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Original Article

A Study on the Effectiveness of Korean Medicine Treatment for Patients' Involved in Traffic Accidents and the Analysis of Factors Affecting the Effectiveness of Korean Medicine Treatment - A Retrospective Review

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ABSTRACT

Background: This study was conducted to verify the effectiveness and effectiveness-related factors of Korean medicine (KM) treatment for patients who have been involved in traffic accidents (TA).

Methods: The medical records of 150 TA patients hospitalized in Dongguk University Bundang Oriental Medicine Hospital from September 2017 to May 2018 were reviewed. Medical records included information on patient demographic characteristics, TA situations, use of KM treatment, clinical characteristics, 4 scales [numeric rating scale (NRS), visual analogue scale (VAS), EuroQol-visual analogue scale (EQ-VAS) and neck disability index (NDI)]. Statistical analyses were performed to determine the effectiveness and effectiveness-related factors of treatment.

Results: The 150 patients (almost 1:1 gender ratio) were typically in their 40's (26.67%), had rear impact to their vehicle (37.33%), were in the driver's seat (70.00%), and without head trauma and loss of consciousness (83.33%). The main symptoms were neck pain (60.66%) and lower back pain (54.00%). All 150 patients showed significant improvement after KM treatment. 4 scales significantly improved when the treatment started within 3 days from the accident and patients were hospitalized longer and took more diverse treatments. The patients experiencing a higher initial pain level (NRS 8-10, VAS ≥70) showed significant improvement of NRS and VAS scores with faster and longer inpatient treatments than the other patients. The patients with higher initial pain levels (VAS ≥70) also showed significant improvement in EQ-VAS scores.

Conclusion: KM treatment was effective for TA patients in this study. Treatment initiation time, hospitalization period, treatment diversity and initial pain level are related to the degree of improvement of a patient's symptoms.

Introduction

In 2017, the number of automobile insurance claims for traffic accidents (TA) reached 15.88million won (2.26% higher than in 2016) and medical costs increased to 1.7698 trillion won (6.70% higher than in 2016). In the analysis of medical costs according to medical fields, Korean medicine (KM) increased by 20.59% in 2017 whilst Western medicine increased by 1.41%. Assessment of medical costs per case showed KM also increased by 11.31%

in 2017 whilst Western medicine increased by 3.45% [1]. This remarkable increase in medical costs for KM reflect the fact that number of patients who choose KM as a treatment for TA-related symptoms has been increased.

The increasing demand for KM treatment of patients involved in TA can be interpreted as the majority of TA patients suffering only minor injuries [2-5]. TA patients with minor injuries tend to be diagnosed with sprains and muscle strains [6] and an absence of radiological abnormalities (as diagnosed by X-ray, CT and

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MRI). Non-surgical treatments available in Western medicine are limited to medication or physical therapy. These limitations or dissatisfaction in Western medicine may result in patients choosing KM for minor TA injuries [7-9].

Accordingly, efforts to enhance the effectiveness of KM and provide a high-quality medical service to patients who have minor injuries resulting from TA are needed. Various studies [10-14] on KM treatment in TA have been conducted, but most of them could not verify the effectiveness of treatment statistically or the factors that specifically affect patient improvement.

Therefore, a retrospective analysis of patients who were hospitalized in Dongguk University Bundang Oriental Medicine Hospital following TA was conducted. By using the medical records, the aim was to identify the general characteristics of patients, and verify significant therapeutic effects of KM treatment, and determine the factors contributing to therapeutic effects through the 4 scales analysis.

Materials and Methods

Subjects

Patients who were hospitalized in Dongguk University Bundang Oriental Medicine Hospital due to TA from September 2017 to May 2018 were investigated.

Ethics statement

This study was approved by Institutional Review Board (IRB) of Dongguk University Bundang Oriental Medicine Hospital on July 2018 (IRB No.: DUBOH 2018-0009).

Korean Medicine Treatments

Acupuncture

After disinfection with 75% alcohol, stainless steel sterilized needles (diameter 0.25 mm, length 3 cm, Dongbang Medical, Korea) were inserted into the selected points to a depth of between 10~20mm and connected to electro-acupuncture apparatus (STN-100, StraTek, Korea). Pulsed stimulus was delivered at a rate of 2/100Hz for 15minutes. Patients were given acupuncture treatment once or twice a day, during the hospitalization period.

Cupping

Dry or wet cupping was selected and conducted once a day. The cups were placed over the painful parts of the body and then removed after 5 minutes.

Physical therapy

Transcutaneous electrical nerve stimulation (TENS) was applied on the painful parts of the body for 10 minutes.

