

## LAPAROSCOPIC PROCEDURES AS A RISK FACTOR OF DEEP VENOUS THROMBOSIS, SUPERFICIAL ASCENDING THROMBOPHLEBITIS AND PULMONARY EMBOLISM – CASE REPORT AND REVIEW OF THE LITERATURE

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*Abstract:* Since its introduction laparoscopic surgery has been used for many indications, e.g., cholecystolithiasis, hernia, appendicitis, fundoplication, benign large bowel disease and gynaecological disorders. It has been considered as safe and efficient procedure for most patients with only few contraindications, mostly heart-lung disease.

When the initial enthusiasm has been replaced by a more critical observation, more complications of laparoscopy or laparoscopic surgery were not only discovered but also reported. In laparoscopic hernia repair there is a tendency for severe complications when compared to open surgery.

There is a controversy on possible side-effects of laparoscopic surgery, e.g., thrombosis, and the increased necessity of prophylaxis for thromboembolic events. Recently a growing number of reports on thromboembolic complications in association with laparoscopic surgery were published. Thrombosis may be caused by detrimental effects of pneumoperitoneum on venous flow (increased abdominal pressure and negative Trendelenburg position) and activation of the haemostatic system. Further risk factors may contribute to the risk to develop venous thrombosis. It is well accepted that varicose veins are associated with an increased risk for the thrombosis. However, the association of varicose veins with complications of laparoscopic surgery is unclear. The possible impact of thrombotic complications makes an analysis of the association of varicose veins or a history of deep vein thrombosis on the development of thrombosis after laparoscopic surgery mandatory. Although this is the first report on ascending thrombophlebitis and thrombosis of the saphenofemoral junction after laparoscopic surgery, the incidence of deep vein thrombosis or superficial thrombophlebitis after laparoscopic surgery or laparoscopy may be much higher according to the pathophysiological changes during and after these procedures. In many patients venous thrombosis may not be recognized or it appears when the patient is already discharged.

*Conclusion:* Laparoscopy and laparoscopic procedures may have an increased risk for the development of thrombosis due to increased abdominal pressure and negative Trendelenburg position. Patients with varicose veins and a history of thromboembolism may aggravate laparoscopy associated risks for the development of thromboembolic complications. Superficial

thrombophlebitis in the thigh is not a benign disease entity and may lead to deep vein thrombosis (DVT) and pulmonary embolism (PE). Urgent surgical treatment (high ligation) may be warranted together with low-molecular weight heparin (LMWH) and compressions therapy. Patients with varicose veins and a history of venous thrombosis may not be suitable candidates for laparoscopic surgery. Family practitioners may be confronted with this complication more often since patients are discharged earlier from hospital after laparoscopic interventions due to legislative regulations.

### CASE REPORT

A 59 years old male presented with aggravating symptoms of superficial venous thrombophlebitis (SVT) (ascending thrombophlebitis) in both thighs. Coloured-flow duplex scan demonstrated thrombosis of the large saphenous vein (LSV) in both thighs reaching until the saphenofemoral junction (SFJ) (Stage II SVT) (Verrel et al. 1998).

This patient has been previously (30 days before) admitted to a hospital for acute pain in left lower abdomen. Diagnosis of a perforated diverticulitis of the sigma was made and the patient was taken to the operation room for a laparoscopic sigmoid resection 10 days later. Information on heparin prophylaxis has not been recorded. Postoperatively superficial vein thrombophlebitis (SVT) developed in both calves, which was treated with compression therapy, local heparin application to the skin and non-steroidal anti-inflammatory drugs (NSAIDs). Deep vein thrombosis (DVT) has been excluded by Doppler-sonography. The patient was discharged nine days after the operation.

In the previous history a right bundle block and a left-anterior hemi block have been diagnosed. In the past, there has been an episode of DVT. The patient was known to have untreated varicose veins in both legs.

One week after hospital discharge the patient complained about increasing pain due to SVT in both legs and was treated with low-molecular weight heparin (LMWH) (Clexanc 40) and NSAIDs.

At the first visit in our clinic the patient was scheduled for urgent high-ligation of the LSV on both sides. The thrombosis has reached already the SFJ left thigh and remained within 5 cm away from the SFJ on the

right side. (Fig. 1) There were no intra-operative complications. Post-operative follow-up was uneventful. The histological evaluation of the sample of the resected part of LSV showed ecatic vein with thrombotic material and inflammatory infiltration. (Fig. 2) The postoperative follow-up (2 months) was uneventful.

