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Original Article

A Retrospective Chart Review of 114 Patients with Knee Pain at a Korean Medicine Hospital Who Had Been Involved in a Traffic Accident

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ABSTRACT

Background: This study aimed to investigate the demographic characteristics of patients with knee pain caused by traffic accidents and test the effectiveness of Korean medicine (KM) treatment.

Methods: The medical charts of 114 inpatients with knee pain caused by a traffic accident were reviewed from July 1, 2019 to October 31, 2019 at Bucheon Jaseng Hospital of KM. The patients' demographics including gender, age, period of hospitalization, and type of pharmacopuncture and herbal medicine prescribed were reviewed. The Numeric Rating Scale scores and Western Ontario and McMaster Universities Osteoarthritis Index scores were used to assess subjective knee pain.

Results: There were more females (55%) than males in this study. Patients were more likely to be in their 30s (27.2%), be hospitalized for 11-14 days (41.2%), treated with Hwangryunhaedok pharmacopuncture (78.1%), and be prescribed Hwalhyeoljitong decoction (62.3%).The mean Numeric Rating Scale score for patients with knee pain caused by a traffic accident decreased significantly from 4.26 ± 1.39 to 2.53 ± 1.60 ($p < 0.001$), and the mean Western Ontario and McMaster Universities Osteoarthritis Index score also decreased significantly from 32.72 ± 18.36 to 23.40 ± 15.80 ($p < 0.001$) following KM treatment.

Conclusion: As a result of analyzing 114 hospitalized patients with knee joint pain due to TAs, inpatients were more likely to be female (55%), a patient in their 30s (27.2%), and be a patient hospitalized for 11-14 days (41.2%). KM treatment of traumatic knee injury using pharmacopuncture therapy and herbal medicine can be an may be effective at reducing pain, and healing functional disorders of the knee.

Introduction

Korea Road Traffic Authority data shows that there were 229,600 traffic accidents (TAs) which occurred in 2019, this was an increase of 5.7% compared with 2018. There were 341,712 people injured in 2019 which was an increase of 5.8% compared with 2018. Of the 341,712 TA injuries that occurred in 2019, the number of minor injuries was 245,524 [1]. A "minor injury" due to a TA is described as requiring treatment for more than 5 days but less than 3 weeks, and includes sprains and strains [2].

Musculoskeletal pain may be difficult to specify anatomically and therefore it is diagnosed as a sprain or strain [3]. X-rays of strains and sprains typically show normal findings. In these cases, anti-inflammatory analgesic drugs and physical therapy are treatments offered in Western medicine [4]. Health Insurance Review and Assessment Service's data showed that the number of visits to Korean medical institutions by TA patients has been rising over the past 3 years [5].

The knee joint is the largest joint in the human body which is structurally flexible. It maintains stability through the surrounding ligaments, and muscles. Due to the anatomical position of the knee joint, when an external forced is applied structural damage is caused by the trauma [6]. Temporary pain caused by the trauma which occurs when tissue is damaged, and the pattern of pain usually localizes to the trauma site, but there are cases where the pain radiates. In cases of temporary pain there is stimulation of nociceptors in the joints, ligaments, muscles, or fascia, and the patient experiences a dull and aching pain [7]. Knee pain after a

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TA is often caused by instability of the knee joint structure [6]. Patients may also experience knee pain where there is no obvious temperamental abnormality of the knee joint.

After a TA, knee pain is the 3rd most common complaint after neck pain, and low back pain [4]. There have been many studies of Korean medicine (KM) treatment of neck pain and back pain caused by TAs [8-10]. However, to date, there have been no published studies examining knee pain caused by TAs.

In this study, a retrospective chart review was performed at Bucheon Jaseng Hospital of Korean Medicine for patients hospitalized with knee pain caused by TAs from July 01, 2019 to October 31, 2019.

Materials and Methods

Patients

Amongst all patients hospitalized at Bucheon Jaseng Hospital of Korean Medicine from July 01, 2019 to October 31, 2019 for knee pain caused by a TA, 114 patients met the inclusion criteria of this retrospective study and their medical charts were reviewed (Fig. 1).