Herbal medicine

For the purpose of pain relief and removal of blood stasis, various herbal medicines including Dangguisu-san, Jakyakgamcho-tang, Galgeun-tang, Banhabakchulcheonma-tang were administered to the patient 3 times a day for the period of hospitalization.

Pharmacoacupuncture

Jungsongouhyul (Jaseng, Korea) or bee venom (10,000:1, 20,000:1, Jaseng, Korea) pharmacoacupuncture were mainly used. 0.02-0.2 ml was injected at every point, using a disposable syringe (Shina Cor., 1 ml, 31 G). (Total 0.1-1 ml, subcutaneous or intramuscular injection)

Chuna manipulation

Patients received chuna manipulation including lumbar extension technique, lateral extension rotation technique (for lower back pain), cervical flexion/extension, lateral flexion/extension, and distraction technique (for neck pain), 3 to 5 times a week.

Moxibustion

Rechargeable electronic moxibustions (Cettum, K-medical Co., Korea) were placed on the pain sites or acupoints for 15 minutes.

Methods

Data collection of electronic medical record

Based on electronic medical records, 150 TA patients' information were collected and analyzed retrospectively. This included; demographic characteristics (gender and age), TA situations (types of collisions, position of patients, head trauma and loss of consciousness), use of KM treatment (the initiation of treatment, routes of visiting hospital, motivations of visiting hospital), and clinical characteristics (chief complaint, hospitalization period, treatment contents, initial pain level).

Evaluation for the effectiveness of KM treatment

Numeric rating scale (NRS) [15] is widely used to express the degree of patient's current pain, from 0 (no pain) to 10 (most severe pain imaginable). Visual analogue scale (VAS) [15] is used to assess patient's pain level on the 100mm horizontal line, from 0mm (no pain) to 100mm (worst imaginable pain). EQ-VAS (EuroQol-visual analogue scale) [16] is one of the internationally standardized health measures to evaluate the health-related quality of life. EQ-VAS is also able to express the health status of the patient by visual representation. Patients provide marks on figures corresponding to their health condition on the line. The highest healthy level was 100 and the lowest level was 0. NDI (Neck disability index) [17] is the most common method to measure how the patient's neck pain influenced their lives, especially on whiplash trauma patients. The questions consisted of 10 items (7 for functional activities, 2 for symptoms and 1 for concentration). A higher score for each item represented greater functional disorders by neck pain.

To evaluate the effectiveness of KM treatment NRS, VAS, EQ-VAS and NDI scale scores were assessed before and after treatment and analyzed for statistically significant change.

Analysis of the effectiveness of KM treatment and clinical factors

The relationship among the clinical characteristics (treatment initiation time, hospitalization period and treatment contents), pain levels (NRS and VAS at the time of hospitalization and at discharge) and the effectiveness of KM treatment were analyzed.

Statistical analysis

All statistical analyses were performed using SPSS for windows version 20.0 (SPSS Inc, Chicago, IL, USA). The demographic characteristics, TA situations, clinical characteristics, and 4 scale scores (NRS, VAS, EQ-VAS and NDI) were analyzed by calculating descriptive statistics. Continuous variables are presented as mean ± SD, and categorical variables were presented as frequency and percentage (%).

A paired t test was used to evaluate the change of scale scores (NRS, VAS, NDI and EQ-VAS) between hospitalization and discharge. Independent 2 sample t test was used to compare the change of scales between 2 groups, or 1-way analysis of variance

(ANOVA) to compare the change of scales among 3 or more groups. 95% confidence intervals were calculated and p value below 0.05 was considered significant for all analyses.

Results

Demographic characteristics (Table 1)

The results of demographic characteristics are shown in Table 1.

Among the 150 patients, 74 patients were males (49.33%) and 76 patients were females (50.67%).

According to the age distribution, 2 patients were aged < 20 years old (1.33%), 20 were in their 20's (13.33%), 24 were in their 30's (16.00%), 40 were in their 40's (26.67%), 34 were in their 50's (22.67%), 19 were in their 60's (12.67%), and 11 were aged over 70 (7.33%). Patients in their 40's were the most common and those aged between 20 to 50 years of age were the majority (78.67%).

TA situations

Table 2 shows the distribution of TA situation in this study.

Rear-impact collisions were experienced by 56 patients (37.33%), side-impact collisions accounted for 46 cases (30.67%), front-impact collisions were suffered by 27 (18.00%), 19 patients were in multi-collisions (12.67%), and 2 patients were in others category (1.33%).