## DISCUSSION

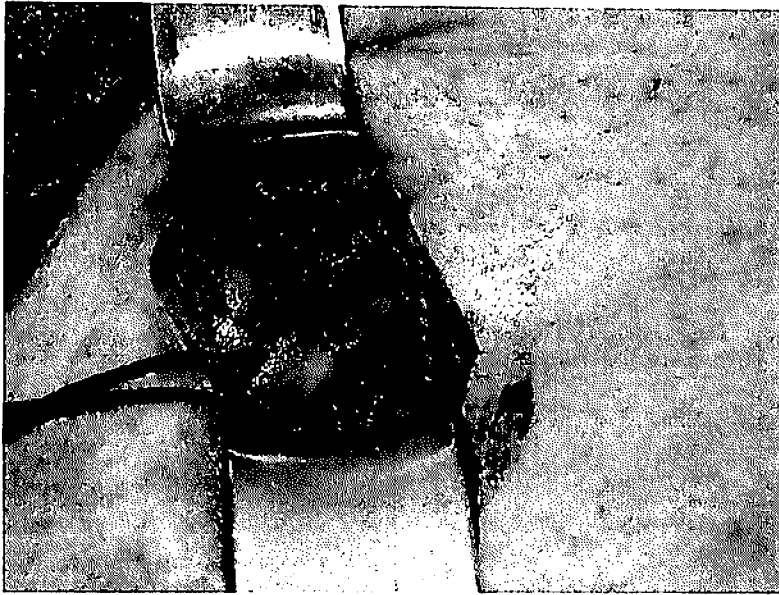
Since its introduction laparoscopic procedures were applied for operation of many diseases: cholecystolithiasis, inguinal hernia, appendicitis, hiatal hernia, large bowel diseases and gynaecological diseases (Filipi et al. 1992; MacFayden et al. 1992; Sackier 1992; Willekes et al. 1997; Marcello et al. 2001; Wichmann et al. 2002; Schaeckens van Riemst et al. 2002;). Laparoscopic surgery has been regarded as a less invasive procedure providing a lower risk for postoperative complications. When the initial enthusiasm gave way to a more critical observation, more complications of laparoscopic procedures were discovered and reported (Schwartz 1993; Bongard et al. 1994; Nordestgaard et al. 1995; Mathisen et al. 2002). In laparoscopic hernia repair there is a tendency for severe complications when compared to open surgery (Hair et al. 2000). Severe thromboembolic complications after laparoscopic procedures have been reported (Bentolila et al. 1994; Mayol et al. 1994; Schindler et al. 1995; Baixauli et al. 2003; Bandyopadhyay and Kapadia 2003; Brink et al. 2003; Hsieh et al. 2003), some complications were lethal (Jaffe and Russell 1994; Rozycki 1996). Despite this, there is a controversy about the necessity of prophylaxis for venous thromboembolism in laparoscopic surgery (Blake et al. 2001; Bergqvist and Lowe 2002). Current practice for anticoagulation shows a wide variation amongst surgeons in the use of anticoagulation measures (Anwar and Scott 2003). In Britain only 20% of the responding surgeons considered that thromboembolism was a problem (Bradbury et al. 1997), in Denmark 20 per cent of the departments reported previous thromboembolic complications following laparoscopic surgery despite the widespread use of thromboprophylaxis (Filtensborg Tvedskov et al. 2001). It has been demonstrated that long laparoscopic operations and reverse Trendelenburg position are potentiating factors for DVT (Catheline et al. 2000). Recently more reports on thrombotic complications after laparoscopic surgery have been published, also after cholecystectomy which is thought to have a lower risk for thrombotic complication than large bowel surgery (Uchida et al. 1999; Davies et al. 2002; Franciosi et al. 2002; Brinks et al. 2003; Hsieh et al. 2003; Steele et al. 2003). Colorectal surgery implies a higher risk of postoperative thromboembolic complications than general surgery which lead to the endorsement of LMWH as primary prophylaxis for venous thromboembolism (VTE) in highest risk patients by the American society of Colorectal Surgeons (AS-CRS) (Ramirez et al. 2003; Wille-Jorgensen et al. 2003). In older studies there was a high frequency of DVT (15% and 17%) even in patients with heparin prophylaxis (Torngren and Rieger 1982).

