Factors Affect Successful Fast-track Total Knee Arthroplasty

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Fast-track total knee arthroplasty (TKA) has been reported to improve patient's clinical outcome, and decrease cost of treatment related to hospital stay. However, some drawbacks of early patient's discharge have been reported, which caused surgeons to hesitate whether or not to apply the fast-track protocol in their practices. Literature has shown that besides patient's factor which a decent patient selection played key role for successful fast-track TKA, other factors, including anesthesia factors and surgical factor, could facilitate the consistency of clinical outcome. The purpose of this review was to update and to determine factors which affected the fast-track protocol.

Keywords: *Fast-track, total knee arthroplasty, TKA, length of stay, LOS*

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Introduction

Total knee arthroplasty (TKA) is well accepted as the useful and effective surgical treatment for late stage knee osteoarthritis in terms of pain elimination and functional improvement. Currently, it has become a common orthopedic procedure worldwide. Before 1990, the literature has shown that the average length of stay (LOS) in the hospital of patients undergoing TKA was over 10 days[1]. Later on, the LOS was reduced to be less than 7 days[2]. Following the improvement of surgical technique towards the minimally invasive surgery, the anesthetic technique towards regional anesthesia, the comprehensive perioperative pain, and the early postoperative rehabilitation protocol, the LOS was markedly reduced. Following the fast-track TKA, which has been introduced by Husted et al.,[3] the LOS of TKA was limited within 3 days[3,4] and this new protocol has become very popular TKA management pathway in several orthopedic surgical centers. The fast-track TKA provides several advantages, including enhancing improvement of patient's clinical outcomes, reduction of infection rate, thromboembolism, urinary retention, and bowel paralytic ileus[5-7]. In fact, it also exhibited a decreased overall cost of treatment.

However, early discharge of patients in the fast-track TKA has raised some conflicts of clinical outcomes in the literature. Whilst a study reported increased readmission rate after fast-track TKA in comparision to that of standard TKA protocol[6], another study demonstrated no difference in readmission rate of both protocols. Although a recent study showed that shorter patient's LOS did not associate with the rate of manipulation under general anesthesia (MUA) after TKA[8], another study reported in the opposite way[9]. These investigators found that the causes of postoperative knee stiffness were multifactors; however, early discharge program in TKA was one related factor[9]. According to several aspects of previous reports, it is controversial whether a shorter hospital stay following the fast-track TKA provided a reduction of mortality rate[6,10,11]. In fact, there has been unclear conclusion whether which patients should be the right candidate for a fast-track protocol in TKA[12-14].

This review article collected the current studies and knowledge related to success fast-track TKA which the authors discussed in specific important factors, including patient factor, anesthesia factor and surgical factor.

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Patient factor

Age

The current literature has shown that the higher patients' age undergoing TKA, the longer LOS did occur. Those patients whose ages were more than 80 years had significantly longer LOS over 4 days[5]. One study had found that the probability of more than 3-day LOS increased by 2.4% for each increment year of the patient's age[15]. However, the younger patients did not always have advantages over those who are older. The risk of manipulation under general anesthesia after fast-track TKA was found higher in the younger age group. The mean age of this at-risk younger patients was 59 years old[8].

Comorbidity

Conditions or diseases, such as congestive heart failure, bleeding disorder, and prior operation within 30 days were found to cause significant risk for delay discharge[15,16]. Evaluation of patient's general condition before surgery is recommended in order to recognize patient's subclinical conditions or diseases, as well as to optimize the goal of fast-track protocol. Regarding the preoperative American Society of Anesthesiologists (ASA) score, studies has shown that patients with increased ASA score related to more LOS[15], especially those who had ASA score more than class 3[16].

Risk Assessment and Prediction Tool

The risk assessment and prediction tool (RAPT) is a tool which evaluates several patient key factors and socioeconomic status, including age, sex, previous ambulation status, gait aid, social support, and caregiver (Table 1.). Before surgery, the RAPT is a useful tool to predict the successful of early patient's discharge. If the RAPT score is higher than 9 points, it is highly predictable that the patient can be early discharged to home[17]. If the RAPT score is between 6 to 9 points (gray zone), health care provider team should consider and manage other factors which may delay early discharge. For those who have lower score than 6 points, there will be higher is for delay ambulation, such as, patients who preoperatively used a gait aid were reported to have a higher chance of poor ambulation with later MUA after fast-track protocol[9].