The positions of the injured patients involved in TA were; 105 in the driver's seat (70.00%), 21 pedestrians (14.00%), 13 in the back seat (8.67%), 9 in the passenger seat (6.00%) and 2 in the others category (1.33%).

There were 125 of 150 TA patients who did not suffer head trauma and loss of consciousness (83.33%), whilst 10 suffered both symptoms (6.67%), 10 suffered loss of consciousness only (6.67%), and 5 suffered head trauma only (3.33%).

KM treatment characteristics

Use of KM treatment is shown in Table 3.

It has been reported that acute phase for sprain refers to the first 3 days after the sprain occurrence [18]. In this study, 124 patients started treatments within 3 days (82.67%) and 26 started treatments after more than 3 days (17.33%).

There were 81 patients who visited other medical institution(s) before visiting the hospital in this current study (54.00%), and 69 who visited this hospital first (46.00%). Of the 81 patients, 67 patients visited a Western medicine institution (82.72%), 6 patients visited a KM institution (7.41%), and 8 visited both Western medicine and KM institutions (9.88%). Among 75 patients who visited a Western medicine institution first (50.00%), 29 transferred to KM institution immediately after radiological diagnosis such as X-ray, CT and MRI (38.67%). There were 46 patients who visited a KM institution after treatment in a Western medicine institution (61.33%).

There were 74 patients who visited a KM hospital due to "Hometown and good accessibility" (49.33%) and this was the most common group. There were 21 patients who reported visiting a KM hospital due to "Continuous Pain after treatment in other hospitals" (14.00%), 17 patients due to "Not satisfied with other hospital treatment" (11.33%), 15 patients due to "Recommendation of Korean medicine from around" (10.00%), 9 patients due to "The preference for Korean medicine" (6.00%), and 6 patients due to "There's no need for surgery" (4.00%), with 8 patients who visited a KM hospital due to other motivations (5.33%), such as "Possibility of variable treatments or intensive care" and "Being talked about good treatments."

Table 1. Demographic Characteristics.

Factor	N (%)
Gender	
Male	74 (49.33)
Female	76 (50.67)
Total (%)	150 (100.00)
Age (y)	
≤ 19	2 (1.33)
20's	20 (13.33)
30's	24 (16.00)
40's	40 (26.67)
50's	34 (22.67)
60's	19 (12.67)
≥ 70	11 (7.33)
Total	150 (100.00)

Data are presented as number of cases (%).

Table 2. Characteristics of Traffic Accidents.

Factor	N (%)
Types of collisions	
Frontal impact	27 (18.00)
Rear impact	56 (37.33)
Side impact	46 (30.67)
Multiple	19 (12.67)
Others	2 (1.33)
Total	150 (100.00)
Position of patients	
Driver's seat	105 (70.00)
Passenger seat	9 (6.00)
Back seat	13 (8.67)
Pedestrian	21 (14.00)
Others	2 (1.33)
Total (%)	150 (100.00)
Head trauma and loss of consciousness	
Head trauma only	5 (3.33)
Loss of consciousness only	10 (6.67)
Both	10 (6.67)
Neither	125 (83.33)
Total (%)	150 (100.00)

Data are presented as number of cases (%).

Clinical characteristics

The results of the analysis of the clinical characteristics are presented in Table 4.

Chief complaint

There were 14 patients who complained of headache or dizziness (9.33%), 91 with a neck problem (60.66%), 11 with upper limb problems (7.33%), 81 with lumbar problems (54.00%), 8 with costal region problems (5.33%), 3 with hip problems (2.00%), 11 with lower limb problems (7.33%), and 2 others (1.33%). Similarly, KCD (Korean standard classification of disease and cause of death) code based on radiological or clinical diagnosis was presented in the following order: 'Sprain and strain of cervical spine (S134)' (78.00%), 'Sprain and strain of lumbar spine (S3350)' (59.33%), 'Sprain and strain of shoulder joint (S434)' (24.00%), 'Sprain and strain of other and unspecified parts of knee (S836)' (14.67%), 'Headache (R51)' (10%).

Hospitalization period

There were 22 patients hospitalized for 3 days or less (14.67%), 60 for 4-7 days (40.00%), 45 for 8-14 days (30.00%) and 23 for over 15 days (15.33%).

KM treatment

There were 31 patients (20.67%) who received only routine treatments such as acupuncture, electro-acupuncture, infrared therapy, cupping (dry or wet), physical therapy and herbal medicine, which was commonly applied to all inpatients. There were 119 patients (79.33%) who received additional treatments such as pharmacoacupuncture, chuna manipulation and moxibustion.