The pneumoperitoneum is felt to predispose to DVT (Catheline et al. 1999) by creating a significant

resistance to venous return (Beebe et al. 1993; Wilson et al. 1994). Femoral vein stasis may not be prevented by graded elastic compression leg bandages (Ido et al. 1995), but it may be influenced by intermittent sequential compression (Schwenk et al. 1998). It has been assumed that minimal soft tissue trauma and early ambulation after laparoscopic cholecystectomy may decrease the risk of thrombosis despite an acute episode of venous stasis (Goodale et al. 1993). This has not been supported by others. Laparoscopic cholecystectomy, despite being a minimally invasive procedure, may be associated with a definite risk of developing postoperative venous thromboembolism (Caprini and Arcelus 1994). Several studies demonstrated an activation of the coagulation system (Caprini et al. 1995; Nguyen et al. 2001; Vecchio et al. 2003). The activation of the coagulation system happened in spite to thromboembolism prophylaxis (Lindberg et al. 2000). However, not all investigators have observed this activation of the coagulation (Martinez-Ramos et al. 1999).

The effect of the pneumoperitoneum on the venous flow is well known, although some investigators did not observe venous stasis in all veins of the limbs (Bais et al. 1998). Pneumoperitoneum produces plethysmographic changes on the venous hemodynamics with a diminished venous return in lower limbs (Maillou et al. 2003) and diminished flow in the common femoral vein as demonstrated by colour flow duplex and B-mode (Morrison et al. 1998). Intraoperative venous distension is associated with factors that lead to DVT (Comerota et al. 1989; Coleridge-Smith et al. 1990). With a pneumoperitoneum in place no device (intermittent pneumatic compression, graded compression) was able to return the depressed blood flow velocity to values recorded without pneumoperitoneum (Jorgensen et al. 1994; Kiudelis et al. 2002).

The true incidence of deep vein thrombosis and pulmonary embolism following laparoscopic surgery is unknown (Baca et al. 1997). This may be due to delayed or failed diagnosis of the DVT and PE, which occur often after cessation of LMWH delivery and patient's discharge (Catheline et al. 1998). That's why underreporting of complications is likely and a request for objective diagnostic methods has been made (Lindberg et al. 1997); quite often DVT is present without clinical symptoms (Scurr et al. 2001). In contrast, clinical signs of superficial thrombophlebitis, which is common in varicose veins, are well recognized: pain, tenderness, warmth, and erythema (Messmore et al. 1991). SVT of the long saphenous vein in the thigh is not a benign disease entity as previously described. Patients with SVT may also have DVT in up to 44% and PE in up to 33.3% (Jorgensen et al. 1993; Chengelis et al. 1996; Verlato et al. 1999; Andreozzi and Verlato 2000; Beatty et al. 2002; Unno et al. 2002). Progression of the thrombotic process from the greater saphenous vein into the deep venous system/ IJ has been reported in 8.6% - 44% of cases (Lofgren and Lofgren 1981; Blattler and Frick 1993; Kock et al. 1997; Blumenberg et al. 1998; Krause et al. 1998 Murgia et al. 1999; Andreozzi and Verlato 2000). The preferred diagnostic procedure is colour flow duplex scanning (Denzel and Lang 2001). Urgent high



*Fig. 1.* Intra-operative view of the sapheno-femoral junction (SFJ) of a 59 years old male with ascending thrombophlebitis after a laparoscopic sigma resection: the greater saphenous vein is completely occluded by thrombosis; the proximal part near to the femoral vein is free of thrombotic material.



*Fig. 2.* Histological section of the greater saphenous vein of a 59 years old male suffering from ascending thrombophlebitis after laparoscopic sigma resection: histological section of the distal part of the greater saphenous vein in the saphenous femoral junction after high ligation showing evidence of acute thrombosis and inflammatory infiltration.

ligation of the SFJ has been recommended by several authors (Petropoulos et al. 1978; Plate et al. 1985; Graupe et al. 1998; Verrel et al. 2001; Rohrbach et al. 2003), which should be combined with LMWH (Pannier and Rabe 2004).

### CONCLUSION

Laparoscopy and laparoscopic procedures may have an increased risk for the development of thrombosis due to increased abdominal pressure and negative Trendelenburg position. Patients with varicose veins and a history of thromboembolism may aggravate laparoscopy associated risks for the development of thromboembolic complications. Superficial thrombophlebitis in the thigh is not a benign disease entity and may lead to deep vein thrombosis (DVT) and pulmonary embolism (PE). Urgent surgical treatment (high ligation) may be warranted together with low-molecular weight heparin (LMWH) and compressions therapy. Patients with varicose veins and a history of venous thrombosis may not be suitable candidates for laparoscopic surgery. Family practitioners may be confronted with this complication more often since patients are discharged earlier from hospital after laparoscopic interventions due to legislative regulations.

