

Thromboprophylaxis for videolaparoscopic cholecystectomy*

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Based in a case of a patient who developed pulmonary embolism three days after a laparoscopic cholecystectomy in spite of using unfractionated heparin starting before surgery and maintained in the first 24hs postoperatively. The authors have analysed the risk factors and the rate of VTE in laparoscopic cholecystectomy, the use of thromboprophylaxis and suggested procedures that should be adopted.

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INTRODUCTION

Deep venous thrombosis (DVT) and pulmonary thromboembolism (PTE) are potentially avoidable manifestations of venous thromboembolism (VTE). It is well known that VTE causes morbidity and mortality among surgical patients. In the short term, VTE can lead to fatal pulmonary embolism and in the medium term it can evolve to post-thrombotic venous insufficiency or chronic thromboembolic pulmonary hypertension.

Primary prophylaxis for VTE has been highly recommended in the medical literature, especially after the first consensus on the subject was published in 1986⁽¹⁾. Surgical patients are under constant threat of thromboembolic complications, and the levels of prophylaxis adopted apply to groups stratified by risk that are classified in accordance with Chart 1:

Even though a great number of studies show that preventive treatment is effective, albeit less than absolute, prophylaxis for VTE is still underutilized.⁽³⁾

Laparoscopy is a procedure that is being used with increasing frequency. Laparoscopic cholecystectomy (LC) was first performed in the early 1980s. In comparison to conventional surgery, LC provides less surgical trauma, reduced postoperative pain with early postoperative mobility, shorter hospital stay (and consequent lower cost) and better aesthetic results⁽⁴⁻⁶⁾.

Such findings may wrongly suggest that the risk of postoperative VTE in laparoscopic surgeries is minimal. However, some factors inherent to VL tend to increase the risk of thrombosis:

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1. Longer duration of the surgical intervention, at least until the technique is improved^(4,7);
2. Insufflation pressure used in pneumoperitoneum causes venous ectasia in the lower limbs after inferior vena cava and iliac compression^(4,8);
3. The reverse Trendelenburg position (supine, inclined), which is necessary for appropriate visual access to the organs, especially in cholecystectomy, accentuates venostasis risk⁽⁸⁾;
4. Hypercoagulability induced by pneumoperitoneum^(8,9,10).

CLINICAL CASE

A 72-year-old white male patient underwent LC on August 13, 2003 at the *Hospital dos Servidores do Estado de Minas Gerais* (Minas Gerais State Worker's Hospital). The patient received subcutaneous injections of prophylactic unfractionated heparin (5000 IU, 12/12 h preoperatively and for the first 24 postoperative hours). On postoperative day 3, the patient presented right-sided chest pain upon inhaling, dyspnea with tachypnea (30 breaths/min), crackles in the right lung base, a heart rate of 120 bpm and hemodynamic stability. A hemogram revealed no leukocytosis, and arterial blood gas analysis showed a PaO₂ of 61 mmHg and a PaCO₂ of 24

Abbreviations used in this paper:

LC - Laparoscopic cholecystectomy
 LMWH - Low molecular weight heparin
 DVT - Deep venous thrombosis
 PTE - Pulmonary thromboembolism
 VTE - Venous thromboembolism
 IPC - Intermittent pneumatic compression

mmHg. Ceftriaxone (1 g intravenously, 12/12h) was administered, and an evaluation was requested from the pulmonology clinic. After physical exams and a chest X-ray, treatment for suspected PTE was started. The patient was given subcutaneous dalteparin (100 IU/kg, 12/12h). An echocardiogram performed on the following day showed dilation of the right heart chambers, slight tricuspid insufficiency and pulmonary artery systolic pressure of 61 mmHg. Spiral angiotomography showed a minor bilateral pleural hemorrhage, plate-like atelectasis in both pulmonary bases and the presence of a thrombosis in the left lower lobe artery, confirming a diagnosis of PTE. After receiving heparin for eight days, the patient was given a prescription for an oral anticoagulant and was discharged.

CHART 1

Stratification of surgical risk for VTE ⁽²⁾

Low risk: minor surgery in patients under 40 presenting no additional risk factors.

Moderate risk: any surgery performed in patients between 40 and 60 with no risk factors; major surgery performed in patients under 40 years old with no risk factors; minor surgery performed in patients with additional risk factors.

High risk: major surgery performed in patients over 60 years old with no additional risk factors; patients between 40 and 60 years old with additional risk factors.