Table 3. Use of Korean Medicine Treatment.

Factor	N (%)
The initiation of treatment	
Within (<) 3 days	124 (82.67)
more than (≥) 3 days	26 (17.33)
Total	150 (100.00)
Via other medical institutions	
Yes	81 (54.00)
No	69 (46.00)
Total	150 (100.00)
Types of medical institutions visited first	
Western medical institution	67 (82.72)
Korean medical institution	6 (7.41)
Western & Korean medical institution	8 (9.88)
Total	81 (100.00)
A visit to the hospital	
Right after examination	29 (38.67)
After medical care	46 (61.33)
Total	75 (100.00)*
Motivations for visiting the hospital	
Continuous Pain after treatment in other hospitals	21 (14.00)
There's no need for surgery	6 (4.00)
Recommendation of Korean medicine from acquaintance	15 (10.00)
Hometown or good accessibility	74 (49.33)
The preference for Korean medicine	9 (6.00)
Not satisfied with other hospital treatment	17 (11.33)
Others	8 (5.33)
Total	150 (100.00)

Data are presented as number of cases (%).
*The number of people who have visited Western medical institutions before visiting the hospital.

Table 4. Clinical Characteristics.

Factor	N (%)
Chief complaint (painful parts)*	
Head (headache, dizziness etc.)	14 (9.33)
Neck	91 (60.66)
Upper extremities	11 (7.33)
Upper & lower back	81 (54.00)
Flank	8 (5.33)
Hip	3 (2.00)
Lower extremities	11 (7.33)
Others	2 (1.33)
Hospitalization period (d)	
≤ 3	22 (14.67)
4~7	60 (40.00)
8~14	45 (30.00)
≥ 15	23 (15.33)
Total	150 (100.00)
Treatment contents	
Routine treatment only	31 (20.67)
Additional treatment	119 (79.33)
Total	150 (100.00)

Data are presented as number of cases (%).
* If there are > 2 symptoms, each is counted separately. Percentage (%) is the ratio of the total number of patients.

Evaluation for the effectiveness of KM treatment

The changes in NRS, VAS, EQ-VAS and NDI scores between hospitalization and discharge were evaluated. The changes in NRS, VAS, EQ-VAS and NDI scores were 2.91 ± 1.83, 19.63 ± 19.14, −13.25 ± 21.12 and 4.48 ± 6.61 respectively. There were statistically significant differences in all of the 4 scale scores (NRS, VAS, EQ-VAS and NDI scale scores) between hospitalization and discharge ($p < 0.001$), see Table 5.

The relationship between treatment initiation time and therapeutic effects

Treatment initiation time, divided into 2 groups, within 3 days and more than 3 days. NRS, VAS, EQ-VAS and NDI scores improved significantly after treatment in both groups ($p < 0.05$). NRS significantly decreased in the within 3 days group versus the more than 3 days group ($p < 0.001$). EQ-VAS and NDI showed more improvement in the within 3 days group than in the other group, but there was no significant difference between the 2 groups (Table 6).

The relationship between hospitalization period and therapeutic effects

Patients were categorized into 4 groups; within 3 days, 4-7 days, 8-14 days and more than 15 days. NRS, VAS and EQ-VAS scores improved significantly after treatment in all 4 groups ($p < 0.05$). NDI score did not improve significantly after treatment in within 3 days group. NRS ($p < 0.001$) and NDI ($p = 0.015$) significantly decreased in proportion to the length of the hospitalization period, and VAS score and EQ-VAS score also showed similar tendencies but these were not statistically significant (Table 7).

The relationship between treatment and therapeutic effects

Treatment was divided into 2 groups; routine treatment and additional treatment. NRS, VAS, EQ-VAS and NDI scores improved significantly after treatment in both groups ($p < 0.05$). The NRS score decreased significantly in the additional treatment group versus routine treatment group ($p = 0.035$). VAS, EQ-VAS and NDI scores also showed similar tendencies, but there was no significant difference between the 2 groups (Table 8).

The relationship among initial pain level (NRS and VAS), other variables and therapeutic effects

Initial pain levels were divided into 3 groups; severe (NRS 8-10, VAS ≥ 70), moderate (NRS 5-7, VAS 40-69) and mild (NRS 0-4, VAS ≤39). The severe pain group tended to start treatment more quickly and received more diverse treatment. They also stayed in hospital for a significantly longer period of time ($p = 0.043$). There were significantly greater changes in NRS and VAS scores in the higher NRS score group ($p < 0.05$). EQ-VAS and NDI

Table 5. Evaluation for Effectiveness of Korean Medicine Treatment.

