


Venous Thromboembolism Prevention Protocol: Experience of 2,000 Cases in Total Knee Arthroplasty*

Protocolo de prevenção do tromboembolismo venoso: Experiência de 2.000 casos em artroplastia total de joelho

Lúcio Honório de Carvalho Júnior^{1,2} Matheus de Almeida Correa¹ Matheus Rezende Lima²
Camila Barreto Silvestre² Víctor Ferreira Almeida² Eduardo Frois Temponi^{1,2} 

¹ Shoulder Group, Orthopaedic and Traumatology Service, Belo Horizonte, MG, Brazil

² Department of Medicine, Pontifícia Universidade Católica, Belo Horizonte, MG, Brazil

Address for correspondence Eduardo Frois Temponi, MSc, Hospital Madre Teresa, Av. Raja Gabáglia 1002, Gutierrez, Belo Horizonte, Minas Gerais, 30430-142, Brazil (e-mail: dufrois@hotmail.com).

Rev Bras Ortop 2020;55(4):426–431.

Abstract

Objective The objective of the present study is to evaluate the impact of an institutional protocol on a tertiary hospital for the prevention of venous thromboembolism in 2005 patients submitted to primary total knee arthroplasty (TKA).

Methods Data from medical records of patients submitted TKA before ($n = 1,115$) and after ($n = 890$) the implementation of the institutional protocol, totaling 2,005 patients, were retrospectively reported. Demographics, comorbidities, and outcomes were analyzed.

Results There was no significant change in the cases of deep venous thrombosis (DVT) (1.6% versus 2.4%; $p = 0.211$). There was an increase in cases of pulmonary embolism (PE) (0.2% versus 0.8% $p = 0.049$).

Conclusion Despite the implementation of the prevention protocol, no reduction in the studied events was observed. The small global incidence makes further studies with larger series necessary to confirm or rule out these findings.

Keywords

- ▶ thromboembolism/ complications
- ▶ arthroplasty, replacement, knee
- ▶ risk factors

Resumo

Objetivo O objetivo do presente estudo é avaliar o impacto de um protocolo institucional em um hospital terciário na prevenção do tromboembolismo venoso em 2.005 pacientes submetidos a artroplastia total primária de joelho.

Métodos Os dados dos prontuários de pacientes submetidos a artroplastia total do joelho antes ($n = 1.115$) e após ($n = 890$) a implantação do protocolo institucional, totalizando 2.005 pacientes, foram relatados retrospectivamente. Dados demográficos, comorbidades e desfechos foram analisados.

Resultados Não houve alteração significativa nos casos de trombose venosa profunda (TVP) (1,6% versus 2,4%; $p = 0,211$). Houve um aumento nos casos de embolia pulmonar (EP) (0,2% versus 0,8%; $p = 0,049$).

Conclusão Apesar da implementação do protocolo de prevenção, não houve redução nos eventos estudados. A pequena incidência global faz com que novos estudos, com séries maiores, sejam necessários para confirmar ou descartar esses achados.

Palavras-chave

- ▶ tromboembolismo/ complicações
- ▶ artroplastia do joelho
- ▶ joelho
- ▶ fatores de risco

* Work conducted at the Hospital Madre Teresa, Belo Horizonte, state of Minas Gerais, Brazil.

Introduction

Total knee arthroplasty (TKA) is one of the most realized orthopedic procedures worldwide.^{1,2} More than 600.000 of these surgeries are performed annually in the USA.¹ Different complications were described, and one of the most feared is venous thromboembolism (VTEs): deep venous thrombosis (DVT) and pulmonary embolism (PE).²

Without prophylaxis, DVT, symptomatic or not, could be detected in 41 to 84% of the image exams.³ Pulmonary embolism is not that common, with incidences varying between 1.5 and 10%, but with mortality rates between 0.1 and 1.7%.⁴ Many risk factors were described: age > 60 years old, obesity, use of oral contraceptives, hormonal reposition therapy, bowel inflammatory disease, personal or family history of DVT or PE, and long tourniquet time.⁵

Basically, there are mechanical and pharmacological methods to prevent PE and DVT. Up to 2015, many of them were used for prevention after TKA at our institution. After that, an institutional prevention protocol was initiated to standardize its prevention. We hypothesize that after the implementation of the protocol, smaller numbers of DVTs and PEs may be found. The objective of the present study is to verify if this new standardized protocol interfered in the incidence of VTEs after primary TKA.

