



## Full Length Article

# Thromboprophylaxis after major orthopedic surgery: Improving compliance with clinical practice guidelines



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## ABSTRACT

**Introduction:** Identifying risk factors and strategies for the prevention of deep venous thromboembolism in major orthopedic surgery has allowed the development of Clinical Practice Guidelines (CPGs). Currently, there is a gap between clinical practice and the implementation of the recommendations of CPGs. The purpose of this paper is to report the impact of the implementation of improvement strategies on adherence to venous thromboembolism (VTE) prophylaxis guidelines.

**Materials and methods:** We defined 3 quality indicators to assess the adequate use of thromboprophylaxis according to CPGs. We obtained a baseline measurement and identified several barriers for adherence. Six improvement strategies to promote adherence to CPGs were designed and applied. A systematic monitoring of these indicators was performed in real time and a description of the data was completed for patients undergoing primary joint replacement of the hip, knee and shoulder, during February 2012 and August 2014.

**Results:** Data from 773 patients were obtained. In the first trimester, the average of adherence was: 98.3% for medical order in the post-operative note, 60.3% for opportune administration and 67% for adherence to therapy at home. In the trimester, the rates of adherence were 100%, 95.7% and 100% respectively.

**Conclusions:** Combined strategies for improvement of adherence to VTE prophylaxis is associated with higher compliance with clinical practice guidelines.

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## 1. Introduction

Thromboembolic disease is one of the most frequent causes of morbidity and mortality after joint replacement surgery [1] and in order to prevent this outcome after primary hip, knee or shoulder arthroplasty a strict implementation of thromboprophylaxis regimens is required. When no prophylaxis is used, thromboembolic events may occur in more than 20% of the patients [2–4]. In contrast, the literature has demonstrated that with the use of effective thromboprophylaxis, the incidence of symptomatic thromboembolic disease can be significantly reduced to 2.8% for hip replacement and 2.1% for knee replacement [5].

Identification of risk factors and the preventable nature of this disease [6] has promoted the development of Clinical Practice Guidelines (CPG) for prevention of deep venous thrombosis and pulmonary embolism [4,7,8]. Nevertheless, several limitations for the implementation of these guidelines have been recognized. In two studies conducted in

hospitals in North America, the average compliance to CPG recommendations was less than 50%, increasing the probability of occurrence of adverse events [5,9]. Similarly, results from the ENDORSE study for Colombia showed that adherence to the ACCP guidelines was only about 60% [10].

We adopted the recommendations for prevention of thromboembolic disease in primary joint replacement patients (CG-92) from the National Institute for Health and Clinical Excellence (NICE) [7] and the Institutional Guidelines for the Management of Thromboprophylaxis in Orthopedics (Table 1) developed in our hospital. Although the prevalence of symptomatic thromboembolic disease after major orthopedic surgery in our center is less than 3% [11], to evaluate our rate of compliance to CPG recommendations is critical to improve patient outcomes.

The extent of compliance to CPG recommendations can be assessed by systematic measurement of performance indicators. From the information obtained with this process, different improvement strategies can be created, implemented and evaluated in real time [12–14]. Similarly, the implementation of these strategies represents an effective methodology for the prevention of venous thromboembolism and a decrease in the incidence of related adverse events [15,16].

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**Table 1**  
Recommendations for thromboprophylaxis from the *Institutional Guidelines for the Management of Thromboprophylaxis in Orthopedics*.

Hip and knee arthroplasty
1. Thromboprophylaxis with both mechanical and pharmacological methods is indicated.
2. During the surgical procedure use anti-embolism stockings and intermittent pneumatic compression devices on the contralateral limb.
3. During hospitalization use: <ol style="list-style-type: none"> <li>Enoxaparin, dabigatran, rivaroxaban, apixaban or fondaparinux.</li> <li>Anti-embolism stockings and intermittent pneumatic compression devices on both limbs, until the patient has restriction of movement.</li> </ol>
4. Continue prophylaxis during 35 days after surgery.
Shoulder arthroplasty
1. Thromboprophylaxis with both mechanical and pharmacological methods is indicated.
2. During the surgical procedure use anti-embolism stockings and intermittent pneumatic compression devices on the legs.
3. During hospitalization use: <ol style="list-style-type: none"> <li>Enoxaparin or rivaroxaban.</li> <li>Anti-embolism stockings and intermittent pneumatic compression devices on both limbs, until the patient has restriction of movement.</li> </ol>
4. Continue prophylaxis during 13 days after surgery.