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### REFERENCES

- Andreozzi GM, Verlato F. Superficial thrombophlebitis. *Minerva Cardiolangiologica* 2000;48(12 Suppl 1):9-14
- Anwar S, Scott P. Current practice for anticoagulation prophylaxis in inguinal hernia surgery: a questionnaire survey. *N Z Med J* 2003;116(1181):U583
- Baca U, Schneider B, Kohler T, Misselwitz F, Zehle A, Muhe F. Prevention of thromboembolism in minimal invasive interventions and brief inpatient treatment. Results of a multicenter, prospective, randomized, controlled study with a low molecular weight heparin. *Chirurg* 1997;68(12):1275-1280
- Bais JE, Schiereck J, Banga JD, van Vroonhoven TJ. Resistance to venous outflow during laparoscopic cholecystectomy and laparoscopic herniorrhaphy. *Surg Laparosc Endosc* 1998;8(2):102-107
- Baixauli J, Delaney CP, Senatore AJ, Remzi FH, Fazio VW. Portal vein thrombosis after laparoscopic sigmoid colectomy for diverticulitis: report of a case. *Dis Colon Rectum* 2003;46(4):550-553
- Bandyopadhyay D, Kapadia CR. Large bowel ischemia following laparoscopic inguinal hernioplasty. *Surg Endosc* 2003;17(3):520-521
- Beatty J, Fitridge R, Benveniste G, Greenstein D. Acute superficial venous thrombophlebitis: does emergency surgery have a role? *Int Angiol* 2002;21(1):93-95
- Beebe DSW, McNeven MP, Crain JM, Letourneau JG, Belani KG, Abrams JA, Goodale RL. Evidence of venous stasis after abdominal insufflation for laparoscopic cholecystectomy. *Surg Gynecol Obstet* 1993;176(5):443-447
- Bentolila S, Samama M, Lumbroso M, Andreassian B. Deep venous thrombosis following laparoscopic cholecystectomy. *Presse Med* 1994;23(39):1832
- Bergqvist D, Lowe G. Venous thromboembolism in patients undergoing laparoscopic and arthroscopic surgery and in leg casts. *Arch Intern Med* 2002;162(19):2173-2176
- Blake AM, Toker SI, Dunn E. Deep vein thrombosis prophylaxis is not indicated for laparoscopic cholecystectomy. *JSL* 2001;5(3):215-219
- Blattler W, Frick E. Complications of superficial thrombophlebitis. *Schweiz Med Wochenschr* 1993;123(6):223-228
- Blumenberg RM, Barton E, Gelfand MI, Skudder P, Brennan J. Occult deep venous thrombosis complicating superficial thrombophlebitis. *J Vasc Surg* 1998;27(2):338-343
- Bongard F, Dubecz S, Klein S. Complications of therapeutic laparoscopy. *Curr Probl Surg* 1994;31(11):857-924
- Bradbury AW, Chan YC, Darzi A, Stansby G. Thromboembolism prophylaxis during laparoscopic cholecystectomy. *Br J Surg* 1997;84(7):962-964
- Brink JS, Brown AK, Palmer BA, Moir C, Rodeberg DR. Portal vein thrombosis after laparoscopic-assisted splenectomy and cholecystectomy. *J Pediatr Surg* 2003;38(4):644-647
- Caprini JA, Arcelus JL. Prevention of postoperative venous thromboembolism following laparoscopic cholecystectomy. *Surg Endosc* 1994;8(7):741-747
- Caprini JA, Arcelus JL, Laubach M, Size G, Hoffman KN, Coats RW 2nd, Blattner S. Postoperative hypercoagulability and deep-vein thrombosis after laparoscopic cholecystectomy. *Surg Endosc* 1995 Mar;9(3):304-9.
- Catheline JM, Gaillard JL, Rizk N, Barrat C, Champault G. Risk factors and prevention of thromboembolic risk in laparoscopy. *Ann Chir* 1998;52(9):890-895
- Catheline JM, Turner R, Gaillard JL, Rizk N, Champault G. Thromboembolism in laparoscopic surgery: risk factors and preventive measures. *Surg Laparosc Endosc Percutan Tech* 1999;9(2):135-139
- Catheline JM, Capelluto E, Gaillard JL, Turner R, Champault G. Thromboembolism prophylaxis and incidence of thromboembolic complications after laparoscopic surgery. *Int J Surg Invest* 2000;2(1):41-47
- Chengelis DL, Bendick PJ, Glover JL, Brown OW, Ranval TJ. Progression of superficial venous thrombosis to deep vein thrombosis. *J Vasc Surg* 1996;24(5):745-749
- Coleridge-Smith PD, Hasty JH, Scurr JH. Venous stasis and vein lumen changes during surgery. *Br J Surg* 1990;77(9):1055-1059
- Comerota AJ, Stewart GJ, Alburger PD, Smalley K, White JV. Operative venodilatation: a previously unsuspected factor in the cause of postoperative deep-vein thrombosis. *Surgery* 1989;106(2):301-308
- Davies M, Satyadas T, Akle CA. Spontaneous resolution of a superior mesenteric vein thrombosis after laparoscopic nissen fundoplication. *Ann R Coll Surg Engl* 2002;84(3):177-180
- Denzel C, Lang W. Diagnosis and therapy of progressive thrombophlebitis of epifascial leg veins. *Zentralbl Chir* 2001;126(5):374-378
- Filipi CJ, Fitzgibbons RJ, Salerno GM, Hart RO. Laparoscopic herniorrhaphy. *Surg Clin North Am* 1992;72(5):1109-1124
- Filtenborg Tvedskov T, Rasmussen MS, Wille-Jørgensen P. Survey of the use of thromboprophylaxis in laparoscopic surgery in Denmark. *Br J Surg* 2001;88(10):1413-1416
- Franciosi C, Romano F, Caprotti R, Giardino A, Piacentini G, Visintini G, Uggeri F. Splenoportal thrombosis as a complication after laparoscopic splenectomy. *J Laparosc Adv Surg Tech A* 2002;12(4):273-276
- Goodale RL, Beebe DS, McNeven MP, Boyle M, Letourneau JG, Abrams JH, Cerra FB. Hemodynamic, respiratory, and metabolic effects of laparoscopic cholecystectomy. *Am J Surg* 1993;166(5):533-537

