

Can mild anaemia increase the risk of complications in patients over 65 years of age compared to younger patients undergoing cardiac surgery?

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According to the World Health Organization (WHO), anaemia is a common symptom occurring in 23.9% of seniors [1]. Many retrospective studies suggest that non-cardiac surgery patients with preoperative anaemia have higher in-hospital mortality [2]. The importance of the pre-operative value of haematocrit is demonstrated by its use in the assessment of pre-operative risk on the the Society of Thoracic Surgeons score (STS) [3]. In a recent study, Kowalczyk-Wieteska *et al.* reported that mild anaemia (Ht 29.0–36.0% and Hb 5.6–6.8 mmol/l (10–12 g/dl) in women and Ht 29.0–39.0% and Hb 5.6–7.4 (10–13 g/dl) in men) did not increase the risk of complications in patients over 65 years of age compared to younger patients undergoing cardiac surgery.

The primary outcome was the in-hospital mortality. The secondary outcomes were as follows: paroxysmal atrial fibrillation *de novo*, bleeding within the chest, gastrointestinal bleeding, acute intestine necrosis, delirium, difficult wound healing of the sternum, pneumothorax, pleural liquid, haemofiltration, and intra-aortic balloon support (Table I).

The inclusion criteria involve: age ≥ 18 years old and mild anaemia diagnosed “*de novo*” on admission to the cardiac surgery clinic, or at the referral centre. The exclusion criteria involve: no anaemia, anaemia more severe than mild, blood transfusions within three months before cardiac surgery, taking iron, folic acid, or vitamin B₁₂ preparations during a period of 3 months before surgery.

In the presented manuscript, both younger and older patients met the criteria for iron deficiency anaemia with increased inflammatory parameters, which can be

classified as hospital-acquired anaemia (HAA) because 1/3 of patients had an acute coronary syndrome and, related to this fact, invasive procedures (coronarography, angioplasty) using thrombolytics due to paroxysmal or fixed atrial fibrillation. In both subgroups there were no significant differences in the preoperative loads, but paroxysmal atrial fibrillation was significantly more frequent in men ($p = 0.036$), which was associated with treatment with vitamin K antagonist (VKA), non-vitamin K antagonist oral anticoagulants (NOAC), or heparin. About 50% of patients before surgery chronically took aspirin. Sulimieri-Michalak *et al.* reported an over threefold increase in the ratio of anaemia chances when using both ASA and anticoagulants (VKA and NOAC) [4]. Additionally, in about 30% of patients, within 3 months before the operation, a myocardial infarction occurred, after which the patients received double antiplatelet therapy (aspirin and clopidogrel), which in 80% of elderly patients leads to gastrointestinal bleeding.

Among the limitations of the study, it should be noted that every fifth patient over 65 years old underwent a minimally invasive TAVI procedure, but no such procedure was performed in the group < 65 years old. The two examined populations were not matched as far as the duration or complexity of the cardiosurgery procedures are concerned, because of the small number of people under 65 years old ($n = 34$), which did not allow for reliable statistical calculations.

Conflict of interest

The authors declare no conflict of interest.

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Table I. Characteristic of patients

Parameter, norm	Before operation			After operation		
	< 65 y (n = 34)	≥ 65 y (n = 66)	P-value	< 65 y (n = 34)	≥ 65 y (n = 66)	P-value
Age	55.41 ±6.72	75.32 ±5.81	< 0.001	55.41 ±6.72	75.32 ±5.81	< 0.001
HT %:	32.73 ±4.01	32.20 ±3.01	0.71	33.51 ±2.57	33.29 ±2.66	0.74
Women: 37–47						
Men: 40–54						
Hb [mmol/l]:	6.65 ±0.81	6.58 ±0.72	0.93	6.74 ±0.65	6.79 ±0.56	0.61
Women: 6.8–9.0						
Men: 7.4–9.5						
Erythrocytes [mln/mm ³]:	3.62 ±0.55	3.64 ±0.42	0.63	3.71 ±0.37	3.76 ±0.38	0.73
Women: 3.5–5.2						
Men: 4.2–5.4						
Iron [μmol/l], 6.6–26.0	11.43 ±6.66	9.93 ±5.28	0.32	6.62 ±2.14	7.99 ±3.85	0.11
Ferritin [ng/ml], 15–150	275.56 ±765.31	198.03 ±228.90	0.86	407.94 ±746.03	328.88 ±240.5	0.69
Transferrin [g/l], 2–3.6	2.65 ±0.69	2.59 ±0.69	0.67	2.14 ±0.44	1.97 ±0.39	0.08
Reticulocytes %, 5–15	18.34 ±9.15	15.44 ±7.35	0.06	20.95 ±9.78	18.11 ±8.20	0.21
C-reactive protein [mg/l] 0–5	15.47 ±29.04	19.61 ±34.76	0.56	67.72 ±70.34	68.8 ±33.30	0.89
GFR glomerular filtration rate > 90 ml/min/1.73 m ²	53.41 ±11.16	53.58 ±9.77	0.65	55.02 ±9.32	53.21 ±10.6	0.26
Endocarditis (%)	5.88	4.55	0.85	5.88	4.55	0.85
Fa paroxysmalis (%)	8.82	19.7	0.25	17.65	13.64	0.81
Fa persistens	8.82	19.7	0.25	8.82	19.7	0.25
LICA, > 50 % stenosis/stent/ endarterectomy (%)	5.88	1.52	0.86	5.88	1.52	0.86
RICA, > 50 % stenosis/stent/ endarterectomy (%)	2.94	6.06	0.85	2.94	6.06	0.85
Stroke (%)	8.82	7.58	0.86	0.00	0.00	< 0.001
TIA (%)	2.94	3.03	0.55	0.00	0.00	< 0.001
Delirium (%)	0.00	1.52	0.73	2.94	6.06	0.82
Gastrointestinal bleeding (%)	2.94	1.52	0.79	0.00	3.03	0.79
Intestinal diverticula (%)	5.88	1.52	0.79	5.88	1.52	0.79
Morbus ulcerosus (%)	5.88	10.51	0.68	5.88	10.51	0.68
Chronic gastritis/duodenitis (%)	14.71	4.55	0.17	14.71	4.55	0.17
Cirrhosis hepatis (%)	2.94	3.03	0.55	2.94	3.03	0.55
Rheumatoid arthritis (%)	2.94	1.52	0.79	2.94	1.52	0.79
Lupus erythematosus (%)	0.00	1.52	0.27	0.00	1.52	0.27
Myocardial infarction < 3 months (%)	32.35	28.78	0.89	32.35	28.78	0.89
Stent implantation < 3 months (%)	6.56	10.20	0.77	6.56	10.20	0.77
Active cancer disease (%)	8.82	7.58	0.86	8.82	7.58	0.86

