



Characterization of Blood Donors with High Haemoglobin Concentration

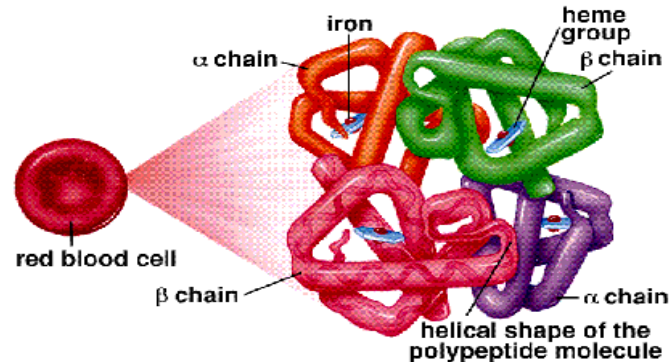
- 3rd IFBDO Seminar, 5. October 2013, Lucca
- Karin Magnussen, Hans Hasselbalch, Henrik Ullum, Ole Weis Bjerrum
Copenhagen University Hospital, Denmark

What is haemoglobin?

- A protein transporting oxygen
- Resides in the red cells

Hemoglobin Structure

- Four subunits
 - two α
 - two β
- Iron
- Heme
- Binds 4 O₂





Introduction

- Donors with abnormally high Hb are rare
- In collaboration with the depts. of clinical haematology, we have looked into the frequency and causes of high Hb in blood donors
- Also, leading up to this study 2 male donors were diagnosed with polycythaemia vera
 - A disease where red cells are produced with no control, like in cancer

Erythrocytosis (Too many red cells)

- Primary
 - Polycythaemia vera
- Secondary
 - Low oxygen, lung disease, smoking
 - Renal (kidney) artery stenosis
 - Increased EPO
 - Hypertension
 - Diabetes mellitus
 - Dehydration related to excessive intake of coffee, tea or alcohol as well as inadequate liquid intake

Method

- Donors with Hb above the WHO limit for polycythaemia vera at 2 donations were included
 - Woman with Hb > 10.2 Mm / 16.5 g/dl
 - Men with Hb > 11.5 Mm / 18.5 g/dl
- They were offered investigations by a specialist in clinical haematology, using JAK2 V617F and JAK2 exon12 tests, and a thorough clinical examination



Inclusion

- Over 2 years Nov. 2009 – Nov. 2011
- 224 357 donations (from app. 55 000 donors)
- 48 donors (35 women, 13 men) with 2x High Hb
 - 2 women declined
 - 1 because of current investigations of Diabetes Mellitus Type II
 - 1 because of a self-motivated reduction in smoking and coffee, which reduced her Hb from 10.3 mM / 16.6 g/dl to 9.5 mM / 15.3 g/dl at her next donation 6 months later
- 46 donors included (33 women, 13 men)

Data on the included donors together with data on the two donors previously diagnosed with PV

	Men with PV	Men no PV	Women no PV
N	4	11	33
Age	61	51	52
Mean (range)	(55-66)	(29-66)	(27-64)
Number donations	115	69	42
Mean (range)	(80-176)	(7-134)	(2-100)
Plethoric	4 (100%)	6 (55%)	5 (15%)
Hyper metabolic symptoms	2 (50%)	1 (9%)	0

Data on the included donors together with data on the two donors previously diagnosed with PV

	Men with PV	Men no PV	Women no PV
N	4	11	33
Smokers	1 (25%)	9 (82%)	29 (88%)

Smokers

- 85% of the high-Hb donors were smokers, while only 18% of our donors in general are smokers
- Although an increased prevalence of PV exists in cigarette smokers, non-smoking donors with high Hb may be suspected of having PV



