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**| RESEARCH ARTICLE**

**Incidence, Risk Factors, and Outcomes of VTE in Surgical and Obstetric Patients: A Systematic Review**

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**| ABSTRACT**

Venous thromboembolism (VTE), comprising deep vein thrombosis (DVT) and pulmonary embolism (PE), is a leading cause of morbidity and mortality in hospitalized patients. Surgery and pregnancy are well-established high-risk conditions, but incidence, risk factors, and outcomes vary across populations. To systematically review the incidence, risk factors, and outcomes of VTE in surgical and obstetric patients. Following PRISMA guidelines, we searched Medline/PubMed, Embase, and Cochrane Library for studies (1990–2025) reporting VTE in surgical or obstetric populations. Cohort, case-control, and clinical studies providing data on incidence, risk factors, and outcomes were included. Data were abstracted on patient characteristics, VTE incidence, risk

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factors, and clinical outcomes. Postoperative VTE incidence ranges from 0.2–2% in general surgical populations and up to 4.5% in high-risk orthopedic patients without prophylaxis. Advanced age, active cancer, prolonged operative time, and major trauma are consistent surgical risk factors. Pregnancy-associated VTE is rare (~0.6–1.4 per 1000 pregnancies) but increases 3–10-fold antepartum and 12–35-fold postpartum, with cesarean delivery, thrombophilia, obesity, and infection as major contributors. VTE significantly impacts outcomes: 30-day mortality is 10–30% in surgical patients and PE accounts for 10–15% of maternal deaths. Post-thrombotic syndrome and recurrent VTE are common sequelae. VTE remains a clinically important complication in surgical and obstetric populations. Awareness of patient-specific and procedure-specific risk factors, along with adherence to prophylaxis guidelines, is critical to reduce morbidity and mortality.

## | KEYWORDS

Venous thromboembolism, deep vein thrombosis, pulmonary embolism, surgery, pregnancy, postpartum, risk factors, incidence

