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# Prevention of VTE in colorectal surgery

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## About the Reviewer



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Professor Andrew Hill completed his general surgical training in 1997 and worked in Kenya as a medical missionary and head of surgery at Kijabe Hospital for four years. Following this he returned to Middlemore Hospital where he now practices as a colorectal surgeon. His research interests are improving outcomes from major abdominal surgery and medical education and he has published over 250 peer-reviewed papers in these areas. He is the author of the international PROSPECT guidelines for pain management after haemorrhoidectomy and has recently edited the Proctology section of Keighley and Williams Colorectal Textbook, a major resource for colorectal surgeons the world over. He is also a Reviewer for 30 journals including the British Medical Journal, The Lancet, Medical Education, British Journal of Surgery and Annals of Surgery. Andrew leads the Auckland Enhanced Recovery After Surgery (AERAS) research group, aiming to improve patient outcomes after major surgery. He is also a councillor for the Royal Australasian College of Surgeons and is President of the International Society of Surgery.

### Abbreviations used in this review

**ACS NSQIP** = American College of Surgeons National Quality Improvement Program  
**aOR** = adjusted odds ratio  
**ASA** = American Society of Anesthesiologists  
**CI** = confidence interval  
**DALYs** = disability-adjusted life-years  
**DVT** = deep vein thrombosis  
**LMWH** = low-molecular-weight heparin  
**NA** = not applicable  
**NS** = non-significant  
**PE** = pulmonary embolism  
**VTE** = venous thromboembolism

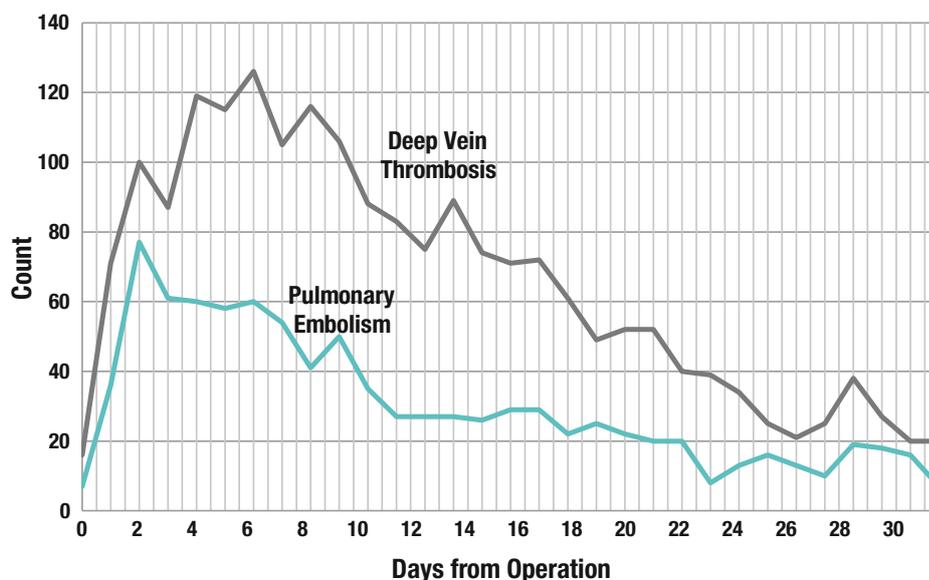
This review focuses on the incidence and prevention of venous thromboembolism (VTE) in colorectal surgical patients. VTE, with an estimated overall prevalence of 1.4-2.4% in this population, is a potentially preventable condition increasing morbidity, mortality, hospitalisation length and cost of care.<sup>1</sup> While the risk of VTE is highest in the first 2 weeks post surgery, it may remain elevated for weeks or months after discharge from hospital.<sup>2,3</sup> It is imperative that the risk of VTE is recognised and thromboprophylaxis used appropriately in patients undergoing colorectal surgery.