- Graupe F, Hansen O, Zarras K, Mackrodt HG, Stock W. Varicose and ascending thrombophlebitis – surgical planning for emergency crosssection by duplex ultrasound. *Langenbecks Arch Chir Suppl Kongressbd.* 1998;115:1240-1242
- Hair A, Duffy K, McLean J, Taylor S, Smith H, Walker A, MacIntyre IM, O'Dwyer PJ. Groin hernia repair in Scotland. *Br J Surg* 2000;87(12):1722-1726
- Harris WJ. Complications of hysterectomy. *Clin Obstet Gynecol* 1997;40(4):928-938
- Hsieh SW, Lan KM, Luk HN, Wang CS, Jawan B. Massive pulmonary embolism presented as sudden cardiac arrest in the immediate postoperative period after laparoscopic hysterectomy. *J Clin Anesth* 2003;15(7):545-548
- Ido K, Suzuki T, Taniguchi Y, Kawamoto C, Isoda N, Nagamine N, Ioka T, Kimura K, Kumagai M, Hirayama Y. Femoral vein stasis during laparoscopic cholecystectomy: effects of graded elastic compression leg bandages in preventing thrombus formation. *Gastrointest Endosc* 1995;42(2):151-155
- Jaffe V, Russell RC. Fatal intestinal ischaemia following laparoscopic cholecystectomy. *Br J Surg* 1994;81(12):1827-1828
- Jorgensen JO, Hanel KC, Morgan AM, Hunt JM. The incidence of deep venous thrombosis in patients with superficial thrombophlebitis of the lower limbs. *J Vasc Surg* 1993;18(1):70-73
- Jorgensen JO, Lalak NJ, North L, Hanel K, Hunt DR, Morris DL. Venous stasis during laparoscopic cholecystectomy. *Surg Laparosc Endosc* 1994;4(2):128-133
- Kiudelis M, Endzinas Z, Mickevicius A, Pundzius J. Venous stasis and deep vein thrombosis prophylaxis during laparoscopic fundoplication. *Zentralbl Chir* 2002;127(11):944-949
- Kock HJ, Krause U, Albrecht KH, van der Laan E, Rudofsky G, Figler FW. Crosssection in ascending superficial thrombophlebitis of the leg veins. *Zentralbl Chir* 1997;122(9):795-800
- Krause U, Kock HJ, Kroger K, Albrecht K, Rudofsky G. Prevention of deep venous thrombosis associated with superficial thrombophlebitis of the leg by early saphenous vein ligation. *Vasa* 1998;27(1):34-38
- Lindberg F, Bergqvist D, Rasmussen I. Incidence of thromboembolic complications after laparoscopic cholecystectomy: review of the literature. *Surg Laparosc Endosc* 1997;7(4):324-331
- Lindberg F, Rasmussen I, Siegbahn A, Bergqvist D. Coagulation activation after laparoscopic cholecystectomy in spite of thromboembolism prophylaxis. *Surg Endosc* 2000;14(9):858-861
- Lofgren EP, Lofgren KA. The surgical treatment of superficial thrombophlebitis. *Surgery* 1981;90(1):49-54
- MacFayden BV, Wolfe BM, McKernan JB. Laparoscopic management of the acute abdomen, appendix, and small and large bowel. *Surg Clin North Am* 1992;72(5):169-183
- Maillo CL, Martin E, Lopez J, Jover JM, Martinez J, Margaleit I, Hernandez A, Ramos JL, Moreno M. Effect of pneumoperitoneum on venous hemodynamics during laparoscopic cholecystectomy. Influence of patients's age and time of surgery. *Med Clin (Barc)* 2003;120(9):330-334
- Marcello PW, Milsom JW, Wong SK, Brady K, Goormastic M, Fazio VW. Laparoscopic total colectomy for acute colitis: a case-control study. *Dis Colon Rectum* 2001;44(10):1441-1445
- Martinez-Ramos C, Lopez-Pastor A, Nunez-Pena JR, Gopegui M, Sanz-Lopez R, Jorgensen T, Pastor L, Fernandez-Chacon JL, Tamanes-Escobar S. Changes in hemostasis after laparoscopic cholecystectomy. *Surg Endosc* 1999;13(5):476-479
