Prevalence and Regional Distribution of Verweyst (Vw) Blood Group Antigen in Southeast Switzerland – Detection of a Local Hotspot

Roininen S. M.[1], Sigurdardottir S.[2], Engström C.[3], Song Y-L.[3], Heer S.[4], Heim N.[5], Zürcher M.[1,4], Gottschalk J.[5], Meyer S.[3], Frey B. M.[1]

[1] Blood Transfusion Service Zurich, Swiss Red Cross, Switzerland
[2] Department of Molecular Diagnostics and Cytometry, Blood Transfusion Service Zurich, Swiss Red Cross, Switzerland
[3] Department of Immunohematology, Blood Transfusion Service Zurich, Swiss Red Cross, Switzerland
[4] Blood Transfusion Service Chur, Swiss Red Cross, Switzerland
[5] Department of Screening, Blood Transfusion Service Zurich, Swiss Red Cross, Switzerland

DGTI 2021, Online Congress

Background

MNS blood group system is encoded by the genes *GYPA* and *GYPB*. Gene conversions between these highly homologous genes result in complex hybrid alleles. Verweyst (Vw, *GYPA*09*) is a low-frequency serologically "Miltenberger (Mia) positive" antigen formed by *GYP(A-B-A)* structure specific for c.140C>T substitution. The anti-Vw antibody has been shown to cause haemolytic transfusion reactions. A high prevalence of Vw has been reported in Grisons in southeast (SE) Switzerland (1.43%) (1). To elucidate the prevalence and local distribution patterns of Vw, we conducted screening in this potential "hotspot" area and in Zurich (ZH).

Methods

A total number of 2447 blood donor samples in SE Switzerland (Grisons) (SE Switzerland, n = 1521) and the Zurich area (ZH, n = 926) were collected (December 2019 – December 2020). An automated serological screening for Mi^a positivity (Mi^a+) was performed in microtiter plates by indirect antiglobulin test using a monoclonal anti-Mi^a antibody (GAMA210, Neo Iris, Immucor Inc.). False positive reactions were eliminated by retesting for Mi^a+ or by a direct agglutination test (DAT). DAT negative samples were serologically confirmed for Mi^a+ by standard tube technique. Genotyping of Mi^a+ samples for Vw specificity was performed by inhouse PCR-SSP kits capable of distinguishing between N- and M-linkage of *GYPA*09*. Donors with Vw were contacted by phone for family history.

Table 1. Characteristics and regional distribution of genetically confirmed GP.Vw cases.

Region	n valid	n anti-Mia-ab reactive	n genetically confirmed	% prevalence (N-Allele*)	% *GYPA*09* in N-antigen linkage	Allele FRQ	Prevalence summary	Allele FRQ summary
Surselva	191	1	0	0 (0%)				
Imboden	155	0	0					
Viamala	126	1	0	0 (0%)				
Landquart	184	6	2	1.09 (100%)	1	**0.54%**	**1.90%**	**0.95%**
Prättigau-Davos	238	6	6	2.52 (100%)	1	**1.26%**		
Plessur	56	0	0					
Albula	33	0	0					
Maloja	99	0	0					
Engadiana Bassa	51	0	0					
Bernina	69	0	0					
St. Gallen	319	4	1	0.31 (100%)	1	0.16%		
All regions Southeast Switzerland (Grisons)	**1521**	**18**	**9**	**0.59 (100%)**		**0.30%**		
Zurich	926	0	0					
All regions	**2447**	**18**	**9**	**0.37 (100%)**	**1**	**0.18%**		

Abbreviations: n: number; FRQ: frequency; pos.: positive; *: percentage *GYPA*09* in N-antigen linkage.

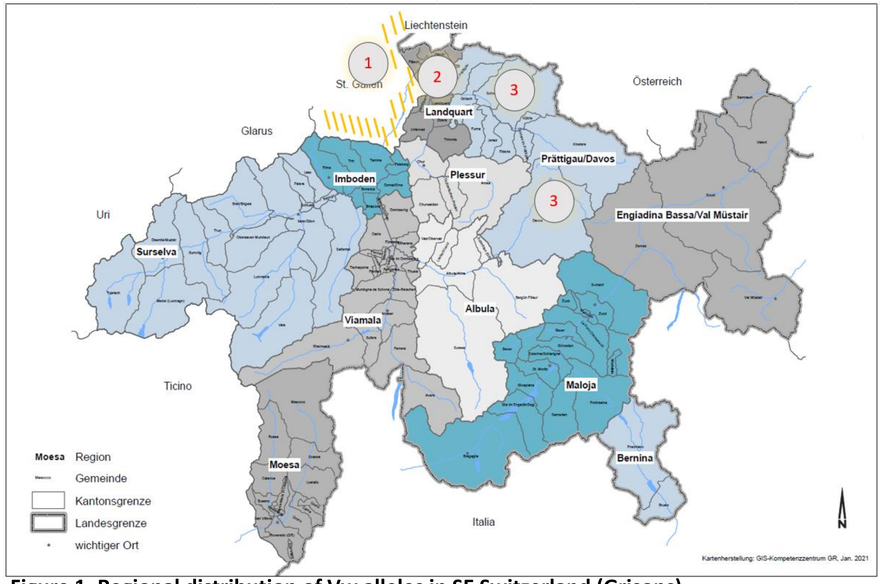

Figure 1. Regional distribution of Vw alleles in SE Switzerland (Grisons).
Numbers in circles represent the number of genetically confirmed Vw positive blood donors.
Map modified from www.gr.ch/DE/kanton/karte/Seiten/GraubuendenKarte.aspx

Results

Serological screening of all blood donors with anti-Mia antibody revealed reactivity in 18 samples (Table 1). Six of them reacted false positive in automated screening and three had a positive DAT. All valid Mia+ donors originated from SE Switzerland (Grisons) (0.59%) and were typed to carry a *GYPA*09* allele in N-antigen linkage. A detailed geographical mapping revealed a hotspot region (8/9) in northern Grisons (Figure 1) with an estimated prevalence of 1.90% and a *GYPA*09* allele frequency of 0.95%. This area covers two neighbouring valleys from Davos to Landquart. All donors were of Swiss origin with a family history of ≥2 generations in that region in most of the cases. Two donors could also be identified as relatives. No Vw allele was detected amongst ZH donors. This is in concordance with a previous study with an estimated prevalence of 0.1% of Vw positive donors in canton ZH (2).

Conclusions

A local geographical hotspot for Vw positive donors was discovered in two northern Grisons valleys in SE Switzerland with a remarkably higher prevalence than usually in Caucasian population (0.06%) and even higher than previously reported for that region (1.43%) (1). Swiss origin and family history suggest Vw to be prevalent in this region for several generations.

References

(1) Daniels (2013), Human Blood Groups, 3rd edition.
(2) Meyer et al. (2016), Br J Haematol., 174:624-36.