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A Prospective Evaluation of Venous Thromboembolic Prophylaxis in 4109 Total Knee Arthroplasty Patients utilizing Modern Prophylactic Methods

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Introduction

Venous thromboembolic (VTE) disease remains a controversial topic in total knee arthroplasty (TKA) literature. While fatal pulmonary embolism (PE) remains a devastating complication following elective knee replacement surgery, methods to prevent it remain unclear. The American College of Chest Physicians (ACCP) Consensus Conference on Antithrombotic Therapy classifies TKA as a high-risk procedure for venous thromboembolism and recommends prophylaxis with (1) low-molecular-weight heparin, (2) oral anticoagulants, (3) adjusted-dose heparin, or (4) intermittent pneumatic compression/elastic stockings plus low-dose unfractionated heparin or low-molecular-weight heparin.[5] This recommendation is based primarily on the reduction of the occurrence of deep venous thrombosis (DVT) detected by venography following TKA. However, the vast majority of DVTs following TKA are asymptomatic, and the available data indicate that DVT prophylaxis does not alter the occurrence of symptomatic DVTs or pulmonary embolism (PE).[1] Furthermore, advances in post surgical rehabilitation including early mobilization would be expected to reduce the rates of VTE previously recorded. Recent literature suggests that the complications originating from chemoprophylaxis may outweigh the benefits from VTE reduction and at the very least have no protective effect.[3,6,8] Furthermore, bleeding complications, including catastrophic gastrointestinal and wound hematoma, which could necessitate return to the operating room, are risks of anticoagulation that must be considered. This has led to the recent NIH consensus statement regarding VTE prophylaxis following TKA "The effectiveness of anticoagulation for the prevention of pulmonary emboli is unclear."[1]

Purpose

This study aims to assess the efficacy of VTE prophylaxis in a community-hospital based total joint registry. To date the Kaiser Permanente Total Joint Registry has captured 20,651 patients prospectively over the past four years. This includes 12,557 total knee arthroplasties and 8,094 total hip arthroplasties. This database is now producing information that can be useful in analyzing the early complications associated with these two procedures. Because multiple modes of prophylaxis are used in this large patient population, a survey was sent to joint surgeons to evaluate the prophylactic preference of each active surgeon in low and high risk patients.

Methods

Using the prospective Kaiser Permanente (KP) Total Joint Registry, we identified all primary, unilateral total knee arthroplasties (TKAs) performed between April 1, 2001 and March 31, 2003 from Southern California. The KP registry contains 12,557 total knees and 8,094 total hip procedures from four different KP regions. The registry consists of 3 standardized data collection forms completed by surgeons and staff in the clinic and operating room. The registry forms capture information on patient demographics, surgical procedures, implant characteristics, and patient outcomes. From the Registry database, we extracted type of VTE prophylaxis, on all TKAs from the KP Southern California region to evaluate the relationship between prophylaxis and 90-day complication rates following TKA. Patient demographics were pulled from both the Registry and hospital database. PE, DVT, wound, and bleeding complications were extracted from the Registry database and also from the hospital utilization database. Complications were validated using a chart review methodology. In addition to the database queries and analyses, a survey was e-mailed to 73 active KP Southern CA total joint surgeons to gather information on current DVT prophylaxis practice patterns.

Kaiser Permanente Questionnaire
DVT prophylaxis practice in Total Joint Replacement

In TOTAL KNEE ARTHROPLASTY

1. Please mark your preferred method of chemical prophylaxis in STANDARD RISK PATIENTS and give intended dosage and duration of treatment in the space on the right (Place more than one X if you use combo therapy)

Chemical Prophylaxis	*Intended Dosage*	*Duration of Treatment*
❑ Nothing		
❑ Aspirin		
❑ Coumadin (Give goal INR or dosage)		
❑ Low molecular weight Heparin		
❑ Anti-inflammatory		

2. Please mark your preferred method of chemical prophylaxis in HIGH RISK PATIENTS and give intended dosage and duration of treatment in the space on the right (Place more than one X if you use combo therapy)

Chemical Prophylaxis	*Intended Dosage*	*Duration of Treatment*
❑ Nothing		
❑ Aspirin		
❑ Coumadin (Give goal INR or dosage)		
❑ Low molecular weight Heparin		
❑ Anti-inflammatory		

3. Do you also use mechanical prophylaxis of any type (TED hose, SCD, Foot pump)?
❑ Yes ❑ No

Statistical Analyses

Chi-square and Fisher's exact tests were used to compare prophylactic group differences on categorical variables. The study sample had greater than .80 power of detecting a 2% difference (3% versus 1%) in complication rates between mechanical alone, coumadin, LMWH, and aspirin groups (two-tailed, alpha=.05).

Results

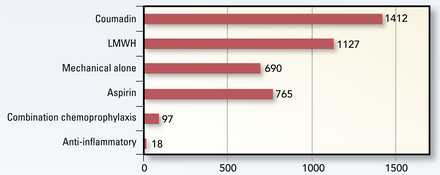
Patient sample

From April 1, 2001 to March 31, 2003, 4,109 primary unilateral TKAs were performed in Southern California at 11 different hospitals by 82 different surgeons. Patient demographics and types of prophylaxis are displayed below.

Patient demographics

Age (mean, std dev)	68 (9)
% female	64%
ASA score (Median)	2
Primary Diagnosis of Osteoarthritis	86%

Prophylaxis TKA volume



Adverse Events

- No fatal PEs occurred during the study period.
- 50 VTEs (DVT and PE) (1.2%)
- 49 wound/bleeding complications (1.2%)
- 99 total adverse events (2.4%).
- No significant differences in VTE rates, bleeds and wound complications, or total adverse events were detected across prophylactic groups.

