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The Importance of Deep Vein Thrombosis Prophylaxis in Laparoscopy Patients

Laparoscopy is a common surgical minimally invasive procedure undertaken using a specialised endoscope and instruments which access the abdominal cavity via small incisions. Laparoscopy is used for both diagnosis and treatment of a wide range of conditions and increasingly is being used by general, urological and gynaecological surgeons to undertake complex procedures which a few years ago would have only been possible via a laparotomy.

During laparoscopy, in order to create space, improve visualization and enable instrument manipulation, the abdominal cavity must first be filled with an insufflating gas to create a pneumoperitoneum. As a result of this, the pressure in the abdominal cavity increases by approximately 10-15 mmHg. Dependent upon the type of laparoscopic surgery to be performed patients may be positioned head up, head down in lithotomy, supine or laterally [1].

Pneumoperitoneum, the effects of anaesthesia and positional changes for laparoscopic surgery all induce haemodynamic changes [1]. Increased intra-abdominal pressure and a head up position results in pooling of venous blood in the legs which in turn reduces flow in the inferior vena cava and a reduced cardiac output [1].

Why does laparoscopic surgery place the patient at risk of venous thromboembolism (VTE) development?

Venous Stasis

Laparoscopic surgery is often associated with longer operating times compared to open procedures [2]. Administration of a general anaesthetic causes a loss of normal physiological muscle contraction in the lower limbs [3] and also results in distension of the deep veins of the leg decreasing venous return [4].

Both a 'head up' position and the elevated intra-abdominal pressure as a result of pneumoperitoneum independently can reduce venous blood return from the lower extremities by as much as 40% [5].

Alteration in fibrinolytic activity

Vessel damage and trauma during the operative procedure lead to the enhanced release of circulating procoagulants. It has been established for many years that major surgery is accompanied by a recognised reduction in the spontaneous fibrinolytic activity of the blood, a so-called 'fibrinolytic shutdown' [6,7,8,9,10]. This phenomenon is reported to commence during or soon after the surgical procedure and last for at least 3 days [6,9]. Despite less tissue trauma in laparoscopic surgery, no differences in fibrinolytic capacity have been identified between patients undergoing conventional versus laparoscopic surgery [11,12,13,14].

Venous Thromboembolism Prophylaxis

Although the incidence of VTE is significantly lower after laparoscopic versus open surgery [14,15], there is still significant risk of VTE during complex and prolonged laparoscopic procedures particularly where there are additional risk factors [16].

The use of intermittent pneumatic compression (IPC) to the lower limbs can counteract the negative effects of elevated intra-abdominal pressure and body position on venous blood return from the lower extremities [5,17,18]. The European Association for Endoscopic Surgery recommends that intra-operative IPC is used for all prolonged laparoscopic procedures [5].

Mechanical and biochemical effects of FLOWTRON® DVT Prophylaxis systems

Prevention of venous stasis

Use of *FLOWTRON* DVT Prophylaxis Systems prevents venous stasis by active augmentation of blood flow[19,20,21,22,23,24,25]. This reduces stasis, flushes valve pockets where thrombi originate, decreases venous hypertension and decreases interstitial oedema[26].

Increases fibrinolytic activity

Use of *FLOWTRON* DVT Prophylactic Systems results in an increase in the fibrinolytic activity of the blood[27,28], suppression of procoagulant factors[27] and may assist in the reversal or prevention of fibrinolytic shutdown.

Clinical studies using the *FLOWTRON* DVT Prophylaxis Systems

Clinical studies undertaken in surgical patients utilising *FLOWTRON* DVT Systems have established high levels of efficacy combined with excellent patient compliance and freedom from adverse effects[3,29,30,31,32].

An additional benefit is that when *FLOWTRON* DVT Systems were used as the method of prophylaxis compared to low molecular weight heparin, the operative field was drier and easier to work in[30,32,33].

Comparative studies[34,35] have identified that use of the *FLOWTRON* DVT Prophylactic System was as effective as use of low molecular weight heparin in preventing DVT and PE. There was significantly lower cost and no side effects associated with use of the *FLOWTRON* Systems.

A recent study comparing thrombotic and haemorrhagic complications after urological laparoscopic surgery concluded that both heparin and the *FLOWTRON* DVT Prophylactic System were equally effective in VTE prophylaxis yet heparin was associated with a significant number of haemorrhagic complications[36].

Duration of prophylaxis

IPC should be commenced pre-operatively if the patient is immobile and then continued intraoperatively as DVT often develops as a result of the surgical procedure. While laparoscopic procedures are associated with shorter hospitalisation, evidence based guidelines and consensus papers[2,37] highlight the requirement for prophylaxis to continue until the patient is fully ambulatory which may mean prophylaxis is continued after discharge.

Additional benefits of IPC

Recent research has suggested that use of IPC significantly improves both cardiac function and visceral perfusion during positive pressure pneumoperitoneum and is recommended for prolonged laparoscopic procedures[38,39]. Cerebral oxygen saturation has also been found to be improved using IPC during laparoscopic cholecystectomy[40].

Conclusion

Laparoscopic surgery results in less tissue trauma, decreased patient pain, increased patient mobility and shortened hospital stays[41], all of which are clearly advantageous for both the patient and the healthcare provider.

However several factors associated with laparoscopic surgery increase risk of morbidity and mortality from VTE. The *FLOWTRON* DVT Prophylactic System can provide safe and costeffective prophylaxis.

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