Inclusion criteria

The inclusion criteria for the patients were (1) aged between 19 and 80 years; (2) hospitalization due to knee pain that occurred within 7 days of a TA; (3) diagnosed by a KM doctor with "sprain and strain of other and unspecified parts of the knee" due to pain limited to the knee joint after TA (regardless of whether a direct injury or bruise had occurred); (4) agreement to receive a radiography examination; and (5) answer the pain survey during hospitalization.

Exclusion criteria

The exclusion criteria were (1) diagnosis of a degenerative disease (e.g., osteoarthritis, chondromalacia patella) that can cause knee pain; (2) diagnosis of a certain serious disease (e.g., malicious tumors, autoimmune diseases, fractures, ligament injuries, infection) that can cause knee pain; (3) history of a certain serious disease (e.g., malicious tumors, autoimmune diseases, fractures, ligament injuries) that can cause knee pain; (4) diagnosis of a

spinal disorder (e.g., herniated inter vertebral disc, spinal stenosis, spondylarthritis) that can cause radiating pain in the knee; (5) presence of a medical disease inappropriate for KM treatment (e.g., tumor, severe cardiovascular disease, kidney disease, hemorrhagic disease); (6) other hospital care for knee pain; (7) administration of steroid, immunosuppressant, psychiatric or other drugs that could influence the level of knee pain; (8) pregnancy or planning for pregnancy; (9) a serious mental illness; (10) patient refusal of KM treatment for the knee pain; (11) hospitalization for less than 3 days.

Ethics Statement

In order to protect the patients' personal information, their medical records were accessed following approval from the Institutional Review Board of the Jaseng Hospital of Korean Medicine (no.: 2020-07-001).

Study methods

The charts of 114 patients who were hospitalized at Bucheon Jaseng Hospital of Korean Medicine were reviewed retrospectively. Patient gender, age, hospitalization period, and treatment prescription were classified, analyzed, and presented in tables and figures. The significance of the effect of KM treatment on knee pain caused by TAs were statistically analyzed.

Treatments

Pharmacopuncture therapy

Considering the patient's symptom and pain intensity, Hwangryunhaedok, jungseong-eohyeol, Shinbaro, or bee venom (BV) pharmacopuncture (Jaseng Wonoe Tangjunwon, Namyangju, Korea) was injected at EX-LE4, EX-LE5, ST35, and SP10. This pharmacopuncture was administered using up to 0.2 cc per session, using a disposable 29 gauge × 1/2″ (12.7 mm) needle on a 1 cc syringe (Sinchangmedical, Gumi, Korea.). The needle depth was 0.5-1.0 cm. This therapy was performed daily during the 1st week of hospitalization and 3 times a week during the 2nd week.

Herbal medicine

Considering patient frame and symptoms of pain, Ansinjitong decoction, Hwalhyeoljitong decoction, Hwalhyeoljeongtong decoction, Bangpung-Gwigung decoction, Gyulchulsamul decoction, Dohongsamul decoction, or Hwallaghyolyeong pills were prescribed (Table 1). The herbal medicine was administered twice a day during hospitalization.

Acupuncture treatment

The needles were 0.25 × 30 mm stainless steel needles (The Eastern acupuncture equipment manufacturer, Boryung, Korea), standardized, and disposable. The needles for electoacupuncture (2 Hz) were inserted at SP9, GB34, ST36, SP6, GB39, and Ashi points, and left for 10 minutes. This acupuncture treatment was performed either twice a day or flexibly depending on the patient's condition.

Evaluation

Numerical rating scale

The numerical rating scale (NRS) is one of the most useful indicators of subjective pain. No pain is 0, and the worst pain imaginable is 10 [11]. The patients were evaluated on the admission day and discharge day. The NRS score was investigated for knee joint pain only (not considering other pain caused to the patient by the TA).

154 patients

Excluded (*n* = 39)
- Age < 19 years (*n* = 2)
- Other knee joint conditions/diseases (*n* = 4)
- History conditions/diseases causing knee pain (*n* = 1)
- Medical conditions/diseases (*n* = 4)
- No treatment for knee pain (*n* = 24)
- Days of treatment < 3 (*n* = 4)

