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Original Article

Utilization of traditional Chinese medicine in different fracture sites – A cohort study of Chang Gung Memorial Hospital

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Background: Different fracture sites need different ways to stabilize and cure. In traditional Chinese medicine (TCM), the "channel conductor theory" is an important part of prescriptions that particular drug can act as guide or conductor to lead the efficacy of other drugs to reach lesion or a certain meridian. **Methods:** By using Chang Gung Research Database (CGRD), we collected data from all patients who suffered from fracture between 2001 and 2020. Fracture patients were defined by ICD-9-CM and ICD-10-CM codes. **Results:** The top three most common prescriptions in the skull and neck fracture group were xue-fu-zhu-yu-tang, shao-yao-gan-cao-tang and gui-lu-er-xian-jiao, and the single herbs were san-qi, dan-shen and shi-chang-pu. In the trunk fracture group, the top three TCM formulas were gui-lu-er-xian-jiao, xue-fu-zhu-yu-tang and zheng-gu-zi-jin-dang, and the single herbs were gu-sui-bu, yan-hu-suo and xu-duan. In the upper limb and lower limb fracture groups, the top three prescriptions were zheng-gu-zi-jin-dang, gui-lu-er-xian-jiao and shu-jing-huo-xue-tang, and the single herbs were gu-sui-bu, xu-duan and yan-hu-suo. The meridian-conducting drug for trunk fractures was yu-jin (Radix Curcumae), for upper limb fractures is sang-zhi, and those for lower limb fractures were chuan-niu-xi (Radix Cyathula) and huai-niu-xi (Radix Achyranthes bidentata). **Conclusion:** The channel conductor drug is used mainly for trunk, upper limb and lower limb fractures. Despite the major effect of formulas appearing in the four groups, channel conductor drugs can act as a guide for other formulas or single herbs. A prescription trend of CGMH TCM doctors for clinical fracture outpatients was observed in this study, which could be the base for future pharmacological investigations and clinical trials.

Keywords: fracture; Chang Gung Research Database; Traditional Chinese medicine; channel conductor drug

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Introduction

A bone fracture is the destruction of the integrity and continuity of bones. In Chinese medicine literature, fracture was also called "broken bone" or "broken trauma", because most cases of fracture were caused by trauma [1]. Soft tissues, such as muscle, tendon and ligament, can be damaged by fracture, which is classified as "sinew trauma". In addition, damage to vessels resulting in local bleeding, swelling, pain and further motor dysfunction is classified as "blood stasis" [2]. Therefore, in treatment of these types of fracture, promoting blood circulation and removing blood stasis are the main purposes. Qi-regulating drugs or tonifying drugs are applied according to the symptoms. A study investigated the prescription patterns of TCM among patients with fractures based on the database of the National Health Insurance (NHI) program in Taiwan [3]. The results revealed that the most frequently used formula was Shu-jing-huo-xue-tang, while the most frequent single drug was Rhizoma Drynariae (gu-sui-bu). This study also found that the use of TCM can reduce the cost of hospitalization within six months after fracture.

There are two kinds of regenerative patterns of fracture healing depending on the histology of the fracture ends[4, 5]. Direct (primary) fracture healing occurs when there is no relative movement between the two ends of the fractured bone. In this way, the interfragmentary strain is reduced, while rigid remodeling units known as “cutting cones” are formed [4]. By reestablishing new Haversian systems and lamellar bone directly, mechanical continuity can be restored [6, 7]. Vascular endothelial cells and mesenchymal cells are involved and produce osteoprogenitor cells that can differentiate into osteoblasts [8]. Indirect (secondary) fracture healing is much more common than direct fracture healing, which occurs when the two ends of the fracture site are near enough to heal or when there is still some relative movement [7]. It does not require and is inhibited by precise anatomical reduction or strictly stable fixation [6]. Usually, it happens after nonoperative fracture treatment. A combination of endochondral ossification and intramembranous ossification is involved in callus formation [8].

The whole healing course can be divided into four steps: acute inflammatory response, soft callus formation, hard callus formation and bone remodeling [4, 9]. The acute phase (inflammatory phase), is controlled by vascular events. Hematoma formation accompanies inflammation, which is influenced by cytokines, including inter-leukin-1 and interleukin-6 (IL-1, IL-6), and tumor necrosis factor alpha (TNF-α) [10]. Degranulating platelets secrete platelet-derived growth factor (PDGF) and transforming growth factor beta (TGF-β) to recruit mesenchymal cells [11, 12]. Additionally, bone morphogenetic protein-2 (BMP-2) is expressed through the osteogenic differentiation of mesenchymal progenitor cells (MSC) from bone marrow [6]. Approximately three days after injury, the proliferation and differentiation of preosteoblasts and osteoblasts are activated by the expression of TGF-β2, TGF-β3, BMP-5 and BMP-6 [11, 13]. Before moving to the next stage, angiogenesis begins with the induction of angiopoietin-1 [6].

In the soft callus formation phase, chondrogenesis and the proliferation of new chondrocytes begin after MSC recruitment. New endochondral bone generates callus around the fractured area with elevated TGF-β2, TGF-β3, and Growth differentiation factor-5 (GDF-5) levels [4]. Endochondral ossification occurs at

the periosteum adjacent to the fracture site and results in soft callus formation [6]. At the same time, intramembranous ossification takes place at periosteal and endosteal surfaces, indicating the direct differentiation of mesenchymal progenitors to osteoblasts [7].

Next, the woven bone constitutes the hard callus [4]. Mineralization of the soft callus begins with cartilage resorption by BMP-2, BMP-4, BMP-7, and BMP-9 [7, 14]. Cell proliferation in intramembranous ossification ceases, while osteoblastic activity continues. During this process, new mesenchymal cells infiltrate, and neo-angiogenesis occurs with vascular endothelial growth factor (VEGF) expression [8, 15]. As the hard callus forms gradually, clinical union of the fracture occurs at the end of this phase. Clinical union may occur earlier than radiographic union, owing to the initial cartilaginous callus, which is not present on radiographic images [16].

