Introduction

Every year in the U.S., about 800,000 patients undergo hip and knee joint replacements, resulting in greatly appreciated reduction in pain and improved mobility.

Joint replacement carries with it a well-documented risk of venous thromboembolism (VTE) for a period of time that begins in the operating suite and continues at least 4 to 6 weeks post operatively (Warwick and Rosencher, 2010).

Without VTE thromboprophylaxis, 40-60% of joint replacement patients will develop embolisms (AHRQ, 2010). Most embolisms are not symptomatic, can only be detected by imaging studies, and require no treatment. But some will result in symptomatic Deep Venous Thrombosis (DVT); a smaller number will result in symptomatic pulmonary embolism (PE); and of those, a few will be fatal.

Studies have demonstrated that this risk for surgical patients can be dramatically reduced (but not eliminated) by a variety of effective prophylactic drugs and measures. The risk attendant with VTE prophylaxis is bleeding. Major bleeding events after joint replacement have been estimated at 1-3% (Geerts, 2008).

Since 2007, professional guidelines on VTE prophylaxis from different organizations have proliferated, some based on strong evidence, and some not. Some are in outright conflict, and some have been recently modified, including those of the major medical specialty organizations for orthopedists and pulmonologists.
To complicate matters further, the Joint Commission issued standards on VTE prophylaxis for hospitals, and CMS (Centers for Medicare and Medicaid Services) now withholds payment for VTE after joint replacement—despite evidence that not all VTE’s can be prevented.

How are orthopedists and other treating physicians to regard all these guidelines and standards? This internet monograph will present an overview of these guidelines and the strength of evidence for them; state which guidelines the physician should be aware of; explain the role of professional guidelines in the physician’s decision-making process; and suggest risk reduction strategies in VTE prophylaxis for joint replacement.

It’s important to keep in mind that guidelines are only guidelines. They were never intended as mandates, nor as the legal standard of care. They were never intended to be applied to every patient in every circumstance. Guidelines are created and intended as an aid to the physician’s decision-making, not a substitute for it.

**Issues of Controversy**

Thrombus versus hemorrhage is the historic conundrum in anticoagulation and thromboprophylaxis. Even with all the latest therapeutic options, anticoagulation is still a delicate balancing act. Orthopedists are confronted with bleeding complications in their surgical patients, leading many of them to believe bleeding is the main danger. Primary care physicians and pulmonologists are confronted with treating the DVT’s and PE’s, leading many of them to believe thrombus is the main danger.

Reports vary widely regarding the utilization of VTE prophylaxis by orthopedists, but it appears to be on the increase. In 2003, a published review of more than 7,500 medical records revealed that only 23% of hip fracture patients received thromboprophylaxis (McGlynn et al., 2003). By 2008, a study indicated that more than 90% of patients undergoing major orthopedic surgery received mechanical or pharmacological prophylaxis (Cohen et al., 2008).

The duration of prophylaxis is another issue not yet agreed upon. Common practice to date has been 7-10 days. New findings indicate that the majority of VTE events occur after discharge from the hospital, extending the prophylactic window from the moment of surgery to 4-6 weeks afterward (Karcher et al., 2011, Warwick and Rosencher 2010). A recent database analysis of patients undergoing hip or knee replacement reported that extended-duration prophylaxis was associated with significantly lower risk of VTE compared with short-duration prophylaxis (Wells et al., 2010).

There has been controversy whether DVT’s cause PE’s or whether they develop independently, but clinical decision-making need not await the outcome of this debate.

There has been a question of whether ultrasonography or venography should be used to detect asymptomatic VTE’s. To date, no guidelines have been issued calling for ultrasonography in all post surgical patients.

There has been controversy over the use of IVC filters with inconclusive results, but there are no current recommendations for their routine use. There has been controversy over the use of compression stockings, duration of use, the type of stockings, and whether stockings alone are adequate for prophylaxis.

Finally, there has been controversy about whether to screen and stratify orthopedic surgery patients
by VTE risks or bleeding risks. Identified risk factors for bleeding are active liver disease and bleeding disorders. While numerous risk factors have been identified for VTE, the most powerful risk factor is major surgery itself (Markovic-Denic 2012; Geerts 2008). Therefore it may be said that the risk assessment has been done when the decision is made for joint replacement. That decision alone places the patient firmly in the highest risk category for VTE.

