ORIGINAL ARTICLE

Safety and Satisfaction of Outpatient Versus Inpatient Care for Arthroscopic Knee Surgery in Thailand

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Background: Although outpatient surgery volume has rapidly grown in the western counties. However, the rate of growth for outpatient surgery has been slow in Thailand. There are limited studies comparing outcomes and cost analysis in outpatient arthroscopic knee surgery in Thailand.

Objective: To compare the 24-hour postoperative pain score, side-effects and the total cost associated between inpatient and outpatient care following arthroscopic knee surgery.

Materials and Methods: A retrospective cohort study of 42 patients undergoing elective arthroscopic knee surgery under general anesthesia and receiving ultrasound guided adductor canal block for post-operative analgesia. The two cohorts were matched with a 1:1 ratio for age, sex, body mass index, type of surgery and operation time. The primary outcome was the 24-hour postoperative pain score. Secondary outcomes included: the incidence of inadequate analgesia, adverse events, cost associated with outpatient versus inpatient care, and patient satisfaction score.

Results: The 24-hour postoperative pain score was median 2 (IQR 0, 3) versus 2 (IQR 1, 3) in the outpatient and inpatient groups, respectively. No major complications, reoperation, or readmission after surgery was seen in either group. The total hospital cost between outpatient versus inpatient showed not significant difference (1,871.09±555.53 USD versus 1,966.49±549.70 USD, p=0.58). The costs related to perioperative service, inpatient surgery ward service, and room and food service were significantly different. Satisfaction score was comparable between groups.

Conclusion: In Thailand, outpatient arthroscopic knee surgery provided the same 24-hour postoperative pain control scores and clinical outcomes when compared to inpatient setting. There was no significant difference in total hospital cost between outpatient and inpatient care. However, costs related to perioperative period (e.g., inpatient room and food service) were significantly different.

Keywords: Ambulatory surgery; Arthroscopic knee surgery; Adductor canal block; Safety and satisfaction; Medical cost

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Arthroscopic knee surgery is a common orthopedic procedure, with over 175,000 cases performed each year in the United States[1]. The advancements in surgical techniques, anesthesia, and rehabilitation in the recent years have decreased tissue trauma and thereby reducing postoperative pain with faster recovery. As a result, the incidence of outpatient surgery for anterior cruciate ligament reconstruction (ACLR) has grown from 57.3% in 1997 to 95.1% in 2006 in the United States[2]. The National Health Service in the U.K., Norway, and Denmark have reported that 20%[3], 38%, and 79% of ACLR were performed in an outpatient setting, respectively[4]. However, in Thailand, the standard management for arthroscopic knee procedures include a postoperative hospital stay for 1 to 2 days to ensure adequate analgesia and to minimize adverse events.

As an anesthesiological perspective, inadequate postoperative analgesia has been reported as main cause of delayed discharge, increases the rate of readmission after surgery, delays functional recovery, and reduces patient satisfaction[5,6]. Regional analgesia plays a critical role in multimodal analgesic regimens[7]. The femoral nerve block (FNB) has been considered the backbone for post-knee arthroscopy analgesia. When compared to FNB, the adductor canal block (ACB) provides equivalent analgesia while preserving quadriceps muscle strength. Hanson

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et al. reported successful pain reduction and opioid-sparing effect in the ACB group when compared with the sham group[8]. Therefore, the multimodal analgesia regimen in the present study hospital includes an ACB.

Since the authors institute is facing a problem with inadequate number of hospital beds, leading to prolonged waiting for surgical procedures. Therefore, efficient hospital bed management is beneficial for the health care system. Realizing the importance of improving hospital bed utility, quality of life convalescing in the comfort of the patient's home, lowering risk of nosocomial infections, improving patient satisfaction, and reducing surgery costs and medical reimbursement[5,6,9]. The authors collaborated on the outpatient arthroscopic knee surgery protocol in their institute.

One of the challenges in outpatient surgery is to maintain the highest quality of patient care with the lowest complication rate. Therefore, the authors performed a retrospective cohort study to compare the pain score at 24 hours after surgery in patients who had arthroscopic knee surgery in the outpatient versus the inpatient setting. The authors hypothesized that the pain score at 24 hours of the outpatient management was similar to that of the inpatient management. Secondary outcome variables were the rate of adequate analgesia, adverse surgical outcomes, cost associated with outpatient versus inpatient care, and satisfaction score.