In the remodeling phase, woven bone is remodeled and subsequently replaced by lamellar bone [9]. The ossification of endochondral callus occurs in conjunction with high levels of IL-1, IL-6 and TNF-α [4, 7].

The treatment strategy of fractures in traditional Chinese medicine can be divided into three stages [17, 18]. In the initial stage, fracture occurs with pain and tissue swelling or ecchymosis around the injured region. The treatments are mainly “promoting blood circulation, dispersing blood stasis, and promoting Qi movement” to relieve pain and reduce swelling. The middle stage occurs after the initial symptoms of the fracture are partially relieved. However, the fracture site is still weak and soft because the sinews and bone have not yet joined. The purpose of TCM treatment is “to join the bone and soothe the sinews”. The late stage features partial healing of the fracture, but it is not stable. At this stage, muscle weakness could be observed due to constant external fixation with a splint and the immobilization of limbs. The TCM pattern of “Qi deficiency”, “blood deficiency” and “liver-kidney depletion” is noted. “Qi supplement, blood nourishing, kidney and liver enrichment” and “bone reinforcement and sinew strengthening” are the goals of this stage to restore normal function in the injured region.

The “channel conductor theory” is an important part of prescriptions in TCM principles, based on the basis of “channel entry theory”. The channel here means the twelve main meridians. The “channel entry theory” originates from the theory of visceral phenomena in “Yellow Emperor's Canon of Internal Medicine”. During the Jin-Yuan period, Zhang Yuan Su (1151-1234) studied these predecessors’ thoughts and proposed “channel entry theory” [19]. He regarded channel entry as one of the formal properties of Chinese medicine herbs, and a large number of reliable herbal cases were documented in his literary work. In addition, he found a more obvious characteristic of channel entry in some particular herbs, and the “channel conductor theory” was therefore established. The channel conductor drug is highly selective and has the effect of guiding the efficacy of other drugs in the same formula to reach lesion or a certain meridian. The channel conductor drugs in upper limb region are Morus alba L. twig (sang-zhi) and Notop-terygium incisum (qiang-huo); in lower limb region, they are Angelica pubescens (du-huo), Achyranthes bidentata (niu-xi) and Chaenomelis Fructus (mu-gua). However, few studies have analyzed TCM use for different fracture sites in the past. The purpose of this study was to analyze the medical records from the database of all branches of Chang Gung Memorial Hospital (CGMH)

from 2001 to 2020 and to analyze the differences in the types and frequency of TCM treatments used in patients with different fracture sites. This study could offer a reference for doctors to prescribe treatments and a basis for bone fracture healing for future clinical trials.

Materials and methods

1. Data source

We collected the medical records of patients with fracture diagnoses from 2001 to 2020, who visited TCM outpatient clinic or been inpatient of all branches of Chang Gung Memorial Hospitals. The branches include Keelung, Lover's Lake Branch, Taipei, Tucheng branch, Linkou, Taoyuan, Yunlin, Chiayi, Kaohsiung, and Fengshan branch. The diagnosis codes correspond to 733 and 803-828 in the International Classification of Disease, 9th Revision, Clinical Modification (ICD-9-CM) and S02-S92, M80, and M84 in ICD-10-CM, which are recorded for primary or secondary diagnosis in the Chang Gung Research Database. The sites of fractures were classified by ICD-10-CM codes S020-S029 (fracture of the skull), S120-S129 (fracture of neck), S22-S32 (fracture of trunk), S42-S62 (fracture of upper limbs), and S72-S92 (fracture of lower limbs). The medical records contain the following information: (1) medical record number with deidentification; (2) date of visit; (3) traditional Chinese medicine type, frequency of administration, dosage, and days of medication; (4) gender; (5) date of birth; (6) diagnosis codes; (7) outpatient visit number with deidentification; and (8) clinical observation.

2. Study Population and Variables

Bony bridging of the soft callus is an important indication of successful fracture healing, while weightbearing ability can be observed clinically. Depending on the fracture site, fracture type, fixation method and individual condition of the patient, 8–16 weeks are generally needed to recover weightbearing ability [5, 20]. The Food and Drug Administration (FDA) of United States defines nonunion as a fracture that continues for a minimum of nine months and shows no signs of healing for at least three consecutive months [21]. For delayed union, the healing process of fracture takes remarkably longer than expected, typically 3–6 months [22]. Thus, we defined three months as a cutoff point.

Patients were entered into or excluded from this research based on the following criteria.

(1) Inclusion Criteria

a. Patient who visited TCM outpatient clinic with a diagnosis of fracture.
b. The TCM outpatient clinic visit date and the date of fracture diagnosis were less than or equal to 90 days apart.
c. TCM prescriptions, such as concentrated medicine, were recompensed by The National Health Insurance (NHI) in Taiwan.
d. There was no lost type, dosage, frequency, or number of days of TCM medicine.

(2) Exclusion Criteria

a. Patients who visited TCM outpatient clinic and were not diagnosed with fracture.
b. The TCM outpatient clinic visit date and the date of fracture diagnosis were greater than 90 days apart.
c. The prescribed TCM herbs, such as crude herbs or paste, were not reimbursed by The National Health Insurance in Taiwan.
d. There was any missing type, dosage, frequency, or number of days of TCM medicine.

After screening using the above criteria, 76,366 people had both fracture diagnosis and experience in TCM outpatient clinic between 2001 and 2020. A total of 69,078 people who had no fracture diagnosis in the TCM outpatient clinic were excluded. A total of 7,288 patients were prescribed traditional Chinese medicine because of fracture diagnosis. Among them, 4963 patients fit the condition of the TCM outpatient clinic visit date and the date of diagnosed fracture being less than or equal to 90 days apart. According to the fracture site, patients were divided into four groups, as shown in Figure 1.