**Barriers to Adequate VTE Prophylaxis in Orthopedic Surgery**

A revealing report (Karcher et al., 2011) describes a survey that was completed by orthopedic surgeons in 2008 regarding barriers to thromboprophylaxis for major orthopedic surgery. The group of orthopedic surgeons (N=84) that completed the survey identified the following challenges:

- Identification of appropriate candidates for VTE prophylaxis (cited by 41% of the group)
- Bleeding concerns (identified by 80% of the group)
- Disagreement with clinical guidelines (stated by 25% of the group)
- Lack of appropriate hospital system support (identified by 25% of the group)

A systematic review article (Tooher et al., 2005) identified other barriers to adequate VTE prophylaxis:

- Underestimation of the true incidence and importance of VTE
- Low absolute numbers of patients with symptomatic VTE
- Perceived lack of need for thromboprophylaxis due to low prevalence of clinically significant events that occur during initial hospitalization

**2008 U.S. Surgeon General’s Call to Arms**

In 2008, the US Surgeon General published a call to action, stating that practicing physicians had a significant lack of awareness about evidence-based guidelines for VTE prevention. Since then, government and private sector organizations have implemented quality initiatives and published guidelines to close the gap of VTE prophylaxis in orthopedic medicine.

**The Joint Commission Weighs In**

In 2008, The Joint Commission addressed anticoagulant medications in a Sentinel Alert and their National Patient Safety Goals, which were updated in 2011. They published a list of recommendations for hospitals to aid in decreasing anticoagulation-associated risks. The top three recommendations include:

- perform an organization-wide assessment for anticoagulant therapy
- define best practices or evidence-based guidelines for using these drugs
- establish institution-wide dose limits and screen all orders for exceptions.

Note that the Joint Commission does not define what those guidelines should be—they just insist that hospitals have them.
CMS Pay-for-Performance and “Never Events”: Contrary to Evidence

In 2003, the Joint Commission joined with the US Centers for Medicare and Medicaid Services (CMS) to publish the Specifications Manual for National Hospital Inpatient Measures. This manual includes two outcome measures for VTE prophylaxis.

The Surgical Care Improvement Project (SCIP) has two measures specific to VTE. They are:

1) SCIP-VTE1 which measures the rate at which VTE prophylaxis is ordered for surgery patients at any time from arrival at the hospital until 24 hours after discharge, and
2) SCIP-VTE2 which measures the rate at which patients received adequate VTE prophylaxis within 24 hours prior to the start of anesthesia and 24 hours after the start of anesthesia.

A recent JAMA editorial states that using these performance measures may have unintended consequences (Baker and Qaseem, 2011). They argue that these Joint Commission/CMS guidelines do not stratify patients based on risk, and instead promote universal VTE prophylaxis for all patients. The authors warn that this is in direct opposition to current professional guidelines which support patient risk stratification. This policy means some patients will receive unnecessary or inappropriate prophylaxis with its attendant risks. They emphasize that “national performance measures should be based on high quality scientific evidence”.

Until such time as the Joint Commission changes these measures, the SCIP-VTE1 measure can still be satisfied by entering documentation in the individual patient record of the rationale or reasons why no prophylaxis was given.

Also in 2008, the CMS added VTE after hip or knee replacement to the list of “Never Events”. Never Events are those that in the opinion of CMS should never happen. This is in flat contradiction to the perfectly good rule in medicine as in life, to “Never Say Never”. Patient falls are another “Never Event” in CMS’ lexicon.

Under this policy, if a patient experiences DVT or PE following joint replacement surgery, a portion of the payment made by CMS to hospitals is withheld.

This policy stands in direct contradiction to scientific evidence. Some patients can be expected to have VTE after these procedures, despite receiving optimal prophylactic treatment (Streiff et al., 2009; Januel, Chen et al., 2012).

Professional Medical Society Guidelines Collide

2007 American Academy of Orthopaedic Surgeons (AAOS)

The AAOS published guidelines for VTE prophylaxis in 2007. These recommended the use of aspirin, or anticoagulant agents, or mechanical prophylaxis in patients without increased bleeding or VTE risk. In patients with increased bleeding risk or prior VTE, the use of aspirin was not recommended, and the
AAOS recommended using low molecular weight heparin (LMWH), pentasaccharides, and warfarin. The 2007 AAOS guidelines also recommended that patients be stratified according to risk profiles for PE and bleeding, but did not specify how to do so. (American Academy of Orthopedic Surgeons Clinical Guidelines on Prevention of Pulmonary Embolism in Patient Undergoing Total Hip or Knee Arthroplasty, May 2007.)

