

# Venous Thromboembolism Prophylaxis in Shoulder Surgery



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## KEYWORDS

- Deep vein thrombosis • Pulmonary embolism • Thromboembolism prophylaxis
- Shoulder surgery • Shoulder arthroplasty • Arthroscopy

## KEY POINTS

- A venous thromboembolic event (VTE) is rare after shoulder surgery.
- VTE is more common after shoulder surgery for fracture and shoulder arthroplasty, compared with shoulder arthroscopy.
- The main risk factors for VTE are malignancy, other procoagulopathic conditions or treatments, dehydration, obesity, and advanced age.
- Mechanical prophylaxis could be universally considered given its risk-benefit profile.
- Chemical prophylaxis should be considered in patients with risk factors for VTE but weighed against the risk of bleeding complications.

## INTRODUCTION

Venous thrombosis is thought to be causally related to 3 factors that comprise Virchow triad: hypercoagulability, stasis, and endothelial injury.<sup>1</sup> Venous thromboembolic events (VTEs) after elective orthopedic surgery can have devastating complications and be costly and potentially fatal.<sup>2–4</sup> Prevention of VTE is key to minimizing risk to patients and the associated increased economic burden.

VTE has been extensively studied as a complication of lower extremity orthopedic surgery.<sup>5–9</sup> Without prophylaxis, the rate of a deep vein thrombosis (DVT) after lower extremity arthroplasty or fracture has been reported between 40% and 60%.<sup>5</sup> As a result, some sort of VTE prophylaxis is routinely recommended after hip arthroplasty and knee arthroplasty.<sup>10</sup>

Historically, rates of VTE after upper extremity surgery were largely unknown but anecdotally considered less than that after lower extremity surgery. The early descriptions of

VTE after shoulder surgery were in the form of case reports.<sup>11–18</sup> Subsequently, several larger series have shown that the rate of DVT after shoulder surgery is not insignificant and may be as high as 13%.<sup>19–21</sup> Unlike lower extremity arthroplasty, there is a paucity of evidence regarding thromboembolic prophylaxis after upper extremity surgery; thus, the American Academy of Orthopaedic Surgeons does not make strong recommendations.<sup>22,23</sup>

The first case report of a symptomatic DVT after shoulder surgery was described by Burkhart<sup>11</sup> in 1990 and was attributed to an underlying undiagnosed previously asymptomatic Hodgkin lymphoma. Arcand and colleagues<sup>16</sup> reported 1 case of axillary DVT with a resultant nonfatal pulmonary embolism (PE) in a 32-year-old man after shoulder arthroplasty. The investigators surmised that traction on the arm during the procedure may have caused an endothelial injury leading to thrombus formation.<sup>1</sup> Scott<sup>12</sup> reported a nonfatal PE in a 24-year-old man after arthroscopic glenohumeral débridement. Saleem and

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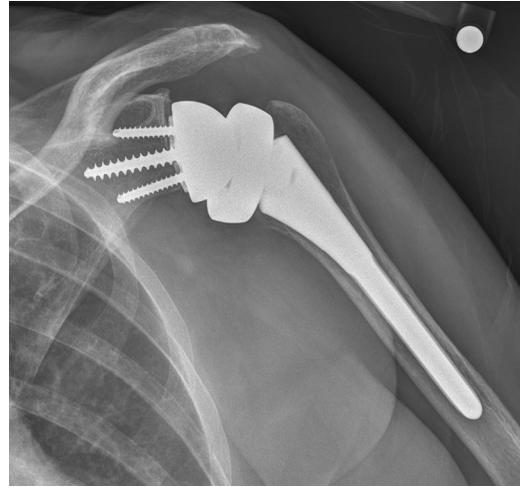
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Markel<sup>14</sup> reported a fatal PE in a 68-year-old man after shoulder arthroplasty; death occurred on postoperative day 1. The investigators speculated the event was related to the patient's long drive prior to surgery. Creighton and Cole<sup>18</sup> reported a symptomatic brachial DVT and subsequent symptomatic PE in a 43-year-old man undergoing an arthroscopic labral repair. Due to the absence of obvious risk factors, the authors attributed the thrombus to the beach chair position. Amarasekera and colleagues<sup>17</sup> reported a symptomatic subclavian DVT with subsequent symptomatic PE after an arthroscopic rotator cuff repair. Madhusudhan and colleagues<sup>15</sup> reported a fatal PE in a 73-year-old woman after shoulder arthroplasty originating from a symptomatic lower extremity DVT. The only risk factors the authors noted was a body mass index (BMI) of 34 kg/m<sup>2</sup>. Several other case reports exist in the literature.<sup>13</sup> Consistent throughout these singular cases, however, is the variability in patient age, procedure, and symptoms.