115 patients

Excluded (*n* = 1)
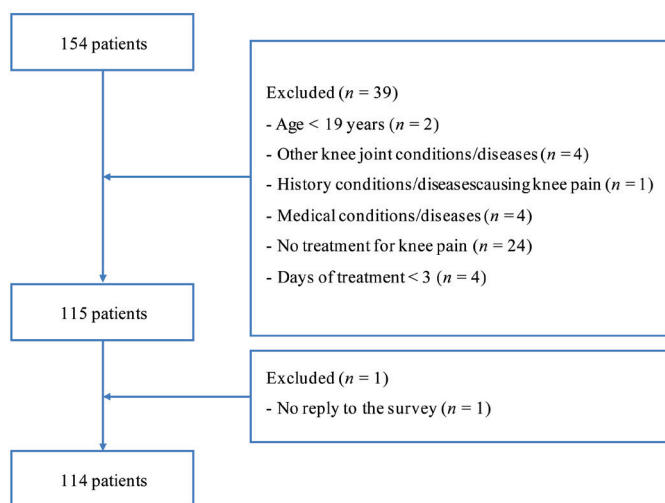- No reply to the survey (*n* = 1)

114 patients

Fig. 1. Flow diagram of patients included in the study.

Table 1. Prescription of Herbal Medicines.

Prescription	Composition of medicinal herbs
Ansinjitong decoction (安神止痛湯)	Zingiberis Rhizoma Crudus6 g, Rehmanniae Radix Siccus 2.8 g, Hoelen 2.8 g, An gelicae Gigantis Radix 2.8 g, Hoelen cum Pini Radix 2.8 g, Polygalae Radix 2 g, Astragali Radix 2 g, Biotae Semen 2 g, Zizyphi Spinosae Semen 2 g, Cnidii Rhizoma 2 g, Osterici Radix 2 g, Angelicae PubescentisRadix 2 g, Persicae Semen 2 g, Pinelliae Praeparatum cum Zingiberis 1.6 g, Ginseng Radix 1.2 g, Glycyrrhizae Radix 1.2 g, Cinnamomi Cortex Spissus 1.2 g, Schizandrae Fructus 1.2 g, Carthami Flos 1.2 g.
Hwalhyeoljitong decoction (活血止痛湯)	Angelicae Gigantis Radix 6 g, Hoelen 4 g, Sappan Lignum 3 g, Carthami Flos 3 g, Paeoniae Radix Rubra 3 g, Olibanum 1.5 g, Myrrha 1.5 g, Citri Pericarpium 2 g, Cnidii Rhizoma 2 g, Glycyrrhizae Radix 2 g.
Hwalhyeol jeongtong decoction (活血定痛湯)	Paeoniae Radix Alba 4 g, Glycyrrhizae Radix 4 g, Angelicae Gigantis Radix 3 g, Persicae Semen 3 g, Dipsaci Radix 3 g, Schizonepetae Spica 3 g, Saposhnikoviae Radix 3 g, Citri Pericarpium 3 g, Linderae Radix 3 g, Akebiae Caulis 3 g, Olibanum1 g, Myrrha 1 g
Bangpung-Gwigung decoction (防風歸芎湯)	Angelicae Gigantis Radix 4 g, Cnidii Rhizoma 4 g, Schizonepetae Spica 3 g, Saposhnikoviae Radix 3 g, Osterici Radix 3 g, Angelicae Dahuricae Radix 3 g, Asia Radix 3 g, Viticis Fructus 3 g, Codonopsis Pilosulae Radix 3 g, Persicae Semen 3 g, Sappan Lignum 3 g, Lycopi Herba 3 g, Olibanum 1 g, Myrrha 1 g, Glycyrrhizae Radix 2 g
Gyulchulsamul decoction (橘朮四物湯)	Citri Pericarpium 4 g, Atractylodis Rhizoma Alba 4 g, Angelicae Gigantis Radix 4 g, Cnidii Rhizoma 4 g, Paeoniae Radix Alba 4 g, Rehmanniae Radix Siccus 4 g, Persicae Semen 4 g, Carthami Flos 4 g, Olibanum 1 g, Myrrha 1 g, Glycyrrhizae Radix 2 g
Dohongsamul decoction (桃紅四物湯)	Angelicae Gigantis Radix 4 g, Cnidii Rhizoma 4 g, Rehmanniae Radix 4 g, Paeoniae Radix Alba 4 g, Persicae Semen 4 g, Carthami Flos 4 g, Glycyrrhizae Radix 4 g
Hwallag hyolyeong pills (活絡效靈丹)	Persicae Semen 2 g, Carthami Flos 2 g, Angelicae Gigantis Radix 2 g, Cnidii Rhizoma 2 g, Paeoniae Radix Rubra 2 g, Rehmanniae Radix 2 g, Codonopsis Pilosulae Radix 2 g, Hoelen 2 g, Alismatis Rhizoma 2 g, Amomi Fructus 2 g, Dipsaci Radix 2 g, Cinnamomi Cortex 2 g, Aucklandiae Radix 2 g.

