0.72 | Carotid calcified plaque | (160) |
| Turan *et al.* | 23159099 | Turkey | 2013 | 5D (HD) | 191 | Male gender at risk | RR 2.79 (1.30–5.98) | CAC score assessed with calcification score measured with computed tomography of the left main, the left anterior descending, the left circumflex and the right coronary artery | (161) |
| Turan *et al.* | 26865177 | Turkey | 2016 | 5D (HD) | 224 | Male more severe | RR 4.14 (2.01–8.51), *p* < 0.001 | Coronary artery calcification (Agatston score) | (89) |
| Vipattawat *et al.* | 24447254 | Thailand | 2014 | 5, 5D,5T | 261 | Neutral | Among 5T patients, OR 2.49 (0.87–7.14), *p* = 0.09  Among 5 and 5D patients, OR 2.02 (0.71-5.78), *p* = 0.19 | Pelvic and lumbar spine lateral radiography  (Total vascular calcification score) | (162) |
| 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 | (163) |
| Wang *et al.* | 24747427 | China | 2014 | 5D (HD) | 77 | Male at risk | female gender OR = 0.20 (0.07–0.55) | CACS using 256-detector-row Brilliance iCT scanner of the of the left main, left anterior descending, left  circumflex, and right coronary arteries | (164) |
| Yamada *et al.* | 18760286 | Japan | 2008 | 5D (HD) | 49 | Male at risk | Female β = -0.178, p = 0.0345 | Vascular  calcification of the hand arteries distal to the wrist joints | (165) |
| Zhang et al. | 31079116 | China | 2019 | 5D (HD) | 105 | Male gender (male = 1, female = 2) | Correlation coefficient = -0.211, p = 0.03 | Interventricular septal thickness (IVST) | (166) |
| Zhang et al. | 31079116 |  |  |  |  |  | Lower A-Klotho -> higher IVST; Female thinner IVST |  |  |
| Zou *et al.* | 27400310 | China | 2016 | 1-5 (pre-dialysis) | 296 | Male at risk | β = 9.21, SE = 3.61, p = 0.01 | LVMI (g/m2) | (167) |
| Zou *et al.* | 27400310 |  |  | Supplemental table看不到 |  |  |  |  |  |
| Zou *et al.* | 32216514 | China | 2020 | 5D | 165 | Male at risk (subgroup) | Among PD patients, male β = 0.259 (0.052–0.416), p = 0.012 | Serum sclerostin | (168) |
| Cai *et al.* | 26159932 | China | 2015 | 5D (HD) | 129 | Neutral | Abdominal aorta severe calcification, male OR 0.549 (0.113–2.661), p = 0.456 | AAC assessed with lateral plain radiograph | (169) |
| Jean *et al.* | 22584463 | France | 2012 | 5D (HD) | 85 | Neutral | Progressors, female OR 0.51 (0.185–1.426), p = 0.2 | VC measured with semiquantitative score on plain radiological films (front pelvis, profile lumbar and knee, right hand and arm, chest, skull, and orthopantomogram) | (95) |
|  |  |  |  |  |  |  |  |  |  |

