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Analysis of risk factors for chronic total occlusion, multi-vessel and trunk of left coronary artery involvement in patients aged over 70 undergoing PCI

Analiza czynników ryzyka przewlekłej całkowitej okluzji, zajęcia wielu naczyń wieńcowych i pnia lewej tętnicy wieńcowej u pacjentów w wieku powyżej 70 lat poddawanych zabiegowi PCI

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Abstract

Introduction and Objective. Percutaneous coronary intervention (PCI) is a non-surgical, invasive procedure used to unblock significantly narrowed coronary arteries in coronary artery disease. Elderly patients who require PCI are often burdened by a medical history. For these patients, percutaneous coronary intervention is a procedure with a significantly increased risk. In addition, several forms of coronary artery disease, such as multi-vessel disease, chronic total occlusion (CTO) or left coronary artery trunk disease, are considered 'high-risk PCI'.

Materials and method. An investigator-initiated, retrospective, single-centre study conducted between 11.2020–12.2021 in the 1st Department of Cardiology of the Medical University of Warsaw involving 150 patients over 70 years of age undergoing PCI. The performance of angioplasty, as recommended by the ESC guidelines, depended on the choice of the interventional cardiologist in the case of acute coronary syndrome, or on the decision of the Heart Group in the case of elective procedure, and subject to the patient's informed consent. Exclusion criteria included age <70 years.

Results. Comorbidities, such as diabetes, chronic kidney disease, high BMI and male gender, appear to be the main risk factors for complex PCI.

Conclusions. The study showed that old age alone was not a significant risk factor for the need for a complex PCI procedure. There were no significant differences in the incidence of left coronary artery trunk disease, multi-vessel disease or chronic total occlusion between the age groups analysed. However, the group of patients who required 'high-risk PCI' had various co-morbidities, such as type 2 diabetes, chronic kidney disease or a higher BMI score.

Key words

high-risk PCI, left main artery disease, risk factors for chronic total occlusion, multi-vessel coronary artery disease

Streszczenie

Wprowadzenie i cel pracy. Przezskórna interwencja wieńcowa (PCI) to niechirurgiczny, inwazyjny zabieg stosowany w celu udrożnienia istotnie zwężonych tętnic wieńcowych w chorobie wieńcowej. Pacjenci w podeszłym wieku, którzy wymagają PCI, są często obciążeni wywiadem chorobowym. W przypadku tych osób przezskórna interwencja wieńcowa jest zabiegiem o znacznie podwyższonym ryzyku. Ponadto kilka postaci choroby wieńcowej, takich jak: choroba wielonaczyniowa, przewlekła całkowita okluzja (CTO) lub choroba pnia lewej tętnicy wieńcowej, jest uważanych za „PCI wysokiego ryzyka".

Materiał i metody. Zainicjowane przez badacza retrospektywne, jednoośrodkowe badanie, przeprowadzone w latach listopad 2020–grudzień 2021 roku w I Katedrze i Klinice Kardiologii Warszawskiego Uniwersytetu Medycznego, obejmowało 150 pacjentów powyżej 70. roku życia poddanych zabiegowi PCI. Wykonanie angioplastyki, zgodnie z wytycznymi ESC, zależało od wyboru kardiologa interwencyjnego – w przypadku ostrego zespołu wieńcowego – lub od decyzji Heart Group – w przypadku zabiegów planowych – i warunkowane było uzyskaniem świadomej zgody pacjenta. Kryteria wykluczenia obejmowały wiek < 70 lat.

Wyniki. Choroby współistniejące, takie jak cukrzyca czy przewlekła choroba nerek, a także wysokie BMI i płeć męska wydają się głównymi czynnikami ryzyka złożonego zabiegu PCI.

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Wnioski. Badanie wykazało, że podeszły wiek nie był sam w sobie istotnym czynnikiem ryzyka skłaniającym do wykonania złożonej procedury PCI. Nie było bowiem istotnych różnic w częstości występowania choroby pnia lewej tętnicy wieńcowej, choroby wielonaczyniowej lub przewlekłej całkowitej okluzji pomiędzy analizowanymi grupami wiekowymi. Jednak grupa pacjentów, którzy wymagali przeprowadzenia „PCI wysokiego ryzyka", miała różne choroby współistniejące, takie jak cukrzyca typu 2, przewlekła choroba nerek, czy też cechował ją wyższy wskaźnik BMI.