Very high risk: multiple risk factors: major surgery performed in patients over 40 with a history of VTE, having a malignant disease or presenting hypercoagulability states (thrombophilia). Orthopedic surgery including hip or knee arthroplasty, femoral neck surgery, multiple trauma or spinal cord lesion.

ASSESSING RISK FACTORS

Ten years ago, Jorgensen *et al.*⁽¹¹⁾ reported three cases of VTE, one fatal, among the 438 LCs he performed. All 438 patients received subcutaneous prophylactic heparin and compression stockings. The author calls attention to the fact that the reverse Trendelenburg position commonly used in LC is an aggravating factor for venostasis.

Concerning duration of surgery, Ross *et al.*⁽⁷⁾ evaluated the results obtained from 724 consecutive patients randomized for either LC ($n = 362$) or minilaparotomy ($n = 362$). Surgical time was longer in LC (100 minutes) than in minilaparotomy (85 minutes). The longer the duration of surgery, the higher the risk of thromboembolic complications becomes.

To decide whether abdominal hyperinflation causes venostasis, Beebe *et al.*⁽¹²⁾ analyzed eight patients submitted to LC under intra-abdominal pressure of 14 mmHg. The right femoral vein was catheterized and a duplex ultrasound of the left femoral vein was performed in order to evaluate blood flow velocity and blood pressure, as well as venous diameter and pulsatility. These parameters were measured prior to pneumoperitoneum, intraoperatively, and five minutes after pneumoperitoneum deflation.

The results show that abdominal insufflation significantly increases femoral venous pressure, reduces blood flow velocity and decreases venous pulse, returning to normal five minutes after deflation. The authors call attention to the risk for VTE and the need for prophylaxis when performing LC.

Investigating hemostatic alterations occurring in ten patients undergoing LC, Prisco *et al.*⁽⁹⁾ concluded that this procedure leads to a prothrombotic state, albeit of low intensity and short duration.

In a review article, Zacharoulis & Kakkar⁽¹³⁾ stated that the three elements of Virchow's triad (venous stasis, hypercoagulability and vascular injury) are present during laparoscopic surgery. The authors also suggest that the risk for thromboembolic complications is equal to that of open surgery.

Occurrence of VTE in laparoscopic cholecystectomy

Patel *et al.*⁽¹⁴⁾, in a prospective study examining the incidence of DVT among patients undergoing

laparoscopy, performed duplex ultrasounds of the lower limbs of twenty patients on postoperative days 1, 7 and 30. All procedures were performed under general anesthesia and lasted approximately 80 minutes. Pneumoperitoneum pressure was limited to 15 mmHg with a pressure valve. As a prophylactic measure, all patients were given graduated compression stockings, and 19 received unfractionated heparin for one to eight days after the surgery. The authors showed that 11 cases of DVT (55%), 3 of which were proximal DVT, occurred. Of those 11 cases, 7 were detected on the first postoperative day. The authors note the high incidence of DVT and suggest that LC should not be considered a procedure with a low risk for VTE.

Lindberg *et al.*⁽⁴⁾, in a review of 60 articles published between January 1994 and April 1995 involving a total of 153,832 patients, suggest that LC presents a lower risk of thrombotic complications than does conventional surgery. However, they admit that the possibility of methodological biases, such as LC performed in younger patients and ill-defined prophylactic regimens, could modify this conclusion. They also note the increasing use of thromboprophylaxis and the progressive reduction in surgical time.

Catheline *et al.*⁽¹⁵⁾ conducted a prospective study of 2384 consecutive laparoscopic surgeries, including 848 LCs, over five years. Their aim was to investigate the incidence of VTE. All patients received prophylaxis in the form of graduated compression stockings and low-molecular-weight heparin (LMWH), the latter starting ten to twelve hours before surgery and maintained until complete recovery of movement. During the surgery, intra-abdominal pressure was set to 12 mmHg. During hospitalization and for thirty days after surgery, all patients were clinically examined in search of signs of VTE. In suspected cases, either Doppler ultrasound of the lower limbs or ventilation-perfusion lung scintigraphy was performed. Despite the preventive measures adopted, there were eight episodes of DVT ($8/2384 = 0.33\%$), five of which were in patients undergoing LC ($5/848 = 0.59\%$).