Materials and Methods

Study participants

The present study was a retrospective cohort cost-minimization study. The study was approved by Ramathibodi Hospital Research Ethics Broad (ID 02-61-42) and patient consents were waived by the ethical committee. After receiving approval, the electronic medical records were searched to identify patients between January 1 and September 16, 2016, meeting the following inclusion criteria:

1) Age 30 to 60 years

2) American Society of Anesthesiologists' (ASA) score 1-2

3) Presenting for elective arthroscopic knee surgery (meniscus repair, ACL reconstruction, or both)

4) ACB was performed for postoperative analgesia

5) Both inpatients and outpatients were included

The exclusion criteria were as follows:

1) Long-term opioid usage or history of chronic pain

2) Patient with a diagnosis of knee osteoarthritis

3) Patient with a history of previous knee surgery on the same site or re-do operation

Eligible inpatients and outpatients were matched 1:1 for age, sex, body mass index (BMI), ASA score, operative time, surgeon, and type of operative procedure. All methods were carried out in accordance with relevant guidelines and regulations.

The primary aim of the present study was to compare pain score at 24 hours after surgery in patients who had arthroscopic knee surgery in the outpatient versus the inpatient setting. The secondary aim was to evaluate rate of adequate analgesia, adverse surgical outcomes (surgical infection, 30-day readmission, and revision surgery), cost associated with outpatient versus inpatient care, and satisfaction score.

ACB performance and intraoperative management

Anesthetic management included a single-shot ACB at the mid-thigh level under ultrasound guidance with 20 mL of 0.5% bupivacaine preoperatively. Intraoperatively, the patient received general anesthesia with laryngeal mask airway using intravenous (IV) propofol (1 to 2 mg/kg), fentanyl 50 to 100 mcg IV with or without muscle relaxant. Anesthesia was maintained with oxygen/desflurane or sevoflurane and morphine 0.1 to 0.2 mg/kg (maximum 10 mg). Additional dexamethasone (5 to 10 mg IV), NSAIDs (parecoxib 40 mg IV or ketorolac 30 mg IV), and ondansetron (4 to 8 mg IV) were given.

Postoperative management

After surgery, all patients were transferred to the postanesthetic care unit (PACU), where they remained until they met the discharge of Modified Aldrete score. Patients were then transferred to the orthopedic ward for further care. Knee pain at rest and with movement was measured using a 10-point numerical rating scale (0=no pain and 10=excruciating pain) by the inpatient nurse.

The discharge criteria inpatients included: pain score at rest and with movement 4 or less, no nausea and vomiting, no bleeding from wound, the ability to ambulate with gait aid and the ability urinating. Once oral intake was tolerated, patients in both groups received multimodal analgesia medication consisting of oral acetaminophen 500 mg every 6 hours, acetaminophen with codeine 325 mg/15 mg oral every 6 hours, celecoxib 400 mg or etoricoxib

90 mg every 24 hours, and gabapentin 300 mg or pregabalin 75 mg oral before bedtime for 3 to 5 days.

Inpatients were followed once daily by the acute pain service starting on postoperative day 1 until discharge. If additional analgesia was required, morphine 3 mg IV was given as a rescue drug.

Conversely, outpatients were discharged on the day of surgery and were followed once daily on the phone by members of ambulatory service for 2 days postoperatively. In addition, outpatients were given a 24-hour clinician contact number in case they needed additional support with pain management and wound care.

For satisfaction with analgesia and process care systems using 0 to 10 scale with 0=vary dissatisfied and 10=completely satisfied (excellent). Overall satisfaction score was evaluated on postoperative day 2 in both groups. All patients were asked to follow-up 2 weeks after surgery.

The present study data were retrospectively collected from the electronic medical records. These included: demographic data, anesthetic and operative technique, pain and analgesics, surgical complications (unplanned admission, revision surgery, surgical site infection, readmission within 30 days), and anesthetic complications (nausea/vomiting and nerve injury).

Cost perspective

The present study was performed from a hospital perspective. Only direct medical costs were included costs of instruments, operating room, medicines and other consumables used in anesthesia, surgery and recovery period, and related to surgical/anesthetic complications.