Table 3. Modifiers of vascular calcification

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Author | PMID | Country | Time | CKD stages | sample | Findings | Data | Potential modifiers | Ref |
| 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) | (170) |
|  |  |  |  |  |  | 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) | (91) |
| Chae *et al.* | 30595681 | Korea | 2018 | 1-5 | 1832 | Neutral | Female in quartile 1 vs. 2 vs. 3 vs. 4 of serum OPG: 36.2 vs. 43.4 vs. 42.5 vs. 38.6, p for trend = 0.517 | Serum OPG | (106) |
| Barreto *et al.* | 19443628 | France | 2009 | 2-5D | 140 | Neutral | Male in 25D ≤ 16.7 ng/ml vs. 25D ≥ 16.7 ng/ml: 59% vs. 62%, p = 0.702 | 25D | (171) |
| 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 | (166) |
| 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) | (172) |
| 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) | (142) |
| Buiten MS | 25495997 | Netherlands | 2014 | 5D | 127 | Female gender | <460 pg/mL vs. >460 pg/mL: 16% vs 31%, p < 0.05 | Klotho | (173) |
| Riphagen *et al.* | 29292751 | Netherlands | 2017 | Not CKD | 4275 | Male gender | <275 vs. 275–479 vs. ≥480: 40.0% vs. 46.9% vs. 51.0% | dp-ucMGP (/pmol/L) | (174) |
|  |  |  |  |  |  |  | Not CKD |  |  |
| Zou *et al.* | 27400310 | China | 2016 | 1-5 (pre-dialysis) | 296 | Neutral | Serum phosphorus tertile 1 vs. 2 vs. 3: 60.2% vs. 50.0% vs. 61.2%, p = 0.21 | Serum phosphorus | (167) |
| Zhou *et al.* | 28455660 | China | 2017 | 5 | 32 | Neutral | OR 0.750 (0.184–3.057), p = 0.688 | Vessel sclerostin | (175) |
| Holden *et al.* | 24855061 | Canada | 2014 | 3-5 | 167 | Neutral | Male in VKORC1 CC vs. CG/GG: 68% vs. 55%, p = 0.11 | VKORC1 (vitamin K epoxide reductase complex 1) | (176) |
|  |  |  |  |  |  |  | mutation into CC/CG increases the risk of vascular calcification |  |  |
| Shiga et al. | 21819721 | Japan | 2011 | Not all CKD | 289 | Male has higher PEDF | PEDF in Male vs. female: 19.8 ± 6.0 vs. 17.4 ± 5.8, p = 0.001 | PEDF, µg/ml | (177) |
| Axelsson *et al.* | 18337634 | Sweden | 2008 | 5 | 198 | Male at risk | Male vs. female to total fat mass: β = –1.68, SE = 0.41, p < 0.001 | Total fat mass correlates to fetuin-A | (178) |
| Stenvinkel *et al.* | 15882283 | Sweden | 2005 | 5 | 258 | Neutral | No differences in the median fetuin-A level were noted between nonsmokers and former/current smokers (0.247 vs. 0.217 g/L), or between males and females (0.225 vs. 0.223 g/L). | Fetuin-A | (179) |
| Zhang *et al.* | 26112236 | China | 2015 | 5D (HD) | 90 | Male at risk | Male to serum ACE2: Correlation coefficient = 0.362, p < 0.001 | Serum ACE2 levels predicts coronary artery calcium assessed with multi-slice CT (Agatston score) | (180) |
| Thambiah *et al.* | 22527202 | UK | 2012 | 3B-4 | 77 | Male at risk | β = 0.23, p = 0.024 | Serum sclerostin predicts vascular calcification | (181) |
| Nakashima *et al.* | 20812007 | Japan | 2010 | 5D (HD) | 151 | Neutral | Parameter estimate = 0.531, SE = 0.814, p = 0.51 | Osteoprotegerin (pmol/L) | (182) |
| Stolic *et al.* | 26781652 | Serbia | 2016 | 5D (HD) | 88 | Neutral | Male vs. Female (mean [range]): 1.2 (0.7–1.6) vs. 1.2 (0.8–1.5), p = 0.896 | Magnesium (mmol/L), whose insufficiency predicts vascular calcification | (183) |
| Sigrist *et al.* | 19491380 | UK | 2009 | 3-4 | 134 | Neutral | Male in patients with OPG ≤25 pmol/L vs. >25 pmol/L: 63% vs. 70%, p = 0.47 | Serum OPG | (184) |
| Ikee *et al.* | 27965186 | Japan | 2016 | 5D (HD) | 86 | Neutral | Mg level in male vs. female: 2.51 ± 0.38 vs. 2.42 ± 0.33 | Mg (mg/dL) | (185) |
| Jean *et al.* | 21178378 | France | 2011 | 5D (HD) | 1138 | Neutral | Female in patients with serum PTH < 50 pg/mL vs. ≥ 50 pg/mL: 43% vs. 40%, p > 0.05 | Serum PTH (pg/mL) | (186) |
| Block *et al.* | 17200680 | US | 2007 | 5D (HD) | 127 | Neutral | Male in patients using Sevelamer vs. Calcium salts: 58% vs. 64%, p > 0.05 | Calcium-containing phosphate binder | (187) |
| Viaene *et al.* | 23605174 | Belgium | 2013 | 5D (HD) | 100 | Neutral | Female in patients with sclerostin < median vs. > median: 47% vs. 35%, p = 0.2 | Sclerostin level | (188) |
| Shimoyama *et al.* | 22200427 | Japan | 2012 | 5D (HD) | 219 | Male at risk | CACS was significantly high in C allele carriers of  rs2273773 in all and male HD patients. | C carrier of SIRT1 mutation | (189) |
|  |  |  |  |  |  |  | C:\Users\patricia\AppData\Local\Temp\vmware-patricia\VMwareDnD\56aaf0d5\2021-04-29 17-32-01 的螢幕擷圖.png |  |  |
| Kato *et al.* | 18663287 | Japan | 2009 | 5D (HD) | 68 | Neutral | Serum PBEF/visfatin was significantly and positively correlated with HD duration (r = 0.30, p = 0.01), but did not correlate with age, gender and diabetes. | Serum PBEF/visfatin | (190) |
| Zhang *et al.* | 24193439 | China | 2013 | 5D (HD) | Cohort 1: 72  Cohort 2: 139  Cohort 3: 508 | Neutral | Female in patients receiving 1.75 mmol/L vs. 1.5 mmol/L dialysate calcium concentration: 53.3% vs. 44.8 %, p = 0.070 | DCa | (191) |
| Hermans *et al.* | 17342178 | Netherlands | 2007 | 5D | 987 | More male receiving PD | Male in patients undergoing HD vs. PD: 57% vs. 64%, p = 0.028 | Dialysis types | (192) |
| Metry *et al.* | 19021697 | Sweden | 2008 | 5D (HD) | 222 | Neutral | Male in group 1 vs. 2 vs. 3 vs. 4: 60.9% vs. 52.5% vs. 44.4% vs. 58.8%, p > 0.05 | Fetuin-A; Group I included patients who had high fetuin-A and low CRP (reference group); Group II included patients who had high fetuin-A and high CRP; Group III included patients who had low fetuin-A and low CRP; Group IV included patients who had low fetuin-A and high CRP | (193) |
| Iseki *et al.* | 12637649 | Japan | 2003 | 5D (HD) | 1243 | Male longer HD vintage | Male in patients with duration of HD 1-12 vs. ≥121 months: 50.2% vs. 67.0%, p < 0.001 | HD vintage | (194) |
| Yoshikawa *et al.* | 23504408 | Japan | 2013 | 5D (HD) | 134 | Neutral | Male in patients with CC vs. CT vs. TT genotype of T-138C: 14% vs. 48% vs. 33%, p = 0.53 | Genotype of T-138C, CT/TT genotype predicts AACVS | (93) |
| Chao *et al.* | 30646802 | Taiwan | 2019 | 5D | 223 | Neutral | Female in patients with high vs. low miRNA-125b: 63% vs. 51%, p = 0.14 | miRNA-125b | (195) |
| Cavallari *et al.* | 30833349 | Italy | 2019 | 5D | 30 | Neutral | Female in patients undergoing mixed online hemodiafiltration vs. bicarbonate hemodialysis: 23% vs. 33%, p = 0.2 | mOL-HDF inhibits vascualr calcification in VSMC | (196) |
| Nithiya *et al.* | 32394910 | India | 2020 | 5D | 113 | Neutral | Male in patients with vs. without pulmonary hypertension: 47.2% vs. 52.8%, p = 0.683 | PHTN | (197) |
| Evenpoel *et al.* | 26505822 | Belgium | 2015 | 5T | 268 | Male gender | P = 0.002 | Sclerostin | (110) |
|  |  |  |  |  |  |  | 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**. |  |  |
| Choi *et al.* | 31048884 | Korea | 2019 | 5D (HD) | 97 | Neutral | 2 vs. 1 vs. 0 malnutrition and inflammation markers, male 61.5% vs. 41.9% vs 34.1%, p = 0.216 | Malnutrition and inflammation markers | (20) |
| Ulusoy *et al.* | 22874483 | Turkey | 2012 | 5D (HD) | 103 | Male at risk | In pre-hemodialysis, male patients' SCUBE1 level was significantly higher than that of females (p=0.000). | SCUBE1 | (198) |
| Miyatake *et al.* | 31945100 | Japan | 2020 | 5T | 50 | Neutral (CTRP9) | LDL-C, male vs. female 113.0 (97.0–132.5) vs. 90.0 (76.5–98.3), p < 0.01  HDL-C, male vs. female 57.0 (51.0–67.0) vs. 78.0 (66.8–96.5), p < 0.01  HMW-ADPN, male vs. female 2.48 (1.62–3.33) vs. 4.52 (3.02–6.79), p < 0.01  LMW-ADPN, male vs. female 1.67 (1.14–1.89) vs. 2.26 (1.85–2.83), p < 0.01  CTRP9, male vs. female 2.08 (2.01–2.13) vs. 2.03 (2.00–2.07), p > 0.05 | Circulating CTRP9 | (63) |
| Miyatake *et al.* | 31945100 |  |  |  |  | Neutral (CTRP9) | Female β = -0.089, p = 0.590 |  |  |
| Okamoto *et al.* | 30128921 | Japan | 2018 | 5D (HD) | 230 | Neutral | Low vs. non-low fetuin-A, male 61% vs. 68%, p = 0.400 | Fetuin-A | (199) |
| Schlieper *et al.* | 21289218 | Serbia | 2011 | 5 | 188 | Neutral | dp-cMGP > vs. < 6139 pmol/L, male OR 0.62 (0.35–1.11), p = 0.11 | Dp-cMGP | (200) |
| Liabeuf *et al.* | 23826225 | France | 2013 | 2-5, 5D | 139 | Neutral | Free p-cresylglucuronide ≤ vs. ≥ 0.041 mg/dL, male 63% vs. 57%, p = 0.5 | Free p-cresylglucuronide | (201) |
| Karsli Ceppioğlu *et al.* | 21859400 | Turkey | 2011 | 3-5 | 84 | Female at risk | The concentration of Cu was significantly increased in women subjects (p = 0.002) | Oxidative stress | (202) |
| Karsli Ceppioğlu *et al.* | 21859400 |  |  |  |  | Neutral | DNA damage not associated with gender | matrix Gla protein (MGP) gene |  |
| Aoun *et al.* | 28592319 | Lebanon | 2017 | 5D (HD) | 50 | Male at risk | dp-ucMGP < vs. > 5000, female 68.3% vs. 22.2%, p = 0.02 | Dp-ucMGP | (203) |
| Park *et al.* | 29960990 | Korean | 2018 | 1-5 | 1741 | Female more severe | ECF quartile 1 vs. 2 vs. 3 vs. 4, male 80.6% vs. 59.0% vs. 39.7% vs. 39.6, p < 0.001  Male β = 0.509 (0.660–0.359), p < 0.001 (Univariate)  Male β = 0.095 (0.421–0.231), p = 0.566 (Multivariate) | ECF excess | (204) |
| Cai *et al.* | 26159932 | China | 2015 | 5D (HD) | 129 | Neutral | Quartile I vs. II vs. III vs. IV, male 59.4% vs. 54.5% vs. 56.3% vs. 53.1%, p > 0.05 | Soluble Klotho | (169) |
| Kuo et al. | 31315601 | Taiwan | 2019 | 5D (PD) | 89 | Male gender | OR 2.882 (1.219–6.815) | above-median sclerostin levels | (135) |