## Introduction

Deep vein thrombosis (DVT) and pulmonary embolism (PE), collectively referred to as VTE, are potential morbid complications after general surgery, with estimated rates of VTE as high as 20% in patients not receiving antithrombotic prophylaxis.<sup>2</sup> This risk is even higher in the colorectal surgical population, with an estimated 30% of thromboprophylaxis-naïve patients developing DVT and a four-fold higher incidence of symptomatic PE in this group compared with the general surgical population.<sup>2,4</sup>

## VTE following colorectal surgery

The American College of Surgeons National Quality Improvement Program (ACS NSQIP) database of 116,029 patients undergoing colorectal resections for benign or malignant colorectal tumours, diverticular diseases, Crohn's disease or ulcerative colitis between 2005 and 2011, revealed a VTE rate of 2%, a DVT rate of 1.2%, an isolated PE rate of 0.7% and a DVT + PE rate of 0.2%.<sup>1</sup> Among patients experiencing PE, 19.8% had been diagnosed with DVT at least 1 day prior.<sup>1</sup> The most common time for the development of VTE was the first week after surgery, with 36.5% of those with DVT and 43.8% of those with PE diagnosed in the first postoperative week (**Figure 1**).<sup>1</sup> Of note, the risk of symptomatic VTE remained high after discharge from hospital, with approximately 30% of VTE events diagnosed post-discharge.<sup>1</sup>



**Figure 1.** Postoperative VTE complications within 30 days of colorectal surgery.<sup>1</sup>

Analysis of another large dataset (UK Hospital Episode Statistics data) involving 35,997 patients undergoing colorectal resection found a similar postoperative VTE rate (2.3%).<sup>3</sup>

Comparing the risk of VTE in laparoscopic colorectal surgery to that with open colorectal resection, two large US studies have suggested a higher incidence of VTE in open cases.<sup>5,6</sup>



## The burden of VTE

Postoperative patients experiencing VTE stay in hospital on average 1 week longer than those without, resulting in significantly higher health care costs compared to patients without such complications.<sup>1</sup>

According to the findings of a large global systematic review, VTE in hospitalised patients was the second most common cause of disability-adjusted life-years (DALYs) in high-income countries, being responsible for more DALYs lost than nosocomial pneumonia, catheter-related bloodstream infections, and adverse drug events.<sup>7</sup>

A study undertaken by the Australia and New Zealand Working Party on the Management and Prevention of VTE, estimated an overall loss associated with VTE for Australia in 2008 of 78,408 DALYs, with premature mortality accounting for 99.7% of the estimated total burden of disease.<sup>8</sup> Australian Institute of Health and Welfare data indicate that 7% of all deaths in Australian hospitals are due to VTE.

Nearly one-third of patients with DVT develop long-term complications, such as post-phlebotic (or post-thrombotic) syndrome, which is associated with limb swelling, leg pain and ulceration, and can develop years after the initial thrombotic event, resulting in substantial disability.<sup>9,10</sup>

It is of critical importance to recognise risk factors for the development of VTE in order to decrease its associated morbidity and mortality.<sup>1</sup> Patient-specific risk factors for VTE, bleeding risks and the specific surgical procedure must all be taken into account when balancing the risks and benefits of specific methods of thromboprophylaxis.<sup>2</sup> Most hospitalised patients will have at least one risk factor for VTE and up to 40% will have ≥3 risk factors. Individuals undergoing colorectal surgery are considered to be at high risk of VTE.<sup>3</sup> In addition, chemotherapy is recognised as a significant risk factor for VTE in cancer patients.<sup>11</sup>

The elevated risk of VTE in colorectal surgical patients is associated with pelvic dissection, intraoperative patient positioning, and the presence of additional risk factors such as pre-existing inflammation in malignancy or inflammatory bowel disease (IBD).

Analysis of data from the ACS NSQIP database of patients undergoing colorectal resection, identified American Society of Anesthesiologists (ASA) score >2 and hypoalbuminaemia (serum albumin <3.5 mg/dL) as important risk factors for the development of DVT, and DVT and disseminated cancer as the most important risk factors for PE, along with a number of other associated factors (Table 1).

