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Chinese Orthopedic Surgeons' Practice Regarding Postoperative Thromboembolic Prophylaxis after Major Orthopedic Surgery

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Key words: venous thromboembolism; major orthopedic surgery; survey; thromboprophylaxis

Objective To assess Chinese surgeon practice of thromboprophylaxis following major orthopedic surgery.

Methods A questionnaire survey was conducted amongst Chinese orthopedic surgeons. A total of 293 surgeons were surveyed concerning five key aspects of thromboembolic prophylaxis after major orthopedic surgery at the proseminar of Chinese guidelines for prevention of venous thromboembolism (VTE) after major orthopedic surgery in January of 2009.

Results Totally, 208 surgeons (71.0%) responded, successfully completing the questionnaire. Of them, 57.6% respondents selected combined basic, mechanical, and pharmacologic methods for thromboprophylaxis; 51.0% respondents prefer starting prophylaxis 12-24 hours after surgery; 60.3% surgeons would use chemoprophylaxis for 7-10 days; 47.6% respondents prefer VTE prevention based on patients' special conditions and needs upon discharge. "Safety" was the most repeated and emphasized factor during VTE prophylaxis.

Conclusions Multimodal thromboprophylaxis is frequently used after major orthopedic surgery. Half surgeons prefer to start chemoprophylaxis 12-24 hours after surgery. Thromboprophylaxis regimen varies for discharged patients.

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PATIENTS undergoing major orthopedic surgery, including total knee arthroplasty (TKA), total hip arthroplasty (THA), and hip fracture surgery (HFS), have particularly high risk in developing venous thromboembolism (VTE).¹ It is reported that the incidence of confirmed deep vein thrombosis (DVT) following major orthopedic surgery in patients who received

no prophylaxis was 40%-60%.¹ Although the risk of VTE was reported to be lower in Asian populations due to ethnic differences,² multicenter studies among Asian countries indicate the risk of VTE was almost equal to that of Caucasian populations.^{3, 4} Therefore, the Asia-Pacific Thrombosis Advisory Board reached a consensus that current guideline recommendations for the routine use of postoperative thromboprophylaxis should be implemented in Asia.⁵

Except for rare consensus, many conflicts exist amongst different guidelines for VTE prophylaxis after major

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orthopedic surgery. For instance, the 8th American College of Chest Physician (ACCP) guidelines recommended against the use of aspirin alone,¹ whereas the American Academy of Orthopaedic Surgeons (AAOS) guidelines recommended aspirin as the sole measure of thromboprophylaxis.⁶ Struijk-Mulder and co-workers compared 11 national or international guidelines on the prevention of VTE in orthopedic surgery and discovered different guidelines recommended different thromboprophylactic regimens thus proving it to be very difficult to reach a consensus with no agreement on the relevance of different endpoints.⁷

Debates also existed in other aspects: mechanical prophylaxis seemed to be effective in preventing VTE after major orthopedic surgery and was recommended as a surrogate for patients who had a high risk of bleeding by ACCP, whether combined mechanical and pharmacologic prophylaxis were more efficacious was uncertain because of the absence of adequate evidence.¹ The initial time and duration of anticoagulant prophylaxis was varied in different studies.^{7, 8} What were the surgeons' choices of thromboprophylaxis for discharged patients in clinical practices was unknown.

The objective of the current investigation was to assess the norm amongst Chinese orthopedic surgeons' practices regarding their post surgical management of VTE in patients undergoing major orthopedic surgery.

MATERIALS AND METHODS

At the proseminar of Chinese guidelines for prevention of VTE after major orthopedic surgery in January of 2009, 293 Chinese orthopedic surgeons with established clinical interest in joint arthroplasty and hip fracture surgery were invited to complete a written questionnaire survey. All invited surgeons were confirmed to being affiliated with a major trauma and/or joint center in China. To further validate the surgeon's qualification, all invited surgeons were asked the number of major orthopedic operations (including TKA, THA, and HFS) carried out in their departments annually. If the number was less than 50, the questionnaire finished by the surgeon was excluded. Meanwhile, if more than 50% of the questions was not finished or finished ineffectively, the questionnaire was also excluded.