Western Ontario and McMaster Universities Osteoarthritis

Western Ontario and McMaster Universities Osteoarthritis (WOMAC) index is used to measure knee pain. It consists of 24 questions covering pain, stiffness, and physical function. Each item is scored and the higher the score, the more severe the pain [12]. The patients were evaluated on the admission day and discharge day.

Data analysis method

The research results were statistically processed using the SPSS Version 18.0 for Windows program. The measured values were presented as mean ± standard deviation. A paired sample *t* test was used for parametric data and Wilcoxon signed-rank test was used for nonparametric data to test the treatment effect in patients before versus after treatment, and if the *p* value was < 0.05, the treatment effects were considered to be significant.

Adverse events

In relation to the treatment performed, the occurrence of adverse events (AEs) e.g., infection, bleeding, hematoma, fatigue, sweating, nausea, headache, and dizziness were checked.

Results

General information

Distribution of gender and age

The patients cohort consisted of 51males (44.7%) and 63 females (55.3%), with a ratio of 1:1.23(Fig. 2). The mean age of all patients was 42.09 ± 14.69 years, with 2 inpatients (1.8%) under 19 years old, 26 (22.8%) in their 20s, 31 (27.2%) in their 30s, 16 (14.0%) in their 40s, 21 (18.4%) in their 50s, 15 (13.2%) in their 60s, and 3

(2.6%) in their 70s or older (Table 2).

Distribution of hospitalization period

The mean hospitalization period was 9.46 ± 3.84 days. There were 22 patients (19.3%) who were hospitalized for 3-5 days, 31 (27.2%) for 6-8 days, 14 (12.3%) for 9-11 days, and 47 (41.2%) for 12-14 days of which the largest number of patients (30 patients; 26.3%) were hospitalized for 14 days (Table 3).

Treatments

Distribution of pharmacopuncture therapy

The most administered pharmacopuncture was Hwangryunhaedok, which was injected into 89 patients (78.1%), followed by Shinbaro
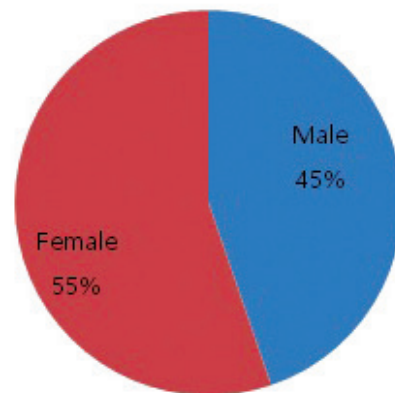

Fig. 2. Distribution of gender.

Table 2. Distribution of Age.

Age (y)	n (%)
≤ 19	2 (1.8)
20-29	26 (22.8)
30-39	31 (27.2)
40-49	16 (14.0)
50-59	21 (18.4)
60-69	15 (13.2)
≥ 70	3 (2.6)
Total	114 (100.0)

Table 3. Distribution of Hospitalization Period.

Time (d)	n (%)
3-5	22 (19.3)
6-8	31 (27.2)
9-11	14 (12.3)
12-14	47 (41.2)
Total	114 (100.0)

Table 4. Distribution of Pharmacopuncture Therapy.

Pharmacopuncture therapy	n (%)
Hwangryunhaedok	89 (78.1)
Shinbaro	13 (11.4)
Jungseong-eohyeol	8 (7.0)
Hwangryunhaedok + bee venom	2 (1.8)
Bee venom	1 (0.9)
Shinbaro+ bee venom	1 (0.9)
Total	114 (100.0)

[13 patients (11.4%)]. Jungseong-eohyeol was used in 8 patients (7.0%), Hwangryunhaedok with BV was used in 2 patients (1.8%), BV was used in 1 patient (0.9%), and Shinbaro with BV was used in 1 patient (0.9%; Table 4).

Table 5. Distribution of Herbal Medicine.