No.	NRS				VAS				EQ-VAS				No.	NDI			
	Adm.	Dis.	Diff.	*p*	Adm.	Dis.	Diff.	*p*	Adm.	Dis.	Diff.	*p*		Adm.	Dis.	Diff.	*p*
	Mean ± SD				Mean ± SD				Mean ± SD					Mean ± SD			
150	6.33	3.42	2.91	0.000*	58.43	38.81	19.63	0.000*	48.24	61.49	-13.25	0.000*	95	19.17	14.68	4.48	0.000*
	±1.62	±1.62	±1.83		±16.55	±18.43	±19.14		±19.65	±18.81	±21.12			±7.78	±6.82	±6.61	

Data are presented as mean ± SD.
* By paired *t* test.
Adm, admission; Dis, discharge; Diff, difference value; NRS, numeric rating scale; VAS, visual analogue scale; EQ-VAS, EuroQol-visual analogue scale; NDI, neck disability index.

Table 6. The Relationship Between Treatment Initiation Time and Therapeutic Effects.

	No.	NRS				VAS				EQ-VAS				No.	NDI			
		Adm.	Dis.	Diff.	*p*	Adm.	Dis.	Diff.	*p*	Adm.	Dis.	Diff.	*p*		Adm.	Dis.	Diff.	*p*
		Mean ± SD				Mean ± SD				Mean ± SD					Mean ± SD			
< 3 days	124	6.45	3.31	3.15	0.000*	59.77	39.45	20.32	0.000*	46.97	60.73	-13.76	0.000*	82	19.11	14.54	4.57	0.000*
		±1.55	±1.58	±1.87		±15.40	±17.87	±18.89		±19.67	±18.77	±21.62			±7.74	±6.76	±6.78	
≥ 3 days	26	5.73	3.96	1.77	0.000*	52.04	35.73	16.31	0.000*	54.31	65.12	-10.81	0.007*	13	19.54	15.62	3.92	0.027*
		±1.82	±1.73	±1.03		±20.34	±20.99	±20.34		±18.71	±18.94	±18.73			±8.36	±7.43	±5.60	
p				0.000†				0.333				0.518					0.744	

Data are presented as mean ± SD.
* By paired *t* test.
† By independent 2 sample *t* test.
Adm, admission; Dis, discharge; Diff, difference value; NRS, numeric rating scale; VAS, visual analogue scale; EQ-VAS, EuroQol-visual analogue scale; NDI, neck disability index.

Table 7. The Relationship Between Hospitalization Period and Therapeutic Effects.

	No.	NRS Adm.	Dis.	Diff.	p	VAS Adm.	Dis.	Diff.	p	EQ-VAS Adm.	Dis.	Diff.	p	No.	NDI Adm.	Dis.	Diff.	p
		Mean ± SD				Mean ± SD				Mean ± SD					Mean ± SD			
≤ 3 days	22	5.41	3.86	1.55	0.000*	47.86	34.55	13.32	0.000*	58.05	66.64	-8.59	0.040*	12	14.17	14.08	0.08	0.942
		±1.84	±1.70	±1.06		±18.06	±19.09	±14.14		±21.53	±16.60	±18.36			±7.44	±8.15	±3.87	
4-7 days	60	6.30	3.47	2.83	0.000*	58.82	40.97	17.85	0.000*	50.97	63.67	-12.70	0.000*	40	17.73	13.70	4.03	0.000*
		±1.57	±1.53	±1.75		±15.64	±17.45	±18.98		±18.22	±19.11	±20.15			±6.00	±6.24	±6.12	
8-14 days	45	6.58	3.31	3.27	0.000*	61.22	37.47	23.76	0.000*	43.02	58.87	-15.84	0.000*	32	20.66	15.34	5.31	0.000*
		±1.31	±1.65	±1.66		±13.77	±19.13	±20.73		±18.22	±18.77	±23.15			±6.90	±6.72	±7.04	
≥ 15 days	23	6.78	3.09	3.70	0.000*	62.09	39.87	22.22	0.000*	41.96	56.04	-14.09	0.000*	11	25.55	17.00	8.55	0.002*
		±1.83	±1.73	±2.27		±19.11	±19.20	±19.36		±20.12	±19.09	±22.41			±11.43	±7.84	±7.06	
p				0.000†				0.143				0.613					0.015†	

Data are presented as mean ± SD.
* By paired t test.
† By 1-way analysis of variance (ANOVA).
Adm, admission; Dis, discharge; Diff, difference value; NRS, numeric rating scale; VAS, visual analogue scale; EQ-VAS, EuroQol-visual analogue scale; NDI, neck disability index.