Słowa kluczowe
PCI wysokiego ryzyka, choroba pnia lewej tętnicy wieńcowej, czynniki ryzyka przewlekłej całkowitej okluzji, wielonaczyniowa choroba wieńcowa

INTRODUCTION

Percutaneous coronary intervention (PCI) is most often performed in patients who have certain risk factors for coronary artery disease, such as diabetes, chronic kidney disease, advanced age, or others. Additionally, the term 'high-risk PCI' is typically understood as PCI executed whenever a patient presents with specific characteristics of coronary artery disease (CAD), such as multi-vessel disease, chronic total occlusion, or left main coronary artery disease. Lastly, haemodynamic features, including ventricular dysfunction, concomitant valvular disease, and unstable characteristics, may also contribute to this definition [1].

Coronary artery disease is one of the leading mortality factors in the human population. It is mostly caused by atherosclerosis and commonly results from the combination of both environmental features and genetic predisposition. A family history of CAD is a very strong predisposing factor. Other risk factors related not only to CAD development, but also its complications and mortality, are nicotinism, diabetes mellitus (particularly 2nd type diabetes mellitus), hyperlipidaemia, hypertension, obesity, stress, menopause and advanced age. There are studies indicating homocystinuria, hyperhomocysteinaemia, and hyperuricaemia are also connected with atherosclerosis [2, 3]. Pathogenesis contains dysregulation of the inflammatory response, endothelial dysfunction, and lipids accumulation [4].

Multi-vessel coronary artery disease (MVD) is characterized by the narrowing of the luminal diameter of at least 70% in two or more major coronary arteries and is associated with significant mortality risk. At present, coronary artery bypass grafting (CABG) is associated with a lower risk of mortality and a reduced need for repeat revascularization procedures, and is still considered the best approach for most patients with multi-vessel disease [2, 5–6]. MVD is linked to conventional factors associated with atherosclerosis development [7].

Chronic total occlusion (CTO) is 100% stenosis of the artery for at least three months. CTO is associated with a worse prognosis combined with other CAD types. It is suggested that revascularization, despite not showing success in mortality management, is successful in reducing symptoms and improving the quality of life of patients [4, 8].

Risk factors are similar to general CAD predisposing features [4].

Left main coronary artery (LMCA) stenosis is associated with a poor prognosis. Its main common etiology remains atherosclerosis, the risk agents of which have been listed previously. The geometry of the artery is also believed to be significantly linked with atherosclerosis risk – the left coronary artery bifurcation angle, when increased, leads to the development of atherosclerotic plaque in this area [9, 10].

Studies show that men usually suffer from more advanced atherosclerotic lesions than the female gender. Men also tend to be more frequently diagnosed with multi-vessel disease and chronic total occlusion, compared to women. Although LMCA disease occurrence does not differ between genders, women have been diagnosed more frequently with ostial stenosis of the left main coronary artery and right coronary artery [11–13].

As mentioned above, advanced age is an independent unmodifiable risk factor for the development of CAD as well as for performing PCI [1,3]. Nonetheless, the group of older patients (understood as ≥ 70 years old) has been under-represented in cardiovascular clinical trials. Understanding the main risk factors in high-risk PCI groups of older adults is crucial to improving outcomes in this population [14].

The main aim of the study was to present high-risk PCI factors in patients over 70 years of age presenting MVD, CTO and LMCA.

MATERIALS AND METHOD

Study design. The study was investigator-initiated, retrospective and single-centre, conducted between 11.2020–12.2021 at the 1st Chair and Department of Cardiology, Medical University of Warsaw, Poland.

Selection of participants. Patients ≥ 70 years of age, diagnosed with acute or chronic coronary syndrome requiring coronary angioplasty procedure were included in the analysis. Haemodynamically significant stenosis was defined as narrowing of ≥ 50% of the vessel diameter and assessed by coronary radiography in all patients, in some cases confirmed in intravascular ultrasonography (IVUS) or optical coherence tomography (OCT). Performance of angioplasty, as recommended by the ESC guidelines [8], depended on the choice of the interventional cardiologist for acute coronary syndrome, or on the decision of the Heart Group for elective procedures and informed patient consent. Exclusion criteria were <70 years of age.

