



# Fetomaternal hemorrhage in delivery

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## AIM OF THE STUDY

To determine the incidence and volume of fetomaternal hemorrhage (FMH) in delivery, identify risk factors, which lead to excessive FMH. Determination of these variables would enable optimization of guidelines for RhD alloimmunization prophylaxis.

## WORKING HYPOTHESIS

Immunoglobulin (Ig) G anti-D in a dose of 10 µg administered intramuscularly should cover 0.5 mL of fetal RhD positive red blood cells (RBCs) or 1mL of whole fetal blood. FMH is fetal RBC volume; fetal blood volume is double (expected fetal hematocrit is 50%). In the great majority of deliveries, less than 2.5 mL of fetal RBCs (5 mL of whole fetal blood, sufficient dose of IgG anti-D 50 µg) enter the maternal circulation. Contrarily, only rarely does FMH exceeding 5 mL (10 mL of whole fetal blood, sufficient dose of IgG anti-D, 100 µg) occur and **delivery by cesarean section, forceps delivery, vacuum extraction, spontaneous twin delivery, manual placental removal and curettage for retained fragments do not present a risk factor.**

## METHODS

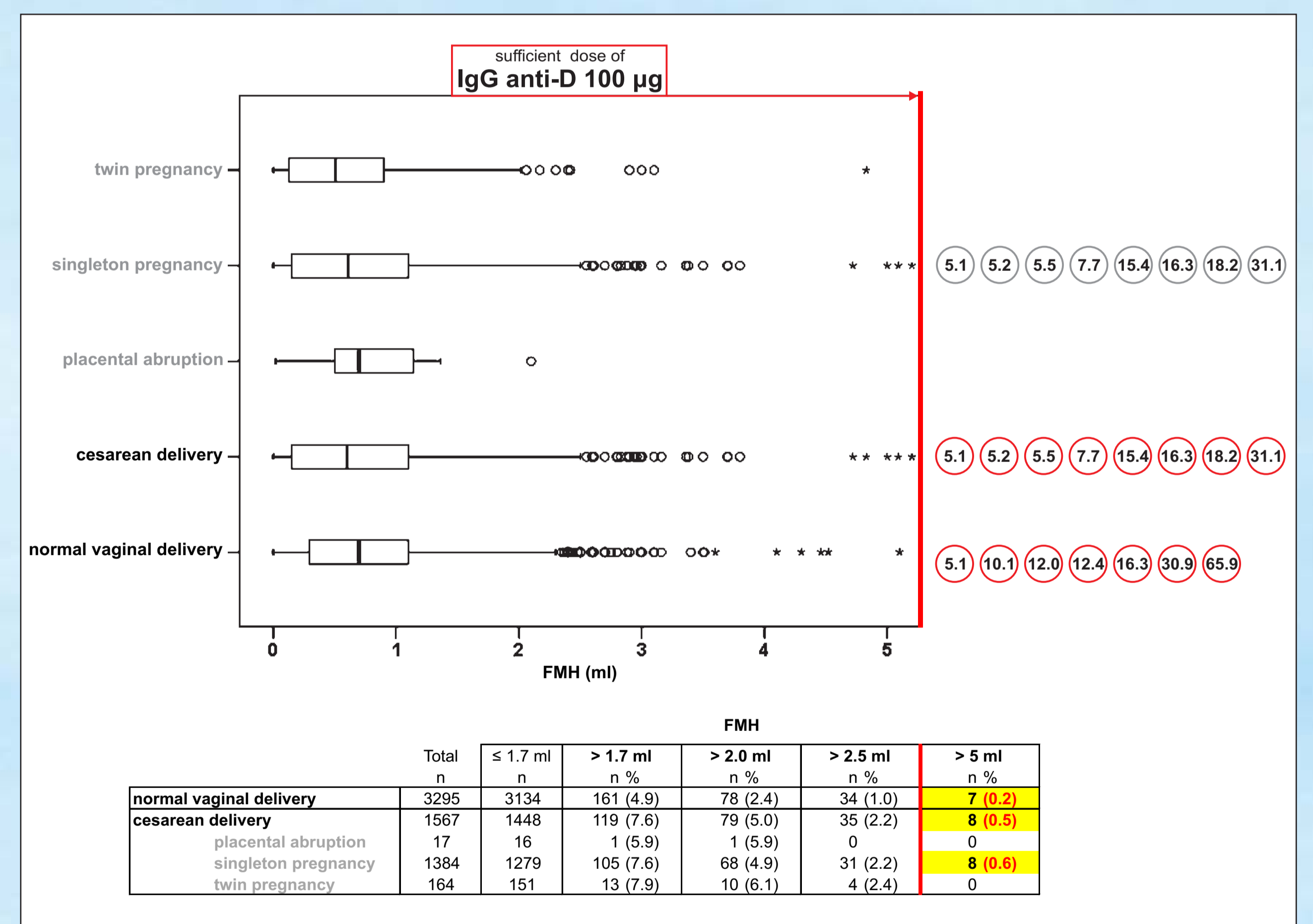
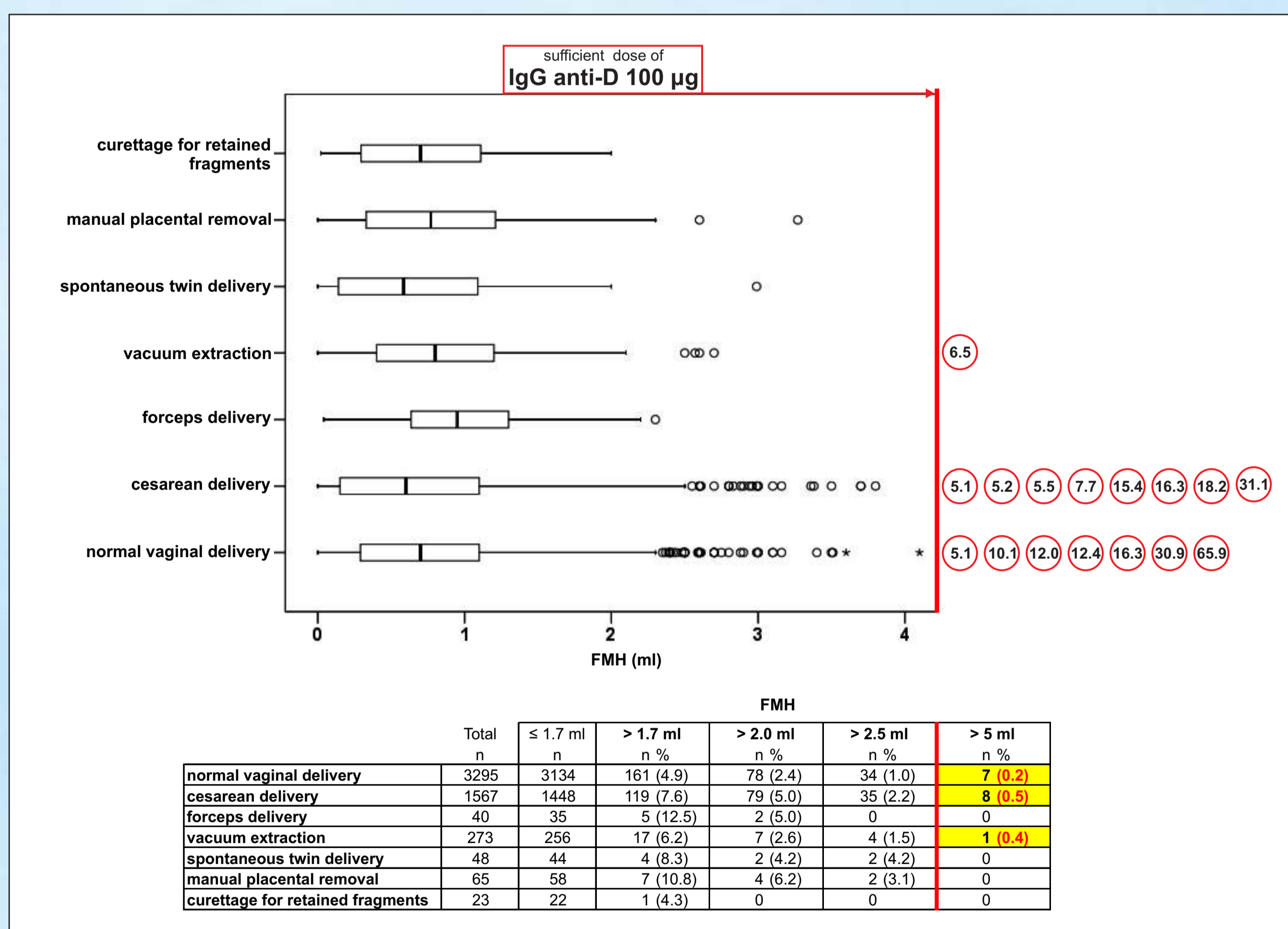
In a prospective cohort study, a total of **5334** examinations were performed after delivery. FMH was assessed by flow cytometry. (FMH is fetal red blood cell [RBC] volume; fetal blood volume is double [expected fetal hematocrit is 50%]).