	Men with PV	Men no PV	Women no PV	Significance
Hb mM Mean (range)	12.0 (11.6-12.6)	11.9 (11.6-12.4)	10.7 (10.3-11.5)	n.s.
Hb g/dl Mean (range)	19.3 (18.7-20.3)	19.2 (18.7-20.0)	17.2 (16.6-18.5)	n.s.
Hct % Mean (range)	54 (51-57)	51 (47-53)	46 (42-52)	p=0.037
EPO IU Mean (range)	3.4 (2.1-5.8)	8.8 (5.7-15.4)	9.4 (2.6-19.4)	p=0.002
MCV fl Mean (range)	79 (74-89)	92 (79-99)	92 (84-99)	p<0.000
Ferritin µg/l Geomean (range)	19 (9-36)	91 (36-194)	37 (15-493)	p=0.008
Leukocyte count 10 ⁹ /l Mean (range)	11.4 (6.5-21.0)	8.6 (5.2-13.1)	8.8 (4.2-16.3)	n.s.
Platelet count 10 ⁹ /L Mean (range)	280 (199-400)	22 (147-282)	280 (177-449)	n.s.

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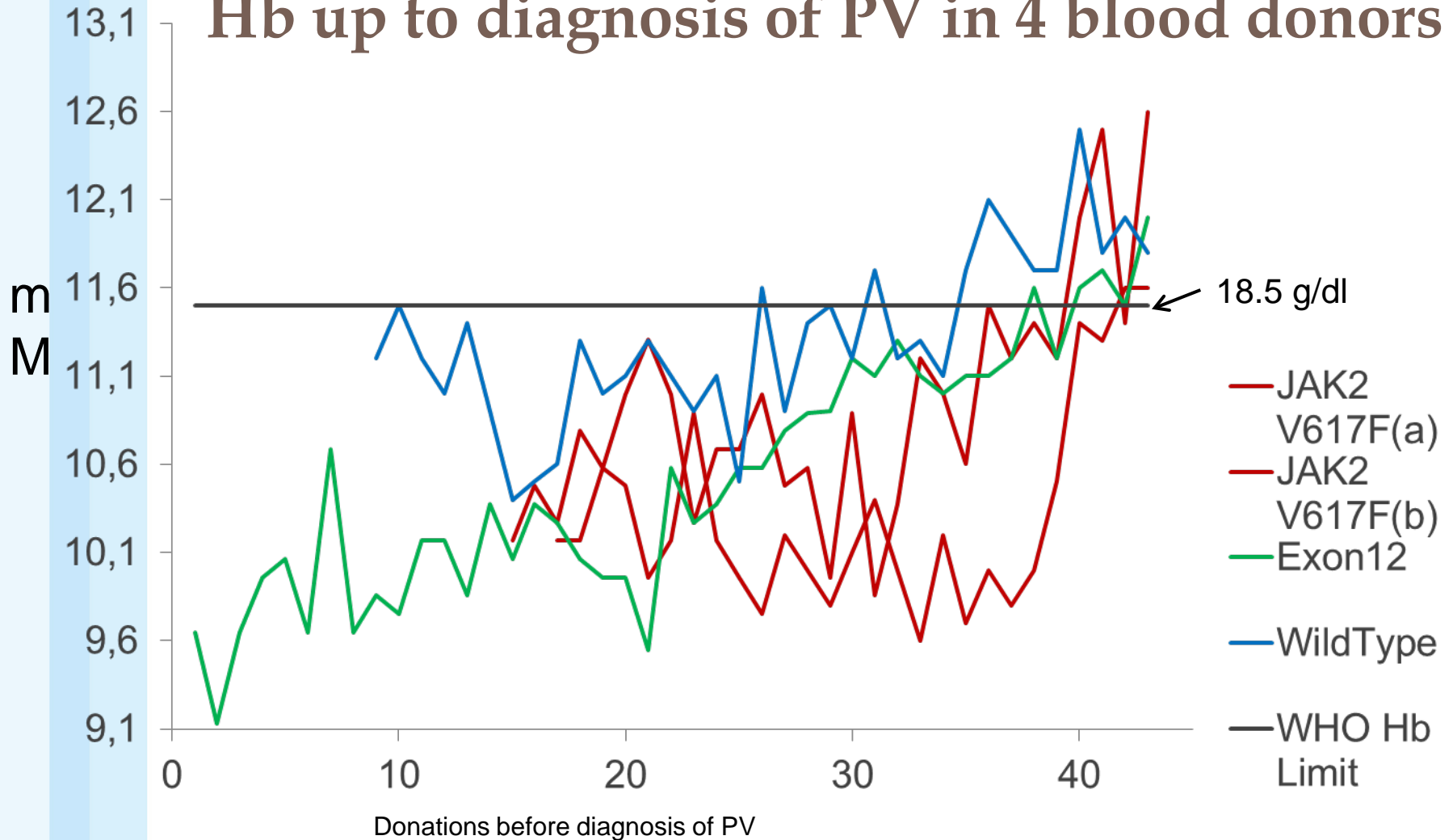
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Polycythaemia vera