Our main objective is to describe the impact of a quality improvement program for the adherence to the CPG recommendations, through a systematic monitoring and measurement of performance indicators.

## 2. Materials and methods

We implemented a continuous quality improvement program to enhance the compliance to thromboprophylaxis guidelines. This program included: 1. Definition of performance indicators, 2. establishment of a baseline of the rate of compliance (February 2012), 3. implementation of improvement strategies [17–19], and 4. systematic monitoring of performance indicators (February 2012 to August 2014).

### 2.1. Definition of indicators

In order to assess the level of adherence to CPG recommendations for thromboprophylaxis, we selected, defined and validated the following performance indicators: 1. Correct order of thromboprophylaxis in the postoperative note, 2. timely administration of thromboprophylaxis according to CPG and 3. adherence to post-discharge thromboprophylaxis.

The definition of these indicators was carried out by a non-formal consensus product of weekly meetings of our working group in joint replacements. We also considered the library of quality indicators provided by JCI. The selection of a given indicator was based on the morbidity rates [5,11,20], structure and relevance of each indicator. Finally, they were externally validated according to the parameters from the *National Guideline Clearinghouse* and by an independent consulting firm [21]. All indicators belong to the “process” domain. The analysis of “outcome” indicators is beyond the scope of this study.

#### 2.1.1. Medical order of thromboprophylaxis in the postoperative note

The indicator of medical order of thromboprophylaxis in the postoperative note represents the standardization of the use of antithrombotic prophylaxis and a safety barrier to ensure drug administration. Cases in which thromboprophylaxis was ordered and recorded in the postoperative note according to CPG recommendations, were considered as cases of completion. The numerator was defined as number of patients in whom the indicator was met, and the denominator as the total number of patients undergoing surgery. The goal of the indicator was set at 100%.

#### 2.1.2. Timely administration of thromboprophylaxis according to CPG

The indicator for timely administration of thromboprophylaxis was defined according to what is recommended by the CPG regarding the start of each antithrombotic agent: rivaroxaban, enoxaparin and fondaparinux should be administered between 6 and 10 h after skin closure, and dabigatran between 1 and 4 h [7]. Timely administration contributes to the prevention of venous thromboembolism and the reduction of adverse events related to these drugs. Completion of the indicator was defined as the cases where the drug was administered within the time frame specified. The numerator was the number of patients in whom the indicator was met, and the denominator was the total number of patients undergoing surgery. The target of this indicator was also set at 100%.

#### 2.1.3. Thromboprophylaxis continued at home

As the risk of developing thromboembolic events is maintained up to 90 days after surgery [22,23], an indicator of thromboprophylaxis continued at home was created. CPG recommend that thromboprophylaxis should be extended during 30 days after discharge, and for a period no longer than 35 days, for patients who underwent hip or knee replacements, and between 10 and 14 days for shoulder arthroplasty. Completion of the indicator was defined as: cases in which the patient had completed extended thromboprophylaxis according to CPG recommendations. This was assessed by a telephone follow up where the patient was asked for how many days he had taken the medication. The numerator was the number of patients in whom the indicator was met, and the denominator was the total number of patients undergoing surgery. The target was set at 100% as well.

## 2.2. Systematic monitoring of indicators

After obtaining approval from the Institutional Ethics Committee, we performed a descriptive analysis of the evolution of the percentage of completion of the performance indicators.

Monthly monitoring of all indicators was performed in real time by reviewing all medical records and by telephonic follow-up at 90 days after surgery. We included all patients undergoing primary joint replacement of the hip, knee or shoulder, for primary or secondary arthritis, or fracture, during February 2012 and August 2014. Patients undergoing joint replacement surgery for oncologic pathology and patients in whom the administration of antithrombotic prophylaxis differ due to a medical indication (e.g. hemodynamic instability), were excluded. Results are described as the percentage of completion of each indicator and its variation over time.

### 2.3. Implementation of improvement strategies

Different improvement strategies were developed and implemented. Due to idiosyncrasies of the indicators these strategies were

**Table 2**  
Description of demographic characteristics of patients included in the analysis.

	Number of patients
Joint replacement	
Hip	425
Knee	331
Shoulder	17
Total	773
Gender	
Female	561
Male	212
	Mean
Age (years)	68.68
Surgeries per month	24.94

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