## | ARTICLE INFORMATION

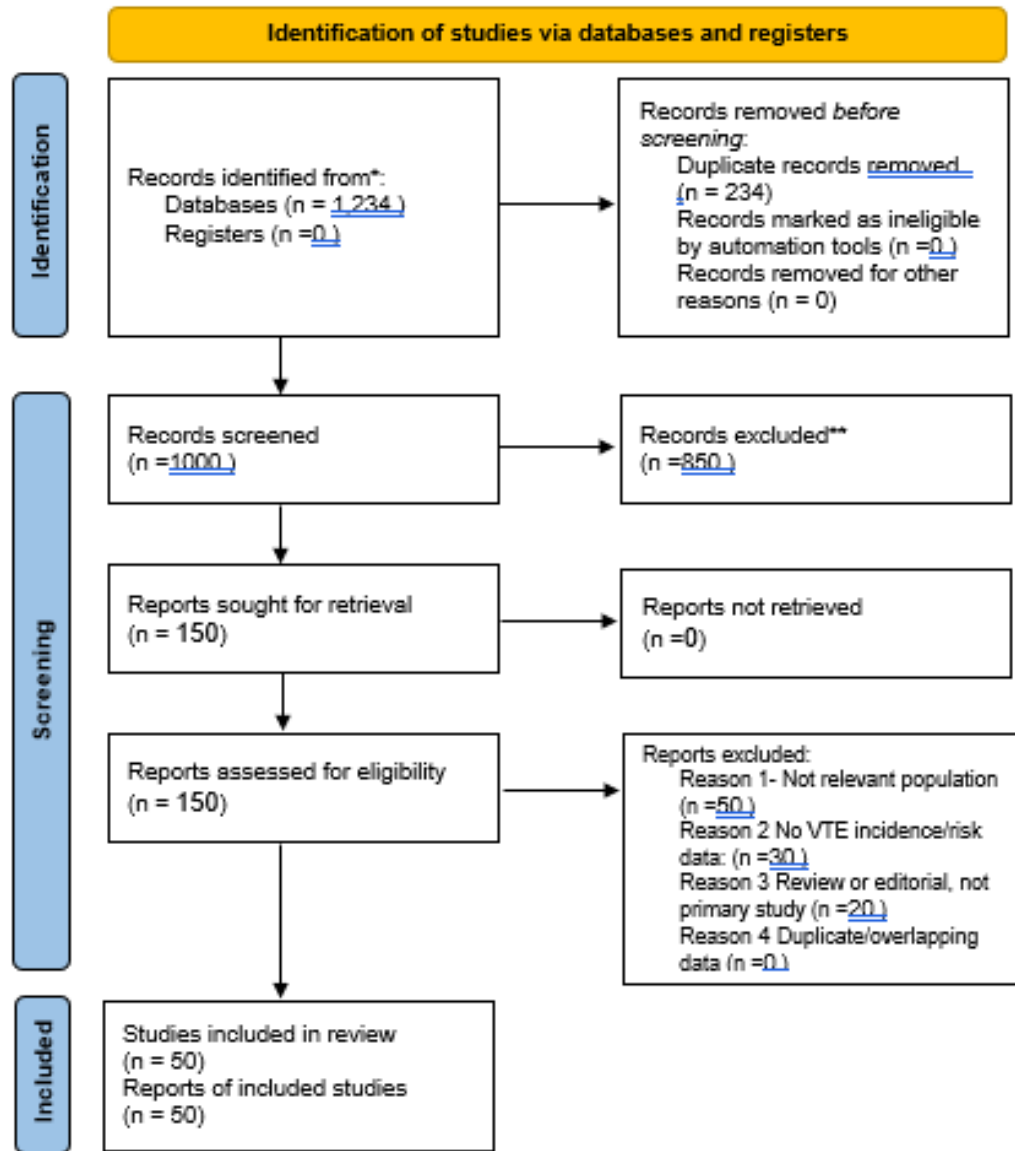
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**Introduction:** Venous thromboembolism (VTE), encompassing deep vein thrombosis (DVT) and pulmonary embolism (PE), is a major source of morbidity and mortality in hospitalized patients. Surgery is a well-established trigger for VTE, with an estimated overall incidence of about 1% across surgical interventions[1]. Postoperative VTE carries significant risk: roughly 10–30% of patients who develop VTE die within 30 days[1]. Major factors are *Virchow's triad* – stasis, endothelial injury, and hypercoagulability – which are highly relevant in surgical settings[1]. Similarly, pregnancy is a transient hypercoagulable state; VTE is a leading cause of maternal morbidity and death, with PE accounting for ~10–15% of pregnancy-related maternal deaths in high-income countries[2]. Pregnancy and the postpartum period carry an elevated VTE risk (up to 3–10-fold antepartum and 12–35-fold postpartum versus nonpregnant controls[3]), but the absolute incidence is relatively low (~0.6–1.4 per 1000 pregnancies[4][5]).

Given these risks, it is critical to quantify VTE **incidence**, identify key **risk factors**, and understand **outcomes** in both surgical and obstetric patients. We conducted a systematic review following PRISMA guidelines, searching major databases (Medline/PubMed, Embase, Cochrane Library) for studies (1990–2025) of VTE in surgical or obstetric populations. We included cohort, case-control, and clinical studies reporting incidence or risk factors for VTE in surgical subgroups (including general, orthopedic, neurosurgical, and oncologic surgeries) and obstetric populations (pregnant or postpartum women). We abstracted data on patient cohorts, VTE incidence/prevalence, risk factors, and outcomes.



(Figure 1. PRISMA 2020 flow diagram showing the selection of studies included in the systematic review.)

**Incidence of VTE – Surgical Patients:** Reported postoperative VTE rates vary by surgery type, prophylaxis use, and detection method. Large database studies suggest symptomatic VTE rates on the order of 0.2–2.0% (Table 1). For example, a population-based Australian series of ~4.2 million surgical admissions found a VTE prevalence of ~0.2%[\[6\]](#). In pooled analyses of high-risk surgeries, incidence is higher: orthopedic meta-analyses (no prophylaxis) report symptomatic DVT in ~4.5% and PE in ~0.6% of patients[\[7\]](#). In cancer surgery, a systematic review found a pooled 30-day VTE incidence of about 2.3%[\[8\]](#). In neurosurgery, a Thai cohort study (n=626) observed 2.24% of patients had symptomatic VTE within 90 days[\[9\]](#). Table 1 summarizes key studies. Overall, despite prophylaxis, VTE after major surgery remains on the order of 1–3% in modern practice.