2008 American College of Chest Physicians (ACCP) Guidelines

In 2008, the ACCP, a professional association of pulmonologists, published extensive guidelines for preventing VTE in orthopedic surgery, strongly recommending against the use of aspirin alone for VTE prevention in any group (Geerts et al., 2008). They also recommended against the use of compression pumps as the sole method of prophylaxis in patients undergoing hip replacement. The ACCP considered all orthopedic surgery patients to be at high risk for VTE, and recommended the use of anticoagulants in all patients undergoing hip or knee replacement, and hip fracture surgery with the exception of patients who have increased bleeding risk. For those patients, the ACCP recommended that mechanical prophylaxis methods be used. (Geerts WH, Bergqvist D, Pineo GF et al. Prevention of venous thromboembolism: American College of Chest Physicians Evidence-Based Clinical Practice Guidelines, 8th Ed. Chest 2008.)

ACCP Criticism of AAOS Guidelines

A scathing review of the 2007 AAOS guidelines appeared in the ACCP publication Chest (Eikelboom et al., 2009). The authors argued that the AAOS guidelines did not take into account the link between DVT and PE, and only took symptomatic PE and fatal PE into account for their literature analysis. They further criticized the AAOS panel by stating that “many of their recommendations are based on expert opinion and lack a scientific basis.” The authors were concerned that patients treated with inadequate prophylaxis due to AAOS guidelines would have an increased risk for fatal PE. They recommended that the ACCP guidelines be followed, as they resulted from the consideration of “only high-quality evidence from randomized trials.”

Orthopedic Criticism of ACCP Guidelines

An article in Orthopedics Today (2010) reported that many orthopedic surgeons were not satisfied with the 2008 ACCP thromboprophylaxis guidelines, because they did not adequately address bleeding risks in orthopedic surgical patients. Some surgeons argued that their main concern was the development of PE, not asymptomatic clots, and that the ACCP guidelines were too inflexible in the insistence on near-universal use of thromboprophylactic agents.

Updated 2011 AAOS Guidelines: Addressing ACCP Criticisms and Concerns

The AAOS recently updated their guidelines for VTE prophylaxis as part of a systematic review of the published orthopedic literature (2011 AAOS Guidelines for Preventing Thromboembolic Disease in Patients Undergoing Elective Hip or Knee Arthroplasty).

Recommendations are graded on strength of the supporting evidence (Strong, Moderate or Weak). In the absence of conclusive evidence, recommendations are made based on the opinions of the AAOS work group (Consensus) or no recommendation is made either for or against (Inconclusive).

The new AAOS guidelines are adapted for the following table below solely as a convenience and as
an introduction. Orthopedists are encouraged to consult the full AAOS guidelines for rationales and evidence.

<table>
<thead>
<tr>
<th>AAOS Recommendation in Elective Hip or Knee Arthroplasty</th>
<th>Grade of Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Against routine post operative duplex ultrasonography</td>
<td>Strong</td>
</tr>
<tr>
<td>In favor of pre operative assessment for the VTE risk factor of history of previous VTE</td>
<td>Weak</td>
</tr>
<tr>
<td>No recommendation for or against assessment of further VTE risk factors</td>
<td>Inconclusive</td>
</tr>
<tr>
<td>In favor of assessing for these bleeding risk factors: known bleeding disorders and active liver disease</td>
<td>Consensus</td>
</tr>
<tr>
<td>No recommendation for or against assessment for any further risk factors for bleeding</td>
<td>Inconclusive</td>
</tr>
<tr>
<td>In favor of discontinuation of antiplatelet agents (aspirin, clopidogrel) prior to surgery</td>
<td>Moderate</td>
</tr>
<tr>
<td>In favor of pharmacological agents and/or compressive devices for patients with no additional risk beyond the surgery itself</td>
<td>Moderate</td>
</tr>
<tr>
<td>No recommendation for or against any specific prophylactics for patients with no additional risk beyond surgery itself</td>
<td>Inconclusive</td>
</tr>
<tr>
<td>In favor of patients and physicians discussing the duration of prophylaxis</td>
<td>Consensus</td>
</tr>
<tr>
<td>In favor of using both pharmacologic agents and compressive devices for patients with history of previous VTE</td>
<td>Consensus</td>
</tr>
<tr>
<td>In favor of using compressive devices for patients with known bleeding disorders or active liver disease</td>
<td>Consensus</td>
</tr>
<tr>
<td>In favor of early mobilization after surgery</td>
<td>Consensus</td>
</tr>
<tr>
<td>Suggest use of neuraxial anesthesia to limit blood loss even though evidence suggests it does not affect occurrence of VTE</td>
<td>Moderate</td>
</tr>
<tr>
<td>No recommendation for or against IVC filters in cases where chemoprophylaxis is contraindicated or there is known residual VTE disease</td>
<td>Inconclusive</td>
</tr>
</tbody>
</table>

