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Deep Venous Thrombosis Prophylaxis is not Indicated for Laparoscopic Cholecystectomy

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ABSTRACT

Objectives: Recent publications have discussed the risk of deep venous thrombosis during laparoscopic cholecystectomy and the need for routine deep venous thrombosis (DVT) prophylaxis. The purpose of this study was to determine the incidence of clinically detectable DVT in patients undergoing laparoscopic cholecystectomy without a standard DVT prophylaxis regimen.

Materials and Methods: We performed completed laparoscopic cholecystectomy in 587 patients over a 4-year period. Eighteen of these patients received some form of perioperative DVT prophylaxis, and 569 patients did not. Routine screening with a duplex Doppler was not used. Patients were followed postoperatively for 4 weeks after discharge from the hospital.

Results: In an average of 4 weeks follow-up, 31 complications and 4 deaths were reported. These complications included wound infection (16), postoperative bleeding (3), persistent pain (3), pneumonia (3), retained CBD stones (2), asthma (1), papillary stenosis (1), ileus (1), and intraoperative bowel injury (1). None of the 587 patients in this study had symptoms of DVT or pulmonary embolism.

Discussion: Despite the fact that DVT in this patient population is rare, many reports suggest the use of routine DVT prophylaxis with sequential compression devices (SCDs) or low-molecular-weight heparin (LMWH). Because no clinically detectable evidence was found of DVT in our study group despite the lack of any perioperative DVT prophylaxis, we question whether routine DVT prophylaxis is indicated or cost effective for routine laparoscopic cholecystectomy. A large prospective trial addressing this question is needed.

Key Words: Laparoscopy, Cholecystectomy, Deep venous thrombosis, Pulmonary embolism.

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INTRODUCTION

Recent publications have described the risk of deep venous thrombosis (DVT) during laparoscopic cholecystectomy and the need for routine prophylaxis. Both hypercoagulation and venous stasis during this procedure have been indicated as risk factors.[1-5] However, the true incidence of DVT with routine screening is controversial, but the incidence of clinically detectable DVT is thought to be small.[1-10] Despite this low incidence of clinically detectable DVT and pulmonary embolism (PE) in many large review studies, 60% of surgeons select some form of DVT prophylaxis for laparoscopic cholecystectomy.[5] Using routine DVT prophylaxis regardless of the individual risk factors exposes patients to the risks of anticoagulation and can lead to a substantial increase in the cost of the procedure. If the incidence of DVT is truly negligible, prophylaxis may not be indicated. The purpose of this review was to determine the incidence of clinically detectable DVT in patients undergoing laparoscopic cholecystectomy without a standard DVT prophylaxis regimen.

METHODS

A retrospective chart review was performed of all patients who underwent a completed laparoscopic cholecystectomy between July 1, 1996 and July 1, 2000. Charts were reviewed for age, sex, acute versus chronic disease, calculous versus acalculous disease, obstructive symptoms, the presence of common bile duct stones, endoscopic retrograde cholangio-pancreatography preoperatively or postoperatively, operative times, follow-up intervals, complications, and any use of DVT prophylaxis (sequential compression devices, low-molecular-weight heparin, heparin, or coumadin). With the assistance of general surgical residents, 5 surgeons performed 587 procedures. Prophylaxis against DVT was used in 18 high-risk patients (ie, patients with 1 or more of the following risk factors: malignancy, prolonged immobilization, morbid obesity, or a history of DVT). The remaining group of 569 patients, considered low-risk for DVT, underwent laparoscopic cholecystectomy without receiving any form of perioperative DVT prophylaxis other than early ambulation. Routine screening with a duplex Doppler or radiolabeled fibrinogen was not used.

Access to the abdominal cavity was uniformly achieved by an open Hassan technique. All cases were performed with patients in the reverse Trendelenburg position with an intraperitoneal pressure of 12 mm Hg to 15 mm Hg. Intraoperative cholangiograms were obtained when felt to be clinically relevant (preoperative suspicion of common duct stone or intraoperative need to define bile duct anatomy). Operative times and the use of DVT prophylaxis were recorded in the hospital chart. Patients with chronic cholecystitis were routinely operated on as outpatients with less than a 23-hour hospital stay, and those with acute or complicated cholecystitis were admitted to the hospital and discharged home when stable. All patients were encouraged to ambulate in the immediate postoperative time period.

Patients were followed in the physician's office for at least 1 return visit. All complaints and unusual physical findings were recorded in the office chart for review. All subsequent hospital admissions were then reviewed for potential association with the original procedure.