Cost related to caregivers, referral, and diagnosis or postoperative medications and general practitioner visits as well as fixed costs related to administration such as electricity was not included.

All costs were estimated for Thai settings from a retrospective database analysis. The costs were converted to U.S. at the rate of 32.11 Thai Baht (THB) per USD[10].

Statistical analysis

Sample size calculation: The sample size was calculated based on the authors' pilot study, in which the differences in the pain score between inpatients and outpatients was 1.5. The standard deviation of pain score in inpatients and outpatients was 1.75 and 1.52, respectively. The confidence level used for the statistical judgment was $1 - \alpha$ (where α was 0.05) and a power of 0.8. The required sample size was 21 participants per group.

Data analysis: Patient characteristics were presented with descriptive statistics as mean ± standard deviation, median and interquartile range (IQR), frequency, or percentage. The means of normally distributed variables were compared with Student's t-test. The Wilcoxon-Mann-Whitney test was used for nonnormally distributed continuous and ordinal variables. Categorical data were analyzed using Fisher exact test or Chi-square test. For all analyses, p-value less than 0.05 was considered statistically significant.

The cost of treatments was calculated and compared. Tornado diagram was performed for a one-way sensitivity analysis.

Results

Forty-two patients with 1:1 matching by age, sex, BMI, ASA score, surgeon, type and duration of surgery were included in the inpatient and outpatient cohorts. Patient demographic data, type of surgical procedures, and operative time were not significantly different between the groups (Table 1).

The median 24-hour pain score in the inpatient and outpatient groups was 2 (IQR 1, 3) and 2 (IQR 0, 3), respectively. No patients reported inadequate analgesia at rest (pain score 4 or more) during the first 24 hours postoperatively. However, 7 inpatients (33.3%) and 5 outpatients (23.8%) reported pain on movement of greater than 4 (p=0.49). The amount of postoperative 24-hour morphine used was not significantly differences between the groups (Table 2).

Postoperative nausea and vomiting were reported in 4.76% of inpatients and 9.52% of outpatients, respectively (p=0.5). Major complications, re-operation, readmission after surgery or nerve injury were not reported in any group. The total hospital cost between the groups was not significantly different (inpatient group versus outpatient group: 1,966.49±549.70 USD versus 1,871.09±555.53 USD, p=0.58). However, costs related to perioperative service, inpatient surgery ward service, and room and food service were significantly different (Table 3).

From the diagram, the authors varied the costs of medication, operation, room, and laboratory to possible minimum and maximum value. The results indicated that the highest impact on the total cost was due to the cost of surgical instrument, medication, and medical supply, followed by operation, room, and laboratory (Figure 1).

Table 1. Demographic data

	In-patient (n=21)	Out-patient (n=21)	p-value
Age (years); mean±SD	34.48±9.8	34.81±12.87	0.93
Body weight (kg); mean±SD	69.02±8.82	71.86±11.01	0.36
Height (cm); mean±SD	167.57±6.43	168.43±7.66	0.69
Body mass index (kg/m^2); mean±SD	24.30±1.99	24.98±3.14	0.41
Sex: female/male; n	4/17	4/17	0.65
ASA physical status; n			0.63
Class I	14	14	
Class II	7	7	
Procedure; n			0.68
Arthroscopic ACL repair	4	4	
Arthroscopic meniscus repair	6	6	
Arthroscopic ACL and meniscal repair	11	11	
Operative time (minutes); mean±SD	100.95±35.66	95.95±33.41	0.64
Tourniquet time (minutes); mean±SD	81.90±35.54	75.53±33.88	0.55

ACL=anterior cruciate ligament repair; ASA=American Society of Anesthesiologists; SD=standard deviation