Out of 14 recommendations (or lack thereof), there is only 1 with an evidence grade of Strong; 3 are Moderate and 1 is Weak. There are 5 based on Consensus, and 4 more are Inconclusive.

Clearly, these guidelines still beg some important questions. Patient safety will improve, and orthopedists will benefit when the AAOS identifies more compelling evidence to support their recommendations, and clarifies the inconclusive recommendations.

**Current ACCP Guidelines: Toward a Middle Ground**

The ACCP has also recently updated their VTE prophylaxis guidelines (Falck-Ytter et al., 2012). The ACCP has moved away from their old 2008 advocacy of anticoagulant therapy for all joint replacement patients excepting only those with increased bleeding risk. Now they recommend considering individual patients’ risk of thrombosis when deciding for or against the use of thromboprophylaxis. They also now recommend risk stratification and consideration of both bleeding risk and risk for thrombosis.

The ACCP guidelines Panel Chair Gordon Guyatt said, “There has been a significant push in health care to administer DVT prevention for every patient, regardless of risk. As a result, many patients are receiving unnecessary therapies that provide little benefit and could have adverse effects…The decision to administer DVT prevention therapy should be based on the patients’ risk and the benefits of
Further, the new guidelines now permit the use of aspirin alone (though not typically the agent of choice); and they recommend considering patient preferences and values when weighing the risks and benefits of each strategy.

The AACCP states these new guidelines are based on better evidence. “The evidence review for the new guidelines was more rigorous than ever before, and our method for grading research studies has become even more stringent,” said guideline co-author David Gutterman (New Guidelines Suggest DVT Prophylaxis not Appropriate for All Patients. Article 02.07.12).

Grade 1 recommendations are strong and indicate that the benefits do or do not outweigh risks, burden, and costs. Grade 2 suggestions imply that individual patient factors may lead to different choices.

The following table is adapted from the ACCP guidelines only as a convenience and as an introduction. Physicians are encouraged to consult the full guidelines for better detail and explanation (Antithrombotic Therapy and Prevention of Thrombosis, 9th ed: American College of Chest Physicians Evidence-Based Clinical Practice Guidelines, published in the February issue of the journal CHEST). Note also that the guideline summary below addresses orthopedic surgery patients, not just joint replacement patients.

<table>
<thead>
<tr>
<th>ACCP Guidelines VTE Prevention in Orthopedic Surgery Patients</th>
<th>Grade of Recommendation*</th>
</tr>
</thead>
<tbody>
<tr>
<td>In favor of using one of the following rather than no antithrombotic prophylaxis: LMWH, fondaparinux, dabigatran, apixaban, rivaroxaban, low-dose unfractionated heparin, adjusted-dose vitamin K antagonist, aspirin, or an intermittent pneumatic compression device (IPCD) for a minimum of 10 to 14 days</td>
<td>Grade 1B (for all methods except IPCD)</td>
</tr>
<tr>
<td>Suggest the use of LMWH in preference to the other recommended agents in patients receiving pharmacologic prophylaxis</td>
<td>Grade 2B/2C</td>
</tr>
<tr>
<td>Suggest adding an IPCD during the hospital stay</td>
<td>Grade 2C</td>
</tr>
<tr>
<td>Suggest extending thromboprophylaxis for up to 35 days</td>
<td>Grade 2B</td>
</tr>
<tr>
<td>For patients at increased bleeding risk, suggest an IPCD or no prophylaxis</td>
<td>Grade 2C</td>
</tr>
<tr>
<td>For patients who decline injections, recommend apixaban or dabigatran</td>
<td>Grade 1B</td>
</tr>
<tr>
<td>Suggest against using IVC filter placement for primary prevention in patients with contraindications to both pharmacologic and mechanical thromboprophylaxis</td>
<td>Grade 2C</td>
</tr>
<tr>
<td>Recommend against duplex ultrasonography screening before hospital discharge</td>
<td>Grade 1B</td>
</tr>
<tr>
<td>For patients with isolated lower-extremity injuries requiring leg immobilization, suggest no thromboprophylaxis</td>
<td>Grade 2B</td>
</tr>
<tr>
<td>For patients undergoing knee arthroscopy without a history of VTE, suggest no thromboprophylaxis</td>
<td>Grade 2B</td>
</tr>
</tbody>
</table>