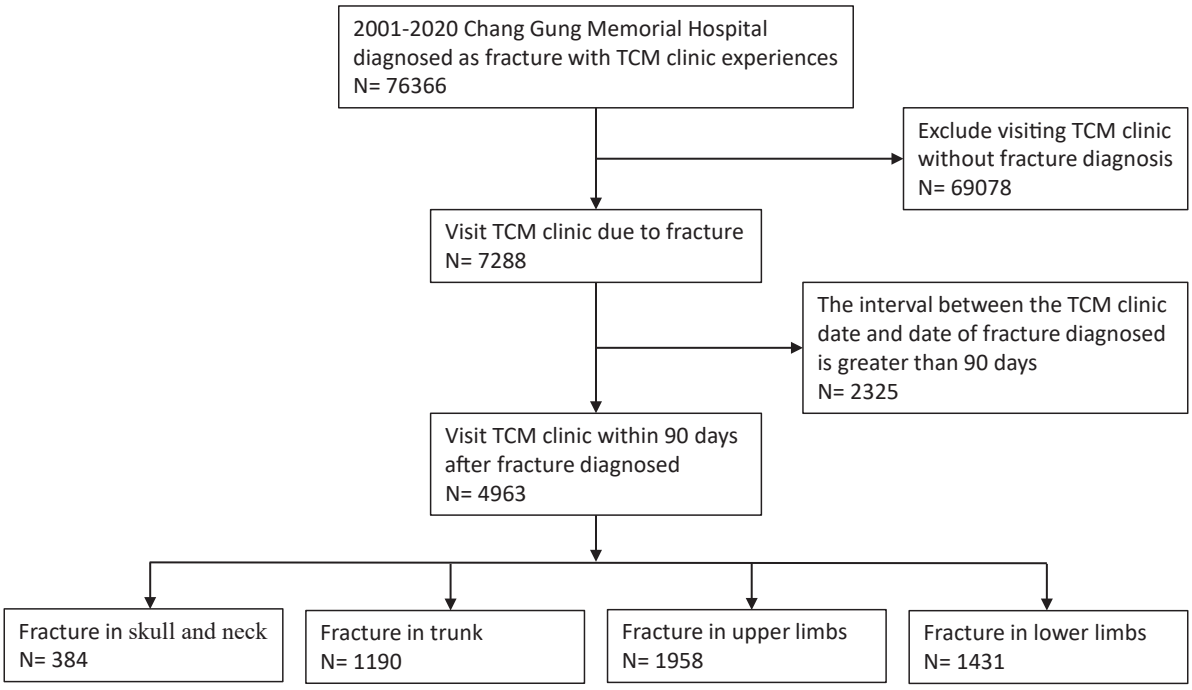

Figure 1. Flow recruitment chart of subjects from the Chang Gung Research Database (CGRD) from 2001 to 2020.

3. Ethical Consideration

All sources provided by the Chang Gung Research Database could not identify individual patients without personal privacy leakage. The data are stored at the Chang Gung Research Database and could only be analyzed by using a designated computer without an external network during the study. All programs during this study were approved by the Chang Gung Medical Consortium's Human Experimental Ethics Committee (IRB number: 202100230B0C102).

4. Statistical analysis

All statistics were performed by SAS 9.4 (SAS Institute, Cary, NC) software. Data analysis included the number and frequency of prescriptions, average daily dosage and standard difference in TCM formulas and single herbs for treating fracture patients. Single-factor analysis of variance (ANOVA) was used to compare age associations and the number of clinic visits in different fracture site groups. The chi-square test was used to compare gender in different fracture site groups.

Results

From the Chang Gung Research Database, patients diagnosed with fractures based on the inclusion and exclusion criteria were distributed into four groups: (1) fracture of the skull and neck group, containing 384 people; (2) trunk fracture group, containing 1190 people; (3) upper limb fracture group, containing 1958 people; and (4) lower limb fracture group, containing 1431 people (Table 1). There were significant differences in age ($P < 0.0001$) and number of clinic visits ($P = 0.0309$). The average number of formula types at each clinic visit was 2.6, and the average number of single herb types was 4.6, as detailed in Table 1.

Table 1. Database of fracture in each group.

	Skull and neck	Trunk	Upper limbs	Lower limbs	P value
Number of sex					
Male	194	476	891	771	
Female	190	714	1067	660	
Total number of cases	384	1190	1958	1431	0.0595
Age ±SD	44.4±20.7	54.6±17.5	46.2±20.4	46.2±19.1	<0.0001
Average number of visits ±SD	2.48±2.6	2.55±2.4	2.70±2.6	2.45±2.37	0.0309
Total number of visits	955	3033	5280	3504	
hospitalization rate (%)	74.0	60.2	56.7	57.8	
Average numbers of herbal formulas *	2.9	2.7	2.7	2.4	
Average numbers of single herbs *	4.0	4.5	4.7	4.7	

* Average numbers of herbal formulas were 2.6 types and single herbs were 4.6 types by TCM doctor (in each visit)

1. Fracture in skull and neck

The most common herbal formula in the skull and neck group was xue-fu-zhu-yu-tang (13.61%), followed by shao-yao-gan-cao-tang (10.47%) and gui-lu-er-xian-jiao (9.74%). The average daily dosage of the top eight common formulas in the skull and neck group was approximately 1.71 to 4.88 g. The most common single herb dispensed in the early period was san-qi (14.24%), followed by dan-shen (14.03%) and shi-chang-pu (11.52%). The average daily dosage of the top eight common single herbs was 0.93 to 1.84 g (Table 2).

2. Trunk fracture

The most common herbal formula in the trunk group was gui-lu-er-xian-jiao (23.8%), followed by xue-fu-zhu-yu-tang (22.45%) and zheng-gu-zi-jin-dang (17.87%). The average daily dosage of the top eight common formulas in the trunk group was approximately 2.74 to 5.23 g. The most common single herb dispensed in the early period was gu-sui-

Table 2. Fracture in skull and neck.

