



A Validated Risk Model to Predict 90-Day VTE Events in Postsurgical Patients

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e-Appendix 1.

Definitions of selected independent variables

Diabetes requiring medication: A patient is not included if diabetes is controlled by diet alone. A diagnosis of diabetes requiring therapy with an oral hypoglycemic agent or daily insulin therapy. Time frame: currently.

Definition: NSQIP.

Chronic obstructive pulmonary disease: Chronic obstructive pulmonary disease (such as emphysema and/or chronic bronchitis) resulting in any one or more of the following: 1. Functional disability from COPD (e.g., dyspnea, inability to perform ADLs) 2. Hospitalization in the past for treatment of COPD -Requires chronic bronchodilator therapy with oral or inhaled agents. 3. An FEV1 of <75% of predicted on pulmonary function testing. Patients are not included whose only pulmonary disease is asthma, an acute and chronic inflammatory disease of the airways resulting in bronchospasm. Patients are not included with diffuse interstitial fibrosis or sarcoidosis. Time frame: currently. Definition: NSQIP.

Pneumonia: Check if the patient has a new pneumonia or recently diagnosed pneumonia in the past month, or is on current antibiotic treatment for pneumonia at the time the patient is brought to the OR. Patients with pneumonia must meet NSQIP criteria from both radiology and signs/symptoms/laboratory sections. *Note time difference from NSQIP. Time frame: <30 days. Definition: MSQC.

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Congestive heart failure: Only newly diagnosed CHF within the previous 30 days or a diagnosis of chronic CHF with new signs or symptoms in the 30 days prior to surgery fulfills this definition. Time frame: <30 days.

Definition: NSQIP.

Peripheral vascular disease: Includes patients with 1) History of revascularization/amputation for PVD, such as any type of angioplasty (including stent placement) or revascularization procedure for atherosclerotic peripheral vascular disease (PVD) (for example, aorta-femoral, femoral-femoral, femoral-popliteal) or a patient who has had any type of amputation procedure for PVD (for example, toe amputations, transmetatarsal amputations, below the knee or above the knee amputations). Does not include patients who have had amputation for trauma or a resection of abdominal aortic aneurysms OR 2) Rest pain/gangrene: Rest pain secondary to occlusive disease occurs at rest and is manifested as a severe, unrelenting pain aggravated by elevation and often preventing sleep. Gangrene is a marked skin discoloration and disruption indicative of death and decay of tissues in the extremities due to severe and prolonged ischemia. This includes patients with ischemic ulceration and/or tissue loss related to peripheral vascular disease but does not include patients with Fournier's gangrene. Time frame: currently. Definition: NSQIP.

Sepsis, septic shock, or SIRS: 1. SIRS (Systemic Inflammatory Response Syndrome): SIRS is a widespread inflammatory response to a variety of severe clinical insults. This syndrome is clinically recognized by the presence of two or more of the following:

- a. Temp >38°C (100.4°F) or < 36°C (96.8°F)
- b. HR >90 bpm
- c. RR >20 breaths/min or PaCO₂ <32 mmHg (<4.3 kPa)
- d. WBC >12,000 cell/mm³, <4000 cells/mm³, or >10% immature (band) forms
- e. Anion gap acidosis: this is defined by either: $[Na + K] - [Cl + HCO_3 \text{ (or serum CO}_2\text{)}]$. If this number is greater than 16, then an anion gap acidosis is present. Or, $Na - [Cl + HCO_3 \text{ (or serum CO}_2\text{)}]$. If this number is greater than 12, then an anion gap acidosis is present.