**Table 1.** Preoperative variables associated with postoperative DVT and PE in 116,029 colorectal surgery patients in the ACS NSQIP database. (Adapted from Moghadamyeghaneh 2014)<sup>1</sup>

Variables	DVT aOR (95% CI)	PE aOR (95% CI)
ASA score >2	<b>1.77</b> (1.50-2.04)	NS
Hypoalbuminaemia	<b>1.69</b> (1.49-1.93)	<b>1.21</b> (1.02-1.42)
Emergency admission	<b>1.55</b> (1.34-1.79)	<b>1.24</b> (1.03-1.50)
Ulcerative colitis	<b>1.48</b> (1.08-2.04)	NS
Open surgery	<b>1.33</b> (1.14-1.55)	<b>1.73</b> (1.43-2.09)
Age >70 years	<b>1.33</b> (1.17-1.52)	<b>1.32</b> (1.12-1.55)
Disseminated cancer	<b>1.29</b> (1.02-1.61)	<b>1.70</b> (1.32-2.19)
Steroid use	<b>1.23</b> (1.01-1.48)	<b>1.48</b> (1.15-1.88)
Anaesthesia length >150 min	<b>1.16</b> (1.002-1.36)	NS
Body mass index >30	<b>1.15</b> (1.02-1.31)	<b>1.34</b> (1.15-1.36)
Colon cancer	NS	<b>1.26</b> (1.03-1.06)
DVT	NA	<b>14.60</b> (11.96-17.81)

aOR = adjusted odds ratio; ASA = American Society of Anesthesiologists; CI = confidence interval; DVT = deep vein thrombosis; NA = not applicable; NS = non-significant; PE = pulmonary embolism

Analysis of the English Hospital Episode Statistics dataset found that the risk of VTE in patients with cancer remains elevated for 6 months post surgery compared with 2 months for those with benign disease, and also identified older age, cancer and emergency admission for IBD to be associated with a higher risk of VTE. In the analysis, patients undergoing minimal access surgery had a lower risk of VTE than those undergoing open surgery; 1.7% vs 2.4% (p = 0.003).<sup>3</sup>

## Preventing VTE after colorectal surgery

Given the varied risk factors for VTE post-surgery, and limited data on the incidence of this complication, the use of post-discharge pharmacoprophylaxis varies considerably in clinical practice.<sup>12</sup>

The American Society of Colon and Rectal Surgeons Clinical Practice Guidelines for the prevention of VTE in colorectal surgery recommend the following:

- The use of a VTE risk assessment model to guide VTE prophylaxis (risk assessment tools include the widely used [Caprini Score](#), the [Post-Discharge Venous Thromboembolism Risk Calculator](#) and the Rogers Score)<sup>12,13</sup>
- Mechanical strategies for VTE prophylaxis, including early mobilisation, elastic stockings, and intermittent pneumatic compression devices, should be deployed
- Pharmacological thromboprophylaxis with either low-molecular-weight heparin (LMWH) or low-dose unfractionated heparin (LDUH) should typically be given to those patients deemed at moderate or high risk of VTE, who are not identified as high risk for bleeding complications
- For high VTE risk patients, where chemoprophylaxis is contraindicated or previously found to be insufficient, an inferior vena cava filter may be considered
- For patients undergoing colorectal cancer resection, deemed to be at high risk for VTE, strong consideration should be given to extended-duration pharmacological thromboprophylaxis (4 weeks)
- Patients with IBD are at high risk for DVT and these patients may benefit from extended prophylaxis.