As several oriental countries, including Thailand, it is quite common that the patient's family members or relatives always encourage and support the patients during hospital admission and after discharge as an additional care giver. Therefore, with a well pre-education to patient's family members or relatives who will be taking care the patient during the perioperative period will increase the success rate of fast-track protocol for TKA.

Table 1 Risk assessment and prediction tool (RAPT) to predict patient disposition according to Hansen VJ. Et al.[17]

Item	Value	Score
Age group (years)	50-65	2
	66-75	1
	> 75	0
Sex	Male	2
	Female	1
Walking distance	Two blocks or more	2
	1-2 blocks	1
	Housebound	0
Use of gait aid	None	2
	Single-point stick	1
	Crutches/frame	0
Use of community supports	None or one per week	1
	Two or more per week	0
Caregiver at home	Yes	1
	No	0

Hemoglobin level

Regarding the preoperative hemoglobin (Hb) level, the patients whose Hb level is less than 13 g/dL for male gender and less than 12 g/dL for female gender or hematocrit (Hct) level is less than 38% is considered as a anemia patient[15,16]. Several studies have shown that preoperative anemia related to increasing of LOS and higher re-admission rate[6,18].

Preoperative usage of opioids

Most studies reported that patients, who have prolonged usage of opioids before surgery, have increased LOS and worse postoperative outcomes[19-21]. However, some investigators emphasized that more attention on rehabilitation should be focused before surgery, the preoperative rehabilitation could enhance patients' general condition, as well as encourage the patients to early ambulate in order to improve their postoperative clinical outcomes[22-24].

Anesthesia Factor

Althogh spinal anesthesia plays an important role for fast-track, as it relates to less systemic effects at perioperative period than general anesthesia. For those patients who have spinal disease which may preclude spinal anesthesia, general anesthesia with the combination with multimodal pain control is an alternative. However, the overall cost of anesthesia of general

anesthesia with multimodal pain control has a higher cost that spinal anesthesia[25,26].

Currently, most fast-track protocols for TKA consist of multimodal perioperative pain control regardless of the type of anesthesia. The use of multiple drugs is aim to reduce the overall usage of opioids, which results in less side effects and enhancing early ambulation[3,12-15].

Surgical Factor

Less Invasive Surgery

A minimally invasive surgery (MIS), which a shorter skin incision in combination with less extensive exposure provided a reducing soft tissue injury relating to less prolonged postoperative knee pain, whilst improved early range of motion after surgery, has been evidenced[27,28]. Therefore, it can enhance the success rate of fast-track TKA.

Same-day Bilateral TKA

Current literature has shown that patients who underwent same-day bilateral TKA could have very satisfactory results which were not different from those who had a unilateral TKA[5]. However, it should aware that in patients who have cardiopulmonary diseases and the ASA classification is more than class 3, there will be high incidence of increasing LOS, as well as the rate of postoperative confusion, delirium, cardiovascular events, and re-admission rate[29,30].

Revision surgery as a fast-track TKA

Although a study reported that revision TKA from aseptic loosening had a similar fast-track result to those with primary TKA[31], some unexpected complications, such as cortical fracture at the distal stem area had occurred after the full weight bearing according to the protocol. Therefore, for those surgeons who propose to use of fast-track protocol in revision TKA, increased risk of postoperative morbidity have to be considered.

Fast-track TKA in Thailand

The fast-track TKA was first published by Tanavalee A. et al. in 2009[32] with a combination of MIS concept, multimodal pain control and early rehabilitation. With a well set up of patient care team, results of fast track TKA has shown a consistent results of 3-day admission protocol with a very satisfactory outcomes, regardless of patient's comorbidities[33]. Later on the modification of fast-track TKA tended to move towards the anesthesia protocol, which a variation of peripheral nerve blocks in combination of periarticular cocktail injection[34,35]. With new improvement of anesthesia protocol, the rate of nausea and vomiting was less, as well as the rate of side effects related to the usage of opioids.