- Mathisen O, Soreide O, Bergan A. Laparoscopic cholecystectomy: bile duct and vascular injuries: management and outcome. *Scand J Gastroenterol* 2002;37(4):476-481
- Mayol J, Vincent-Hamelin E, Sarmiento JM, Oshiro EO, Diaz-Gonzales J, Tamayo FJ, Fernandez-Represa JA. Pulmonary embolism following laparoscopic cholecystectomy: report of two cases and review of the literature. *Surg Endosc* 1994;8(3):214-217
- Messmore HL, Bishop M, Wehrmacher WH. Acute venous thrombosis. Therapeutic choice for superficial and deep veins. *Prostgrad Med* 1991;89(7):73-77
- Morrison CA, Schreiber MA, Olsen SB, Hetz SP, Acosta MM. Femoral venous flow dynamics during intraperitoneal and preperitoneal laparoscopic insufflation. *Surg Endosc* 1998;12(10):1213-1216
- Murgia AP, Cisno C, Pansini GC, Manfredini R, Liboni A, Zamboni P. Surgical management of ascending saphenous thrombophlebitis. *Int Angiol* 1999;18(4):343-347
- Nguyen NT, Owings JT, Gosselin R, Pevec WC, Lee SJ, Goldman C, Wolfe BM. Systematic coagulation and fibrinolysis after laparoscopic and open gastric bypass. *Arch Surg* 2001;136(8):90-91
- Nordesgaard AG, Bodily KC, Osborne RW, Buttorff JD. Major vascular injuries during laparoscopic procedures. *Am J Surg* 1995;169(5):543-545
- Pannier F, Rabe E. Emergencies in phlebology. *Hautarzt* 2004;55(6):533-542
- Petropoulos P, Enderli JB, Hadji H, Hahnloser P. The risk of lung embolism in isolated thrombosis of the V. saphena magna. *Helv Chir Acta* 1978;44(5-6):797-798
- Plate G, Eklof B, Jensen R, Ohlin P. Deep venous thrombosis, pulmonary embolism and acute surgery in thrombophlebitis of the long saphenous vein. *Acta Chir Scand* 1985;151(3):241-244
- Ramirez JH, Vassiliu P, Gonzalez-Ruiz C, Vukasin P, Ortega A, Kaiser AM, Beart RW. Sequential compression devices as prophylaxis for venous thromboembolism in high-risk colorectal surgery patients: reconsidering American Society of Colorectal Surgeons parameters. *Am Surg* 2003;69(11):941-945
- Rohrbach N, Mouton WG, Naef M, Otten KT, Zehnder T, Wagner HE. Morbidity in superficial thrombophlebitis and its potential surgical prevention. *Swiss Surg* 2003;9(1):15-7
- Rozycki D. Fatal outcome six days following laparoscopic cholecystectomy. *Przegl Lek* 1996;53(11):833-834
- Sackler JM. Laparoscopy in the emergency setting. *World J Surg* 1992;16(6):1083-1088
- Schaepkens van Riepmst JT, van Hee RH, Wyler JJ. Deep venous thrombosis after laparoscopic cholecystectomy and prevention with nadroparin. *Surg Endosc* 2002;16(1):184-187
- Scurr JH, Machin SJ, Bailey-King S, Mackie IJ, McDonald S, Smith PD. Frequency and prevention of symptomless deep-vein thrombosis in long-haul flights: a randomized trial. *Lancet* 2001;357(9267):1485-1489
- Schindler E, Muller M, Kelm C. Cerebral carbon dioxide embolism during laparoscopic cholecystectomy. *Anesth Analg* 1995;81(3):643-645
- Schwartz RO. Complications of laparoscopic hysterectomy. *Obstet Gynecol* 1993;81(6):1022-4
- Schwenk W, Bohm B, Fugener A, Muller JM. Intermittent pneumatic sequential compression (ISC) of the lower extremities prevents venous stasis during laparoscopic cholecystectomy. A prospective randomized study. *Surg Endosc* 1998;12(1):7-11
- Steele SR, Martin MJ, Garafalo T, Ko TM, Place RJ. Superior mesenteric vein thrombosis following laparoscopic Nissen fundoplication. *JSLS* 2003;7(2):159-163
- Torngren S, Rieger A. Prophylaxis of deep venous thrombosis in colorectal surgery. *Dis Colon Rectum* 1982;25(6):563-566