RESULTS

Completed laparoscopic cholecystectomy was performed in 587 patients (463 females, 124 males) (average age 45 years) (range 16-97 years for day-surgery patients, average age 44 years) (average age 45.6 years for inpatients) from July 1, 1996 to July 1, 2000 **(Table 1)**. Day-surgery patients included 342 patients (270 women, 72 men) who underwent completed laparoscopic cholecystectomy, and inpatients included 245 patients (191 women, 54 men) who underwent laparoscopic cholecystectomy. The average anesthesia time for all cases was 84 minutes (range 40 minutes to 160 minutes with an average of 81 minutes for outpatients and 88 minutes for inpatients). Average length of stay for all patients was 2.1 days. Patients from day-surgery stayed less than 23 hours in the hospital. Patients admitted to the hospital had an average length of stay of 4.3 days (range 1 day to 22 days). DVT prophylaxis was given to 18 patients overall, 17 inpatients (13 SCDs, 2 LMWH, 2 coumadin) and 1 day-surgery patient (low-molecular-weight heparin). All patients were followed as outpatients for an average of 4 weeks postoperatively for the development of complications.

The indication for laparoscopic cholecystectomy in day-surgery was chronic biliary colic with cholelithiasis in 243 patients **(Table 2)**. Forty-five patients underwent cholecystectomy for biliary dyskinesia. The most common indication for laparoscopic cholecystectomy in hospitalized patients was acute cholecystitis with cholelithiasis (175 patients). In addition, 27 patients had known underlying chronic cholelithiasis prior to admission for acute cholecystitis. Ten hospitalized patients underwent laparoscopic cholecystectomy for biliary dyskinesia. Acute acalculous cholecystitis was found exclusively in the inpatient population, representing only 8 cases.

Intraoperative cholangiograms (IOC) were performed when patients were suspected of having choledocholithiasis, such as jaundice, pancreatitis, elevated liver function tests (LFTs), or cholangitis. Overall, 137 cholangiograms were performed (65 for associated pancreatitis, 61 for elevated LFTs, 10 for jaundice alone, and 1 for cholangitis). Thirty-five outpatients underwent cholangiography (5 for pancreatitis and 30 for elevated LFTs). None of these patients had common bile duct stones.

Table 1.
Comparison of patient age, operative time, and DVT prophylaxis between day-surgery and hospitalized patients.

	Total	Day-Surgery	Inpatients
Number of Patients	587	342	245
Number of Women	463	272	191
Number of Men	124	70	54
Average Age	45	44	45.6
Anesthesia Time (Minutes)	82	81	88
Length of Stay (Days)	2.1	0.5	4.3
DVT Prophylaxis	18	1	17
Weeks Follow-up	4	4	4

Table 2.
Indications for laparoscopic cholecystectomy for both day-surgery and hospitalized patients.

	Total	Day-Surgery	Inpatients
Acute Cholecystitis	218	43	175
Acute and Chronic Cholecystitis	38	11	27
Chronic Cholecystitis	268	243	25
Acute Acalculous Cholecystitis	8	0	8
Biliary Dyskinesia	55	45	10

Endoscopic retrograde cholangio-pancreatography (ERCP) was performed postoperatively in 2 patients, 1 for a retained common bile duct stone not seen with IOC and 1 for recurrent symptoms of pain. IOC was performed in 102 hospitalized patients (60 for acute pancreatitis, 31 for elevated LFTs, 10 for elevated bilirubin, and 1 for ascending cholangitis). This demonstrated 28 patients with common duct stones, leading to 10 laparoscopic common bile duct explorations, and postoperative ERCP with stone extraction for the remaining 18 patients. Twenty-eight preoperative ERCPs demonstrated 24 patients with common duct stones. After ERCP with stone extraction, all IOCs were negative.

