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ASA ABSTRACTS

A905

Title: HEMODYNAMIC EFFECTS OF THE PNEUMATIC TOURNIQUET IN PATIENTS WITH AND WITHOUT CARDIOVASCULAR DISEASE.

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Since the introduction of the pneumatic tourniquet in 1904, a detailed study of its hemodynamic effects has not been reported. We describe the hemodynamic changes associated with tourniquet inflation and release in patients with and without cardiovascular disease.

Twenty ASA I - III patients, ages 24 to 79 years, scheduled for knee operations, gave informed consent to a protocol approved by the institution. Group I (n = 10) patients had no evidence of cardiac disease; they underwent knee arthrotomy or tibial osteotomy. Patients with known cardiovascular disease (n = 10) comprised Group II and underwent knee replacement or tibial osteotomy. Three patients had ECG evidence of myocardial ischemia, 2 had an old myocardial infarction, and 5 had hypertension. Their cardiovascular medications were continued until the day of operation. All patients received general anesthesia (N_2O-O_2-enflurane and fentanyl). Pulmonary and systemic hemodynamic measurements were made before and during tourniquet inflation (300 - 400 mm Hg; duration 115 - 129 min) and after tourniquet release. Arterial blood gases and end-tidal CO_2 were also measured. Data was analyzed by analysis of variance.

Important hemodynamic changes occurred after 45 min and continued during tourniquet application. These changes were significantly higher in patients with cardiovascular disease. Arterial pressure increased from 130/84 to 156/92 mm Hg ($P < 0.05$) in Group I and from 148/88 to 185/96 in Group II patients. Pulmonary arterial pressures also increased significantly. Pulmonary wedge pressure increased from 11 ± 2 to 26 ± 3 mm Hg in Group II patients. Myocardial ischemia (ECG) worsened in three patients; infusion of nitroglycerin reversed these changes. Release of the tourniquet was associated with significant decreases in systemic and pulmonary arterial pressures and an increase in cardiac output. End-tidal CO_2 and arterial PCO_2 increased significantly.

Tourniquet-induced hemodynamic changes may be deleterious to myocardial oxygenation. The increases in afterload, wedge pressure and heart rate augment myocardial oxygen consumption. Myocardial contractility is also altered as reflected by the increase in wedge pressure. Such changes can explain the worsening of myocardial ischemia. Although Group I patients exhibited a similar trend in their hemodynamic responses to tourniquet inflation, the magnitude of these changes was less intense.

Tourniquet release causes abrupt and significant reductions in both pulmonary and systemic pressures. This may decrease myocardial O_2 supply. Indeed, acute myocardial infarction occurred in one patient. Elevation of end-tidal and arterial PCO_2 following tourniquet release also increases intracranial pressure.

In conclusion, use of the pneumatic tourniquet may be hazardous in patients with a compromised myocardium.

A906

TITLE : **The rationale for performing normovolemic hemodilution (NH) the day before surgery.**

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A variety of blood salvage technics are now communly used in order to avoid infections diseases related to homologus transfusions. Among these technics, peroperative NH is still not routinely used since it is time consuming and since plasma substitutes could induce hemostatic alterations (1). In order to estimate the most suitable moment for performing NH, this work aimed to study the time-course of blood components 1 hour and 20 hours before surgery.

METHODS

After obtaining institutional approval, 23 ASA I-II patients (62.3 ± 8.1 years) sheduled for total hip replacement were hemodiluted the day before surgery (mean delay : 20.6 ± 3.6 hours). The volume of blood withdrawn was calculated in order to obtain a post NH hematocrit close to 30% (mean : 29.9 ± 4.5 %). Simultaneously 150% of this volume was replaced using a 6% dextran 60 solution. Blood mass was isotopically (cr 51) determined in only 6 patients 1 hour and 20 hours after NH. The following data : Hgb, Hct, bleeding time (BT), PT, PTT, plasma oncotic pressure, albuminemia, pre-albuminemia, $\alpha1$, $\alpha2$, β,γ globulins and immuno globulins A, G, and M, were determined before NH (control value), 1 hour (NH + 1) and 20 hours (NH + 20) after NH. Results are expressed as mean ± SD and compared using paired student t tests.

RESULTS

The mean amount of blood withdrawn was 966 ± 204 ml and the isotopical measures confirmed that the whole blood volume remained stable between NH + 1 AND NH + 20. There was no significant alteration in BT, PT, PTT. Changes in other parameters are shown in the table.

Our results regarding the rapid correction of plasma volume and protein stores after acute anemia are in agreament with those in the literature (2,3). It is concluded that performing NH the day before surgery is i) easier for the medical team and more confortable for the patient ii) the partial restoration of the decrease in red cells and proteins improves the humoral immunologic status of the patient during surgery iii) this latter effect could account for the decrease in the post operative morbidity when the patient is not transfused (4).

1) - Thromb. Hemost. 54, 697-699, 1985.
2) - Am. J. Physiol. 210, 57-62, 1966.
3) - Surg. Gynecol. Obstet. 152, 983-996, 1967.
4) - Am. J. Surg. 152, 479-482, 1986.

	CONTROL	NH + 1	NH + 20
Hgb (g/dl)	14.3 ±2	10.4 ± 0.9	11.5 ± 0.6*
Hct (%)	42.6 ± 5.4	29.8 ± 4.5	33.9 ± 4.8*
Alb. (g/l)	40 ± 4.3	26.9 ± 2.4	31.2 ± 2.8*
Pre-Alb(g/l)	0.4 ± 0.1	0.2 ± 0.04	0.28 ±0.05*
α1 (g/L)	2.2 ± 0.5	1.2 ± 0.3	1.9 ± 0.4*
α2 (g/L)	5.6 ± 0.9	3.5 ± 0,5	4.2 ± 0.8*
β (g/l)	8.6 ± 1.2	5.2 ± 0.8	6.5 ± 1*
γ (g/l)	11 ± 2	6.7 ± 0.9	7.9 ± 1*
Immunoglob. A (g/l)	2.5 ± 0,9	1.2 ± 0.5	1.5 ± 0.7
Immunoglob. G (g/l)	13.6 ± 1.6	7.2 ± 1.5	9.1 ± 1.7*
Immunoglob. M (g/l)	0.9 ± 0.2	0.5 ± 0.2	0.6 ± 0.2
Oncotic Pressure (mmHg)	29 ± 4.3	34.3 ± 5.6	27.7 ± 8.3

*P < 0,05 between NH + 1 and NH + 20