Table I. Cont.

Parameter, norm	Before operation			After operation		
	< 65 y (n = 34)	≥ 65 y (n = 66)	P-value	< 65 y (n = 34)	≥ 65 y (n = 66)	P-value
Aspirin (%)	47.06	51.52	0.83	47.06	51.52	0.83
Clopidogrel (%)	23.53	1.08	0.10	23.53	1.08	0.10
Brillique (%)	0.00	1.52	0.73	0.00	1.52	0.73
Heparin (%)	11.76	3.02	0.19	11.76	3.02	0.19
NOAC/VKA (%)	3.82	16.7	0.32	3.82	16.7	0.32
TAVI (%)	–	–	–	0.00	19.70	0.01
CABG (%)	–	–	–	35.29	16.67	0.86
OPCAB (%)	–	–	–	14.71	18.18	0.81
AVR (%)	–	–	–	14.71	16.15	0.73
AVR mini (%)	–	–	–	3.24	0.00	0.73
AVR + CABG (%)	–	–	–	2.94	10.61	0.34
RE AVR (%)	–	–	–	0.00	1.52	0.73
AVR + MV plasty (%)	–	–	–	0.00	4.55	0.52
AVR + MVR (%)	–	–	–	0.00	1.52	0.73
AVR + TV plasty (%)	–	–	–	0.00	3.03	0.79
TV plasty (%)	–	–	–	2.94	0.00	0.73
AVR + MV plasty + TV plasty (%)	–	–	–	2.94	0.00	0.73
RE TV plasty (%)	–	–	–	0.00	1.52	0.73
AAA + ASD (%)	–	–	–	2.94	0.00	0.73
TVR (%)	–	–	–	2.94	0.00	0.73
MVR + TV plasty (%)	–	–	–	2.94	0.00	0.73
Tamponade (%)	–	–	–	2.94	0.00	0.73
Sternum refixation (%)	–	–	–	2.94	0.00	0.73
ASDII (%)	–	–	–	2.94	0.00	0.73
Chest bleeding (%)	–	–	–	5.88	3.03	0.88
Acute intestine necrosis (%)	–	–	–	0.00	1.52	0.74
Complicated wounds (%)	–	–	–	0.00	1.52	0.74
Pneumothorax (%)	–	–	–	0.00	3.03	0.79
Pleural liquid (%)	–	–	–	8.82	3.03	0.42
Haemodiafiltration (%)	–	–	–	2.94	4.55	0.88
Intra-aortic balloon pump during operation (%)	–	–	–	0.00	4.55	0.52
Death (%)	–	–	–	2.94	4.55	0.88

Ht – haematocrit, Hb – haemoglobin, FA – atrial fibrillation, TIA – transient ischaemic attack, LICA – leftarteria carotis interna, RICA – right arteria carotis interna, NOAC – novel oral anticoagulants, VKA – vitamin K antagonists, TAVI – transcatheter aortic valve implantation, OPCAB – off-pump coronary artery bypass grafting, CABG – on-pump coronary artery bypass grafting, AVR – aortic valve replacement, RE AVR – reoperation aortic valve replacement, MVR – mitral valve replacement, MV plasty – mitral valve plasty, TVR – tricuspid valve replacement, TV plasty – tricuspid valve plasty, RE TV plasty – reoperation tricuspid valve plasty, ASD II – ostium secundum atrial septal defect, AAA – aneurysm operation.

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