Table 8. The Relationship Between Treatment Contents and Therapeutic Effects.

	No.	NRS Adm.	Dis.	Diff.	p	VAS Adm.	Dis.	Diff.	p	EQ-VAS Adm.	Dis.	Diff.	p	No.	NDI Adm.	Dis.	Diff.	p
		Mean ± SD				Mean ± SD				Mean ± SD					Mean ± SD			
Routine Tx.	31	5.74	3.45	2.29	0.000*	53.16	34.39	18.77	0.000*	52.58	60.90	-.8.32	0.019*	20	16.40	13.65	2.75	0.038*
		±1.44	±1.31	±1.47		±15.94	±13.92	±20.07		±18.62	±19.96	±18.66			±9.09	±6.60	±5.51	
Add. Tx.	119	6.48	3.41	3.07	0.000*	59.81	39.96	19.85	0.000*	47.11	61.65	-14.54	0.000*	75	19.91	14.96	4.95	0.000*
		±1.64	±1.70	±1.89		±16.49	±19.32	±18.97		±19.83	±18.58	±21.60			±7.29	±6.90	±6.83	
p				0.035†				0.782				0.145					0.188	

Data are presented as mean ± SD.
* By paired t test.
† By independent 2 sample t test.
Tx, treatment; Add, additional; Adm, admission; Dis, discharge; Diff, difference value; NRS, numeric rating scale; VAS, visual analogue scale; EQ-VAS, EuroQol-visual analogue scale; NDI, neck disability index.

scores showed similar tendencies, but these were not statistically significant. There were significantly greater changes in NRS, VAS and EQ-VAS scores in the higher VAS score group (p < 0.05). The NDI score showed a similar tendency but it was not significant (Table 9,10).

Discussion

The number of car owners in Korea has increased from 530,000 in 1980 to 22.5 million in 2017. Since 2008, TA (2.0%) and TA-associated injuries (2.4%) have increased annually [2] with social costs in 2016 amounting to 23.748 trillion won, equivalent to 1.4% of gross domestic product. This has been reported to be a serious social problem [3]. Among patients involved in TA, the proportion of patients with minor injuries has increased from 89.1% in 2014

and 89.3% in 2015, to 94.4% in 2016, and 94.6% in 2017 [2-5]. The resultant medical cost for minor injuries due to TA was 77.3% of the total TA-related medical costs [3]. Therefore, it is important to manage patients with minor injuries.

Patients with minor injuries due to TA are not easy to treat with Western medicine [7-9] because minor injuries are offered limited treatment with pain killers and physical therapy. Abnormalities in radiological tests are not observed, but continuous pain still exists for the patient. In contrast, KM recognizes damage caused by TA as a pathological situation of Qi and blood stagnation, and aims to correct the abnormality of blood stream caused by the impact of the accident, adjust the blood stream for the injured area and remove blood stagnation [19]. KM also provides various treatments such as acupuncture, cupping, moxibustion, pharmacoacupuncture, chuna manipulation and herbal medicine

Table 9. The Relationship Among Initial NRS Level, Initiation Treatment Time, Hospitalization Period, the Number of Additional Treatments and the Changes of NRS, VAS, EQ-VAS and NDI.

NRS		Initiation	Hospitalization	Additional treatments (No.)	NRS		VAS		EQ-VAS			NDI	
		(d)	(d)		Adm.	Diff.	Adm.	Diff.	Adm.	Diff.		Adm.	Diff.
	No.		Mean ± SD		Mean ± SD		Mean ± SD		Mean ± SD		No.	Mean ± SD	
8-10	38	1.11	11.89	1.35	8.19	4.08	69.57	23.84	42.14	-19.49	26	21.15	4.35
		±1.35	±10.25	±0.82	±0.52	±2.01	±14.07	±22.94	±17.44	±21.77		±5.34	±6.92
5-7	95	1.32	8.89	1.11	6.15	2.77	57.98	19.90	50.43	-11.57	59	18.64	5.28
		±1.62	±6.28	±0.83	±0.84	±1.58	±13.60	±17.24	±19.63	±21.47		±7.85	±6.91
0-4	17	1.44	6.94	0.89	3.18	1.12	35.65	8.47	49.22	-9.33	10	17.10	1.50
		±1.65	±5.36	±0.68	±0.88	±0.87	±12.46	±17.04	±22.38	±20.51		±11.75	±5.04
p		0.678	0.043*	0.125	0.000*		0.020*		0.148			0.291	

Data are presented as mean ± SD.
* By 1-way analysis of variance (ANOVA).
Adm, admission; Dis, discharge; Diff, difference value; NRS, numeric rating scale; VAS, visual analogue scale; EQ-VAS, EuroQol-visual analogue scale; NDI, neck disability index.