The most common complaints after surgery were gastrointestinal in nature, most often for diarrhea (21 cases). The only intraoperative complication was a bowel injury during placement of a Hassan port in a patient with multiple abdominal adhesions. This injury was immediately identified and repaired prior to completion of laparoscopic cholecystectomy. The patient recovered uneventfully. In an average of 4 weeks follow-up, 30 postoperative complications and 2 deaths were reported. These complications included infection (16), persistent pain (3), postoperative bleeding (3), pneumonia (3), retained CBD stone (2), asthma exacerbation (1), ileus (1), and papillary stenosis (1). Of the patients with wound infection complications, 2 had infected IV sites, and another 2 had to be readmitted for parenteral antibiotics for incisional infections. The remaining 12 wound infections cleared with oral antibiotics on an outpatient basis. Three patients were readmitted with symptoms of biliary obstruction. Two had retained common bile duct stones. These stones were extracted during ERCP evaluation without incidence. The remaining patient had a papillary stenosis of the distal CBD that was treated with biliary stenting at the time of ERCP. This stenosis was not related to the original surgery. Postoperative bleeding was a complicating factor for 3 patients with end-stage renal failure, all of whom underwent reexploration and placement of drains. Four pulmonary complications occurred, including 1 asthma exacerbation (resolved with nebulizer treatment) and 3 pneumonias. Two of these patients were elderly with multiple medical problems and were admitted for biliary pancreatitis. After prolonged hospital courses, both of these patients progressed to pulmonary sepsis and died.

Perioperative DVT prophylaxis other than early ambulation was not given to 569 of 587 patients, but 18 patients received either LMWH or SCDs based on the presence of various risk factors including: obesity (13), immobility (3), history of prior DVT (1), and malignancy (1). Patients were followed for at least 1 visit in an outpatient setting over an average of 4 weeks postoperatively. No patient developed symptoms of either DVT or PE. Routine duplex Doppler examinations or radiolabeled fibrinogen assays were not used.

DISCUSSION

The risk of developing deep venous thrombosis (DVT) increases with the number of risk factors present.[11] For the general surgical population, the risk factors for DVT include a history of prior DVT or pulmonary embolism (PE), the presence of a malignancy, age over 40, prolonged immobilization, obesity, and prolonged exposure to general anesthesia.[4,11,12] In addition to the known risk factors for thrombosis, the greatest risk factors for DVT formation in patients undergoing laparoscopic cholecystectomy are thought to be reverse Trendelenburg positioning and pneumoperitoneum with increased operative times (greater than 2 hours).[4,5] Pneumoperitoneum is thought to increase the risk for DVT by decreasing venous flow, thus resulting in diminished venous return and decreased cardiac output.[3] In addition, the reverse Trendelenburg position decreases femoral venous blood flow by as much as 42%.[3]

Despite the theoretical risk of thromboembolic disease due to pneumoperitoneum and the reverse Trendelenburg position, the frequency of reported DVT is low in patients receiving DVT prophylaxis (either SCDs, LMWH, or both).[3] Ido et al[1] reported an incidence of PE of 1 in 850 patients after laparoscopic cholecystectomy in patients with no specific regimen for DVT prophylaxis. Based on a Medline review of 78,747 patients,[8] even the highest estimated rates suggest the probability of the most serious of the complications, including PE, is less than 5 in 1000. In another report,[10] the incidence of PE after laparoscopic cholecystectomy was reported as 3 in 77,604. Our results correlate with these review papers in that we have not identified any clinically significant DVT or PE in our group of 587 patients.

The diagnosis for DVT and PE reported in most published prospective studies has been made within the first week of surgery. Although pulmonary angiography is necessary to diagnose PE, a variety of less invasive techniques are commonly used in studies to presume the

diagnosis.[11,12] Most of these studies used either computed tomography (CT) scan or ventilation perfusion scans to make the diagnosis and then based results and recommendations on these tests. Doppler instrumentation is an accurate noninvasive method for diagnosing DVT, but interpretation of the results is subjective and requires experience for proficiency.[12] When used alone, this test provides few false-negatives but many false-positives. The addition of duplex imaging does increase the accuracy of the examination.[12] Because we did not use any screening in asymptomatic patients, it is possible that a number of our patients did form venous thrombosis without our knowledge. Patel et al[6] found an incidence of calf vein thrombosis of 40% after laparoscopic cholecystectomy as diagnosed by routine duplex examination. With no occurrence of PE despite their high rate of calf vein DVT, we agree with their conclusion that the significance and natural history of calf vein DVT in a healthy mobile population are not known.