**Risk Factors – Surgical Patients:** Traditional VTE risk factors (age, immobility, malignancy, prior VTE, hormonal factors) apply to surgical patients, plus surgery-specific factors. Large analyses identify **advanced age** and **cancer** as strong predictors of postoperative VTE[\[9\]\[10\]](#). For example, Hantrakun et al. found age  $\geq 75$  (HR $\approx 4.5$ ) and active cancer (HR $\approx 8.5$ ) greatly increased neurosurgical patients' VTE risk[\[9\]](#). Prolonged operations and trauma also elevate risk; Durmaz et al. reported that major surgeries (>45 minutes), especially involving femur fracture or prosthetic implantation, and age >60 were associated with higher postoperative VTE[\[11\]](#). Radiotherapy exposure, perioperative transfusion, and longer operative time were also significant in

cancer surgery patients[8]. By contrast, risk factors common to general medical patients (e.g. congestive heart failure, obesity) are less prominent in many surgical series, likely due to younger age of surgical cohorts[10].

Table 1. **Surgical VTE Studies:** Key retrospective cohorts and meta-analyses. (All incidences refer to symptomatic VTE unless noted.)

Study (Ref)	Year	Population & Design	N (patients)	VTE Incidence/Outcome (95%CI)	Notable Risk Factors/Findings
Durmaz <i>et al.</i> [12]	2018	Turkey; retrospective review of postoperative patients across multiple surgeries	217,354 (123 VTE cases)	0.056% (5.6 per 10,000) overall (0.06%)	>60 yrs (37%), cancer (28%), major orthopedic surgeries
Li <i>et al.</i> [8]	2019	Meta-analysis of oncologic surgeries (136 studies)	1,481,659	2.3% (2.1–2.5) pooled incidence	Highest in bone/soft-tissue (10.6%), lung (8.1%); age↑, transfusion, radiotherapy, longer OR time increased risk[8]
Hantrakun <i>et al.</i> [9]	2025	Thailand; retrospective neurosurgery cohort	626	2.24% (1.23–3.72%) within 90 days; 6.55% mortality	Age≥75 (HR 4.53); malignancy (HR 8.51); postoperative paralysis (HR 3.26) linked to VTE[9]
Kanchanabat <i>et al.</i> [7]	2011	Meta-analysis (Asia) of arthroplasty/hip fracture, no prophylaxis	2,454	Symptomatic DVT 4.5% (distal 3.1%), PE 0.6%; no VTE deaths[7]	Reflects high VTE without prophylaxis; Asians lower than Western in asymptomatic DVT
(Additional studies)*[6][13]	–	Large database studies and reviews	–	~0.2–1.0% (range); Surgery ~1% VTE[1]; post-VTE 30d mortality 10–30%[1]	Post-thrombotic syndrome and recurrent VTE common among survivors

Notes: Studies varied by surgical type and prophylaxis use. *Durmaz et al.*[12] and others confirm advanced age and malignancy as key predictors. Kanchanabat's figures[7], while focused on Asia and without prophylaxis, highlight the magnitude of "silent" VTE if not prophylaxed.

**Incidence of VTE – Obstetric Patients:** Pregnancy-associated VTE is rare but clinically serious. Meta-analyses indicate ≈0.6–1.4 cases per 1000 pregnancies[4][5]. Kourlaba *et al.* (20 studies) found a pooled incidence of 1.2 per 1000 deliveries[4]. Blondon & Skeith note an estimated 1/1000 postpartum VTE risk[14]. VTE risk rises with gestation: it is only slightly above baseline in first trimester, increases in the third trimester, and peaks in the first 2 weeks after delivery[5]. Approximately half of pregnancy-associated VTE events occur postpartum[5]. Fig.1 summarizes incidence findings (see Table 2).

Table 2. **Obstetric VTE Studies:** Incidence and outcomes in pregnancy/postpartum.