Herb formulas	Frequency of prescription N (%)	Average daily dose (g) ±SD	Single herb	Frequency of prescription N (%)	Average daily dose (g) ±SD
Xue-fu-zhu-yu-tang	130(13.61)	4.30±2.35	San-qi	136(14.24)	1.02±0.44
Shao-yao-gan-cao-tang	100(10.47)	3.08±1.58	Dan-shen	134(14.03)	1.23±0.37
Gui-lu-er-xian-jiao	93(9.74)	3.22±1.48	Shi-chang-pu	110(11.52)	0.93±0.35
Bu-yang-huan-wu-tang	85(8.80)	4.6±1.70	Tian-ma	104(10.89)	1.24±0.72
Jia-wei-xiao-yao-san	73(7.64)	4.88±1.29	Yuan-zhi	94(9.84)	1.01±0.38
Tong-qiao-huo-xue-tang	73(7.64)	3.72±2.05	Huang-qi	78(8.06)	1.84±1.20
Ma-zi-ren-wan	71(7.43)	1.71±1.06	Xu-duan	77(8.06)	0.98±0.42
Du-huo-ji-sheng-tang	70(7.33)	4.7±1.53	Du-zhong	74(7.75)	0.97±0.37

Table 3. Fracture in trunk.

Herb formulas	Frequency of prescription N (%)	Average daily dose (g) ±SD	Single herb	Frequency of prescription N (%)	Average daily dose (g) ±SD
Gui-lu-er-xian-jiao	722(23.80)	3.32±1.64	Gu-sui-bu	823(27.13)	1.23±0.48
Xue-fu-zhu-yu-tang	681(22.45)	4.57±1.99	Yan-hu-suo	751(24.76)	1.46±0.62
Zheng-gu-zi-jin-dang	543(17.87)	4.52±2.48	Xu-duan	642(21.17)	1.13±0.39
Du-huo-ji-sheng-tang	392(12.92)	5.23±2.49	San-qi	566(18.66)	1.22±0.64
Shao-yao-gan-cao-tang	354(11.67)	3.31±1.48	Du-zhong	517(17.05)	1.12±0.48
Shu-jing-huo-xue-tang	309(10.19)	4.39±1.81	Dan-shen	514(16.95)	1.29±0.48
Shen-tong-zhu-yu-tang	280(9.23)	4.6±2.05	Yu-jin	311(10.25)	0.94±0.30
Fu-yuan-huo-xue-tang	243(8.01)	2.74±1.65	Bu-gu-zhi	246(8.11)	1.17±0.76

bu (27.13%), followed by yan-hu-suo (24.76%) and xu-duan (21.17%). The average daily dosage of the top eight common single herbs was 0.94 to 1.46 g (Table 3).

3. Upper limbs fracture

The most common herbal formula in the upper limbs group was zheng-gu-zi-jin-dang (33.03%), followed by gui-lu-er-xian-jiao (25.34%) and shu-jing-huo-xue-tang (12.01%). The average daily dosage of the top eight common formulas in the upper limbs group was approximately 3.09 to 4.61 g. The most common single herb dispensed in the early period was gu-sui-bu (35.09%), followed by xu-duan (29.26%) and yan-hu-suo (20.63%). The average daily dosage of the top eight common single herbs was 1.12 to 1.41 g (Table 4).

4. Lower limbs fractures

The most common herbal formula in the lower limbs group was zheng-gu-zi-jin-dang (31.65%),

Table 4. Fracture in upper limbs.

Herb formulas	Frequency of prescription N (%)	Average daily dose (g) ±SD	Single herb	Frequency of prescription N (%)	Average daily dose (g) ±SD
Zheng-gu-zi-jin-dang	1744(33.03)	4.52±2.24	Gu-sui-bu	1853(35.09)	1.20±0.51
Gui-lu-er-xian-jiao	1338(25.34)	3.45±1.78	Xu-duan	1545(29.26)	1.18±0.54
Shu-jing-huo-xue-tang	851(16.12)	4.20±1.95	Yan-hu-suo	1089(20.63)	1.41±0.60
Xue-fu-zhu-yu-tang	634(12.01)	4.48±2.06	San-qi	1051(19.91)	1.20±0.61
Shao-yao-gan-cao-tang	573(10.85)	3.09±1.44	Sang-zhi	777(14.72)	1.12±0.56
Liu-wei-di-huang-wan	361(6.83)	3.73±1.61	Dan-shen	673(12.75)	1.23±0.53
Dang-gui-nian-tong-tang	344(6.52)	4.25±2.33	Du-zhong	657(12.44)	1.12±0.55
Shen-tong-zhu-yu-tang	325(5.16)	4.61±1.88	Bu-gu-zhi	520(9.85)	1.39±1.00

Table 5. Fracture in lower limbs.

Herb formulas	Frequency of prescription N (%)	Average daily dose (g) ±SD	Single herb	Frequency of prescription N (%)	Average daily dose (g) ±SD
Zheng-gu-zi-jin-dang	1109(31.65)	4.70±2.24	Gu-sui-bu	1145(32.68)	1.30±0.59
Gui-lu-er-xian-jiao	947(27.03)	3.53±1.69	Xu-duan	1057(30.14)	1.24±0.56
Shu-jing-huo-xue-tang	413(11.79)	4.39±1.88	Yan-hu-suo	623(17.78)	1.39±0.58
Dang-gui-nian-tong-tang	379(10.82)	4.73±2.17	San-qi	615(17.55)	1.22±0.55
Shao-yao-gan-cao-tang	344(9.79)	3.23±1.35	Du-zhong	591(16.83)	1.14±0.43
Du-huo-ji-sheng-tang	333(9.50)	5.01±2.16	Mu-gua	568(16.21)	1.18±0.66
Shen-tong-zhu-yu-tang	268(7.59)	4.95±1.97	Chuan-niu-xi	506(14.41)	1.21±0.51
Zhi-bai-di-huang-wan	256(7.30)	4.58±1.99	Huai-niu-xi	471(13.44)	1.19±0.56

followed by gui-lu-er-xian-jiao (27.03%) and shu-jing-huo-xue-tang (11.79%). The average daily dosage of the top eight common formulas in the lower limbs group was approximately 3.23 to 5.01 g. The most common single herb dispensed in the early period was gu-sui-bu (32.68%), followed by xu-duan (30.14%) and yan-hu-suo (17.78%). The average daily dosage of the top eight common single herbs was 1.14 to 1.39 g (Table 5).