Clinical data collection and treatment. Data were collected from the registry and database of patients undergoing coronary angiography and PCIs in the haemodynamics laboratory during the index hospitalization. Samples for laboratory tests were collected on admission, and analysis of the tests was performed in the unit according to standard procedures. All patients underwent coronarography and PCI via femoral, radial, subclavian, or carotid access. The procedures were performed by an interventional cardiologist in a hybrid operating room. All patients continued their indicated treatment by the treating physician before admission, and received standard treatment afterwards, according to the guidelines.

Stratification. The analyzed population was stratified based on nominal variables. High risk procedure was defined as presence of at least one feature – chronic total occlusion (complete or nearly complete blockage of one or more coronary arteries), multi-vessel coronary artery disease (defined as luminal stenosis of at least 70% in at least two major coronary arteries, or in one coronary artery, in addition to a 50% or greater stenosis of the left main trunk) and left main trunk disease (a significant stenosis (>50%) of the left main coronary artery). The existence was then assessed of statistically significant differences between subgroups.

Statistical analysis. Statistical analyses were performed using SPSS version 28.0. Distribution of the numerical data was assessed using the Kolmogorov-Smirnov testfollowed by the unpaired T-student or U-Mann-Whitney test, as appropriate. Differences between categorical variables were assessed by Chi-square or Fischer exact tests, as appropriate. Adjusted logistic regression was performed for variables with P < 0.05 together with gender, BMI category (BMI<25 or BMI>=25) and age. Two-sided P-value < 0.05 was considered significant.

RESULTS

A total of 150 patients with a mean age of 77.47±4.34 and a mean BMI of 27.47±4.34 were included. High-risk PCI was performed on 60 patients. There were significantly more men (47–78.3% vs 51–56.7%; p=0.006) and bifurcations (18–30.0% vs 4–4.4%) among patients undergoing high-risk PCI (Fig. 1). OR for men – 2.765 (95%CI:1.316–5.808; p=0.007), and for BMI≥25, OR=0.830 (95%CI:0.407–1.694; p=0.609). These patients had significantly lower median glucose levels at baseline (108.0, IQR=95.75–131.0 vs 120.5, IQR=105.0–158.5; p=0.034), however, the DM frequency did not differ significantly (24–40.0% vs 28–31.1%; p=0.262. They also had significantly lower median neutrophil (5.43, IQR=3.73–7.08 vs 6.24, IQR=4.07–9.28; p=0.029) and higher median potassium levels (4.43, IQR=4.19–4.79 vs 4.19, IQR=3.97–4.67; p=0.010). More contrast volume was used during the procedure for patients undergoing high-risk PCI, and the fluoroscopy time was also longer.

Age subgroup analysis revealed no difference in the frequency of high-risk PCI (Fig. 1). On adjusted logistic regression including gender, BMI, age, glucose, and neutrophil/lymphocyte ratio, none of the covariates were significantly associated with high-risk PCI.

A separate analysis for each component of the high-risk PCI is shown in Figure 2. Patients with chronic total occlusion more frequently had DM2 (12–57.1% vs 40–31.0%; p=0.020) or CKD (11–52.4% vs 33–25.6%; p=0.012) and had higher mean BMI (29.52±4.61 vs 27.14±4.22; p=0.019) than patients without this complication. There was no significant difference in DM2 or BMI≥25 frequency between patients with multi-vessel disease and one-vessel disease; however, the median glucose level was lower (107.0, IQR=96.0–121.0 vs 120.0, IQR=105.0–157.0; p=0.031), whereas bifurcation frequency was higher (17–42.5% vs 5–4.5%; p<0.001).

Patients who underwent PCI of the left main coronary artery had a significantly higher median level of urea (51.5, IQR=48.5–66.8 vs 41.0, IQR=30.0–55.0; p=0.005). There were no differences in the frequency of any of the left main disease, multi-vessel disease, or chronic total occlusion between the age groups (Fig. 2).

DISCUSSION

High-risk PCI in the group of patients over 65 years is associated with higher mortality and MACCE ratio, compared to younger patients [16]; therefore, it is important to know about the factors predicting this type of procedure. Pre-procedural awareness of the higher risk of having to perform a complex procedure may potentially contribute to more prudent management of the contrast agent, which is used in much larger quantities during this intervention. Therefore, the main objective of the study was to compare patients requiring complex PCI versus those with non-complex procedures in different age groups, and to identify the associated factors. The study showed that elderly patients do not have a higher risk for the need of complex PCI. However, the high-risk procedure was more frequent among men. Currently, there is no universal definition of complex or high-risk PC and researchers use different criteria. The current study focused on characteristics related to the procedure itself, such as the number of vessels or the coronary anatomy, without considering the general characteristics of the patients.