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2. Sepsis: Sepsis is the systemic response to infection. Report this variable if the patient has clinical signs and symptoms of SIRS listed above and one of the following:

- a. Positive blood culture
- b. Clinical documentation of purulence or positive culture from any site thought to be causative. In addition, a patient with a suspected pre-operative clinical condition of infection, or bowel infarction, (which leads to the surgical procedure and meets the criteria for SIRS above), the findings at operation must confirm the diagnosis with one of more of the following: Confirmed infarcted bowel requiring resection or purulence in the operative site or enteric contents in the operative site, or positive intra-operative cultures

3. Severe Sepsis/Septic Shock: Sepsis is considered severe when it is associated with organ and/or circulatory dysfunction. Report this variable if the patient has sepsis AND documented organ and/or circulatory dysfunction. Examples of organ dysfunction include: oliguria, acute alteration in mental status, acute respiratory distress. Examples of circulatory dysfunction include: hypotension, requirement of inotropic or vasopressor agents. Severe Sepsis/Septic Shock is assigned when it appears to be related to Sepsis and not to a Cardiogenic or Hypovolemic etiology. Time frame: currently. Definition: NSQIP.

Prior operation within 30 days: The patient has had a major surgical procedure performed within 30 days prior to the assessed operation that is listed on the CPT Code Inclusion List. Also *include* any transplant procedures or trauma procedures if performed within 30 days prior to the assessed operation. Time frame: <30 days. Definition: NSQIP.

Varicose veins: Varicose veins are distended, tortuous, superficial veins with incompetent valves resulting from congenital conditions, thrombophlebitis, or conditions that cause increased venous pressure. Review history and physical (H & P) for indication patient has EVER had varicose veins. Check even if patient has history of vein stripping or other treatment for varicose veins. Leave blank if not mentioned. Time frame: ever. Definition: MSQC.

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Hypercoagulable state (any): Most disorders that cause thrombophilia* increase the risk of blood clot formation in veins; a few increase the risk of clot formation in both arteries and veins. Some of the disorders that cause thrombophilia are inherited. Many of these result from changes in the amount or function of certain proteins in the blood that control clotting. For example, activated protein C resistance (Factor V Leiden mutation); a specific mutation in the prothrombin gene (prothrombin 20210 mutation); and a deficiency of protein C, protein S, or antithrombin all cause an increase in the production of fibrin, an important protein involved in clot formation. Hyperhomocysteinemia, an increase in the amount of homocysteine (a type of amino acid) in the blood, may increase the risk of clotting in veins and arteries. *Thrombophilia is the propensity to develop thrombosis (blood clots) due to an abnormality in the system of coagulation. Time frame: ever. Definition: MSQC.

Personal history of DVT or PE: A vein may never be the same after an initial episode of DVT and is therefore a place of origin for future DVT. The formation of a clot results in vein scarring, valvular destruction and muscle pump deterioration that in turn leads to blood stasis and a decrease in fibrinolytic activity. Patients with a past history of thrombosis may be found to have a positive marker for thrombophilia. Do NOT include "thrombophlebitis" which is vein inflammation. Thrombophlebitis may occur after the recent use of an intravenous (IV) line, after trauma to the vein, or for no apparent reason in persons at risk for thrombophlebitis. Time frame: ever. Definition: MSQC.

Family history of DVT or PE: Patients with a first degree (parents, siblings) family history of thrombosis may have a positive marker for thrombophilia. If not discussed in H & P or if history unknown, then leave blank. Time frame: ever. Definition: MSQC.

Inflammatory bowel disease (IBD): IBD is the classification given to ulcerative colitis and Crohn's disease, which are chronic diseases of unknown etiology characterized by inflammation of the intestinal tract. Several studies have concluded that thromboembolism is a specific feature of IBD as neither rheumatoid arthritis, another chronic inflammatory disease, nor celiac disease, another chronic bowel disease, have an increased risk of thromboembolism. This may be due to hyperhomocysteinemia (homocysteine is an amino acid), an established risk

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for arterial and venous thrombosis, because it may be more prevalent in IBD due to vitamin deficiencies. Only include colitis if the history specifies ulcerative colitis - otherwise, colitis, spastic colitis and/or infectious colitis are not included. Irritable Bowel Disease/Syndrome (mechanical issue-not a risk factor) is not to be confused with Inflammatory Bowel Disease. Time frame: ever. Definition: MSQC.