Sufficient data exist to justify the use of DVT prophylaxis in a high-risk population to prevent pulmonary embolism (PE).[12] Multiple regimens for DVT prophylaxis are used in the high-risk population including compression stockings, sequential compression devices, and low-dose heparin (5000 units subcutaneously b.i.d.) or low molecular weight heparin (eg. enoxaparin 1 mg/kg sq divided b.i.d.). Studies have shown that compression stockings are shown to only decrease the incidence of DVT by 10%.[12] Taken twice daily, low-dose heparin reduced DVT from 25% to 10%, and fatal PE from 0.7% to 0.2% in the general surgery population.[12]

Although no one questions the need for DVT prophylaxis during long, complicated cases, the need for prophylaxis in patients under 40 years of age with no known risk factors undergoing uncomplicated operative procedures may not be necessary.[12] The NIH consensus study recently suggested that in low-risk patients with little chance of DVT, early ambulation and SCDs are sufficient prophylaxis against DVT.[12] Despite the theoretical risk of thromboembolic disease due to pneumoperitoneum in laparoscopic cholecystectomy, the frequency of clinically detectable DVT is low.[3] In our group of patients, it was nonexistent. For these uncomplicated laparoscopic cases, the minimally invasive nature and shorter recovery times leading to quicker mobilization may result in a decrease in DVT and pulmonary embolism as compared with that in the general surgery population.[4] Others have shown that femoral blood flow quickly returns to baseline with the release of pneumoperitoneum, suggesting that the intraoperative release of pneumoperitoneum (every 30 minutes or so) would be sufficient to prevent thrombosis.[1]

In the healthy population (especially patients younger than 40 years) undergoing brief surgical procedures, reports[12] suggest that early ambulation may be sufficient to prevent the formation of DVT and, therefore, PE. In our experience, early ambulation was the only form of DVT prophylaxis for 569 patients (with an average age of 45 years and anesthesia time of 84 minutes), none of whom developed clinically significant DVT or PE. A recent prospective study of 60 patients undergoing uncomplicated laparoscopic procedures without any DVT prophylaxis showed no development of DVT with routine postoperative duplex screening, despite the documented decrease in venous flow of the lower extremities.[2] All of these studies lead to the question of whether or not DVT prophylaxis is truly indicated in otherwise healthy patients undergoing routine laparoscopic cholecystectomy.

The risks of DVT prophylaxis are dependent on the method used. SCDs are an effective noninvasive method for reducing DVT; however, they are often used inappropriately and inconsistently, thus negating their effect.[13] Coumadin and heparin each have a bleeding risk and require monitoring of prothrombin time (PT) and partial thromboplastin time (PTT). Recent improvements in standard heparin treatment are the low-molecular-weight heparin preparations. Enoxaparin, for example is prepared from the degradation products of unfractionated porcine heparin.[14] It exerts its effect on factor Xa and antithrombin III but does not bind thrombin well, thus preventing clots with less risk of bleeding.[13-15] Large studies have shown that when compared with heparin, the low-molecular-weight heparins like enoxaparin show no difference in DVT recurrence, bleeding incidence, and mortality.[13] Because prophylactic doses of LMWH do not affect the PT or PTT, routine monitoring of these tests is not required. However, cases have been reported of severe hyperkalemia in patients after the initiation of LMWH. This has prompted some authors to suggest routine monitoring of potassium, especially in patients with diabetes, renal failure, and concomitant use of medications that alter potassium balance.[16] Standard heparin treatment can induce thrombocytopenia and delayed-type hypersensitivity reactions due to antibody formation.[14] In these patients with hypersensitivity, when

LMWH had been used as an alternative choice for anticoagulation, similar adverse reactions occurred.[14] A distinct disadvantage of the LMWHs is that their half-lives are long, and effects are not reversed by protamine. In the event of bleeding, the only choice of treatment is platelet transfusion, which decreases the drug's receptor occupancy on antithrombin III.[15]

The practice of using routine DVT prophylaxis regardless of the individual risk factors can lead to a substantial increase in the cost of the procedure. If the incidence of DVT in laparoscopic cholecystectomy is truly low, is it worth the cost of across the board prophylaxis? The cost at our institution for SCDs is a $142.68 1-time charge. This represents $81,898.32 for the entire group of patients. Likewise, our patients are charged $17.23 per 30 mg subcutaneous dose of enoxaparin (3 perioperative dosing charges of $51.69), representing a $29,670.06 charge for the group. Because no clinically detectable evidence of DVT existed in our study group despite the lack of any perioperative DVT prophylaxis, we question whether DVT prophylaxis is indicated for routine laparoscopic cholecystectomy.

CONCLUSION

We believe that our observations of these 569 low-risk patients who underwent laparoscopic cholecystectomy without specific DVT prophylaxis correlate well with the larger published reviews. Deep venous thrombosis and pulmonary embolism are rare events following this procedure. A prospective trial, large enough to detect the benefit of intervention, is required to finally answer the question of whether all patients should be given DVT prophylaxis during laparoscopic cholecystectomy. In the mean time, we suggest using clinical judgment based on individual risk factors to dictate any prophylactic regimen.

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