For some time, research has been on-going to determine the best treatment method (CABG vs PCI) for the left main disease, which has provided a great deal of data on the occurring frequency among different age groups. It is inconclusive whether older age is associated with the left main artery disease, and the results obtained in the current study did not present a trend in an increase in its occurrence among older patients [17, 18, 27].

Analysis of the results of the current study showed that patients treated for left main artery disease had significantly higher median levels of urea. The machine-learning approach revealed that its level may be crucial in predicting chronic kidney disease in a group of older patients [19], which is known to have an impact on higher cardiovascular risk. This may be a point for future research, to investigate whether baseline urea level in this group of patients may predict future left main disease occurrence, or the association with the long-term outcomes in patients in whom it is already present.

Chronic total occlusion in the elderly co-occurs more frequently with other high-risk diseases, such as three-vessel disease or left main disease, compared to the younger population [20]; however, data showed that the older group can better benefit from this type of intervention [21, 22]. The current study showed that its frequency does not vary between age groups, but patients with concomitant diseases, such as DM2 and CKD or with higher mean BMI, are more prone to being at risk. This can be associated with the changes occurring at the vessel or plaque level in these diseases which favour the progress of the plaques leading to complete blockage of the vessel.

An unexpected finding was that none of the lipidic indicators was associated with a later performance of high-risk PCI, or the occurrence of any of the individual components from this term. This was contrary to other published studies.

Table 1. A results of a comperative analysis between HighRisk & nonHighRisk patients

	Non-HighRisk (n=90)	HighRisk (n=60)	P
x	51 (56.7%)	47 (78.3%)	0.006
Scheduled hospital admission	37 (41.1%)	29 (48.3%)	0.383
BMI>25	65 (72.2%)	41 (68.3%)	0.608
LM treat	0	19 (31.7%)	<0.001
LAD	36 (40.0%)	34 (56.7%)	0.045
DG	0	16 (26.7%)	<0.001
LCX	13 (14.4%)	21 (35.0%)	0.003
MG	5 (5.6%)	10 (16.7%)	0.026
RCA	32 (35.6%)	12 (20.0%)	0.040
Multivessel	0	40 (66.7%)	<0.001
Bifurcation	4 (4.4%)	18 (30.0%)	<0.001
STEMI	19 (21.1%)	9 (15.0%)	0.347
HT	84 (93.3%)	54 (90.0%)	0.544
DM	28 (31.1%)	24 (40.0%)	0.262
Hyperlipidaemia	55 (61.1%)	43 (71.1%)	0.183
HF	35 (38.9%)	32 (53.3%)	0.081
CKD	23 (25.6%)	21 (35.0%)	0.213
TIA	1 (1.1%)	0	1.000
PAD	5 (5.6%)	5 (8.3%)	0.522
CAD	6 (6.7%)	4 (6.7%)	1.000
Past Smoker	29 (32.2%)	15 (25.0%)	0.341
Prev MI (myocardial infarction)	24 (26.7%)	24 (40.0%)	0.086
ASA	77 (85.6%)	53 (88.3%)	0.624
Klopi	66 (73.3%)	42 (70.0%)	0.656
Tika	16 (17.8%)	14 (23.3%)	0.405
Statin	79 (87.8%)	54 (90.0%)	0.674
B-Blocker	71 (78.9%)	51 (85.0%)	0.347
ACEI/ARB	73 (81.1%)	54 (90.0%)	0.139
Calcium Blocker	29 (32.2%)	25 (41.7%)	0.238
Insuline	11 (12.2%)	6 (10.0%)	0.674
Metformin	16 (17.8%)	15 (25.0%)	0.285
SGLT2 inhibitors	4 (4.4%)	7 (11.7%)	0.117
Loop diuretic	48 (53.3%)	29 (48.3%)	0.548
NSTEMI	28 (31.1%)	18 (30.0%)	0.885
Weight			0.328
BMI			0.679
Age			0.538
EF			0.724
AcT			0.751
Fluoroscopy exposure			0.006
Contrast volume			0.006
CRP			0.479
Cholesterol			0.115
D-Dimer			0.940
Fibrinogen			0.091
Glucose			0.034
%HbA1C			0.718
HDL			0.389
INR			0.845
Creatinine			0.688
LDL			0.174
Urea			0.222
NT-proBNP			0.840
Potassium			0.010
Sód			0.558
Triglycerides			0.607
Troponin			0.363
WBC			0.054
RBC			0.753
HGB			0.521
PLT			0.616
MPV			0.492
Neutrofil			0.029
Lymphocyte			0.168