Table 2 Characteristic of Fast-track TKA patients at our institution according Kampitak W. et al.[34,35]

Patient characteristic	Adductor block alone (N = 59)	Adductor block + local LIA (N = 30)	LIA alone (N = 28)
Age ± SD (year)	72.28 ± 7.95	69.1 ± 5.36	68.89 ± 5.65
Co-morbidity	ASA 1 = 0 ASA 2 = 57 (96.61%) ASA 3 = 2 ASA 4 = 0	ASA 1 = 0 ASA 2 = 28 (93.33%) ASA 3 = 2 ASA 4 = 0	ASA 1 = 0 ASA 2 = 28 (100%) ASA 3 = 0 ASA 4 = 0
RAPT score	<6 = 0% 6-9 = 46.67% >9 = 53.33%	<6 = 0% 6-9 = 13% >9 = 87%	<6 = 0% 6-9 = 13.8% >9 = 86.20%
Hemoglobin level Male (mean ± SD) >13 g/dl <13 g/dl Female (mean ± SD) >12 g/dl <12 g/dl	 13.33 ± 0.78 66.67% 33.33% 12.3 ± 1.12 76.47% 23.53%	 13.05 ± 1.08 50% 50% 12.69 ± 0.64 80% 20%	 13.4 ± 1.95 50% 50% 12.6 ± 1 70% 30%
Pre-operative opioid drug use	Yes = 0% No = 100%	Yes = 0% No = 100%	Yes = 0% No = 100%
Operation type	Primary TKR = 100%	Primary TKR = 100%	Primary TKR = 100%
LOS (days)	3	3	3

N = Number of patients, LIA = Local infiltration analgesia, ASA = American Society of Anesthesiologists physical status, RAPT = Risk Assessment and Prediction Tool, TKR = total knee replacement, LOS = length of hospital stays, SD = standard deviation

Since 2010, most institutions in Thailand have used their individual fast-track TKA protocol whilst the patient selection criteria has not been clarified. However, based on several international publications which the investigation were performed in Thailand, the mean LOS of patients who underwent primary TKA were reduced from those studies in the past, which was ranged from 3 to 6 days[34-38].

Currently, the fast-track TKA protocol at our institution, King Chulalongkorn Memorial Hospital, incudes admission the patient one day before surgery for preoperative anesthesiology visit, evaluation and management of any possible correctable patient's negative factors for fast-track protocol, such as hematocrit and hemoglobin. Regarding patient's selection, the ASA classification must be within class 3, and the RAPT score must be $\geq$ 6 points (Table 2.). However, minor degree of anemia is acceptable. With combined MIS surgical technique and peripheral nerve block & simple spinal anesthesia, all surgeries could be the opioid-sparing TKA. The overall immediate to short-term results were satisfied in terms of LOS, patient's satisfaction, functional improvement and unexpected complications[34,35].

Conclusion

Fast-track TKA seemed to provide more advantages over its disadvantages. Besides effective perioperative pain control, patients should be able to happily ambulate, which resulted in early discharge from the hospital. Several factors were reported to affect the fast-track pathway. Select the right patient into a well set-up patient care team with a multi-disciplinary care is mandatory for a consistent outcome.

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ปัจจัยที่มีผลต่อความประสบความสำเร็จในการเปลี่ยนข้อเข่าเทียมแบบเชิงรุกเร็ว (Fast-track Protocol)

โชติตะวันณ ตนาวลี, พบ, สีหธัช งามอุโฆษ, พบ, วัชระ วิไลรัตน์, พบ, อารี ตนาวลี, พบ

การผ่าตัดเปลี่ยนข้อเข่าเทียมโดยการดูแลผู้ป่วยแบบเชิงรุกเร็ว (fast-track protocol) มีส่วนช่วยทำให้ผลการรักษาดีขึ้นและลดค่าใช้จ่ายขณะอยู่โรงพยาบาลของผู้ป่วย อย่างไรก็ตาม การจำหน่ายผู้ป่วยออกจากโรงพยาบาลภายในระยะเวลาสั้น อาจส่งผลให้เกิดปัญหาการเกิดภาวะแทรกซ้อนเมื่อกลับบ้าน ซึ่งอาจทำให้แพทย์ที่สนใจใช้ fast-track protocol เกิดความไม่มั่นใจที่จะใช้ หรือเกิดข้อจำกัดในการใช้ จากการทบทวนวรรณกรรม นอกจากปัจจัยจากตัวผู้ป่วย ซึ่งการเลือกผู้ป่วยและเตรียมผู้ป่วยล่วงหน้าอย่างเหมาะสมเป็นสิ่งสำคัญต่อความสำเร็จของ fast track protocol แล้ว ปัจจัยอื่นๆ คือ วิธีทางวิสัญญีและการระงับปวดแบบต่าง ๆ และปัจจัยที่เกี่ยวกับการผ่าตัด ก็เป็นปัจจัยสำคัญที่ทำให้ fast-track protocol ประสบผลสำเร็จ การทบทวนวรรณกรรมนี้จะมุ่งเน้นไปที่ปัจจัยที่มีผลต่อความสำเร็จของ fast track protocol