### Antithrombotics approved for use in NZ for the prevention of VTE in general surgery patients

- LMWHs (e.g. enoxaparin, dalteparin)
- Unfractionated heparin

## Evidence supporting the use of extended thromboprophylaxis

A meta-analysis of three randomised controlled trials of extended thromboprophylaxis (3-4 weeks after surgery) with LMWH in major abdominal surgery (70.6% of patients had neoplastic disease) revealed a significant reduction in the incidence of VTE with such therapy compared to in-hospital prophylaxis (5.93% vs 13.6%; RR 0.46; 95% CI 0.28-0.7); DVT 5.93% versus 12.9% (RR 0.46; 95% CI 0.29-0.74), proximal DVT 1% versus 4.72% (RR 0.24; 95% CI 0.09-0.67).<sup>14</sup> The analysis also demonstrated the relative safety of extended thromboprophylaxis with regard to bleeding risk, with no significant difference in major or minor bleeding between the two groups; 3.85% versus 3.48% (RR 1.12; CI 95% 0.61-2.06).<sup>14</sup> These findings were supported by a study investigating VTE in patients undergoing colorectal surgery for suspected or confirmed malignancy, and in a Cochrane review of RCTs investigating extended-duration thromboprophylaxis (typically LMWH) for 4 weeks after open abdominal or pelvic surgery (VTE incidence 14.3% vs 6.1%; OR 0.41 [95% CI 0.26-0.63]).<sup>11,15</sup>

The benefit of extended thromboprophylaxis has also been demonstrated in patients undergoing laparoscopic resection for colorectal cancer in a randomised controlled trial investigating either 7 days or 28 days of heparin therapy, with VTE rates of 9.7% and 0.9%, respectively (relative RR 91%; 95% CI 0.3-0.99).<sup>16</sup>



## EXPERT'S CONCLUDING REMARKS

Virchow's triad of stasis, coagulation status and vessel wall abnormality has long been the key to the understanding and prevention of VTE for surgeons undertaking major surgery.<sup>17</sup> While altering coagulation status has been a mainstay of prevention of VTE, little attention has been paid to the stasis that accompanies postoperative immobility.

Henrik Kehlet, the high priest of fast-track surgery, has taken another look at the role of postoperative immobility in a series of very interesting studies in Denmark on patients undergoing hip and knee joint replacement, similar to colorectal surgery as procedures long known to place patients at high risk of VTE.<sup>18</sup> What these studies have shown is that excellent management of pain and early and aggressive mobilisation (as a result of management of pain) reduces VTE rates in these patients to almost zero.

Colorectal surgeons, and other surgeons undertaking large painful operations, need to take these findings into account, although it is acknowledged that they are from a surgical field other than colorectal surgery. The risks of immobilisation in colorectal surgery (often due to poor pain relief) are real and it is likely that the benefits of early mobilisation and good pain relief go beyond simply making it possible to send patients home early. Thus, any modern perioperative care programme needs to make sure that surgical care for the patient does not stop at the operating theatre door. VTE prevention is not just anticoagulants and VTE stockings although these are important. It must include comprehensive multimodal pain relief and early aggressive mobilisation. With this approach, in selected cases of fast-track surgery, thromboprophylaxis could be limited to hospitalisation only, and extended thromboprophylaxis reserved for high-risk procedures, and this should be a future focus for colorectal perioperative care research.<sup>19</sup>

## TAKE-HOME MESSAGES

- Patients undergoing colorectal surgery are at increased risk of VTE
- The most common time for VTE is in the first postoperative week
- VTE risk may be elevated up to 6 months post surgery
- Mechanical strategies for VTE prophylaxis, including early mobilisation, elastic stockings, and intermittent pneumatic compression devices, should be deployed
- Thromboprophylaxis significantly reduces the risk of postsurgical VTE
- Risk factors for VTE should be taken into account when balancing the risks and benefits of specific methods of thromboprophylaxis
- Extended prophylaxis (4 weeks) is recommended for patients at high risk of VTE.

### Useful resources:

National Policy Framework: VTE Prevention in Adult Hospitalised Patients in NZ. Available from: <https://www.hqsc.govt.nz/assets/Other-Topics/QS-challenge-reports/VTE-Prevention-programme-National-Policy-Framework.pdf>

NZ Best Practice VTE prevention guidelines. Available from: [https://www.surgeons.org/media/19372/VTE\\_Guidelines.pdf](https://www.surgeons.org/media/19372/VTE_Guidelines.pdf)

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