Prescription	n (%)
Hwalhyeoljitong decoction	71 (62.3)
Gyulchulsamul decoction	26 (22.8)
Ansinjitong decoction	8 (7.0)
Hwallaghyolyeong pills	6 (5.3)
Hwalhyeoljeongtong decoction	1 (0.9)
Bangpung-Gwigung decoction	1 (0.9)
Dohongsamul decoction	1 (0.9)
Total	114 (100.0)

Distribution of herbal medicine

Hwalhyeoljitong decoction was prescribed to 71 patients (62.3%) and was the most common, followed by Gyulchulsamul decoction [26 patients 2(2.8%)], Ansinjitong decoction [8 patients (7.0%)], Hwallaghyolyeong pills [6 patients (5.3%)]. Hwalhyeoljeongtong decoction, Bangpung-Gwigung decoction, and Dohongsamul decoction were also administered in 1 case each (0.9%; Table 5).

Assessments

NRS

The mean NRS score decreased from 4.26 ± 1.39 at the time of admission to 2.53 ± 1.60 at discharge, which was statistically significant ($p < 0.001$). The p values significantly reduced when patients were classified by gender, age ≥ 50 years versus < 50 years, and period of hospitalization ($p < 0.01$; Table 6).

WOMAC

The mean WOMAC index score decreased from 32.72 ± 18.36 at the time of admission to 23.40 ± 15.80 at discharge, which was statistically significant ($p < 0.001$). When patients were classified by gender, and age ≥ 50 years versus < 50 years significant differences were observed ($p < 0.001$). When the period of hospitalization was examined in the group of patients who were hospitalized for 3-5 days there was no significant difference observed ($p > 0.05$), however, there was a significant difference inpatients hospitalized for more than 6 days ($p < 0.01$; Table 7).

Report of AEs

There were no reports of AEs that interfered with treatment.

Discussion

This study aimed to investigate the demographic characteristics of the study population and test the effectiveness of KM treatment of knee pain caused by TAs. Amongst the patients admitted to the Bucheon Jaseng Hospital of Korean Medicine from 2019 July 1, 2019 to October 31, 2019, a total of 114 patients were studied. The patients' gender, age, period of hospitalization, type of prescribed pharmacopuncture, and herbal medicine were assessed.

Table 6. Comparison of NRS Score.

		N	Admission NRS score	Discharge NRS score	p
Gender	Male	51	3.92 ± 1.51	2.16 ± 1.79	< 0.001*
	Female	63	4.53 ± 1.23	2.83 ± 1.37	< 0.001*
Age (y)	< 50	75	4.09 ± 1.44	2.23 ± 1.58	< 0.001*
	≥ 50	39	4.59 ± 1.23	3.10 ± 1.50	< 0.001*
Period of hospitalization (d)	3-5	22	4.27 ± 1.55	3.14 ± 1.67	< 0.001†
	6-8	31	4.03 ± 1.47	2.10 ± 1.66	< 0.001*
	9-11	14	4.07 ± 1.14	2.07 ± 1.59	0.001†
	12-14	47	4.47 ± 1.33	2.66 ± 1.46	< 0.001*
Total		114	4.26 ± 1.39	2.53 ± 1.60	< 0.001*

Data are presented as mean ± SD.
* Statistical significance was evaluated by paired sample *t* test.
† Statistical significance was evaluated by Wilcoxon signed-rank test.
NRS, numerical rating scale.

Table 7. Comparison of WOMAC Score.

		N	Admission WOMAC score	Discharge WOMAC score	p
Gender	Male	51	26.75 ± 17.01	18.61 ± 16.25	< 0.001*
	Female	63	37.46 ± 18.16	27.29 ± 14.40	< 0.001*
Age (y)	< 50	75	29.59 ± 17.53	20.57 ± 14.77	< 0.001*
	≥ 50	39	38.74 ±18.63	28.85 ± 16.45	< 0.001*
Period of hospitalization (d)	3-5	22	27.41 ± 17.23	25.50 ± 16.65	0.166†
	6-8	31	34.22 ± 16.71	22.64 ± 15.92	< 0.001*
	9-11	14	33.21 ± 17.42	17.86 ± 16.00	0.001*
	12-14	47	34.06 ± 20.19	24.57 ± 15.34	< 0.001*
Total		114	32.72 ± 18.36	23.40 ± 15.80	< 0.001*

Data are presented as mean ± SD.
* Statistical significance was evaluated by paired sample *t* test.
† Statistical significance was evaluated by Wilcoxon signed-rank test.
WOMAC, Western Ontario and McMaster Universities Osteoarthritis.