References

1. 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.

2. 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.

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. Arjona Barrionuevo JD, Gonzales Vargas-Machuca MF, Gomez Pulido F, Gil Sacaluga L, Gentil Govantes MA, Martinez-Martinez A. Transthoracic echocardiographic findings in patients with chronic kidney disease awaiting kidney transplantation. Transplant Proc. 2010;42(8):3123–5.

5. Asci G, Ok E, Savas R, Ozkahya M, Duman S, Toz H, et al. The link between bone and coronary calcifications in CKD-5 patients on haemodialysis. Nephrol Dial Transplant [Internet]. 2011;26(3):1010–5. Available from: http://www.embase.com/search/results?subaction=viewrecord&from=export&id=L361347859

6. Avramovski P, Avramovska M, Sotiroski K, Sikole A. Acute-phase proteins as promoters of abdominal aortic calcification in chronic dialysis patients. Saudi J kidney Dis Transplant an Off Publ Saudi Cent Organ Transplantation, Saudi Arab. 2019;30(2):376–86.

7. Bae E, Seong EY, Han B-G, Kim DK, Lim CS, Kang S-W, et al. Coronary artery calcification in Korean patients with incident dialysis. Hemodial Int. 2017;21(3):367–74.

8. Ballotta E, Renon L, Toffano M, Piccoli A, Da Giau G. Patency and limb salvage rates after distal revascularization to unclampable calcified outflow arteries. J Vasc Surg [Internet]. 2004;39(3):539–46. Available from: http://search.ebscohost.com/login.aspx?direct=true&db=cmedm&AN=14981445&site=ehost-live&scope=site

9. Bellasi A, Block GA, Ferramosca E, Ratti C, Raggi P. Integration of clinical and imaging data to predict death in hemodialysis patients. Hemodial Int. 2013 Jan;17(1):12–8.

10. Bundy JD, Cai X, Mehta RC, Scialla JJ, de Boer IH, Hsu C-Y, et al. Serum Calcification Propensity and Clinical Events in CKD. Clin J Am Soc Nephrol. 2019 Nov;14(11):1562–71.

11. 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.

12. Chandra A, Raj G, Awasthi NP, Rao N, Srivastava D. Evaluation of the relationship between blood cell parameters and vascular calcification in dialysis-dependent end-stage renal disease patients. Saudi J kidney Dis Transplant an Off Publ Saudi Cent Organ Transplantation, Saudi Arab. 2020;31(1):136–43.