Discussion

Under the diagnostic classification of ICD-9 and ICD-10, skull fractures include skull, facial bone, mandible bone and cervical spine. Trunk fractures include the rest of vertebrae, pelvis and ribs. Upper limb fractures include clavicle, humerus, radius, ulna, carpal bone, metacarpal bone and phalanx. Lower limb fractures include femur, tibia, fibula, ankle, metatarsal

bone and phalanges. The top three most common fracture sites in adults were distal radius fracture, metacarpal fracture and proximal femur fracture [23]. A study based on the Taiwan Health Insurance Research Database (NHIRD) investigated the sex differences in 498,586 patients with different fractures between 2008 and 2013. The results showed that 33.7% of female patients experienced fractures in the upper limbs, 49.4% in the lower limbs; while for males, it was 27.9% in the upper limbs and 45.2% in the lower limbs [24]. The results of our study were also distributed over the upper and lower limb groups, which shown as Table 1.

There were statistically significant differences in age and the number of visits in each group. The results show that the average age of each group was close to 46 years old, except for trunk fractures. The risk of most types of fracture increases with age and increases substantially in women after age of 50 [25]. In the trunk group, the mean age was higher and more concentrated. This distribution could be related to osteoporotic fractures, which are most common in the thoracolumbar spine [23], happening in 15% among women in age of fifties and in 50% among women over 85 years old [26, 27]. Once an osteoporotic thoracolumbar vertebral compression fracture occurs, most patients need conservative treatments including pain control and activity modification instead of vertebral augmentation [28], who are more willing to receive TCM treatment. On the other hand, our data revealed that the hospitalization rate of the skull and neck group was relatively higher. Some skull fractures were sports injuries, accounting for approximately 10-42% [29]; the other part was due to car accident damage, which tended to be treated as a traumatic brain injury. Owing to being directly hospitalized in the acute phase, the hospitalization rate of the skull and neck group was relatively higher.

The number of visits was mostly between 1 and 3 in past research [3]. The average number of visits in our study was approximately 2.5, which was consistent. However, the number of visits for the upper limb group was higher than that for the other groups with significant differences, indicating that patients with upper limb fractures require more treatment with clinical follow-up. One study suggested that wrist immobilization with appropriate adjustment should persist for a month and radiographs should be taken on the third, seventh, and twelfth days after reduction for the patient with distal radius fracture [30], which is the most common fracture in the upper extremity [31].

In this study, the number of prescribed TCM formulas was 2.6, and the number of single herbs was 4.6 per person at each clinic visit. The prescription pattern highly corresponded with a previous study [3, 17]. TCM doctors in Chang Gung Memorial Hospital use formulas chiefly and use single herbs as assistants.

1. Fracture in skull and neck

In the skull and neck fracture group, the TCM formula used most commonly is xue-fu-zhu-yu-tang. Xue-fu-zhu-yu-tang is a prescription for treating Qi stagnation and blood stasis patterns in various situations. It can provide neuroprotection and improve neurological dysfunction in mice that have experienced traumatic brain injury by increasing synapsin expression and inhibiting inflammation [32, 33]. The top three most frequently used single herbs are san-qi, dan-shen and shi-chang-pu. San-qi is able to stop bleeding without causing blood stasis and to dispel blood stasis without damaging healthy Qi. In mice that experience traumatic brain injury, san-qi can protect nerves by reducing intracranial

hemorrhage and inhibiting apoptosis of surrounding cells [34, 35]. Dan-shen is an essential TCM herb for promoting blood circulation and removing blood stasis. Its pharmacological mechanism has the functions of resisting oxidative stress, preventing neurodegeneration, and providing antithrombotic effects, which can prevent further deterioration after head trauma [36]. Shi-chang-pu can open the orifices and enlighten the mind, which means being clearer in thoughts, and is clinically used for patients with epilepsy, dementia, depression or other mental disorders [37, 38]. It can regulate neuroinflammation and reduce neurotoxicity by inhibiting microglia [39, 40] while lessening the damage caused by oxidative stress [41].

Among the four groups, it is noted that san-qi and dan-shen are used in the other groups in a considerable proportion, while shi-chang-pu is only used for skull fractures. According to traditional Chinese medicine theory, heart governs mental and emotional activities, which is considered analogous to the function of the brain. It gives shi-chang-pu the ability to treat skull and neck fracture due to its characteristic of entry to the Heart meridian (channel). However, the number of patients with head fractures in this study was small, and the statistical representation may be insufficient. In addition, if the injury involves the brain more than just the bony structure, it will not be treated simply as a fracture. Thus, the medication will not be consistent with other groups.