Material and Methods

Data from patients submitted to primary TKA between January 2011 and December 2017 were retrospectively collected from our institution database, totalizing 2,005 patients. The present study was approved by the ethical committee of the institution. An informed signed consent was obtained before the study. No financial incentive was offered to any participant. Every primary TKA patient was included. The exclusion criteria were another surgical procedure together with TKA, and associated infectious disease.

Every patient was operated on by the same surgical team, with pneumatic tourniquet, through the anterior approach and with medial parapatellar arthrotomy. Every TKA was with sacrifice of the posterior cruciate ligament, and both components were cemented at the same time. A patellar component was not used. Up to December 2014, there was not a standard protocol regarding VTE prophylaxis, either pharmacological or mechanical, inside or outside the institution. The prevention was performed according to the guidance provided by each surgeon to the patient. Starting in January, 2015, the Hospital Madre Teresa standardized a clinical protocol to deal with VET prevention (– Fig. 1). In this protocol, every patient received 40 mg of low molecular weight heparin (LMWH) subcutaneously starting 6 hours after the end of the surgery, and continuously every 24 hours up to the hospital discharge. In this occasion, oral anticoagulants (factor Xa inhibitors) were initiated for up to 14 days postoperatively. The same dose of LMWH was used every 12 hours if the body mass index (BMI) of the patient was > 30. Among the mechanical measures, full-weight bearing with a walker was initiated

in the first postoperative day after peripheral nerve recovery, or after release from the intensive care unit. The average length of stay in the hospital was 54 hours. Home rehabilitation, as well as ambulatory physiotherapy facilities, were prescribed for every patient.

The patient data analyzed were gender, age, weight, height, classification according to the American Anesthesiology Association (ASA), presence of diabetes, high blood pressure, smoking habits, time to the first walking, anticoagulant use after discharge, EP or DVT history and their occurrence up to 6 months postoperatively. Only VTE symptomatic cases were analyzed, as well as those who needed any form of treatment. Asymptomatic cases were not studied.

Statistical Analysis

Data were analyzed using averages and standard deviation (SD). Categorical data were compared using the chi-squared and the Fisher exact tests. For continuous variables, an evaluation was performed regarding a normal distribution using the Kolmogorov-Smirnov test. The difference between averages was calculated using the parametric Student t-test and, for others, the nonparametric Mann-Whitney test. The significance level was set at 0,05. The statistical analysis was performed with IBM SPSS Statistics for Windows, version 20.0 (IBM Corp., Armonk, NY, USA).

Results

A total of 2,005 patients were analyzed. A total of 1,115 patients were part of the group operated before the implementation of the protocol; 275 patients were male (24.7%), and 840 (75.3%) were female. The average age was 72 years old. The average weight was 78.9 kg, and the average height was 1.63 m, with an average BMI of 29.69. A total of 4.8% of the patients were classified as ASA I, 91.4% as ASA II, and 3.8% as ASA III. Diabetes mellitus (DM) was present in 14.9% of the patients, and 60.9% had high blood pressure (HBP). A total of 2.5% of the patients were smokers. Walking training started in up to 24 hours after the surgery in 85.8% of the patients. In this group, 44.1% used anticoagulants up to 2 weeks postoperatively. A history of DVT or of PE was present in 3.8% of the cases. Deep venous thrombosis was detected in 1.6% of the patients, and PE in 0.2%.