Thankfully, it appears that the AAOS and ACCP are aiming toward a common ground for VTE prophylaxis. The Agency for Healthcare Research and Quality commented, “The AAOS and the ACCP have intentions to collaboratively construct guidelines for the prevention of VTE in orthopedic surgery” (AHRQ 2010).
Which Thromboprophylactic Medication and For How Long?

The many clinical investigations and noninferiority trials of thromboboprophylactic medications have found relatively small differences in efficacy and risk. No current professional guidelines insist on the use of one over another.

The Joint Commission standard requires hospitals have an evidence based policy on thromboprophylaxis. Again, the Commission doesn't care which policy the facility has as long as there is one. Many hospitals have policies and formularies stating which medications are available for the physicians to prescribe.

At this time, it may matter little which thromboprophylactic agent the physician chooses as long as the patient's individual circumstances and risks are considered. Physicians are encouraged to document their rationale if no agent is used.

Many recent studies have been published demonstrating that the majority of post operative VTE events occur after discharge (AHRQ, 2010; Wells et al., 2010; Warwick et al., 2010; Karcher et al., 2011; Heit J, 2012). This preponderance of evidence suggests that the guidelines for the duration of thromboprophylaxis are poised to change. The prudent physician may anticipate a change in guidelines on this topic.

Summary

• Patients undergoing major surgery, especially hip and knee replacement have a high risk of developing VTE.
• Appropriate thromboprophylaxis may significantly decrease this risk.
• Thromboprophylaxis has been underutilized in the past, but has increased in recent years.
• There are many effective treatment options for thromboprophylaxis in joint replacement; no single agent is superior in all cases.
• The typical duration of antithrombotic therapy after joint replacement surgery may be suboptimal. Anticipate changes to current guidelines on duration of therapy due to preponderance of new evidence.
• The AAOS and ACCP are moving closer to finding a middle ground for their VTE prophylaxis guidelines, with the AAOS tending toward strengthening their stance and the ACCP toward softening theirs. It is important to be aware of the changing dialogue between these and other organizations.
• Orthopedists should evaluate each patient on a case-by-case basis, taking into account risk factors for thrombus as well as bleeding, before choosing the best anticoagulation strategy.

Risk Management Suggestions for Physicians When Guidelines Collide

As we have seen, guidelines are works in progress. They are based on greater and lesser levels of evidence. As more and better data becomes available, certain guidelines may be modified, updated or discarded.

Guidelines were never meant to apply to all cases. In the preamble to the 2008 ACCP Guidelines, the authors say,
In a world with a bewildering number of guidelines and performance measures, which guidelines should be attended to?

- It’s a good idea for physicians to be familiar with 2 sources of guidelines: those of their own medical specialty organization, and those of their own facility or institution.
- Be aware of the strength of evidence supporting those guidelines. Anticipate an evolutionary process.
- When departing from those guidelines, it’s a good idea to document your rationale in doing so.
- Let the record reflect that you took into account the individual circumstances of your patient and made treatment decisions that were best for your patient.
- Recall that guidelines are an aid to the physician’s decision-making process, not a substitute for it.

Copyright 2012 LAMMICO. All rights reserved.

Bibliography

Web links are provided as a convenience and are subject to change. If the link does not work, web-search the document by title at the time of use.