2. Trunk fracture

From the results in Table 3, the most frequently used TCM formulas for trunk fractures are gui-lu-er-xian-jiao and xue-fu-zhu-yu-tang. Gui-lu-er-xian-jiao can tonify the original Qi greatly and supply kidney yin and yang. It contains BMP-4 to regulate bone growth and promote bone regeneration. It is one of the top three most used TCM formulas in Chang Gung Memorial Hospital [42]. In addition, the frequency of gui-lu-er-xian-jiao prescription in the trunk, upper limb and lower limb groups in this study is much larger than their results, which indicates that fracture is a deficiency pattern and tonifying the original Qi mighty is needed. Xue-fu-zhu-yu-tang is mainly used to treat chest pain caused by obstruction of blood stasis and Qi stagnation over the thoracic region. Rib fractures and vertebral fractures are the most common fracture types in the trunk area. Xue-fu-zhu-yu-tang could reduce the probability of complications of rib fractures with a decreased level on the Abbreviated Injury Scale (AIS) by 1 to 2 points [43]. Owing to anatomy and TCM theory, xue-fu-zhu-yu-tang is suitable for trunk region and could be further applied in head and in the upper limb group instead of the lower limb group.

The top three single herbs in the trunk, upper limbs and lower limbs groups are gu-sui-bu, xu-duan and yan-hu-suo. In Chinese medicine theory, the effects of both gu-sui-bu and xu-duan are promoting blood circulation and healing injury, nourishing the liver and kidney, and strengthening muscles and bones. Yan-hu-suo can move Qi, activate blood and relieve pain; thus, it is suitable for treating all kinds of pain in the whole body. Gu-sui-bu is commonly used in patients with osteoporosis and osteoporotic fractures [44]. It can activate the PI3K/AKT pathway in osteoblasts to reduce oxidative stress [45], increase BMP-2 levels to promote bone mineralization [46], and reduce the expression of inflammatory factors, such as IL-1β and TNF-α, by inhibiting the MAPK pathway [47]. In animal experiments, xu-duan can stimulate the differentiation of mouse osteoblasts through the BMP-2/MAPK pathway [48], regulate osteoblasts

and osteoclasts and prevent the loss of bone mass [49, 50] and has been widely applied to the coating of intraosseous grafts [51, 52]. Yan-hu-suo has a relieving effect on acute, inflammatory or neuropathic pain [53, 54]. The sedative, antidepressant, and nonaddictive properties [55, 56] can effectively relieve pain in various areas of the body. Gu-sui-bu, xu-duan and yan-hu-suo used together have the effects of accelerating bone healing and relieving pain in the fractures of the trunk and extremities. On the other hand, yu-jin has a similar effect of activating blood, moving Qi and relieving pain as yan-hu-suo. The difference between them is that yu-jin is especially aimed at pain in the chest, flank, and abdomen, which indicates a region-specific property.

3. Upper and lower limb fractures

In the upper and lower limb fracture groups, zheng-gu-zi-jin-dang and gui-lu-er-xian-jiao are the top two TCM formulas prescribed most frequently, which also account for a considerable proportion of prescriptions in the trunk region. A study based on the Taiwan NHIRD demonstrated that the top two TCM formulas used for fracture patients were shu-jing-huo-xue-tang and zheng-gu-zi-jin-dang [3], which correlates with our study. Zheng-gu-zi-jin-dang tonifies blood, activates blood, dispels blood stasis and relieves pain, which is most generally used in fractures or injuries due to falls and knocks. The angiogenesis activity and anticoagulation effect from dang-gui (radix Angelicae Sinensis) [57, 58] and hong-hua (flos Carthami) [59] are possible pharmacological mechanisms, which could also be found in other herbal formulae. It also contains xue-jie (resin Draconis Sanguis) that can stimulate mineralization by increasing the expressions of BMP-2 and OCN mRNA in osteoblastic cells [60] and enhance vascular endothelial growth factor (VEGF) expression [61]. Shu-jing-huo-xue-tang is mainly used for pain throughout the body with the effects of unblocking the meridians and activating blood. It can protect nerves and inhibit osteonecrosis [62, 63]. Among the frequency of prescriptions in the upper and lower limb fracture groups, zheng-gu-zi-jin-dang accounted for 31.65 to 33.03 percent, and shu-jing-huo-xue-tang accounted for 11.79 to 16.12 percent, which are significantly higher than other prescriptions in the same group. It is shown that shu-jing-huo-xue-tang and zheng-gu-zi-jin-dang are prescriptions that can be used and are suitable for fractures in different areas of the body and are the most commonly used formulas for treating fractures clinically.

In TCM theory, channel conductor drugs have the characteristics of region specificity and accuracy. For example, yu-jin (Radix Curcumae) was prescribed only in the trunk group. Despite the same effect of activating blood, moving Qi, and relieving pain as yan-hu-suo, the hepatoprotective activity and protective effects on the gastric mucosa could be the possible mechanism for the trunk-limited property of yu-jin [64, 65]. The channel conductor drug of the upper limbs is Sang-zhi, which is the fifth most common in the upper limbs group. The first four herbs above sang-zhi could also be noted as the top four most commonly used herbs in the trunk and lower extremity groups. The effect of the channel conductor drug was in line with the expectations of this study. As in the lower limb fracture group, chuan-niu-xi (Radix Cyathula) and huai-niu-xi (Radix Achyranthes bidentata) were the classic channel conductor drugs. In addition to nourishing the liver and kidney and strengthening muscles and bones, which resemble gu-sui-bu and xu-duan, chuan-niu-xi and huai-niu-xi guide the effects of other drugs to the lower parts of the body. In one study, the addition of chuan-

niu-xi was reported to promote both the absorption amount and rate of the original formula [66]. Another study demonstrated that huai-niu-xi could enhance the distribution of berberine in knee and ankle to increase the anti-inflammatory effect. Downregulation of MDR1 mRNA and P-glycoprotein expression is prominently found in the knee joints [67].

Our limitations are that the samples for this study were all obtained from CGRD, whose scale may not be as enormous as a national database. However, compared with national databases, namely, the NHIRD in Taiwan, the CGRD is significantly higher than the NHIRD and other medical centers in terms of disease severity and specificity [68]. The selection of TCM will be different from that of other medical institutions, especially in the skull and neck group. In addition, in some proportion of the samples, especially the skull and neck group, the date of fracture diagnosed is not necessarily the same as the date of the first visit to the TCM clinic, which affects the use of TCM and may lead to statistical bias. Patients using self-pay medications were also excluded from this study. We cannot determine whether these excluded examples would affect the statistical results.