Table 10. The Relationship Among Initial VAS Level, Initiation Treatment Time, Hospitalization Period, the Number of Additional Treatments and the Changes of NRS, VAS, EQ-VAS and NDI.

VAS		Initiation	Hospitalization	additional Treatments (No.)	NRS		VAS		EQ-VAS			NDI	
(mm)		(d)	(d)		Adm.	Diff.	Adm.	Diff.	Adm.	Diff.		Adm.	Diff.
	No.		Mean ± SD		Mean ± SD		Mean ± SD		Mean ± SD		No.	Mean ± SD	
≥ 70	55	1.16	10.91	1.22	7.29	3.66	74.71	29.18	41.35	-19.02	38	21.66	5.66
		±1.20	±8.99	±0.74	±0.91	±1.69	±5.78	±20.98	±17.71	±20.02		±6.74	±6.62
40-69	76	1.17	10.18	1.16	6.09	2.58	53.66	16.50	50.37	-10.38	48	19.00	4.69
		±1.64	±11.69	±0.88	±1.47	±1.81	±8.26	±14.53	±19.51	±21.11		±7.77	±5.69
≤ 39	19	2.05	6.47	0.84	4.28	2.00	27.83	3.17	59.68	-8.05	9	9.56	0.33
		±1.93	±5.53	±0.76	±1.71	±1.66	±4.64	±15.44	±19.13	±18.61		±3.68	±1.42
p		0.053	0.073	0.222	0.002*		0.000*		0.044*			0.099	

Data are presented as mean ± SD.
* By 1-way analysis of variance (ANOVA).
Adm, admission; Dis, discharge; Diff, difference value; NRS, numeric rating scale; VAS, visual analogue scale; EQ-VAS, EuroQol-visual analogue scale; NDI, neck disability index.

to treat minor injuries of TA. Therefore, the increasing medical costs of KM reflect the demands.

In several studies about the satisfaction with KM treatment for TA injuries [20,21], more than 90% of the patients answered that they were satisfied and 80-90% of these patients expressed an intention to visit a KM institution again [22]. However, these studies dealt with clinical and statistical investigations without analysis of the effectiveness of KM treatment. Only a few scales were used or the patient's condition was divided into 4~5 Likert scales which was not specific enough to identify the changes after treatment [7,10-14,23]. Therefore, in this study common characteristics of patients injured in TA were identified to analyze the relationship between effectiveness and clinical factors of KM in various ways and included NRS, VAS, EQ-VAS, NDI diverse scales.

This study analyzed retrospectively the medical records of 150 TA patients who were hospitalized in Dongguk University Bundang Oriental Medicine Hospital from September 2017 to May 2018. The results obtained showed an even gender and patients aged in their 40's (26.67%) were the most common; those aged 20-50 years old were the majority (78.67%). This was similar to previous studies [11-13] where this age group was engaged in greater numbers of social activities and was thus deemed to have a higher frequency of TA.

Rear impact was the most common (37.33%) types of collisions, and consistent with the results of previous studies [7,11,12]. Shim [24] observed that front or side collisions were related to severe injuries and patients without head trauma and loss of consciousness were in the majority (83.33%) of all TA injuries, it

could be interpreted that most of patients who visited KM hospital were suffering minor injuries.

In this study the chief complaints were neck pain (60.66%) and lower back pain (54.00%) similar to previous studies [7,10-14,23]. This is thought to be due to flexion and extension from the neck and the waist during collision [25].

Of the 150 patients injured in TA, 75 patients (50.00%) visited a KM institution first (69 in this hospital and 6 in other KM institutions) following the TA. The proportion of patients receiving KM first compared to patients receiving Western medicine first has been reported [7,11,14,20], with an increasing demand for KM in the treatment of injuries caused by TA [26].

In this study the major motivation for visiting KM institutions were identified as "Hometown and good accessibility" so this response was related to distance, not medical reasons. There were 21 patients (14.00%) who replied "Continuous Pain after treatment in other hospitals" and 17 patients (11.33%) replied "Not satisfied with other hospital treatment." These responses could be interpreted as the reason for the increasing demand for KM to treat TA injuries.