Leg immobilization: The incidence of phlebographically confirmed DVT after plaster-case immobilization of the lower extremity has been reported to be between 4 and 30 %. Long bone casting leads to blood flow reduction and stasis due to immobilization. Time frame: currently. Definition: MSQC.

Hip, pelvis, or proximal femur fracture: Patients with trauma to the pelvic area sufficient enough to cause fracture of the pelvis or proximal femur have an incidence of DVT equal to 35-40%. A hip or proximal femur fracture can cause trauma and compression to the femoral vein, leading to a site of hypercoagulability as well as lower extremity immobilization, venous stasis, and edema. Time frame: <30 days. Definition: MSQC.

Central venous catheter: The development of a fibrin sleeve thrombosis and eddy flow formation around the area of insertion of a catheter creates stasis and predisposes veins to DVT formation. In addition, prolonged use of a catheter predisposes to infection and sepsis, which increases the risk of catheter-related thrombogenesis (formation of a thrombus or blood clot). There is an increased risk of DVT (see malignancy below) in cancer patients receiving chemotherapy via central venous access. Venous thrombi may arise around these catheters and can break off to produce pulmonary emboli. Check if central venous line/PICC (a peripherally inserted central intravenous access that can be used for a prolonged period of time), or hemodialysis catheter, is present on admission, or placed at any time prior to the index surgery. Time frame: currently. Definition: MSQC.

Major trauma within 30 days: DVT has been reported to occur in 20 - 40% of high-risk trauma patients who have not received recommended prophylaxis. Trauma can predispose patients to multiple risk factors including immobilization, major surgery, central venous access and infection depending on the severity of the trauma. Using the NSQIP definitions, review if patient has suffered any trauma within the preceding month: falls from a ladder or



down stairs, admitted to trauma service/team or trauma team is activated - i.e. motor vehicle accidents, gun-shot wounds, stabbing/knife injuries, etc. Time frame: <30 days. Definition: MSQC.

Present malignancy: Review history and physical for indication patient has an existing malignancy. Thrombotic complications are especially prevalent in patients with pancreatic malignancies, brain tumors, and hematological malignancies. Do NOT check if patient has had "organ removal" or lumpectomy, chemotherapy/radiation therapy in the past and/or currently has no evidence of disease or is considered in remission. Also do NOT check if patient has or had basal cell or superficial squamous cell skin cancer. Time frame: currently. Definition: MSQC.

Female-pregnant or postpartum: The risk of DVT increases five-fold in patients who are pregnant, less than one month (<30 days) post-partum, or less than (<30 days) post spontaneous abortion over non-pregnant women. The cause of recurrent pregnancy loss is in most cases unknown, although hypercoagulability and placental infarction have been proposed as etiologic factors. Data in support of this hypothesis include the observation of placental thrombi in patients with the antiphospholipid syndrome and reports of hypofibrinolysis and deficiencies of coagulation factor XII in patients with recurrent fetal loss. Note if patient is pregnant, this will be captured in NSQIP. This does not include "elective" abortion as this occurs due to "mechanical" means - not due to suspected deficiencies of coagulation/placental thrombi. Time frame: <30 days. Definition: MSQC.

Female-oral contraceptives: Contraceptives increase the risk of DVT three- to four-fold. Hormone replacement therapy (HRT) is the administration of exogenous estrogen or estrogen/progesterone preparations in post-menopausal women. Administration of these hormones in patients with thrombophilic defects such as Factor V Leiden or Prothrombin 20210A can produce an enormous increase in the incidence of venous thromboembolism. Tamoxifen and aromatase inhibitor therapy post breast lumpectomy are included in this category. They are hormonal drugs and VTE is listed as one of the side effects. This also includes bioidenticals which are creams compounded specific to one's individual hormone blood levels. OTC creams and herbal mixtures will not be included as there is no regulation on the amount of hormones in each dose. Time frame: <30 days. Definition: MSQC.

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