13. 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.

14. Chao C-T, Liu Y-P, Su S-F, Yeh H-Y, Chen H-Y, Lee P-J, et al. Circulating MicroRNA-125b Predicts the Presence and Progression of Uremic Vascular Calcification. Arterioscler Thromb Vasc Biol. 2017 Jul;37(7):1402–14.

15. Chao C-T. A combined microrna and target protein-based panel for predicting the probability and severity of uremic vascular calcification. J Am Soc Nephrol [Internet]. 2020;31:177–8. Available from: https://www.embase.com/search/results?subaction=viewrecord&id=L633703091&from=export

16. 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.

17. 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

18. 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.

19. 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

20. Choi SR, Lee Y-K, Cho AJ, Park HC, Han CH, Choi M-J, et al. Malnutrition, inflammation, progression of vascular calcification and survival: Inter-relationships in hemodialysis patients. PLoS One. 2019;14(5):e0216415.

21. Chou F-F, Chen J-B, Huang S-C, Chan Y-C, Chi S-Y, Chen W-T. Changes in serum FGF23 and Klotho levels and calcification scores of the abdominal aorta after parathyroidectomy for secondary hyperparathyroidism. Am J Surg [Internet]. 2019 Sep;218(3):609–12. Available from: http://search.ebscohost.com/login.aspx?direct=true&db=cmedm&AN=30594298&site=ehost-live&scope=site

22. 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

23. 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

24. Coen G, Manni M, Agnoli A, Balducci A, Dessi M, De Angelis S, et al. Cardiac calcifications: Fetuin-A and other risk factors in hemodialysis patients. ASAIO J. 2006;52(2):150–6.

25. Coll B, Betriu A, Martinez-Alonso M, Amoedo ML, Arcidiacono MV, Borras M, et al. Large artery calcification on dialysis patients is located in the intima and related to atherosclerosis. Clin J Am Soc Nephrol. 2011;6(2):303–10.

26. 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

27. Davis B, Marin D, Hurwitz LM, Ronald J, Ellis MJ, Ravindra K V, et al. Application of a Novel CT-Based Iliac Artery Calcification Scoring System for Predicting Renal Transplant Outcomes. Am J Roentgenol. 2016;206(2):436–41.

28. DeLoach SS, Joffe MM, Mai X, Goral S, Rosas SE. Aortic calcification predicts cardiovascular events and all-cause mortality in renal transplantation. Nephrol Dial Transplant. 2009;24(4):1314–9.

29. 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

30. 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

31. El Amrani M, Maoujoud O, Belarbi M, El Farouki MR, Zajjari Y, Boukili Y, et al. Screening and risk factors of cardiac calcification in hemodialysis: contribution of ultra-fast multi-slice scanner and transthoracic echocardiography. Ann Cardiol Angeiol (Paris). 2015;64(2):87–93.

32. 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

33. Fabbian F, Catalano C, Orlandi V, Conte MM, Lupo A, Catizone L. Evaluation of aortic arch calcification in hemodialysis patients. J Nephrol [Internet]. 2005;18(3):289–93. Available from: http://search.ebscohost.com/login.aspx?direct=true&db=cmedm&AN=16013017&site=ehost-live&scope=site

34. Fayed A, Soliman A, El Mahdy H, Hamza W, Abdulazim DO, Salem MM, et al. Intraoperative Arterial Biopsy in Incident Hemodialysis Patients: Differences Observed. Nephron. 2019;143(1):54–61.

35. 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

36. Gunen Yilmaz S, Yilmaz F, Bayrakdar IS, Harorli A. The Relationship between carotid artery calcification and pulp stone among hemodialysis patients: A retrospective study. Saudi J kidney Dis Transplant an Off Publ Saudi Cent Organ Transplantation, Saudi Arab. 2019;30(4):755–63.

37. 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

38. 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.

39. He L, He W-Y, A L-T, Yang W-L, Zhang A-H. Lower Serum Irisin Levels Are Associated with Increased Vascular Calcification in Hemodialysis Patients. Kidney Blood Press Res [Internet]. 2018;43(1):287–95. Available from: http://search.ebscohost.com/login.aspx?direct=true&db=cmedm&AN=29490308&site=ehost-live&scope=site

40. 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

41. H. AH, N. A-H, A.A.M.H. A, V.T. N, M.R.N. N, A.M. R, et al. Vascular calcification in dialysis patients. Transplant Proc [Internet]. 2005;37(10):4183–6. Available from: http://www.embase.com/search/results?subaction=viewrecord&from=export&id=L43015985

42. 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

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. 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.

45. 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

46. Jiménez Villodres M, García Gutiérrez G, García Frías P, Rioja Villodres J, Martín Velázquez M, Sánchez Chaparro MÁ, et al. Fractional excretion of phosphorus and vascular calcification in stage 3 chronic kidney disease. J Investig Med Off Publ Am Fed Clin Res. 2019 Mar;67(3):674–80.

47. 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).

48. 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.

49. Kim HG, Song SW, Kim TY, Kim YO. Risk factors for progression of aortic arch calcification in patients on maintenance hemodialysis and peritoneal dialysis. Hemodial Int [Internet]. 2011;15(4):460–7. Available from: http://www.embase.com/search/results?subaction=viewrecord&from=export&id=L362808583

50. Kim SM, Jung IM, Kim D, Lee JP, So YH. Effect of Inflow Arterial Calcification on Arteriovenous Fistula Maturation. Ann Vasc Surg. 2019 Jul;58:331–7.

51. Kimura K, Saika Y, Otani H, Fujii R, Mune M, Yukawa S. Factors associated with calcification of the abdominal aorta in hemodialysis patients. Kidney Int Suppl. 1999;71:S238-41.

52. 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.

53. 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

54. Lee MJ, Park JT, Park KS, Kwon YE, Han SH, Kang S-W, et al. Normal body mass index with central obesity has increased risk of coronary artery calcification in Korean patients with chronic kidney disease. Kidney Int. 2016;90(6):1368–76.