Lord *et al.*⁽¹⁶⁾ designed a controlled prospective study to assess the effect of pneumoperitoneum on the incidence of DVT in patients undergoing either LC ($n = 59$) or mini-LC ($n = 41$). Doppler ultrasound of the lower limbs was performed before

surgery, during the first 24 postoperative hours, and between the second and fourth postoperative weeks. Time under anesthesia was longer in the LC group (188 minutes) than in the mini-LC group (98 minutes). During the procedure, maximum insufflation pressure was 15 mmHg and at least one deflation was performed in all cases. Patients were treated with standard thromboprophylaxis, which consisted of the use of graduated compression stockings, intraoperative intermittent pneumatic compression (IPC), and LMWH (preoperatively and postoperatively until discharge). One case of DVT was detected in each group on the first postoperative day. The authors concluded that, despite pneumoperitoneum, the risk for LC-related thrombosis is low if correct prophylactic measures are implemented.

Pneumoperitoneum insufflation pressure is known to cause venous ectasia. Therefore, performing surgery under low tension can be advantageous, even though visual access of intra-abdominal structures is impaired, thereby increasing the duration of the surgery.

Wallace et al.⁽¹⁷⁾ randomized forty patients for LC into two different groups of twenty patients each, using insufflation pressures of 15 and 7.5 mmHg, respectively. After surgery, the low-tension group presented pain and hemodynamic alterations less frequently than did the higher-tension group.

Barczynski et al.⁽¹⁸⁾ analyzed the surgical outcomes of 148 consecutive patients undergoing LC at two different intra-abdominal pressure levels: 7 and 12 mmHg. The results showed that the procedures performed under low insufflation pressure presented better outcomes in terms of postoperative quality of life without increasing surgical time.

The use of VTE prophylaxis during LC

To date, the number of controlled studies is insufficient to make final recommendations for thromboprophylaxis in patients undergoing laparoscopic procedures. Some studies merit consideration:

In 1997, Bradburry et al.⁽¹⁹⁾ conducted a survey designed to determine the use of thromboprophylaxis in England and Ireland. Questionnaires were sent to 800 members of the Surgeons Association, 515 of whom responded, and the results showed that 417 surgeons (76%) performed LC. Heparin was the most frequently

used method of prophylaxis and LMWH was used in one-third of the cases. Graduated compression stockings (74%) and pneumatic compression (37%) were also used. Only seven of the surgeons claimed not to use any kind of prophylaxis. Tvedskov et al.⁽²⁰⁾ conducted a similar survey in Denmark, in which questionnaires were completed by surgeons in 46 of 53 surgery departments.

In the latter study, PTE prophylaxis was administered in 93% of the departments. In all cases, LMWH was administered preoperatively and for a total of one to seven days. In 34 of the 46 responding departments, compression stockings were also used.

In a rare randomized, double-blind prospective study, Okuda et al.⁽²¹⁾ evaluated the use of heparin + IPC versus IPC alone in relation to markers of thrombogenesis (D-dimers) and in relation to platelet activation (thromboglobulin) in 30 patients undergoing LC. The results suggest that the use of heparin + IPC is more effective in preventing thrombosis in the lower limbs.

Schaepkens et al.⁽²²⁾ evaluated the effectiveness of LMWH use in preventing DVT in 238 patients undergoing LC and preoperative/postoperative duplex ultrasound of the lower limbs. Nadroparin was administered subcutaneously to 105 patients, and the other 133 received no prophylaxis. There were four cases of DVT in the control group (1.68%) and one in the nadroparin group (0.27%). Although the difference is not statistically significant ($p = 0.27$), the author recommends the adoption of preventive treatment.

The Society of American Gastrointestinal Endoscopic Surgeons recently published (on its site: http://www.sages.org/sg_pub_c.html) the statement that "Until adequate data become available, the recommendations for open surgical procedures should be followed when the same procedures are accomplished via laparoscopic access."

CONCLUSION

Although the advantages, such as reduced surgical trauma, early mobility and shorter hospital stays, are undeniable, there is no scientific evidence leading to the conclusion that LC is a procedure presenting a low risk for VTE. On the contrary, we can suggest that thromboprophylaxis in LC should be the same as that used in conventional surgery, according to each respective risk category.

Whether unfractionated heparin or LMWH is administered, patients should receive the treatment preoperatively and at least until the seventh postoperative day. Mechanical methods of prevention include the use of graduated compression stockings and intraoperative IPC.

The patient should remain in the reverse Trendelenburg position for the shortest time possible and pneumoperitoneum insufflation pressure should be maintained at less than 12 mmHg. In prolonged operations, insufflation should be discontinued intermittently (every 30 minutes). In addition, early postoperative mobilization of patients should be practiced. Underestimating the risk of VTE as a complication of LC may lead to inappropriate prophylaxis or premature interruption of the preventive measures, which can result in undesired consequences.

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