Hemodynamic Effects of Intermittent Pneumatic Compression of the Lower Limbs During Laparoscopic Cholecystectomy

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BACKGROUND: The effects of surgical pneumoperitoneum on lower-limb venous hemodynam-ics have already been studied; however, the effects of intermittent compression boots are not known in such venous-stasis conditions.

METHODS: In 12 volunteers and 12 patients, the venous hemodynamic effects of intermittent leg compression were studied under external abdominal pressure or during laparoscopic cholecystectomy, respectively. Femoral venous diameter and velocity were measured. Venous pressure was monitored during the surgical procedures.

RESULTS: External abdominal pressure of 50 mm Hg and pneumoperitoneum were found to increase the diameter (17% in the volunteers and 14% in the patients) and decrease peak velocity (49% and 32%, respectively) in the femoral vein. Femoral pressure was increased (106%) during pneumoperitoneum. In both venous-stasis circumstances, intermittent compression of the legs restored venous flow velocity, but had no effect on vessel diameter and pressure.

CONCLUSIONS: The lower-limb venous hemodynamic changes were similar during external abdominal pressure or pneumoperitoneum, and the flow velocity decrease was intermittently reversed by pneumatic compression boots. *Am J Surg.* 1995;170:395-398.

Minimally invasive laparoscopic surgery is becoming increasingly popular because of its advocated lower morbidity and mortality.[1]-' This well-codified technique also reduces pain and enables earlier mobilization of patients.[3,4] Even though the rate of major complications after this type of surgery seems low, the precise incidence of deep venous thrombosis and pulmonary embolism and, consequently, the potential benefit of thromboembolism prevention have never been objectively documented. Nevertheless, the pneumoperitoneum created during the operation is able to induce major venous stasis in the lower extremities that could contribute to the development of a throm-botic process.[5,5] The principal aim of our project was to study the effects of intermittent pneumatic compression boots, a widely used nonpharmacologic thromboembolism prophylactic method, on venous hemodynamics during surgical pneumoperitoneum. Before studying patients during laparoscopic cholecystectomy, we developed an original, noninvasive model of external abdominal pneumatic compression in norrrtal volunteers to simulate the stasis effects of die pneumoperitoneum.

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Manuscript submitted December i2, 1994 and accepted in revised form March 30, 1995.

METHODS

Twelve male volunteers with a mean age (± standard deviation) of 34 ± 7 years, and 12 patients who were ASA grade I or II (7 women and 5 men) with a mean age of 53 ± 20 years were recruited for 2 different protocols to study the effects of intermittent pneumatic compression boots under venous-stasis conditions of the lower extremities. In the first protocol, stasis was induced by external abdominal pressure, and in the second, by surgical pneumoperitoneum during elective laparoscopic cholecystectomy. Both studies were approved by the Ethics Committee of the Department of Surgery of our institution, and all volunteers and patients gave written informed consent. Volunteers and patients with history of thromboembolism or varicose veins were excluded.

Noninvasive Abdominal Pressure

External abdominal pressure was obtained by a 10-cm-wide pneumatic cuff rolled up around the abdomen of supine volunteers. The inflation of the cuff was provided by a plethysmograph air compressor under sphygmomano-metric control (Plethysmograph SP2, Medimatic, Copenhagen, Denmark). To obtain significant hemodynamic changes in the lower legs to simulate the pneumoperitoneum venous-stasis effects, we tested the hemodynamic consequences of different pressure levels (25, 50, and 75 mm Hg) maintained during 3 minutes, after which the abdominal compression was interrupted to allow pressure to return to baseline values. To study the pneumatic boots' compression effects during a period of lower-leg venous stasis, an abdominal pressure level of 50 mm Hg was chosen for all volunteers and was maintained during 2 monitoring