55. Lee C-T, Lee Y-T, Tain Y-L, Ng H-Y, Kuo W-H. Circulating microRNAs and vascular calcification in hemodialysis patients. J Int Med Res. 2019 Jul;47(7):2929–39.

56. 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.

57. Liu J, Zhang L, Zhou Y, Zhu D, Wang Q, Hao L. Aberrant activation of Wnt pathways in arteries associates with vascular calcification in chronic kidney disease. Int Urol Nephrol. 2016;48(8):1313–9.

58. Lockhart ME, Robbin ML, McNamara MM, Allon M. Association of pelvic arterial calcification with arteriovenous thigh graft failure in haemodialysis patients. Nephrol Dial Transplant [Internet]. 2004;19(10):2564–9. Available from: http://www.embase.com/search/results?subaction=viewrecord&from=export&id=L39360105

59. London GM, Pannier B, Marchais SJ. Vascular calcifications, arterial aging and arterial remodeling in ESRD. Blood Purif. 2013;35(1–3):16–21.

60. 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

61. 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

62. Merjanian R, Budoff M, Adler S, Berman N, Mehrotra R. Coronary artery, aortic wall, and valvular calcification in nondialyzed individuals with type 2 diabetes and renal disease. Kidney Int [Internet]. 2003;64(1):263–71. Available from: http://www.embase.com/search/results?subaction=viewrecord&from=export&id=L36714180

63. Miyatake N, Adachi H, Nomura-Nakayama K, Okada K, Okino K, Hayashi N, et al. Circulating CTRP9 correlates with the prevention of aortic calcification in renal allograft recipients. PLoS One. 2020;15(1):e0226526.

64. Mizuiri S, Nishizawa Y, Yamashita K, Mizuno K, Ishine M, Doi S, et al. Coronary artery calcification score and common iliac artery calcification score in non-dialysis CKD patients. Nephrology (Carlton). 2018 Sep;23(9):837–45.

65. Moorhead JF, Tatler GL, Baillod RA, Varghese Z, Wills MR, Farrow SC. Effects of age, sex, and polycystic disease on progressive bone disease of renal failure. Br Med J. 1974;4(5944):557–60.

66. 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

67. Munguia P, Caramelo R, Rubio M V, Sahdala L, Arnaudas L, Paul J, et al. Pre-Transplant Assessment of Vascular Calcification as a Risk Factor of Mortality, Graft Loss, and Cardiovascular Events in Renal Transplant Recipients. Transplant Proc. 2015;47(8):2368–70.

68. 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.

69. 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

70. Niu Q, Yang S, Gan L, Zhao H, Zuo L. Different type and dosage of heparin were not associated with the progression of coronary artery calcification in haemodialysis patients. Nephrology (Carlton). 2020 Jul;25(7):551–8.

71. Niu Q, Zhao H, Wu B, Tsai S, Wu J, Zhang M, et al. Abdominal aortic calcification is superior to other arteries calcification in predicting the mortality in peritoneal dialysis patients - a 8 years cohort study. BMC Nephrol. 2019 Dec;20(1):439.

72. Oh J, Wunsch R, Turzer M, Bahner M, Raggi P, Querfeld U, et al. Advanced coronary and carotid arteriopathy in young adults with childhood-onset chronic renal failure. Circulation. 2002;106(1):100–5.

73. Oh D-J. Continuous ambulatory peritoneal dialysis patients show high prevalence of carotid artery calcification which is associated with a higher left ventricular mass index. J Korean Med Sci. 2005;20(5):848–52.

74. 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.

75. 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.

76. Petrovic M, Baralic M, Brkovic V, Arsenovic A, Stojanov V, Lalic N, et al. Significance of acPWV for Survival of Hemodialysis Patients. Medicina (Kaunas). 2020 Aug;56(9).

77. 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.

78. Raggi P, Bellasi A, Gamboa C, Ferramosca E, Ratti C, Block GA, et al. All-cause mortality in hemodialysis patients with heart valve calcification. Clin J Am Soc Nephrol. 2011 Aug;6(8):1990–5.

79. 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.

80. Ribeiro S, Ramos A, Brandão A, Rebelo JR, Guerra A, Resina C, et al. Cardiac valve calcification in haemodialysis patients: Role of calcium-phosphate metabolism. Nephrol Dial Transplant [Internet]. 1998;13(8):2037–40. Available from: http://www.embase.com/search/results?subaction=viewrecord&from=export&id=L28356772

81. Roca-Tey R, Paez R, Rivas A, Samon R, Ibrik O, Gimenez I, et al. Prevalence and functional effect of arteriovenous fistula calcifications, evaluated by spiral CT in chronic haemodialysis patients. NEFROLOGIA. 2009;29(3):214–21.

82. 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

83. 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

84. 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.

85. 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

86. Strózecki P, Odrowaz-Sypniewska G, Manitius J. Cardiac valve calcifications and left ventricular hypertrophy in hemodialysis patients. Ren Fail. 2005;27(6):733–8.

87. 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

88. Tomiyama C, Carvalho AB, Higa A, Jorgetti V, Draibe SA, Canziani MEF. Coronary calcification is associated with lower bone formation rate in CKD patients not yet in dialysis treatment. J Bone Miner Res. 2010;25(3):499–504.

89. 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.

90. Wang AYM, Wang M, Woo J, Lam CWK, Li PKT, Lui S fai, et al. Cardiac valve calcification as an important predictor for all-cause mortality and cardiovascular mortality in long-term peritoneal dialysis patients: A prospective study. J Am Soc Nephrol. 2003;14(1):159–68.

91. 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.

92. Wu C-F, Lee Y-F, Lee W-J, Su C-T, Lee LJ-H, Wu K-D, et al. Severe aortic arch calcification predicts mortality in patients undergoing peritoneal dialysis. J Formos Med Assoc. 2017;116(5):366–72.