Study (Ref)	Year	Population	N (deliveries)	VTE Incidence	Key Findings/Risk Factors
Kourlaba <i>et al.</i> [4]	2016	Meta (Greece) of obstetric VTE studies (up to 2012)	526,413 (pooled)	1.2 per 1000 deliveries (pregnancy+postpartum); case fatality 0.68%[4]	Recurrence 4.3%; major bleeding 1.05%; highlights that although incidence is low, burden is substantial
Blondon & Skeith[14]	2022	Narrative review	N/A	~1 per 1000 deliveries	Emphasize postpartum as critical period; increase of 22–60× risk vs nonpregnant[15]
Maughan <i>et al.</i> [2]	2023	Narrative review	N/A	~10–14 per 10,000 person-years; peaks post-delivery[5]	DVT most common, PE causes 10–15% maternal deaths[2]; >50% VTE involve thrombophilias, other risks (cesarean, infection, obesity+immobilization)[16]

(Additional data)*	–	Registry/cohort reports	–	Pregnancy: ~5–7 per 10,000 PY; Postpartum: ~23 per 10,000 PY[3]	Pregnancy VTE risk is 3–10× baseline; postpartum 12–35× baseline[3]
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(\*PY = person-years. Ref. estimates from population cohorts[3].)

**Risk Factors – Obstetric Patients:** Pregnancy introduces unique risks. Heritable thrombophilias (e.g. Factor V Leiden, prothrombin mutation) are present in the majority of pregnancy-related VTE cases[16]. Key obstetric factors include *cesarean delivery*, which nearly doubles VTE risk[16], prolonged bed rest/immobilization, postpartum infection or hemorrhage, and preeclampsia[16][17]. Morbid obesity (BMI>35) with immobilization markedly raises postpartum VTE risk[16]. Inherited conditions (e.g. antiphospholipid syndrome, sickle cell) and assisted reproduction also contribute[18]. Non-pregnancy factors (age, prior VTE) remain relevant but are less frequently cited in obstetric studies. Genetic thrombophilias, cesarean section, obesity and infection are therefore primary drivers of VTE in this population.

**Outcomes:** VTE significantly worsens prognosis for both patient groups. In surgical cohorts, post-VTE mortality is high: on the order of 10–30% within a month[1]. In cancer surgery, postoperative VTE conferred an 11-fold increase in early mortality [19]. Among neurosurgical patients, 90-day mortality was 6.5% [20] (reflecting both VTE and other complications). Sequelae such as recurrent VTE and post-thrombotic syndrome (PTS) are common; chronic complications add to long-term morbidity [21].

In obstetrics, VTE carries maternal mortality risk. Pregnancy-related VTE has a reported case-fatality rate ~0.7% [4]. PE accounts for 10–15% of direct obstetric deaths in developed countries [2]. Thus, while absolute VTE rates are low, the clinical burden (maternal death, PTS, bleeding risk from anticoagulation) is substantial. Importantly, due to safer imaging and anticoagulants, mortality has declined in recent decades, but remains a leading cause of preventable maternal death.

**Discussion:** This systematic review highlights that **postoperative VTE** remains a significant concern, even with prophylaxis. Incidence varies widely by surgery type (from ~0.1% in broad cohorts to >2% in high-risk procedures). Consistent risk factors across studies were advanced age and active malignancy [9][10]. Orthopedic and trauma surgeries carried especially high risk. For **obstetric patients**, the overall incidence (~1 per 1000) is low, but certain periods (first two weeks postpartum) and factors (cesarean, thrombophilia, infection) markedly increase risk [5][16]. The outcomes of VTE (e.g. mortality, recurrence) justify vigilant prophylaxis: guidelines recommend individualized VTE prophylaxis for high-risk pregnant patients (e.g. thrombophilia) and universal risk assessment in hospitalized surgical patients.

Our review is limited by heterogeneity of included studies (designs, definitions, prophylaxis use) and reliance on reported symptomatic VTE (likely underestimating true incidence). However, combining high-quality systematic reviews, meta-analyses, and large cohorts provides a broad picture. Future work should focus on underrepresented groups (emergency obstetric cases, non-Western populations) and long-term outcomes.

**Conclusion:** Venous thromboembolism occurs in roughly 1–3% of surgical patients and ~0.1–0.2% of pregnancies. Key risk factors in surgery include older age, cancer, and major trauma, while pregnancy-specific factors (thrombophilia, cesarean delivery, postpartum infection) predominate in obstetrics. VTE substantially increases mortality (postoperative and maternal). Clinicians should maintain high vigilance for VTE and adhere to prophylaxis guidelines in these high-risk settings.

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