A total of 890 patients were part of the group operated after the implementation of the protocol; 233 were male (26.2%), and 657 were female (73.8%). The average age was 72 years old. The average weight was 78.3 kg; the average height was 1.63 m, with an average BMI of 29.47. A total of 9.7% of the patients were classified as ASA I, 83.6% as ASA II, and 6.7% as ASA III. Diabetes mellitus was present in 22.7% of the patients, and 76.9% had HBP. A total of 5.2% of the patients were smokers. Walking training started in up to 24 hours after the surgery in 78% of the patients. In this group, 98% used anticoagulants for up to 2 weeks postoperatively. A history of DVT or of PE was present in 4.8% of the cases. Deep venous thrombosis was detected in 2.4% of the patients, and PE in 0.8%.

PROTOCOLO INSTITUCIONAL

ARTROPLASTIA TOTAL DO JOELHO PRIMÁRIA

INÍCIO

Consultório Médico

Após exame clínico e radiográfico e uma vez decidido pela realização da artroplastia, solicitar exames pré-operatórios; hemograma, coagulograma, ureia, creatinina, glicemia de jejum, urina rotina, urocultura com antibiograma e a critério do cirurgião VHS e PCR. Solicitar avaliação cardiológica e consulta pré-anestésica.

Consulta com cardiologista

Consulta pré-anestésica

Retorno do paciente para agendar cirurgia

- Solicitar reserva de UTI quando indicado pelo anestesiológico;
- Aplicar Termo de Consentimento informado e esclarecer quanto a sua obrigatoriedade;
- Orientar preparo pré-operatório: realizar banho nos 03 dias que antecedem a cirurgia com solução a base de clorexidina degermante e aplicação nasal de Mupirocina 2% de 12/12h durante os 03 dias, conforme recomendação do SCIH;
- Orientar a possibilidade de ingestão de 200ml de líquido claro adoçado (chá ou suco claro, coado e sem fibra) 02 horas antes da cirurgia;
- Emitir guia cirúrgica (incluir materiais com especificação correta e colocar todos os códigos necessários para procedimento, registrar local a ser operado);
- Encaminhar paciente para pré-internação.

Agendar cirurgia no sistema informatizado

Confirmar pré-internação por contato telefônico

Internar paciente e encaminhar para sala pré-operatória

Sala Pré-operatória

- Iniciar check-list de cirurgia segura;
- Marcar o membro a ser operado, conforme Protocolo de Lateralidade

Sala Cirúrgica ou Pré-operatória

- Dar continuidade na aplicação do check-list de cirurgia segura;
- Administrar antibiótico profilático conforme Kit 02 (para cirurgias com prótese) 60 minutos antes da incisão cirúrgica + repique com 2G de cefazolina a cada 03 horas de cirurgia;
- Indução anestésica, optar por um dos esquemas: peridural com anestésico local + morfina ou peridural com anestésico local + bloqueio femoral e isquiático ou raquiinestesia com anestésico local + bloqueio femoral e isquiático ou geral + bloqueio femoral + bloqueio isquiático;
- Encaminhar paciente para sala cirúrgica, caso esteja na sala pré-anestésica.

Critérios para alta hospitalar:

- Paciente tolera deambular com auxílio de andador
- Paciente com dor controlada sem necessidade de opióides fortes
- Realizado profilaxia estendida para TEV
- Realizado orientações de alta pela equipe médica
- Alta hospitalar em até 72 horas



PI07V022018

Sala Cirúrgica

- Realizar tonsura se necessário;
- Fazer antisepsia de pele com PVPI degermante + PVPI alcoólico ou clorexidina degermante + clorexidina alcoólica. Realizar degermação durante 03 minutos, após fricção com solução alcoólica tinctura ou clorexidina alcoólica de 01 a 02 minutos;
- Realizar cirurgia;
- Ao término do procedimento, fazer RX de controle;
- Transferir paciente da mesa cirúrgica para maca e encaminhar paciente para SRPA (Sala de Recuperação Pós-Anestésica) ou UTI.

Sala de Recuperação Pós-Anestésica

- Monitorizar o paciente;
- Realizar admissão pelo Enfermeiro, contemplando aplicação Score de Mews Cirúrgico, Gerenciamento de Risco e intervenção de Enfermagem;
- Aplicar Escala de Aldret;
- Realizar cuidados com dreno, conforme recomendação do cirurgião;
- Providenciar junto a equipe de cirurgia pedido de interconsulta para clínica médica ou endocrinologia;
- Realizar avaliação médica pelo anestesiológico;
- Após avaliação da condição de alta, liberar para Unidade de Internação ou UTI.