The design of the questionnaire referenced guidelines for prevention of VTE after major orthopedic surgery (draft).⁹ Questions focused on 5 key aspects: different ways to prevent VTE; the initial time to start chemoprophylaxis; the duration of chemoprophylaxis; prophylactic

regimens for discharged patients, and the major concerns when preventing VTE. Each multiple-choice question was followed by 4-7 possible answers. An open-ended response option was available for appropriate questions to the answers that were not listed as a choice.

Question 1: What is your preferred method for VTE prophylaxis after major orthopedic surgery in your department?

- ☐ basic prophylaxis+mechanical prophylaxis+pharmacological prophylaxis
- ☐ basic prophylaxis+mechanical prophylaxis
- ☐ basic prophylaxis+pharmacological prophylaxis
- ☐ basic prophylaxis only
- ☐ mechanical prophylaxis only
- ☐ pharmacologic prophylaxis only
- ☐ no prophylaxis

Three different options were provided according to the guidelines imposed in China:⁹ basic prophylaxis, mechanical prophylaxis, and pharmacologic prophylaxis. Basic prophylaxis included: (1) precise and careful intraoperative procedures, avoiding unnecessary vascular injury; (2) standard usage of tourniquets; (3) elevating of the affected limb(s); (4) patients education, courage of turning over, functional exercise in early stage after operation, early ambulation, and taking deep breath or coughing movement; (5) appropriate fluid infusion during and after operation, avoiding dehydration. Mechanical prophylaxis included venous foot pump (VFP), intermittent pneumatic compression (IPC), and graduated compression stockings (GCS). Anticoagulants in pharmacologic prophylaxis were low-dose unfractionated heparin (LDUH), low-molecular-weight heparin (LMWH), vitamin K antagonist (VKA), and fondaparinux. One type only or combined two or three different types were provided as options.

Question 2: When do you usually initiate chemoprophylaxis after surgery when LMWH were used?

- ☐ 12 hours before surgery
- ☐ 4-6 hours after surgery (half dose)
- ☐ 12-24 hours after surgery
- ☐ more than 48 hours after surgery

Question 3: How long would chemoprophylaxis last after surgery?

- ☐ 7-10 days
- ☐ normally 7-10 days, prolong to 28-35 days in high risk patients
- ☐ until patients' ambulation
- ☐ until 24-72 hours after surgery

☐other _____

Question 4: What was your method for VTE prophylaxis for discharged patients?

- ☐oral anticoagulants and GCS
- ☐oral anticoagulants
- ☐GCS
- ☐stop prophylaxis
- ☐based on patients' special conditions _____

Question 5: What do you think is the emphasized factor for VTE prophylaxis? (Please make an order for the following options. "1" is the most emphasized factor, and from "2" to "5", the importance decreases)

- ☐cost
- ☐convenience
- ☐safety
- ☐efficacy
- ☐compliance

These five questions are only part of all questionnaires, the other about how to revise the Chinese guidelines is not reported.

All the questionnaires were collected and reviewed by the authors. Unqualified questionnaires were ruled out and the remaining ones were analyzed. Oral informed consent was obtained from all respondents.

RESULTS

A total of 208 surgeons responded and successfully completed the survey (71.0% response rate).

Totally, 205 surgeons answered Question 1. The clear majority response was combined basic, mechanical, and pharmacologic prophylaxis, selected by 118 of 205 (57.6%). The second and third most common choice were combined basic prophylaxis and pharmacologic prophylaxis (39 of 205, 19.0%) and combined basic prophylaxis and mechanical prophylaxis (30 of 205, 14.6%), respectively. Seventeen of 205 surgeons chose one method for VTE prophylaxis, in which 8 (3.9%) chose basic prophylaxis only, 3 (1.5%) chose mechanical prophylaxis only, and 6 (2.9%) chose pharmacologic prophylaxis only. Only 1 (0.5%) surgeon selected no prophylaxis.

And 192 surgeons responded to Question 2. The greatest proportion of respondents started to use anticoagulants 12-24 hours after surgery (98 of 192, 51.0%), followed by 4-6 hours after surgery with half dose (55 of 192, 28.6%) and 12 hours before surgery (35 of 192, 18.2%). Only four respondents (2.1%) chose to start pharmacologic prophylaxis 48 hour after surgery.