The changes of various scales (NRS, VAS, EQ-VAS and NDI) from 150 patients were analyzed to evaluate the effectiveness of KM treatment. This study showed significant improvement ($p <$ 0.001) in scores for the 4 scales tested (NRS, VAS, EQ-VAS and NDI). In previous studies [12,27,28], the majority of the results were classified into 4-5 Likert scales without evaluation scales making it difficult to verify statistical significance. In addition, the effectiveness of KM treatment was evaluated by using 1 or 2 scales. However, this study used various scales based on the questionnaire which found that KM treatment for patients of TA was effective at improving the quality of life (EQ-VAS), pain relief (NRS, VAS), and disability by neck pain (NDI).

The changes of NRS, VAS, EQ-VAS and NDI scores were analyzed according to the treatment initiation time, hospitalization period, and treatment contents. In the treatment initiation time, NRS significantly decreased in the within 3 days group, and VAS, EQ-VAS and NDI also showed more improvement in the within 3 days group. Similarly, Cho et al [29] suggested that faster treatment initiation contributed better therapeutic effects and Jeon et al [30] and Shin [31] confirmed the tendency to shorten the hospitalization period by earlier treatment initiation after TA. Consistent with previous studies, this study showed that treatment initiation time could affect improvement in pain, the quality of life and functional disorders.

In the hospitalization period, scores for NRS ($p <$ 0.001) and NDI ($p =$ 0.015) significantly decreased in proportion to the hospitalization period, and scores for VAS, EQ-VAS showed an equal tendency. Similarly, Cho et al [29] and Seo et al [32] suggested that patients showed more improvement when they were hospitalized for more than 1 week, and Jeon et al [12] also reported effectiveness of treatment increased significantly with prolonged hospitalization period. It was inferred that a longer hospitalization period contributes to more effective treatment. However, the changes of scores for VAS, EQ-VAS in the more than 15 days hospitalization group, were smaller than the 1~2 weeks hospitalization group. This result may imply that patients with severe injuries from TA such as cerebral hemorrhage, fractures and nerve damage were hospitalized for more than 15 days and this influenced the scores for VAS and EQ-VAS.

In the treatment contents, scores for NRS ($p =$ 0.035) significantly decreased in the additional treatment group. Scores for VAS, EQ-VAS and NDI also showed a similar tendency. Previous studies also reported a greater therapeutic effect when combination treatment was performed; pharmacoacupuncture or chuna

manipulation rather than acupuncture alone [27,33-38]. In addition, Lee et al [28] reported that combining acupuncture with both chuna manipulation and pharmacoacupuncture significantly reduced VAS and NDI scores, and significantly reduced NDI scores when comparing acupuncture treatment alone, to acupuncture treatment plus pharmacoacupuncture or chuna manipulation. These results suggest that the more diverse KM treatments contribute to a more effective treatment as supported by using scores from NRS.

The initial pain level category had patients in the severe initial pain group (NRS 8-10, VAS $\geq$ 70) showed a tendency to be treated faster and with more diverse treatments, and experienced a significantly longer hospitalization period ($p =$ 0.043). In addition, this group showed greater score changes for NRS, VAS, EQ-VAS and NDI than other groups. Particularly, scores for NRS and VAS that were significantly different in higher initial pain level group compared to the rest of the groups. The EQ-VAS score of the severe VAS group ($\geq$ 70) showed significantly greater change than the other groups ($p =$ 0.044). It could be inferred that patients injured in TA with higher initial levels of pain were treated quickly, had more diverse KM treatment, and had a longer hospitalization period, resulting in more improvements. In this regard, further studies are needed to provide adequate care according to the patient's pain level.

This study identified the characteristics of patients involved in TA who were hospitalized in KM institution and verified the effectiveness of KM treatment by using various scales including NRS, VAS, EQ-VAS and NDI. The study showed that KM had significant effects on patient's pain relief, quality of life and advanced the patients' health condition, which could explain the increasing demand for KM as a treatment for minor TA injuries. This study also confirmed that treatment initiation, hospitalization period, treatment diversity and initial pain level influenced the improvement of TA-related symptoms. However, there are some limitations to this study. Firstly, the study conducted in a single institution for less than a year, and the sample size was small. Secondly, the effect of each treatment was not analyzed, so no specific comparison among diverse KM treatments could be made. Thirdly, the relationship between the effectiveness of KM treatment and patient satisfaction should be analyzed.

However, this study identifies the general characteristics of patients injured in TA, and verifies the effectiveness of KM treatment with various scales, and confirms clinical factors that affect therapeutic effects.

Conflicts of Interest

The authors have no conflicts of interest to declare.

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