Pós Operatório Imediato

- Administrar cefazolina 1G de 08/08h (máximo de 03 doses);
- Profilaxia TEV: HBPM SC 40mg 06 após termina da cirurgia e manter 24/24h após 1ª dose. Pacientes com IMC > 30 HBPM 40mg manutenção de 12/12h;
- Controlar a dor conforme protocolo de analgesia;
- Se dreno presente, deixa-lo aberto com ou sem sucção (a critério do cirurgião) até a manhã do dia seguinte à cirurgia;
- Manter paciente no leito sem deambular até liberação pelo médico responsável;
- Acionar clínica médica ou a endocrinologia para acompanhamento assim que o paciente estiver no quarto.

Pós Operatório em dias subsequentes

- Controlar a dor conforme protocolo de analgesia;
- Solicitar hemograma (1º dia);
- Iniciar exercícios de reabilitação e treino sob a responsabilidade da fisioterapia ou médico assistente;
- Banho no 1º DPO: Cadeira de rodas ou em pé com andador, caso seja liberado pelo médico assistente, sem molhar a ferida operatória;
- Fazer curativo no 2º DPO.

Alta em até 72 horas

Orientações de Alta

- Orientar usar medicação prescrita;
- Deambulação com andador;
- Manter ferida operatória seca após o banho;
- Realizar os exercícios recomendados dentro da tolerância;
- Realizar profilaxia estendida para TEV;
- Orienta paciente para acompanhamento ambulatorial e retorno eventual ao Atendimento 24 Horas caso necessário.

MÉDICO

INTERNAÇÃO

ENFERMAGEM

EQUIPE MÉDICA E ENFERMAGEM

Fig. 1 Institutional protocol for venous thromboembolism prevention - Total knee arthroplasty.

Table 1 Characteristics of the Patients

Condensed Table							
Variable	Category	General (n = 2.0005)		Before 2014 (n = 1.115)		After 2015 (n = 890)	
		N	%	N	%	N	%
Gender	Male	508	25,3	275	24,7	233	26,2
	Female	1,497	74,7	840	75,3	657	73,8
	Total	2,005	100,0	1115	100,0	890	100,0
VTE	Yes	9	0,4	2	0,2	7	0,8
	No	1,980	98,8	1112	99,7	868	97,5
	Not informed	16	0,8	1	0,1	15	1,7
	Total	2,005	100,0	1,115	100,0	890	100,0
DVT	Yes	39	1,9	18	1,6	21	2,4
	No	1,950	97,3	1,096	98,3	854	96,0
	Not informed	16	0,8	1	0,1	15	1,7
	Total	2,005	100,0	1,115	100,0	890	100,0
Anticoagulants use	Yes	1,364	68,0	492	44,1	872	98,0
	No	641	32,0	623	55,9	18	2,0
	Total	2,005	100,0	1,115	100,0	890	100,0
HBP	Yes	1,294	64,5	613	55,0	681	76,5
	No	598	29,8	393	35,2	205	23,0
	Not informed	113	5,6	109	9,8	4	0,4
	Total	2,005	100,0	1,115	100,0	890	100,0
DM	Yes	368	18,4	166	14,9	202	22,7
	No	1,636	81,6	949	85,1	687	77,2
	Not informed	1	0,0	0	0,0	1	0,1
	Total	2,005	100,0	1,115	100,0	890	100,0
Smoking	Yes	74	3,7	28	2,5	46	5,2
	No	1,931	96,3	1,087	97,5	844	94,8
	Total	2,005	100,0	1,115	100,0	890	100,0
VTE history	Yes	85	4,2	42	3,8	43	4,8
	No	1,918	95,7	1,073	96,2	845	94,9
	Not informed	2	0,1	0	0,0	2	0,2
	Total	2,005	100,0	1,115	100,0	890	100,0
Walking training	2 hour	2	0,1	2	0,2	0	0,0
	24 hour	1,648	82,2	954	85,6	694	78,0
	48 hour	316	15,8	141	12,6	175	19,7
	72 hour	32	1,6	14	1,3	18	2,0
	96 hour	4	0,2	1	0,1	3	0,3
	120 hour	3	0,1	3	0,3	0	0,0
	Total	2,005	100,0	1,115	100,0	890	100,0
ASA	I	100	5,0	14	1,3	86	9,7
	II	1,005	50,1	265	23,8	740	83,1
	III	70	3,5	11	1,0	59	6,6
	Not informed	830	41,4	825	74,0	5	0,6
	Total	2,005	100,0	1,115	100,0	890	100,0