There were more females than males in this study (1:1.23). The age distribution of the inpatients was 22.8% in their 20s and 27.2% in their 30s, accounting for half of the total. The distribution of hospitalization period was the highest in 11 to 14 days (41.2%). Most inpatients were treated with Hwangryunhaedok pharmacopuncture (78.1%) and prescription of Hwalhyeoljitong decoction (62.3%).

In order to assess subjective knee pain, the NRS score and WOMAC index score were used, inpatients before and after hospitalization. mean NRS score decreased from 4.26 ± 1.39 to 2.53 ± 1.60, the mean WOMAC decreased from 32.72±18.36 to 23.40±15.80. Both *p* values were 0.001 or less, indicating that the

patient's subjective knee pain was significantly reduced.

KM has been used to treat many injuries including falls, bruises, falls from a horse, and fractures all of which fall within "trauma injury." Similarly, TA injury falls within "trauma injury." For these injuries, the pathological concept of "blood stasis" was established, recognized as a condition/disease, and treated [8]. Therefore, effective treatment can be performed for TA patients by removing blood stasis and helping the circulation of blood [9].

Pharmacopuncture therapy is a unique treatment of KM which is based on the meridian system and herbal medicine, and is reported to be effective in anti-inflammatory and analgesic treatment [13]. Due to the local delivery of medicine to the painful area, it is possible to increase the therapeutic effect whilst reducing the dose of the drug to be injected. Pharmacopuncture therapy is typically used for the treatment of musculoskeletal conditions/diseases [14]. Hwangryunhaedok pharmacopuncture (the most commonly used pharmacopuncture in this study) is composed of Scutellariae Radix, Coptidis Rhizoma, Phellodendri Cortex, and Gardeniae Fructus. Yang et al reported that Hwangryunhaedokdecation inhibited the production of inflammatory mediators such as cytokines, and demonstrated excellent anti-inflammatory and analgesic effects [15]. Another pharmacopuncture therapy, Shinbaro (which consists of 6 herbs: Ledebouriellae Radix, Achyranthis Radix, Acanthopanacis Cortex, Cibotii Rhizoma, Glycine Semen, and Eucommiae Cortex)has been reported to inhibit the production of prostaglandin E_2 and anti-Type II collagen antibody, which are substances which cause inflammation, thereby removing inflammation in muscles and ligaments, and reducing pain [16].

Herbal medicine is prepared by mixing herbs for the prevention or treatment of conditions/diseases based on the theory of KM. Herbal medicine has the advantage of being prescribed according to the human frame and the specific requirements of the patient. The main herbs prescribed in this study (Angelicae Gigantis Radix and Cnidii Rhizoma) had the effect of increasing blood flow [17]. Persicae Semen and Carthami Flos also have antithrombotic effects dissolving blood clots caused by contusion [18]. Consequently, the prescriptions used in this study may have helped reduce pain by improving blood circulation.

Do et al [4] reported that patients complaining of knee pain were the 3rd most common form of musculoskeletal pain caused by TAs. According to Health Insurance Review and Assessment Service's data, knee pain that occurred after a TA is one of the major conditions that TA patients are treated for at medical institutions, along with spine pain, shoulder pain, and concussion [5]. However, to date there are no KM studies published on knee pain caused by TAs. This study is the 1st report of KM treatment for traumatic knee pain. The findings of this study may be referred to when designing a prospective study examining the effect of KM used during hospitalization on traumatic knee pain.

Since this study was a retrospective chart review researcher intervention was not possible, and therefore this study was not highly reliable. In addition, details of KM treatment for traumatic knee pain were not always evident. However, KM treatment was shown to be significantly effective in this study. Further controlled studies will be needed to substantiate the findings reported in this study.

Conclusion

As a result of analyzing 114 hospitalized patients with knee joint pain due to TAs inpatients were more likely to be female (55%), a patient in their 30s (27.2%), and be a patient hospitalized for 11-14 days (41.2%). KM treatment of traumatic knee injury using pharmacopuncture therapy and herbal medicine may be effective at reducing pain, and healing functional disorders of the knee.

Conflicts of Interest

The authors have no conflicts of interest to declare.

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