93. Yoshikawa K, Abe H, Tominaga T, Nakamura M, Kishi S, Matsuura M, et al. Polymorphism in the human matrix Gla protein gene is associated with the progression of vascular calcification in maintenance hemodialysis patients. Clin Exp Nephrol. 2013;17(6):882–9.

94. Zhou Y, Hellberg M, Kouidi E, Deligiannis A, Hoglund P, Clyne N. Relationships between abdominal aortic calcification, glomerular filtration rate, and cardiovascular risk factors in patients with non-dialysis dependent chronic kidney disease. Clin Nephrol. 2018;90(6):380–9.

95. Jean G, Bresson E, Lorriaux C, Mayor B, Hurot J-M, Deleaval P, et al. Increased levels of serum parathyroid hormone and fibroblast growth factor-23 are the main factors associated with the progression of vascular calcification in long-hour hemodialysis patients. Nephron Clin Pract. 2012;120(3):c132-8.

96. Abd Alamir M, Radulescu V, Goyfman M, Mohler 3rd ER, Gao YL, Budoff MJ. Prevalence and correlates of mitral annular calcification in adults with chronic kidney disease: Results from CRIC study. Atherosclerosis [Internet]. 2015;242(1):117–22. Available from: http://search.ebscohost.com/login.aspx?direct=true&db=cmedm&AN=26188533&site=ehost-live&scope=site

97. Adragao T, Pires A, Lucas C, Birne R, Magalhaes L, Gonçalves M, et al. A simple vascular calcification score predicts cardiovascular risk in haemodialysis patients. Nephrol Dial Transplant [Internet]. 2004;19(6):1480–8. Available from: http://www.embase.com/search/results?subaction=viewrecord&from=export&id=L38786742

98. 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.

99. 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.

100. 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

101. Blacher J, Demuth K, Guerin AP, Safar ME, Moatti N, London GM. Influence of biochemical alterations on arterial stiffness in patients with end-stage renal disease. Arterioscler Thromb Vasc Biol. 1998;18(4):535–41.

102. 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.

103. Budoff MJ, Rader DJ, Reilly MP, Mohler ER 3rd, Lash J, Yang W, et al. Relationship of estimated GFR and coronary artery calcification in the CRIC (Chronic Renal Insufficiency Cohort) Study. Am J Kidney Dis. 2011;58(4):519–26.

104. 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.

105. 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

106. Chae SY, Chung W, Kim YH, Oh YK, Lee J, Choi KH, et al. The Correlation of Serum Osteoprotegerin with Non-Traditional Cardiovascular Risk Factors and Arterial Stiffness in Patients with Pre-Dialysis Chronic Kidney Disease: Results from the KNOW-CKD Study. J Korean Med Sci. 2018;33(53):e322–e322.

107. 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.

108. Claes KJ, Viaene L, Heye S, Meijers B, D’Haese P, Evenepoel P. Sclerostin: Another vascular calcification inhibitor? J Clin Endocrinol Metab [Internet]. 2013;98(8):3221–8. Available from: http://www.embase.com/search/results?subaction=viewrecord&from=export&id=L369563218

109. 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.

110. 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

111. 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.

112. Fayed A, Elnokeety MM, Attia K, Sharaf El Din UA. Calcification of abdominal aorta in patients recently starting hemodialysis: A single-center experience from Egypt. Saudi J kidney Dis Transplant an Off Publ Saudi Cent Organ Transplantation, Saudi Arab. 2019;30(4):819–24.

113. Filgueira A, Carvalho AB, Tomiyama C, Higa A, Rochitte CE, Santos RD, et al. Is Coronary Artery Calcification Associated with Vertebral Bone Density in Nondialyzed Chronic Kidney Disease Patients? Clin J Am Soc Nephrol. 2011;6(6):1456–62.

114. 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

115. 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.

116. 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.

117. Witteman JC, Grobbee DE, Valkenburg HA, van Hemert AM, Stijnen T, Burger H, et al. J-shaped relation between change in diastolic blood pressure and progression of aortic atherosclerosis. Lancet (London, England). 1994 Feb;343(8896):504–7.

118. Fusaro M, Gallieni M, Rebora P, Rizzo MA, Luise MC, Riva H, et al. Atrial fibrillation and low vitamin D levels are associated with severe vascular calcifications in hemodialysis patients. J Nephrol [Internet]. 2016;29(3):419–26. Available from: http://www.embase.com/search/results?subaction=viewrecord&from=export&id=L610468679

119. 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

120. 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

121. 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.

122. Gross M-L, Meyer H-P, Ziebart H, Rieger P, Wenzel U, Amman K, et al. Calcification of coronary intima and media: Immunohistochemistry, backscatter imaging, and X-ray analysis in renal and nonrenal patients. Clin J Am Soc Nephrol. 2007;2(1):121–34.

123. Gruppen MP, Groothoff JW, Prins M, van der Wouw P, Offringa M, Bos WJ, et al. Cardiac disease in young adult patients with end-stage renal disease since childhood: a Dutch cohort study. Kidney Int. 2003 Mar;63(3):1058–65.

124. 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.

125. 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

126. 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

127. Bover J, Ureña-Torres P, Cozzolino M, Rodríguez-García M, Gómez-Alonso C. The Non-invasive Diagnosis of Bone Disorders in CKD. Calcif Tissue Int [Internet]. 2021 Jan 4; Available from: http://search.ebscohost.com/login.aspx?direct=true&db=cmedm&AN=33398414&site=ehost-live&scope=site

128. 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.

129. 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

130. 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.

131. 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

132. 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

133. Kestenbaum BR, Adeney KL, de Boer IH, Ix JH, Shlipak MG, Siscovick DS, et al. Incidence and progression of coronary calcification in chronic kidney disease: the Multi-Ethnic Study of Atherosclerosis. Kidney Int [Internet]. 2009;76(9):991–8. Available from: http://www.embase.com/search/results?subaction=viewrecord&from=export&id=L50616874

134. 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.

135. 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.