- Of the 46 high-Hb donors 2 (4%) had PV
 - One JAK2 V617F pos. 59 y 99 donations
 - Hb was 11.6 mM / 18.7 g/dl and mutation load 37%
 - One JAK2 negative for V617F and exon12, endogenous erythroid colony assay pos. 66 y 103 donations
 - Hb 11.8 mM /19.0 g/dl
- The two donors found in the preceding year
 - One JAK2 V617F pos. 55 y 80 donations
 - Hb 12.6 mM /20.3 g/dl
 - One JAK2 exon 12 pos. 64y 176 donations
 - Hb 12.0 mM /19.3 g/dl

Hb up to diagnosis of PV in 4 blood donors



Frequency of Polycythaemia Vera

- PV is a rare disease, and higher prevalence among blood donors has been suggested
 - prevalence of 0.2% positive for JAK2 V617F in the Cph City Heart Study among 10 507 participants aged 20–95
- In the present study, only 0.02% of donations had Hb above the WHO level for investigating for PV
- In 3 years, we found 4 donors with PV, of whom only two were JAK2 V617F positive
- This does not suggest increased incidence in the donor population

PV and donation

- Donors diagnosed with polycythaemia vera are permanently deferred
- They need to receive treatment to prevent symptoms owing mainly to hyper viscosity

Hypertension

- 5 donors (11%) had severe hypertension

	Age	BP mmHg	Hb mM	Hb g/dl	Other diagnosis	Smoker
Woman	48	228/146	11.2	18.0	Kidney artery ste.	Yes
Woman	59	192/107	10.8	17.6	High cholesterol	Yes
Woman	55	180/100	10.5	16.9		Yes
Woman	47	230/114	10.5	16.9	DM II	Yes
Man	65	211/112	12.3	19.8		No

Diabetes mellitus

- Two women, 4%
 - 1 DM II and hypertension
 - 1DM II and myxoedema
- Also one donor was excluded from the study because of DM II diagnosed right after her last donation

Normal variation?

- One male donor (2%) was JAK2 *wild type*, and no cause of erythrocytosis was found
 - Hb 12 mM / 19.3 g/dl
- At his latest donation Hb was 10.9 mM / 17.6 g/dl

In all

- The clinical investigations identified
 - 10 donors (22%) were permanently deferred from blood donation
 - 34 (74%) continued as blood donors
 - 2 (4%) chose not to donate again
- In the group of high Hb donors, we found a high prevalence of morbidities (22%)
- And bare in mind that the risk of thromboembolic disease increases with increased Hct

Conclusion

- Among donors with high Hb
 - High prevalence of smokers (85%)
 - High prevalence of disease (22%)
 - PV
 - Hypertension
 - DM II
- PV should be suspected when donors with abnormally high Hb have iron-deficiency
- We did not find an increased prevalence of PV

Thank You