In this study, the types and frequencies of TCM used in fracture patients are discussed and analyzed. Among fractures in different regions, the similarities and differences in traditional Chinese medicines are compared. Under the principle of TCM theory for treating fractures, formulas and single herbs with the same effect appear in all four groups. channel conductor drugs for different regions are applied to enhance the therapeutic effect of the above drugs in an auxiliary way. Although the relevant pharmacological mechanism behind the channel conductor drugs is not yet clear, further research is needed to prove how the channel conductor drugs affect other drugs to achieve the purpose of "channel conductor" or "targeting"; the channel conductor drugs still have their particularities and necessity. The use of herbal formulas and single herbs collected in this study can provide suggestions for clinical prescription and directions for future research.

Conclusion

This study is the first multi-institutional survey to analyze TCM utilization patterns in patients with different fracture sites in Taiwan. The channel conductor drug is used mainly for trunk, upper limb and lower limb fractures. Despite the major effect of formulas appearing in the four groups, channel conductor drugs can act as a guide for other formulas or single herbs. The result demonstrated an application pattern that embodies the channel conductor theory among different fractures. A prescription trend of CGMH TCM doctors for clinical fracture outpatients was observed in this study, which could be the base for future pharmacological investigations and clinical trials.

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References

1. 武春發、張安楨，中醫骨傷科學，知音出版社，台北，pp. 166，2011.
2. 武春發、張安楨，中醫骨傷科學，知音出版社，

台北，pp. 170-171，2011.

3. Liao HH, Yeh CC, Lin CC, et al. Prescription patterns of Chinese herbal products for patients with fractures in Taiwan: A nationwide population-based study. *J. Ethnopharmacol*., 2015; 173: 11-19.
4. Marsell R, Einhorn TA. The biology of fracture healing. *Injury*, 2011; 42(6): 551-555.
5. Claes L, Recknagel S, Ignatius A. Fracture healing under healthy and inflammatory conditions. *Nat. Rev. Rheumatol*., 2012; 8(3): 133-143.
6. Oryan A, Monazzah S, Bigham-Sadegh A. Bone injury and fracture healing biology. *Biomed. Environ. Sci*., 2015; 28(1): 57-71.
7. Cottrell JA, Turner JC, Arinzeh TL, O'Connor JP. The Biology of Bone and Ligament Healing. *Foot. Ankle. Clin*., 2016; 21(4): 739-761.
8. Watson EC, Adams RH. Biology of Bone: The Vasculature of the Skeletal System. *Cold Spring Harb. Perspect. Med*., 2018; 8(7): a031559.
9. Hellwinkel JE, Miclau T 3rd, Provencher MT, Bahney CS, Working ZM. The Life of a Fracture: Biologic Progression, Healing Gone Awry, and Evaluation of Union. *JBJS Rev*., 2020; 8(8): e1900221.
10. Lončar SR, Halcrow SE, Swales D. Osteoimmunology: The effect of autoimmunity on fracture healing and skeletal analysis. *Forensic Sci Int Synerg*., 2023; 6: 100326.
11. Bahney CS, Zondervan RL, Allison P, et al. Cellular biology of fracture healing. *J. Orthop. Res*., 2019; 37(1): 35-50.
12. Poniatowski ŁA, Wojdasiewicz P, Gasik R, Szukiewicz D. Transforming growth factor Beta family: insight into the role of growth factors in regulation of fracture healing biology and potential clinical applications. *Mediators. Inflamm*., 2015; 2015: 137823.
13. Mountziaris PM, Mikos AG. Modulation of the inflammatory response for enhanced bone tissue regeneration. *Tissue Eng. Part. B Rev*., 2008; 14(2): 179-186.
14. Hughes-Fulford M, Li CF. The role of FGF-2 and BMP-2 in regulation of gene induction, cell proliferation and mineralization. *J. Orthop. Surg. Res*., 2011; 6: 8.
15. Runyan CM, Gabrick KS. Biology of Bone Formation, Fracture Healing, and Distraction Osteogenesis. *J. Craniofac. Surg*., 2017; 28(5): 1380-1389.
16. Bhandari M, Fong K, Sprague S, Williams D, Petrisor B. Variability in the definition and perceived causes of delayed unions and nonunions: a cross-sectional, multinational survey of orthopaedic surgeons. *J. Bone Joint Surg. Am*., 2012; 94(15): e1091-1096.
17. Tseng CY, Huang CW, Huang HC, Tseng WC. Utilization Pattern of Traditional Chinese Medicine among Fracture Patients: A Taiwan Hospital-Based Cross-Sectional Study. *Evid. Based Complement. Alternat. Med*., 2018; 2018: 1706517.
18. 武春發、張安楨，中醫骨傷科學，知音出版社，台北，pp. 176-178，2011.
19. Yu CC, You JS, Wiseman N, Liu GH. Study on Zhang Yuan-Su's Theory of Channel Entry and Channel Conductor. *Journal of Chinese Medicine*, 2013; 24(1):37-47.
20. Frost HM. The biology of fracture healing. An overview for clinicians. Part I. *Clin. Orthop. Relat. Res*., 1989; 248: 283-293.
21. Cunningham BP, Brazina S, Morshed S, Miclau T 3rd. Fracture healing: A review of clinical, imaging and laboratory diagnostic options. *Injury*, 2017; 48

Suppl 1: S69-S75.