136. Maia PRL, Medeiros AMC, Pereira HSG, Lima KC, Oliveira PT. Presence and associated factors of carotid artery calcification detected by digital panoramic radiography in patients with chronic kidney disease undergoing hemodialysis. Oral Surg Oral Med Oral Pathol Oral Radiol. 2018;126(2):198–204.

137. 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

138. Maréchal C, Coche E, Goffin E, Dragean A, Schlieper G, Nguyen P, et al. Progression of coronary artery calcification and thoracic aorta calcification in kidney transplant recipients. Am J kidney Dis Off J Natl Kidney Found. 2012 Feb;59(2):258–69.

139. Leckstroem DCT, Bhuvanakrishna T, McGrath A, Goldsmith DJA. Prevalence and predictors of abdominal aortic calcification in healthy living kidney donors. Int Urol Nephrol. 2014;46(1):63–70.

140. Muntner P, Ferramosca E, Bellasi A, Block GA, Raggi P. Development of a cardiovascular calcification index using simple imaging tools in haemodialysis patients. Nephrol Dial Transplant Off Publ Eur Dial Transpl Assoc - Eur Ren Assoc. 2007 Feb;22(2):508–14.

141. 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.

142. 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.

143. 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.

144. 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

145. Nishizawa Y, Mizuiri S, Yorioka N, Hamada C, Tomino Y. Determinants of coronary artery calcification in maintenance hemodialysis patients. J Artif Organs Off J Japanese Soc Artif Organs [Internet]. 2015;18(3):251–6. Available from: http://search.ebscohost.com/login.aspx?direct=true&db=cmedm&AN=25805429&site=ehost-live&scope=site

146. 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

147. 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.

148. 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.

149. 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

150. 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.

151. 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.

152. 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

153. 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

154. Sharma R, Pellerin D, Gaze DC, Mehta RL, Gregson H, Streather CP, et al. Mitral annular calcification predicts mortality and coronary artery disease in end stage renal disease. Atherosclerosis. 2007 Apr;191(2):348–54.

155. 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

156. 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.

157. Stavroulopoulos A, Porter CJ, Pointon K, Monaghan JM, Roe SD, Cassidy MJD. Evolution of coronary artery calcification in patients with chronic kidney disease Stages 3 and 4, with and without diabetes. Nephrol Dial Transplant [Internet]. 2011;26(8):2582–9. Available from: http://www.embase.com/search/results?subaction=viewrecord&from=export&id=L362261849

158. 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

159. 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.

160. 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.

161. Turan MN, Gungor O, Asci G, Kircelli F, Acar T, Yaprak M, et al. Epicardial adipose tissue volume and cardiovascular disease in hemodialysis patients. Atherosclerosis [Internet]. 2013;226(1):129–33. Available from: http://www.embase.com/search/results?subaction=viewrecord&from=export&id=L52305037

162. 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

163. 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;

164. Wang M, Li H, You L, Yu X, Zhang M, Zhu R, et al. Association of Serum Phosphorus Variability with Coronary Artery Calcification among Hemodialysis Patients. PLoS One. 2014;9(4).

165. Yamada S, Inaba M, Shidara K, Okada S, Emoto M, Ishimura E, et al. Association of glycated albumin, but not glycated hemoglobin, with peripheral vascular calcification in hemodialysis patients with type 2 diabetes. Life Sci. 2008 Sep;83(13–14):516–9.

166. 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.

167. Zou J, Yu Y, Wu P, Lin F-J, Yao Y, Xie Y, et al. Serum phosphorus is related to left ventricular remodeling independent of renal function in hospitalized patients with chronic kidney disease. Int J Cardiol. 2016;221:134–40.

168. Zou Y, Yang M, Wang J, Cui L, Jiang Z, Ding J, et al. Association of sclerostin with cardiovascular events and mortality in dialysis patients. Ren Fail. 2020 Nov;42(1):282–8.

169. Cai H, Lu R, Zhang M, Pang H, Zhu M, Zhang W, et al. Serum Soluble Klotho Level Is Associated with Abdominal Aortic Calcification in Patients on Maintenance Hemodialysis. Blood Purif. 2015;40(2):120–6.

170. 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.

171. Barreto DV, Barreto FC, Liabeuf S, Temmar M, Boitte F, Choukroun G, et al. Vitamin D Affects Survival Independently of Vascular Calcification in Chronic Kidney Disease. Clin J Am Soc Nephrol [Internet]. 2009;4(6):1128–35. Available from: http://www.embase.com/search/results?subaction=viewrecord&from=export&id=L358071572

172. 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;

173. 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.

174. 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).

175. Zhou H, Yang M, Li M, Cui L, H. Z, M. Y, et al. Radial artery sclerostin expression in chronic kidney disease stage 5 predialysis patients: a cross-sectional observational study. Int Urol Nephrol [Internet]. 2017;49(8):1433–7. Available from: http://www.embase.com/search/results?subaction=viewrecord&from=export&id=L615773259

176. Holden RM, Booth SL, Tuttle A, James PD, Morton AR, Hopman WM, et al. Sequence variation in vitamin K epoxide reductase gene is associated with survival and progressive coronary calcification in chronic kidney disease. Arterioscler Thromb Vasc Biol. 2014;34(7):1591–6.

177. Shiga Y, Miura S, Mitsutake R, Yamagishi S, Saku K. Significance of plasma levels of pigment epithelium-derived factor as determined by multidetector row computed tomography in patients with mild chronic kidney disease and/or coronary artery disease. J Int Med Res. 2011;39(3):880–90.

178. Axelsson J, Wang X, Ketteler M, Qureshi AR, Heimbürger O, Bárány P, et al. Is fetuin-A/alpha2-Heremans-Schmid glycoprotein associated with the metabolic syndrome in patients with chronic kidney disease? Am J Nephrol. 2008;28(4):669–76.

179. 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

180. Zhang Q, Sun L, Jin L. Association Between Angiotensin-Converting Enzyme 2 and Coronary Artery Calcification in Patients on Maintenance Hemodialysis Therapy. Ther Apher Dial. 2015;19(5):466–70.