LM – left main coronary artery; LAD – left anterior descending; DG – diagonal branch; LCX – left circumflex artery; MG – marginal branch; RCA – right coronary artery; HT – hypertension; DM – diabetes mellitus; HF – heart failure; CKD – chronic kidney disease; TIA – transient ischemic attack; PAD – peripheral artery disease; CAD – coronary artery disease; BMI – body mass index

CONCLUSIONS

The high-risk PCI becomes more frequent as patients with multiple co-morbidities and complicated coronary status are often disqualified from surgical treatment. The rapid development of percutaneous methods, materials used in these procedures, and wide range of pharmacotherapeutic strategies, make it beneficial to qualify these patients for percutaneous treatment. The problem of complex vascular anatomy can also be partially solved by new imaging techniques, such as intravascular ultrasound and optical coherence tomography, which, however, makes the procedure much longer. The current study shows that patients with more complex procedures received both higher doses of contrast and greater fluoroscopy exposure. This may not be seem surprising, but may be a burden to later recovery and should be closely watched, especially in patients with co-morbidities, such as kidney failure. Planning of the procedure and assessment of the plaque and stent positioning should be performed with the highest possible precision, using the available tools in the high-risk PCI group, as their prognosis is worse than that patients with non-complex PCI [23, 24].

Research to date has not confirmed that mechanical circulatory support in patients with complex PCI wil be beneficial [25, 26]. However, the studies have mainly focused on intra-aortic balloon counter-pulsation, and no firm conclusions can be made about other methods of support.

Disclaimer and declaration

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Table 2. A results of a comperative analysis between Chronic Total Occlusion (CTO) & Multivessel characteristic

I	nCTO (n=131)	CTO (n=19)	P
Gender	83 (64.3%)	15 (71.3%)	0.527
Scheduled hospital admission	55 (42.6%)	11 (16.7%)	0.404
BMI>25	88 (68.2%)	18 (85.7%)	0.608
LM treat	19 (14.5%)	2 (10.5%)	1.000
LAD	60 (46.5%)	10 (47.6%)	1.000
DG	13 (10.1%)	3 (14.3%)	0.472
LCX	29 (22.5%)	5 (23.8%)	1.000
MG	14 (10.9%)	1 (4.8%)	0.696
RCA	38 (29.5%)	6 (28.6%)	0.934
Multivessel	36 (27.9%)	4 (19.0%)	0.395
Bifurcation	18 (14.0%)	4 (19.0%)	0.515
STEMI	26 (20.2%)	2 (9.5%)	0.368
HT	119 (92.2%)	19 (90.5%)	0.676
DM	40 (31.0%)	12 (57.1%)	0.020
Hyperlipidaemia	81 (62.8%)	17 (81.0%)	0.105
HF	54 (41.9%)	13 (61.9%)	0.087
CKD	33 (25.6%)	11 (52.4%)	0.012
Stroke	14 (10.9%)	2 (9.5%)	1.000
TIA	1 (0.8%)	0	1.000
PAD	7 (5.4%)	3 (14.3%)	0.148
CAD	7 (5.4%)	3 (14.3%)	0.148
Past Smoker	39 (30.2%)	16 (23.8%)	0.549
Prev MI	38 (29.5%)	10 (47.6%)	0.098
Weight	n		0.035
BMI	n		0.019
Age			0.950
EF			0.765
CRP			0.732
Cholesterol	n		0.444
Glucose			0.908
%HbA1C			0.427
HDL			0.673
Creatinine			0.343
LDL			0.175
Urea			0.616
NT-proBNP			0.593
Triglicerydes			0.726
RBC			0.900
HGB	n		0.343
PLT			0.681
MPV	n		0.762