## RESULTS

The fetal RBC volume diagnosed in maternal circulation after delivery ranged from insignificant FMH ≤ 0.1 mL to excessive FMH = 65.9 mL (median, 0.7; mean, 0.79; SD, 1.38). FMH > 2.5 mL (immunoglobulin [Ig] G IgG anti-D insufficient dose **50 µg**) was observed in **1.5%** (79/5334) and excessive volumes of FMH > 5mL (insufficient dose, **100 µg**) in **0.32%** (17/5334). Delivery by cesarean section presented a higher risk of incidence of FMH > 2.5 mL (odds ratio 2.2; p 0.002) when compared with normal vaginal delivery. It did not, however, present a statistically significant risk factor for the incidence of excessive volumes of FMH > 5mL. Forceps delivery, vacuum extraction, spontaneous twin delivery, manual placental removal and curettage for retained fragments did not present a statistically significant risk factor for volumes of FMH > 2.5 mL or > 5.0 mL.

## CONCLUSION

During normal vaginal delivery FMH < 5 mL occurs in the great majority of cases, and thus for the prevention of RhD alloimmunization, **an IgG anti-D dose of 100 µg should be sufficient.** Contrarily, only rarely does greater FMH occur and delivery by cesarean section, forceps delivery, vacuum extraction, spontaneous twin delivery, manual placental removal and curettage for retained fragments do not present a risk factor.



Delivery Method	FMH (ml)	n (%)	Control group n (%)	Odds Ratio	Lower	Upper	P value
forceps delivery	> 1.7	5/40 (12.5)	161/3295 (4.9)	2.8	1.1	7.2	0.046
	> 2.0	2/40 (5.0)	78/3295 (2.4)	2.2	0.5	9.2	0.249
	> 2.5	0	34/3295 (1.0)				
	> 5	0	7/3295 (0.2)				
vacuum extraction	> 1.7	17/273 (6.2)	161/3295 (4.9)	1.3	0.8	2.2	0.312
	> 2.0	7/273 (2.6)	78/3295 (2.4)	1.1	0.5	2.4	0.835
	> 2.5	4/273 (1.5)	34/3295 (1.0)	1.4	0.5	4.0	0.531
	> 5	1/273 (0.4)	7/3295 (0.2)	1.7	0.2	14.1	0.471
spontaneous twin delivery	> 1.7	4/48 (8.3)	161/3295 (4.9)	1.8	0.6	5.0	0.297
	> 2.0	2/48 (4.2)	78/3295 (2.4)	1.8	0.4	7.5	0.320
	> 2.5	2/48 (4.2)	34/3295 (1.0)	4.2	1.0	17.9	4.170
	> 5	0					
manual placental removal	> 1.7	7/65 (10.8)	161/3295 (4.9)	2.3	1.1	5.2	0.042
	> 2.0	4/65 (6.2)	78/3295 (2.4)	2.7	1.0	7.6	0.073
	> 2.5	2/65 (3.1)	34/3295 (1.0)	3.0	0.7	13.0	0.153
	> 5	0					
curettage for retained fragments	> 1.7	1/22 (4.5)	161/3295 (4.9)	0.9	0.1	6.9	1.000
	> 2.0	0					
	> 2.5	0					
	> 5	0					

Delivery Method	FMH (ml)	n (%)	Control group n (%)	Odds Ratio	Lower	Upper	P value
cesarean delivery (CD)	> 1.7	119/1567 (7.6)	161/3295 (4.9)	1.6	1.3	2.0	0.0002
	> 2.0	79/1567 (5.0)	78/3295 (2.4)	2.2	1.6	3.0	<0.0001
	> 2.5	35/1567 (2.2)	34/3295 (1.0)	2.2	1.4	3.5	0.002
	> 5	8/1567 (0.5)	7/3295 (0.2)	2.4	0.9	6.7	0.097
CD - placental abruption	> 1.7	1/17 (5.9)	161/3295 (4.9)	0.2	0.2	9.2	0.575
	> 2.0	0					
	> 2.5	0					
	> 5	0					
CD - singleton pregnancy	> 1.7	105/1384 (7.6)	161/3295 (4.9)	1.6	1.2	2.1	0.0004
	> 2.0	68/1384 (4.9)	78/3295 (2.4)	2.1	1.5	3.0	<0.0001
	> 2.5	31/1384 (2.2)	34/3295 (1.0)	2.2	1.3	3.6	0.002
	> 5	8/1384 (0.6)	7/3295 (0.2)	2.7	1.0	7.5	0.051
CD - twin pregnancy	> 1.7	13/164 (7.9)	161/3295 (4.9)	1.7	0.9	3.0	0.096
	> 2.0	10/164 (6.1)	78/3295 (2.4)	2.7	1.4	5.3	0.008
	> 2.5	4/164 (2.4)	34/3295 (1.0)	2.4	0.8	6.8	0.103
	> 5	0					