To some extent, these limitations in the literature are related to the overall low occurrence of VTEs. Additionally, studies vary in regard to study population and end points. This article attempts to delineate the reported rates of symptomatic versus asymptomatic DVTs as well as fatal versus nonfatal PE. This article also attempts to differentiate the rates after shoulder arthroplasty, arthroscopy, and trauma. Lastly, literature is reviewed in regard to recommendations for venous thromboembolism prophylaxis after shoulder surgery.

## INCIDENCE

The true incidence of VTE after shoulder surgery is difficult to extrapolate from the literature due to variations in diagnostic criteria, endpoints, and procedures analyzed. Ojike and colleagues<sup>24</sup> performed a systematic review on 8 separate studies in an effort to determine the incidence, risk factors, and diagnosis of VTE after shoulder surgery. Seven of the studies included were considered level II evidence, whereas 1 study was level IV. The study collected information on a total of 40,537 patients. Of these, 7314 had undergone an anatomic total shoulder arthroplasty, 9432 a hemiarthroplasty, and the remaining 23,791 an arthroscopic procedure. The overall reported rate of DVT in these studies ranged from 0.02% to 13%. The overall rate of VTE across all patients was 0.35%, with 0.24% of these having a DVT and 0.11% having a PE. VTE was more common for arthroplasty procedure with a rate of 0.7%, compared with 0.08% for arthroscopic procedures (Fig. 1).



**Fig. 1.** Shoulder arthroplasty seems to be associated with a higher risk of VTE than shoulder arthroscopy.

Three recent prospective studies have attempted to delineate the incidence of VTE after shoulder arthroplasty,<sup>19</sup> arthroscopy,<sup>20</sup> and trauma<sup>21</sup> (Table 1). Willis and colleagues<sup>19</sup> prospectively studied 100 consecutive patients undergoing shoulder arthroplasty (73 anatomic total shoulder arthroplasties and 27 hemiarthroplasties). All patients underwent 4-limb surveillance Doppler ultrasounds 2 days after surgery. Additionally, 50 patients underwent a repeat ultrasound at 12 weeks postoperatively. The investigators documented 13 (13%) DVTs in 12 patients, 10 of which had occurred by day 2, whereas 3 were diagnosed at week 12. The location of the DVTs varied, with 6 in the ipsilateral upper extremity, 5 in the ipsilateral lower extremity, and 2 in the contralateral lower extremity. None of these patients seemed symptomatic. In this cohort, there were 2 (2%) symptomatic nonfatal PEs and 1 (1%) fatal PE at 7 weeks postoperatively.

Takahashi and colleagues<sup>20</sup> prospectively studied 175 consecutive patients undergoing shoulder arthroscopy. Similarly, all patients underwent 4-limb Doppler ultrasound. Unlike the study by Willis and colleagues,<sup>19</sup> these investigators performed preprocedural baseline ultrasound scans, scans at 1 to 2 days postoperatively, and scans 3 weeks to 3 months postoperatively. Ultrasound detected 10 (5.7%) DVTs in this cohort, with only 1 occurring in the upper extremity and only 1 occurring in the subacute (3 weeks to 3 months) phase. Additionally, 1 patient was noted to have an asymptomatic PE in the subacute phase. The same institution performed surveillance scans in

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