There were 199 respondents who answered Question 3. Most surgeons stated that they would use pharmacologic prophylaxis for "normally 7-10 days, and prolong to 28-35 days in high-risk patients" (120 of 199, 60.3%). Only 49 of the 199 surgeons (24.6%) selected "7-10 days". And 18 respondents (9.0%) stated they would "stop chemoprophylaxis until patients' ambulation", whereas 9 respondents (4.5%) would "stop chemoprophylaxis 24-72 hours after surgery". There were 3 respondents choosing "other" durations in which 1 stated "5-7 days" and the other 2 stated it should be determined "according to patients' special conditions" but they did not point out what the "special conditions" were.

And 206 surgeons responded to Question 4. Of them, 59 (28.6%) surgeons selected oral anticoagulants, 20 (9.7%) selected GCS, and 19 (9.2%) chose to combine oral anticoagulants and GCS to prevent VTE. Ten (4.9%) respondents selected to stop prophylaxis for discharged patients. The majority of "based on patients' special conditions" reflected the prophylactic methods varied in surgeons' clinical practice (98 of 206, 47.6%).

Some respondents understood Question 5 incorrectly, thus only 157 effective answers were obtained. It turned out that the emphasized factor order was safety, efficacy, convenience, compliance, and cost (the last two was thought to be equally important).

Additionally, we analyzed the most emphasized factor in detail. A majority respondent thought "safety" should be the most emphasized factor in thromboprophylaxis, selected by 113 of 157 (72.0%) surgeons. This was followed by efficacy (36 of 157, 22.9%), convenience (7 of 157, 4.5%), and compliance (1 of 157, 0.6%). No respondent thought cost was the most important factor.

DISCUSSION

The use of mechanical thromboprophylaxis alone had been proven to be effective,¹⁰ which was recommended by ACCP in preventing VTE in patients with high risk of bleeding.^{1,6} However, because of the absence of adequate evidence, multimodal prophylaxis was not recommended. Despite of that, multimodal prophylaxis was common in clinical practice and seemed to be more effective.^{11, 12} Dorr *et al*¹³ retrospectively reviewed the records on 1179 consecutive total joint arthroplasty in 970 patients. Different multimodal methods including mechanical prophylaxis and pharmacologic prophylaxis were used according to patients' risk level. Their results showed that there were only three (0.25%) cases with symptomatic pulmonary embolism, and five (0.4%) with clinically symptomatic DVT. In our survey, a

majority surgeons selected multimodal methods, which was consistent with the previous reports.¹¹⁻¹³ Although routine chemoprophylaxis was recommended after major orthopedic surgery by ACCP, approximately one fifth of surgeons did not choose pharmacologic prophylaxis in our questionnaire survey, which might be influenced by the standpoint that routine chemoprophylaxis was not necessary in Asian population.¹⁴⁻¹⁶

Because LMWH was the most common anticoagulant used in clinical practice and the most controversies are those about the administration time, we only asked the timing of initial administration of LMWH for VTE prophylaxis. Chemoprophylaxis with LMWH was usually started 12 hours preoperatively in Europe (usually the night before surgery) and 12-24 hours postoperatively (usually the next morning after surgery) in North America. In a systematic review, 1926 patients who used a preoperative regimen were compared with 925 patients who received a postoperative regimen. It concluded that starting chemoprophylaxis with LMWH postoperatively provided comparable protection to preoperative initiation.¹⁷ In our study, half of surgeons in China preferred to start chemoprophylaxis 12-24 hours after surgery.

Starting chemoprophylaxis in close proximity to surgery (early before or after surgery) which was not recommended by Chinese guidelines was indicated to have greater efficacy, but related bleeding complications also increased.¹⁸ Subsequently, Hull *et al*¹⁹ indicated LMWH initiated postoperatively in close proximity to surgery (approximately 6 hours after surgery) at half the usual dose was not associated with a clinically or statistically significant in major bleeding rates in the systematic review. Therefore, starting chemoprophylaxis 4-6 hours after surgery with half dose of LMWH was also used by some surgeons.