Table 2. Pain, side-effects, satisfaction score, and length of hospital stay

	In-patient (n=21)	Out-patient (n=21)	p-value
Intra-operative morphine requirement (mg); mean±SD	11.62±4.46	11.86±4.15	0.86
Pain at rest at PACU; median (IQR)	2 (1, 3)	2 (1, 2)	0.83
Pain on movement at PACU; median (IQR)	2 (2, 5)	3 (2, 4)	0.98
24-hour pain at rest; median (IQR)	2 (1, 3)	2 (0, 3)	0.27
24-hour pain on movement; median (IQR)	4 (3, 5)	3 (2, 4)	0.32
24-hour post-operative morphine requirement (mg)*; median (IQR)	3 (0, 4)	3 (0, 4)	0.88
48-hour pain at rest; median (IQR)	0 (0, 3)	1 (0, 2)	0.65
48-hour pain on movement; median (IQR)	2 (1, 5)	3 (2, 4)	0.23
PONV required treatment at PACU; n (%)	1 (4.76)	2 (9.52)	0.5
Satisfaction score (days); mean±SD	9.14±0.65	9.38±0.74	0.28
Length of hospital stay (days); mean±SD	2.14±0.48	N/A	N/A

IQR=interquartile range; N/A=not applicable; PACU=post-anesthetic care unit; PONV=post-operative nausea vomiting; SD=standard deviation

* 24-hour post-operative morphine requirement in out-patient group included when patients received morphine at post-anesthetic care unit or recovery ward (before hospital discharge).

Table 3. Total hospital cost between in-patient and out-patient

	In-patient (USD)	Out-patient (USD)	p-value
Surgical instrument; mean±SD	990.20±475.39	1,005.21±430.74	0.86
Surgical procedure fee; mean±SD	332.48±83.40	328.48±101.56	0.97
Operating room nursing & supplies; mean±SD	193.38±41.04	192.86±70.81	0.95
Perioperative service; mean±SD	26.82±8.41	11.46±2.21	<0.001
Anesthesia related cost and supplies; mean±SD	196.49±50.06	186.87±38.21	0.57
Room service + food; median (IQR)	46.09 (43.60, 89.69)	15.43 (15.43, 15.43)	<0.001
Pharmacy; mean±SD	70.28±21.65	57.38±19.88	0.06
Diagnostic imaging; median (IQR)	46.09 (44.22, 63.53)	43.82 (30.86, 45.68)	0.012
Inpatient surgery ward service; median (IQR)	29.27 (24.29, 37.37)	14.82 (11.73, 17.28)	<0.001
Total cost; mean±SD	1,966.49±549.70	1,871.09±555.53	0.58

IQR=interquartile range; SD=standard deviation

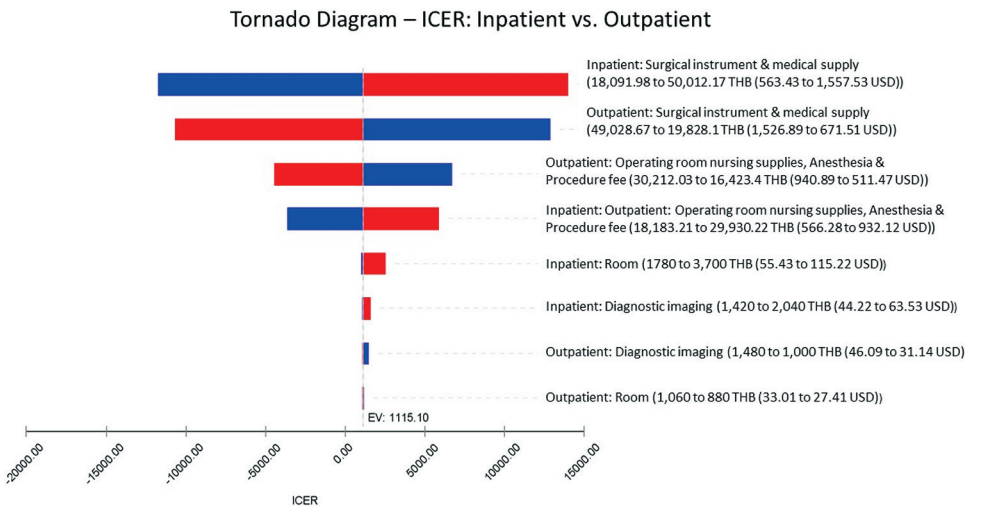

Figure 1. Tornado diagram - incremental cost effectiveness ratio (ICER): inpatient vs. outpatient.

