Does Heparin Dosage Calculated with Ideal Body Weight Reduce Blood Product Use in Open Heart Surgery?

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Background and Aim

Heparin is used for its anticoagulant effects and requires neutralization after cardiopulmonary bypass. Anticoagulant efficacy in open heart surgery (OHS) is established with heparin dosages calculated based on patient actual weight. When heparin is administered based on ideal body weight (IBW) rather than actual weight in OHS, changes are observed in activated clotting time (ACT) sufficiency, protamine neutralization dosage, postoperative drainage and blood product transfusion.

Materials and Methods

After ethical committee approval, 100 adults requiring OHS were included. Patients were divided into two equal groups. The amount of heparin was calculated from 350 IU/kg based on actual body weight in Group 1 and IBW in Group 2. ACT was measured after 5 min, and an additional heparin dose was given if ACT<400 before cardiopulmonary bypass. Demographic characteristics, intraoperative data, transfusion and heparin-protamine levels were compared between the two groups. Drainage at postoperative hours 6 and 24, blood transfusion, reoperation, complications, time in intensive care and mortality were also compared.

Results and Discussion

Mean ages were 59.3 ± 11.36 in Group 1 and 59.78 ± 10.34 in Group 2. Heparin doses before cardiopulmonary bypass were lower in Group 2 (p<0.001). Intra- and postoperative Erythrocyte and fresh frozen plasma transfusions were higher in Group 1 (p<0.001). Protamine requirement was lower in Group 2 (p<0.001). Drainage and length of intensive care stay at postoperative hours 6 and 24 were higher in Group 1 (p<0.001).

Conclusion(s)

Greater use of heparin in OHS can lead to greater postoperative blood/blood product and protamine use and it increases side-effects. In many cases less heparin usage provides enough ACT levels. In our study, less heparin and protamine were used when administered according to IBW, and complication levels and transfusion requirements were also lower.

Table 1. Preoperative characteristics of the study population			
	Group I	Group II	p value
Age (years) (mean±SD)	59.3±11.3	59.78±10.34	0.72
Gender; Female/male, n(%)	%52	%76	0.07
Height (cm)	165.8±7.4	163.6±9.7	0.35
Actual body weight (kg) (mean±SD)	74.0±11.0	73.0±15.7	0.53
Ideal body weight (kg) (mean±SD)	-	59.8±8.0	-
Diabetes n(%)	9 (%36)	9 (%36)	1.00
Dyslipidaemia n(%)	6 (%24)	6 (%24)	1.00
Hypertension n(%)	13 (%52)	14 (%54)	0.77
Smoker n(%)	5 (%20)	6 (%24)	0.73
COPD n(%)	5 (%20)	7 (%28)	0.50
OSAS	0 (%0)	0 (%0)	-
Stroke	0 (%0)	0 (%0)	-
Renal failure	0 (%0)	0 (%0)	-
Heart disease			0.64
Ischaemic	19 (%76)	20 (%80)	
Valvular	4 (%16)	2 (%8)	
Ischaemic, valvular	2 (%8)	3 (%12)	
Antiplatelet agents			0.18
None	19 (%76)	17 (%68)	
Acetylsalicyclate	2 (%8)	7 (%28)	
Warfarin	1 (%4)	0 (%0)	
Clopidogrel	3 (%12)	1 (%4)	
SD: standart deviation, COPD: chronic obstructive pulmonary disease, OSAS: obstructive sleep apnoea syndrome			

Table 2. Laboratory data of the study population(mean±SD)			
	Group I	Group II	p value
Haemoglobin (gr/dL)	14.2±1.6	14.9±1.3	0.07
Haematocrit (%)	42.2±6.0	45.1±4.1	0.10
Platelets (10 ⁹ L ⁻¹)	239,7±68	265,4±64	0.18
Phrothrombin time (10.5-14.9 sn)	13.2±1.58	12.7±0.8	0.28
Aptt (21-35sn)	25.8±5.0	25.0±2.3	0.79
Fibrinogen (180-350 mg/dL)	353.0±48.4	326.1±73.8	0.11
SD: standart deviation, aPTT: activatedpartialthromboplastin time			

Table 3. Intra- and postoperative data of the study population			
	Group I	Group II	p value
Surgery type, n (%)			0.34
CABG	19 (%76)	20 (%80)	
AVR	1 (%4)	0 (%0)	
MVR	3 (%12)	1 (%4)	
CABG, MVR	2 (%8)	1 (%4)	
CABG, AVR	0 (%0)	1 (%4)	
AVR, MVR	0 (%0)	4 (%8)	
CPB time (sn) (mean±SD)	77.0±20.2	83.4±31.5	0.48
Aortic clamp time (sn) (mean±SD)	53.4±18.4	54.6±38.7	0.08
RBC (units) (mean±SD)	3,96±2.23	1.48±0.51	<0.001*
Platelets (units) (mean±SD)	0	0	-
FFP (units) (mean±SD)	2.12±1.01	1.12±0.67	<0.001*
Fibrinogen (180350 mg/dL) (mean±SD)	0	0	-
Heparin initial dose (IU) (mean±SD)	21856.0±3505.6	17964.0±2400.5	<0.001*
Reinjection dose n (%)	0 (%0)	6 (%24)	0.02*
Total heparindose (IU) (mean±SD)	21856.0±3505.6	18824.0±3527.9	0.004*
Protamin dose (IU) (mean±SD)	33500.0±5199.9	26618.0±4066.7	<0.001*
ACT-1 (sn) (mean±SD)	124.3±20.5	142.6±20.8	0.005*
ACT-2 (sn) (mean±SD)	605.2±20.5	526.7±74.1	0.002*
ACT-3 (sn) (mean±SD)	117.5±14.8	127.8±12.4	0.001*
Blood loss – H6 (mL) (mean±SD)	548.0±108.4	403.2±101.2	<0.001*
Blood loss– H24 (mL) (mean±SD)	770.0±170.7	596.4±149.6	<0.001*
Post-op RBC (units) (mean±SD)	2.3±0.9	1.56±0.5	0.001*
Post-op platelet (units) (mean±SD)	0	0	-
Post-op FFP (units) (mean±SD)	2.3±0.6	1.0±0.7	<0.001*
Reoperation n(%)	3 (%12)	2 (%8)	1.00
Complication			0.35
None	19 (%76)	21 (%84)	
Stroke	2 (%8)	0 (0)	
Sepsis	2 (%8)	1 (%4)	
Acute renal failure	1 (%4)	0 (%0)	
Respiratuar complication	1 (%4)	3 (%12)	
Length of ICU stay (days) (mean±SD)	3.8±1.2	3.0±0.9	0.005*
Mortality n(%)	5 (%20)	2 (%8)	0.41
*: statisticallysignificant, SD: standart deviation, Valuesareexpressed as mean, SEM, or n (%). FFPr6, freshfrozenplasma; H24, 24th hourpostoperation; H6, sixthhourpostoperation;			