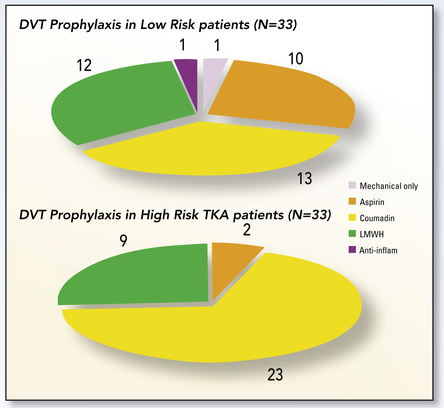
Adverse events by Prophylaxis group

		N	*# VTE*	*VTE %*	*# wound/ bleed*	*wound/ bleed %*	*Total Number of Adverse Outcomes*	*%*
Mechanical only prophy		690	5	0.72%	10	1.45%	15	2.17%
Coumadin	with mechanical	1090	14	1.28%	14	1.28%	28	2.57%
	without mechanical	322	7	2.17%	2	0.62%	9	2.80%
	Total Coumadin	1412	21	1.49%	16	1.13%	37	2.62%
Low Molecular Weight Heparin	with mechanical	1033	9	0.87%	11	1.06%	20	1.94%
	without mechanical	94	2	2.13%	2	2.13%	4	4.26%
	Total LMWH	1127	11	0.98%	13	1.15%	24	2.13%
Aspirin	with mechanical	736	10	1.36%	9	1.22%	19	2.58%
	without mechanical	29	0	0.00%	0	0.00%	0	0.00%
	Total ASA	765	10	1.31%	9	1.18%	19	2.48%
Anti-inflammatory	with mechanical	15	0	0.00%	0	0.00%	0	0.00%
	without mechanical	3	0	0.00%	0	0.00%	0	0.00%
	Total anti-inflam	18	0	0.00%	0	0.00%	0	0.00%
Combination	with mechanical	81	2	2.47%	1	1.23%	3	3.70%
	without mechanical	16	1	6.25%	0	0.00%	1	6.25%
	Total Combo	97	3	3.09%	1	1.03%	4	4.12%
Total		4109	50	1.22%	49	1.19%	99	2.41%

DVT Prophylaxis Practice Survey

A total of 34 surgeons responded to the DVT prophylaxis survey for an overall response rate of 47%. Definition of high risk was determined individually by the attending surgeon.

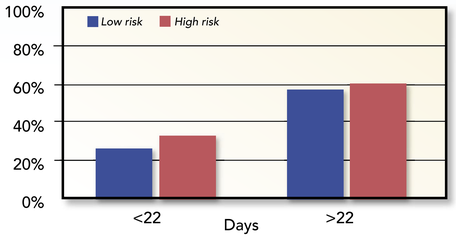
- 94% of the respondents use some type of mechanical prophylaxis (n=31)



DVT survey intended dosage

Prophylaxis	*Dosage*	*Low risk TKA*	*High Risk TKA*
Aspirin	325 mg	80% (n=8)	50% (n=1)
LMWH	30 bid	83% (n=10)	78% (n=7)
Coumadin	Goal INR 1.8-3.5	67% (n=8)	78% (n=18)

Duration of TKA DVT prophylaxis



Discussion

Our cohort of over 4000 primary unilateral TKA's has the power to detect a 2% difference in complication rate to a power of 0.8. We were unable to detect a difference in VTE outcomes or any complications across prophylactic practices. While many surgeons abide by expert recommendations for VTE prophylaxis following elective knee replacement surgery, no study has conclusively evaluated the effects of prophylaxis vs. no prophylaxis in the modern knee replacement era. This has led to continued controversy. Furthermore, chemoprophylaxis is not without risks to the patient. Modern literature suggests that coumadin may in-fact do more harm than good.[6] With the numbers available, we were unable to discover a significant difference in bleeding complications or wound problems with any prophylactic agent. Current literature has also utilized venography for the assessment of outcome. While venogram confirmed VTE rates may be high in the TKA patient population, its effect on outcome remains unclear. No increased morbidity was detected in a cohort of 318 patients when those with venogram confirmed distal DVT went untreated relative to those without DVT.[3] One study showed that DVT in the calf after TKA disappeared spontaneously with time and no long-term sequelae developed.[7] This information sheds doubt on the numerous studies revealing improved efficacy of one chemoprophylactic agent over another utilizing venography to detect DVT.[2,4] Although no conclusive evidence exists regarding clinically significant VTE protection, our surgeon survey revealed a definite shift in prophylactic practice when treating high risk patients towards the use of coumadin and LMWH. The survey findings underline the need for more clinically relevant data regarding the use of chemoprophylaxis following elective TKA.

Conclusions

- No difference in efficacy or complications was discovered in our community-based joint registry with over 4000 primary unilateral TKAs when evaluating various chemoprophylactic agents as well as no chemoprophylaxis at all.
- No fatal pulmonary emboli occurred in our study population.
- This data adds to the literature in support of utilizing early mobilization with low risk VTE prophylactic agents in the prevention of VTE complications amongst primary unilateral TKA patients.
- The numbers required to evaluate truly significant differences amongst agents is large and may be reached with the type of registry currently underway at Kaiser Permanente.

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