Discussion

The present study results suggest that outpatient arthroscopic knee surgery with ACB provide equivalent 24-hour postoperative pain score while maintaining patient safety and satisfaction. The overall cost showed a non-statistical difference from the hospital perspective. However, cost related to perioperative, inpatient service, room and food services showed statistical differences.

Based on age, comorbidities, and operation-matched cohort, the authors were able to compare patients who underwent arthroscopic knee surgery in a traditional in and out-patient setting. Both groups had similar preoperative ASA scores, BMI, operation type, and time. Postoperatively, the outpatient group had comparable 24-hour pain score and complications. None in the outpatient group required readmission or reoperation within 30 days. The same results were also found in the previous studies[11,12].

A meta-analysis study reported that outpatient care reduces overall cost, ranging from 1,371 to 7,390 USD[13]. However, most studies were from Western countries, which have varying health care delivery costs. The World Health Organization analysis of health economics revealed a considerable difference in costs for inpatient versus outpatient health care delivery in the high-income North American countries (cost per outpatient and inpatient visit: 50.96 and 786.93 USD, respectively) versus the Southeast Asian countries (7.32 and 52.54 USD, respectively)[14,15]. From this data, a significant difference can be assumed in health care costs between the two regions.

The present study findings revealed no significant difference in overall cost between inpatient versus outpatient groups. The main expense was from surgical instruments and medications, the perioperative cost was different, but it had a low impact on the overall cost. The present study's institute is a public hospital, costs related to personnel, such as nurses and physical therapists; room charge; or procedures involved may not be as high as those in other institutes or private hospital. However, increasing outpatient surgeries would increase the availability of beds, for those patients requiring an overnight stay. The additional income for the hospital is assume by a reduction of 1 day in the length of stay per person per procedure. Based on the present study hospital information, the average cost gained was approximately 150 USD/day per patient.

Outpatient surgery is not as readily accepted in Asian countries as in Western countries, where there is a greater emphasis on patient empowerment[16,17]. The slow growth in outpatient surgery in the Southeast Asian region can be attributed to the health care reimbursement system, the level of ancillary home health care services and the difference in cultural-life style[16-18]. The present study revealed that up to 86% of patients would consider outpatient care surgery in the future. One may assume that Thai patients are becoming more self-reliant and Thailand's health care system has the potential to provide a high standard outpatient care. Sharing clinical experiences from various countries (e.g., Southeast Asian region) and clinical setting (e.g., public hospitals) may help improve the understanding and promote growth of

this challenging field.

There may be some possible limitations in the present study. First, the analysis was from a public hospital perspective. The direct non-medical costs were not included in the analysis. Therefore, it is unknown whether there was any cost difference between the groups with respect to factors such as caregiver, over-the-counter medications, and other community services. Second, the present study was a retrospective study which may introduce selection bias. The authors minimized selection bias by using the same predeterminate inclusion and exclusion criteria for all consecutive patients who underwent arthroscopic knee surgery with ACB for post-operative pain control. Also, both cohort patients were identified using the same criteria and matched by age, sex, ASA score, type of surgery, operating time, and surgeon. Finally, the sample size was relatively small. Therefore, surgical or anesthesia-related complications may be underpowered to identify any differences between the groups. In the future, a larger prospective study is required to definitively establish the outcomes and safety of outpatient arthroscopic knee surgery.

Conclusion

The present study suggests that outpatient arthroscopic knee surgery with ACB provided the same 24-hour postoperative pain score while maintaining the same clinical quality and outcomes as an inpatient setting. Even though the overall total cost was not significantly different from the hospital perspective, costs related to perioperative, inpatient surgery ward, room, and food service were significantly different.

What is already known on this topic?

Outpatient arthroscopic knee surgery is safe and has cost-saving compare with inpatient care. However, the cost for inpatient and outpatient services varies among different countries.

What this study adds?

In Thailand, outpatient arthroscopic knee surgery with ACB provided the same 24-hour postoperative pain score while maintaining the same clinical quality and outcomes as an inpatient setting. Even though the overall total cost was not significantly different from the hospital perspective, costs related to perioperative, inpatient surgery ward, room, and food service were significantly different.

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Availability of data and materials

The datasets during and/or analyzed during the current study available from the corresponding author on reasonable request.

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Conflicts of interest

The authors declare that they have no competing interests.

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