Abbreviations: ASA, American Anesthesiology Association; DM, Diabetes Mellitus; DVT, Deep vein thrombosis; HBP, had high blood pressure; VTE, venous thromboembolism.

Comparing the results between the 2 groups, a statistical difference was found between the ASA classification ($p < 0.05$). Critical cases (ASA III) were much more frequent after the implementation of the protocol ($p < 0.05$). Statistically significant differences were found between patients with DM ($p < 0.05$), HBP ($p < 0.05$) and smoking ($p < 0.05$). After the protocol, these characteristics were more frequent. After the protocol, the time for walking training was significantly delayed ($p < 0.05$). The use of anticoagulants was also higher ($p < 0.05$). No difference was found in the DVT numbers ($p > 0.05$), and the incidence of PE was considered statistically significant ($p = 0.049$). The results are summarized in **Table 1**.

Discussion

The main result of the present study was that, despite the implementation of this protocol, there was no reduction in DVT cases, with an increase in the incidence of PE. We should be aware of the increase in the incidence of comorbidities and of a significant increase in intensive care utilization postoperatively. The delay in walking training could explain the increase in the number of patients with VTE, since the patients are not able to walk during their time in the intensive care unit (ICU). Walking is a proven way to reduce VTE. Chandrasekaran et al.⁴ reported a 0% incidence in a population that initiated walking training in the first 8 hours postoperatively. Kjaersgaard-Andersen et al.⁶ described a 25% reduction in VTE when first walking was initiated in up to 24 hours postoperatively.

Several studies observed the important relationship between VTE and TKA. Khokhar et al.³ reported 13% of DVT and 3% of PE. O'Reilly et al.⁷, using only symptomatic cases, found 0.6 to 5.7% of VTE, with 0.33 to 2.1% of, DVT, and PE between 0 and 1%. Song et al.⁸ used bilateral phlebography in 109 patients and found symptomatic DVT in 4.6% of the patients, and asymptomatic DVT in 18.3%. Without prevention, DVT could reach 60% in the first 90 postoperative days⁹, and the incidence of fatal PE could be 1.5%.¹⁰ In the present study, the general incidence was 2.3% of VTE, with 1.6% and 2.4% of DVT and 0.2% and 0.8% of PE pre- and postimplementation of the protocol, respectively.

Several risk factors were related to VTE. Zhang et al.¹¹ performed a meta-analysis and evaluated 1,150,000 patients after total knee and hip replacements. They found as risk factors age > 70 years old, female gender, BMI > 30 , black ethnicity, and ASA ≥ 3 .¹¹ Besides several studies that show that the prevention protocol decreases the incidence of VTE, we found an increase in VTE complications after TKA. An explanation would be the increase in the complexity and comorbidities of the patients. In the present study, we found an increase in DM, HBP and smoking, although these are not related to the higher prevalence of VTE. The small number of patients with a previous or family history of VTE could explain the lack of relationship observed in cases with DVT and PE.