II	nMultivessel (n=110)	Multivessel (n=40)	P
Gender	68 (61.8%)	30 (75%)	0.134
Scheduled hospital admision	50 (45.5%)	24 (40.0%)	0.552
BMI>25	83 (75.5%)	23 (57.5%)	0.033
LM treat	3 (2.7%)	16 (40.0%)	<0.001
LAD	42 (38.2%)	28 (70.0%)	<0.001
DG	1 (0.9%)	15 (37.5%)	<0.001
LCX	17 (15.5%)	17 (15.5%)	<0.001
MG	6 (5.5%)	9 (22.5%)	0.004
RCA	36 (32.7%)	8 (20.0%)	0.130
Bifurcation	5 (4.5%)	17 (42.5%)	<0.001
STEMI	20 (18.2%)	8 (20.0%)	0.800
HT	102 (92.7%)	46 (90.0%)	0.586
DM	40 (36.4%)	12 (30.0%)	0.469
Hyperlipidaemia	71 (64.5%)	27 (67.5%)	0.737
HF	47 (42.7%)	20 (50.0%)	0.428
CKD	33 (30.0%)	11 (27.5%)	0.766
Stroke	12 (10.9%)	4 (10.0%)	0.873
TIA	1 (0.9%)	0 (0.0%)	1.000
PAD	6 (5.5%)	4 (10.0%)	0.324
CAD	8 (7.3%)	2 (5.0%)	1.000
Past Smoker	35 (31.8%)	9 (22.5%)	0.268
Prev MI	33 (30.0%)	15 (37.5%)	0.384
Weight	n		0.529
BMI	n		0.056
Age			0.895
EF			0.941
CRP			0.801
Cholesterol			0.961
Glucose			0.031
%HbA1C			0.630
HDL	n		0.744
Creatinine			0.820
LDL			0.904
Urea			0.561
NT-proBNP			0.962
Triglicerydes			0.977
RBC			0.727
HGB	n		0.286
PLT			0.375
MPV	N		0.089

Table 3. Analysis of the results of the relationship between nonLMTreat & LMTreat patients

	nLMTreat (n=131)	LMTreat (n=19)	P
Gender	81 (61.8%)	17 (89.5%)	0.018
Scheduled hospital admission	54 (41.2%)	12 (63.2%)	0.072
BMI>25	92 (70.2%)	14 (73.7%)	0.757
LAD	59 (47.2%)	11 (44.0%)	0.770
DG	12 (9.6%)	4 (16.0%)	0.309
LCX	28 (22.4%)	6 (24.0%)	0.862
MG	14 (11.2%)	1 (4.0%)	0.468
RCA	38 (30.4%)	6 (24.0%)	0.521
Multivessel	26 (20.8%)	14 (56.0%)	<0.001
Bifurcation	15 (12.0%)	7 (28.0%)	0.059
STEMI	22 (17.6%)	6 (24.0%)	0.573
HT	121 (92.4%)	17 (89.5%)	0.664
DM	48 (36.6%)	4 (21.1%)	0.182
Hyperlypidaemia	83 (63.4%)	15 (78.9%)	0.182
HF	58 (44.3%)	9 (47.4%)	0.800
CKD	38 (29.0%)	6 (31.6%)	0.818
Stroke	15 (11.5%)	1 (5.3%)	0.695
TIA	1 (0.8%)	0	1.000
PAD	7 (5.3%)	3 (15.8%)	0.116
CAD	8 (6.1%)	2 (10.5%)	0.616
Past Smoker	41 (31.3%)	3 (15.8%)	0.165
Prev MI	39 (29.8%)	9 (47.4%)	0.124
Weight	N		0.291
BMI	n		0.741
Age			0.852
EF			0.837
CRP			0.907
Cholesterol	n		0.302
Glucose			0.009
%HbA1C			0.719
HDL	n		0.354
Creatinine			0.308
LDL	n		0.502
Urea			0.005
NT-proBNP			0.862
Triglicerydes			0.912
RBC			0.455
HGB			0.179
PLT			0.616

Comparison between age groups (materials to Fig. 1)?

	<75	<80	>=80	P
High Risk	27 (45.0%)	17 (28.3%)	16 (26.7%)	0.206

CTO x Age Categories (materials to Fig. 2)?

	CTO	P=0.349
<75	9 (13.4%)	
<80	7 (21.2%)	
>=80	5 (10.0%)	

LM treat x Age categories

	LM Treat	P=0.780
<75	9 (13.4%)	
<80	3 (9.1%)	
>=80	7 (14.0%)	

Multivessel & Age categories

	Multi-vessel	P=0.610
<75	17 (25.4%)	
<80	11 (33.3%)	
>=80	12 (24.0%)	

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