181. Thambiah S, Roplekar R, Manghat P, Fogelman I, Fraser WD, Goldsmith D, et al. Circulating Sclerostin and Dickkopf-1 (DKK1) in Predialysis Chronic Kidney Disease (CKD): Relationship with Bone Density and Arterial Stiffness. Calcif Tissue Int. 2012;90(6):473–80.

182. Nakashima A, Carrero JJ, Qureshi AR, Hirai T, Takasugi N, Ueno T, et al. Plasma osteoprotegerin, arterial stiffness, and mortality in normoalbuminemic Japanese hemodialysis patients. Osteoporos Int [Internet]. 2011;22(6):1695–701. Available from: http://www.embase.com/search/results?subaction=viewrecord&from=export&id=L51056189

183. Stolic R V, Jovanovic AN, Trajkovic GZ, Kostic MM, Odalovic AM, Sovtic SR, et al. Is low magnesium a clue to arteriovenous fistula complications in hemodialysis? Int Urol Nephrol. 2016;48(5):773–9.

184. 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.

185. Ikee R, Toyoyama T, Endo T, Tsunoda M, Hashimoto N. Impact of sevelamer hydrochloride on serum magnesium concentrations in hemodialysis patients. Magnes Res. 2016 Apr;29(4):184–90.

186. Jean G, Lataillade D, Genet L, Legrand E, Kuentz F, Moreau-Gaudry X, et al. Association between Very Low PTH Levels and Poor Survival Rates in Haemodialysis Patients: Results from the French ARNOS Cohort. NEPHRON Clin Pract [Internet]. 2011;118(2):c211–6. Available from: http://www.embase.com/search/results?subaction=viewrecord&from=export&id=L51201905

187. Block GA, Raggi P, Bellasi A, Kooienga L, Spiegel DM. Mortality effect of coronary calcification and phosphate binder choice in incident hemodialysis patients. KIDNEY Int. 2007;71(5):438–41.

188. 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.

189. Shimoyama Y, Mitsuda Y, Tsuruta Y, Suzuki K, Hamajima N, Niwa T. SIRTUIN 1 gene polymorphisms are associated with cholesterol metabolism and coronary artery calcification in Japanese hemodialysis patients. J Ren Nutr. 2012;22(1):114–9.

190. Kato A, Odamaki M, Ishida J, Hishida A. Relationship between serum pre-B cell colony-enhancing factor/visfatin and atherosclerotic parameters in chronic hemodialysis patients. Am J Nephrol. 2009;29(1):31–5.

191. 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.

192. Hermans MMH, Brandenburg V, Ketteler M, Kooman JP, van der Sande FM, Boeschoten EW, et al. Association of serum fetuin-A levels with mortality in dialysis patients. KIDNEY Int. 2007;72(2):202–7.

193. 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

194. Iseki K, Tozawa M, Takishita S. Effect of the duration of dialysis on survival in a cohort of chronic haemodialysis patients. Nephrol Dial Transplant. 2003;18(4):782–7.

195. Chao C-T, Yuan T-H, Yeh H-Y, Chen H-Y, Huang J-W, Chen H-W. Risk Factors Associated With Altered Circulating Micro RNA -125b and Their Influences on Uremic Vascular Calcification Among Patients With End-Stage Renal Disease. J Am Heart Assoc. 2019 Jan;8(2):e010805.

196. Cavallari C, Dellepiane S, Fonsato V, Medica D, Marengo M, Migliori M, et al. Online Hemodiafiltration Inhibits Inflammation-Related Endothelial Dysfunction and Vascular Calcification of Uremic Patients Modulating miR-223 Expression in Plasma Extracellular Vesicles. J Immunol. 2019 Apr;202(8):2372–83.

197. Nithiya N, Indhumathi E, Jagadeswaran D, Jayaprakash V, Jayakumar M. Pulmonary hypertension - prevalence, risk factors, and its association with vascular calcification in chronic kidney disease and hemodialysis patients. Saudi J kidney Dis Transplant an Off Publ Saudi Cent Organ Transplantation, Saudi Arab. 2020;31(2):380–7.

198. Ulusoy S, Ozkan G, Menteşe A, Yavuz A, Karahan SC, Sümer AU. Signal peptide-CUB-EGF domain-containing protein 1 (SCUBE1) level in hemodialysis patients and parameters affecting that level. Clin Biochem. 2012 Nov;45(16–17):1444–9.

199. Okamoto T, Tsutaya C, Hatakeyama S, Konishi S, Okita K, Tanaka Y, et al. Low serum butyrylcholinesterase is independently related to low fetuin-A in patients on hemodialysis: a cross-sectional study. Int Urol Nephrol. 2018 Sep;50(9):1713–20.

200. Schlieper G, Westenfeld R, Krüger T, Cranenburg EC, Magdeleyns EJ, Brandenburg VM, et al. Circulating nonphosphorylated carboxylated matrix gla protein predicts survival in ESRD. J Am Soc Nephrol. 2011 Feb;22(2):387–95.

201. Liabeuf S, Glorieux G, Lenglet A, Diouf M, Schepers E, Desjardins L, et al. Does p-cresylglucuronide have the same impact on mortality as other protein-bound uremic toxins? PLoS One. 2013;8(6):e67168.

202. Karsli Ceppioğlu S, Yurdun T, Canbakan M. Assessment of matrix Gla protein, Klotho gene polymorphisms, and oxidative stress in chronic kidney disease. Ren Fail. 2011;33(9):866–74.

203. Aoun M, Makki M, Azar H, Matta H, Chelala DN. High Dephosphorylated-Uncarboxylated MGP in Hemodialysis patients: risk factors and response to vitamin K(2), A pre-post intervention clinical trial. BMC Nephrol. 2017 Jun;18(1):191.

204. Park S, Lee CJ, Jhee JH, Yun H-R, Kim H, Jung S-Y, et al. Extracellular Fluid Excess Is Significantly Associated With Coronary Artery Calcification in Patients With Chronic Kidney Disease. J Am Heart Assoc. 2018 Jun;7(13).