Azboy et al.¹², in a retrospective study with 26,415 primary and revision TKAs, recommended VTE prevention in the first 2 weeks postoperatively, as they found 81% of the documented

or symptomatic cases of PE in the first 3 days after surgery, 89% in the first week, and 94% in the first 2 weeks PO. We did not find a prophylaxis protocol similar to the one used in this series. The association between LMWH and Xa inhibitors is not described. Every analyzed study used the same drug during the entire prophylaxis period.^{4,7,9,13} Different factor Xa inhibitors were not considered a confounding factor because, in spite of the different drugs used (rivaroxaban, apixaban and dabigatran), all of them have the same site of function and were used in prophylactic doses, according to the recommendation of the manufacturers.¹

The limitation of the present study lies on its retrospective nature, based on the database of the hospital. The search strategy using procedure codes and a careful reading of each record tried to minimize this fact. Because VTE is a low-prevalence event, a longer follow-up would be necessary to check the real number of this event. Another point is that the protocol has been changing over the years with the publication of new international consensus for the prevention of PE and VTE.

Conclusion

Despite the implementation of the prevention protocol, a reduction in the studied events was not observed. The small global incidence of these diseases demands more studies with a longer follow-up in order to confirm or deny these findings.

Conflicts of Interests

The authors have no conflicts of interests to declare.

Acknowledgment

The authors would like to thank the other fellow surgeons of the Knee Group of the Hospital Madre Teresa: Mateus Jacques, Tiago Jacques, and Luiz Fernando Machado Soares and undergraduate student in Medicine - PUC Minas - João Victor Soares Assunção.

References

- 1 HCPUnet, Healthcare Cost and Utilization Project. Agency for Healthcare Research and Quality. Available at: <http://hcupnet.ahrq.gov>
- 2 Ethgen O, Bruyère O, Richy F, et al. Health-related quality of life in total hip and total knee arthroplasty. A qualitative and systematic review of the literature. *J Bone Joint Surg Am* 2004;86(05):963-974
- 3 Khokhar A, Chari A, Murray D, et al. Venous thromboembolism and its prophylaxis in elective knee arthroplasty: an international perspective. *Knee* 2013;20(03):170-176
- 4 Chandrasekaran S, Ariaretnam SK, Tsung J, et al. Early mobilization after total knee replacement reduces the incidence of deep venous thrombosis. *ANZ J Surg* 2009;79(7-8):526-529
- 5 Anderson DR, Dunbar M, Murnaghan J, et al. Aspirin or Rivaroxaban for VTE Prophylaxis after Hip or Knee Arthroplasty. *N Engl J Med* 2018;378(08):699-707
- 6 Kjaersgaard-Andersen P, Kehlet H. Should deep venous thrombosis prophylaxis be used in fast-track hip and knee replacement? *Acta Orthop* 2012;83(02):105-106
- 7 O'Reilly RF, Burgess IA, Zicat B. The prevalence of venous thromboembolism after hip and knee replacement surgery. *Med J Aust* 2005;182(04):154-159

- 8 Song K, Xu Z, Rong Z, et al. The incidence of venous thromboembolism following total knee arthroplasty: a prospective study by using computed tomographic pulmonary angiography in combination with bilateral lower limb venography. *Blood Coagul Fibrinolysis* 2016;27(03):266–269
- 9 Quinlan DJ, Eikelboom JW, Dahl OE, et al. Association between asymptomatic deep vein thrombosis detected by venography and symptomatic venous thromboembolism in patients undergoing elective hip or knee surgery. *J Thromb Haemost* 2007;5(07):1438–1443
- 10 Howie C, Hughes H, Watts AC. Venous thromboembolism associated with hip and knee replacement over a ten-year period: a population-based study. *J Bone Joint Surg Br* 2005;87(12):1675–1680
- 11 Zhang ZH, Shen B, Yang J, et al. Risk factors for venous thromboembolism of total hip arthroplasty and total knee arthroplasty: a systematic review of evidences in ten years. *BMC Musculoskelet Disord* 2015;16:24
- 12 Azboy I, Barrack R, Thomas AM, et al. Aspirin and the prevention of venous thromboembolism following total joint arthroplasty: commonly asked questions. *Bone Joint J* 2017;99-B(11):1420–1430
- 13 Chung LH, Chen WM, Chen CF, et al. Deep vein thrombosis after total knee arthroplasty in asian patients without prophylactic anticoagulation. *Orthopedics* 2011;34(01):15