For patients undergoing major orthopedic surgery, the Chinese guidelines recommended chemoprophylaxis VTE for 7-10 days and it should be extended to 28-35 days in patients with other risk factors for VTE.⁹ The ACCP guidelines recommended chemoprophylaxis is extended beyond 10 days and up to 35 days after surgery.¹ The AAOS recommended the use of LMWH or fondaparinux for 7-12 days, warfarin for 2-6 weeks, and aspirin for 6 weeks.⁶ Several randomized, clinical trials have demonstrated that extended thromboprophylaxis for up to 35 days was both effective at reducing VTE and safe.^{20, 21} Nevertheless, the compliance with VTE guidelines in clinical practice was poor; thromboprophylaxis was frequently stopped on discharge.²²⁻²⁴

Unlike shorter hospitalization of 3-5 days in America,²³

hospital stay was longer in China, normally 7-14 days after surgery. Therefore, stopping chemoprophylaxis on discharge can still meet the requirement of Chinese guidelines. In this survey, more than eighty percent surgeons selected to prevent VTE for at least 7-10 days. However, there were still less than twenty percent surgeons who chose to stop thromboprophylaxis until patients' ambulation or 24-72 hours after surgery.

It was not surprising that thromboprophylaxis regimen varied for discharged patients. About 4.9 percent patients selected to stop prophylaxis. Since LMWH and IPC or VFP was not convenient for discharged patients, more than forty percent surgeons selected oral anticoagulants and/or GCS. Almost half surgeons thought it should be determined based on patients' special conditions. It was a pity that those surgeons did not specify those special conditions and corresponding prophylactic methods.

Efficacy and safety were the most important aspects during thromboprophylaxis.²⁵ Cost-effectiveness was also considered by surgeons.^{26, 27} But what was more emphasized in surgeons' standpoint was unknown. Thus, the respondents were asked to make an order of five factors during VTE prophylaxis. More than 70% of surgeons thought "safety" was most important, followed by "efficacy", "convenience", "compliance", and "cost" in turn. The "safety" concern was about bleeding complications during chemoprophylaxis, including major and minor bleeding complications. Major bleeding complications, such as intracranial haemorrhage, intramuscular haemorrhage causing compartment syndrome, might need surgical intervention and could put patients on the risk of death.²⁸ That is why "safety" was most emphasized. However, these results indicated that surgeons in China were relatively conservative in determining the protocols of thromboprophylaxis after major orthopedic surgery.

There were several limitations of the current study. The data represents surgeons' opinions and perceptions of their practices. As the survey was carried out during the proseminar of Chinese guidelines for prevention of VTE after major orthopedic surgery (surgeons from larger general hospitals had a higher chance of being surveyed compared to those from tier 2 hospitals) and the response rate was relatively lower, it may not precisely reflect the actual practices for all orthopedic surgeons in China. Moreover, the questionnaire was designed according to the Chinese guidelines (draft), with limited options. Inherent in a multiple-choice type survey, responses were limited to the choices provided. In addition, the questionnaire did not cover all aspects of thromboprophylaxis after major orthopedic surgery. Only several main aspects were sur-

veyed. So details of each aspect could not be concluded, for instance about pharmacologic prophylaxis, which anticoagulant was preferred was not surveyed.

In recent years, new oral anticoagulants, such as dabigatran and rivaroxaban, were used in preventing VTE after major orthopedic surgery, indicating lower incidence of VTE and no increase of bleeding complications compared with LWMH.²⁹ Nevertheless, aforementioned debates still existed and our survey presented Chinese orthopedic surgeons' practice.

Conclusively, this study was a survey about thromboprophylaxis after major orthopedic surgery in Chinese orthopedic surgeons. Regarding the different methods of thromboprophylaxis preferred, a majority of surgeons selected multimodal prophylaxis. Half of the surveyed surgeons prefer starting chemoprophylaxis treatment 12-24 hours after surgery. Most surgeons abide by the Chinese guidelines to prevent VTE with continued treatment for 7-10 days. However, the thromboprophylaxis regimen varied for discharged patients.

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