- Uchida S, Yamamoto M, Masaoka Y, Mikouchi H, Nishizaki Y. A case of acute pulmonary embolism and acute myocardial infarction with suspected paradoxical embolism after laparoscopic surgery. *Heart Vessels* 1999;14(4):197-200
- Unno N, Mitsuoka H, Uchiyama T, Yamamoto N, Saito T, Ishimaru K, Kaneko H, Nakamura S. Superficial thrombophlebitis of the lower limbs in patients with varicose veins. *Surg Today* 2002;32(5):397-401
- Vecchio R, Cacciola E, Martino M, Cacciola RR, MacFadyen BV. Modifications of coagulation and fibrinolytic parameters in laparoscopic cholecystectomy. *Surg Endosc* 2003;17(3):428-433
- Verlato F, Zuchetta P, Prandoni P, Camporesi G, Marzola MC, Salmistraro G, Bui F, Martini R, Rosso F, Andreozzi GM. An unsuspectedly high rate of pulmonary embolism in patients with superficial thrombophlebitis of the thigh. *J Vasc Surg* 1999;30(6):1113-1115
- Verrel F, Steckmeier B, Parzhuber A, Rauh G, Tato F. Ascending varicose phlebitis – classification and therapy. *Langenbecks Arch Chir Suppl Kongressbd.* 1998;115:1237-1239
- Verrel F, Ruppert V, Spengel FA, Steckmeier B. Stage-adapted therapy in ascending thrombophlebitis. *Zentralbl Chir* 2001;126(7):531-536
- Wichmann MW, Meyer G, Angele MK, Schildberg FW, Rau HG. Recent advantages in minimally invasive colorectal cancer surgery. *Onkologie* 2002;25(4):318-323
- Willekes CJ, Eidoga JK, Frezza EE. Laparoscopic repair of paraesophageal hernia. *Ann Surg* 1997;225(1):31-38
- Wille-Jørgensen P, Rasmussen MS, Andersen BR, Borly L. Heparins and mechanical methods for thromboprophylaxis in colorectal surgery. *Cochrane Database Syst Rev* 2003;(4):CD001217
- Wilson YG, Allen PE, Skidmore R, Baker AR. Influence of compression stockings on lower-limb venous haemodynamics during laparoscopic cholecystectomy. *Br J Surg* 1994;81(6):841-846

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