22. Fisher JS, Kazam JJ, Fufa D, Bartolotta RJ. Radiologic evaluation of fracture healing. *Skeletal. Radiol*., 2019; 48(3): 349-361.
23. Court-Brown CM, Caesar B. Epidemiology of adult fractures: A review. *Injury*, 2006; 37(8): 691-697.
24. Chou FP, Chang HC, Yeh CC, et al. Sex differences in fracture outcomes within Taiwan population: A nationwide matched study. *PLoS One*, 2020; 15(4): e0231374.
25. Holloway KL, Brennan SL, Kotowicz MA, et al. Age- and sex-related patterns of first fracture and fracture prevalence. *Calcif. Tissue. Int*., 2015; 96(1): 38-44.
26. Diacinti D, Guglielmi G. How to define an osteoporotic vertebral fracture? *Quant. Imaging Med. Surg*., 2019; 9(9): 1485-1494.
27. Cummings SR, Melton LJ. Epidemiology and outcomes of osteoporotic fractures. *Lancet*, 2002; 359(9319): 1761-1767.
28. Buchbinder R, Johnston RV, Rischin KJ, et al. Percutaneous vertebroplasty for osteoporotic vertebral compression fracture. *Cochrane Database Syst. Rev*., 2018; 4(4): CD006349.
29. Viozzi CF. Maxillofacial and Mandibular Fractures in Sports. *Clin. Sports Med*., 2017; 36(2): 355-368.
30. Fernandez DL. Closed manipulation and casting of distal radius fractures. *Hand. Clin*., 2005; 21(3): 307-316.
31. Chung KC, Spilson SV. Spilson, The frequency and epidemiology of hand and forearm fractures in the United States. *J. Hand. Surg. Am*., 2001; 26(5): 908-915.
32. Xing Z, Xia Z, Peng W, et al., Xuefu Zhuyu decoction, a traditional Chinese medicine, provides neuroprotection in a rat model of traumatic brain injury via an anti-inflammatory pathway. *Sci. Rep*., 2016; 6: 20040.
33. Zhu L, Tang T, Fan R, et al. Xuefu Zhuyu decoction improves neurological dysfunction by increasing synapsin expression after traumatic brain injury. *Neural. Regen. Res*., 2018; 13(8): 1417-1424.
34. Jiang T, Zhou X, Jiang H, et al. Efficacy of Sanqi (Radix Notoginseng) in treating cerebral hemorrhage in rats with traumatic brain injury. *J. Tradit. Chin. Med*., 2021; 41(2): 262-269.
35. Yang Y, Cheng L, Li L, et al. Relationship between HIF-1α and apoptosis in rats with traumatic brain injury and the influence of traditional Chinese medicine Sanqi. *Saudi. J. Biol. Sci*., 2019; 26(8): 1995-1999.
36. MEIm XD, Cao YF, Che YY, et al. Danshen: a phytochemical and pharmacological overview. *Chin. J. Nat. Med*., 2019; 17(1): 59-80.
37. Chen XY, Liao DC, Sun ML, Cui XH, Wang HB. Essential Oil of Acorus tatarinowii Schott Ameliorates Aβ-Induced Toxicity in Caenorhabditis elegans through an Autophagy Pathway. *Oxid. Med. Cell Longev*., 2020; 2020: 3515609.
38. Tran DNH, Hwang IH, Chen FJ, et al. Core prescription pattern of Chinese herbal medicine for depressive disorders in Taiwan: a nationwide population-based study. *Integr. Med. Res*., 2021; 10(3): 100707.
39. Jiang J, Kim JJ, Kim DY, et al. Acorus gramineus inhibits microglia mediated neuroinflammation and prevents neurotoxicity in 1-methyl-4-phenyl-1,2,3,6-tetrahydropyridine (MPTP)-induced mouse model of Parkinson's disease. *J. Ethnopharmacol*., 2012; 144(3): 506-513.
40. Lee SY, Moon E, Kim SY, Choi SU, Lee KR. Quinone derivatives from the rhizomes of Acorus

gramineus and their biological activities. *Biosci. Biotechnol. Biochem*., 2013; 77(2): 276-280.

41. Yan L, Mahady G, Qian Y, et al., The Essential Oil from Acori Tatarinowii Rhizome (the Dried Rhizome of Acorus tatarinowii Schott) Prevents Hydrogen Peroxide-Induced Cell Injury in PC12 Cells: A Signaling Triggered by CREB/PGC-1α Activation. *Evid. Based. Complement. Alternat. Med*., 2020; 2020: 4845028.
42. Shao SC, Lai EC, Huang TH, et al., The Chang Gung Research Database: Multi-institutional real-world data source for traditional Chinese medicine in Taiwan. *Pharmacoepidemiol. Drug Saf*., 2021; 30(5): 652-660.
43. Zhu T, Hu ZD, Mai JY. Effect of Xuefu Zhuyu decoction in preventing complications of rib fracture in patients with blunt chest injury. *Zhongguo Zhong Xi Yi Jie He Za Zhi*, 2010. 30(9): 905-907.
44. Mu P, Hu Y, Ma X, Shi J, Zhong Z, Huang L. Total flavonoids of Rhizoma Drynariae combined with calcium attenuate osteoporosis by reducing reactive oxygen species generation. *Exp. Ther. Med*., 2021; 21(6): 618.
45. Lv W, Yu M, Yang Q, Kong P, Yan B. Total flavonoids of Rhizoma drynariae ameliorate steroid-induced avascular necrosis of the femoral head via the PI3K/AKT pathway. *Mol. Med. Rep*., 2021; 23(5): 345.
46. Sun W, Li M, Zhang Y, et al. Total flavonoids of rhizoma drynariae ameliorates bone formation and mineralization in BMP-Smad signaling pathway induced large tibial defect rats. *Biomed. Pharmacother*., 2021; 138: 111480.
47. Zhao K, Chen M, Liu T, et al. Rhizoma drynariae total flavonoids inhibit the inflammatory response and matrix degeneration via MAPK pathway in a rat degenerative cervical intervertebral disc model. *Biomed Pharmacother*, 2021; 138: 111466.
48. Niu, Y.B., et al., *Radix Dipsaci total saponins stimulate MC3T3-E1 cell differentiation via the bone morphogenetic protein-2/MAPK/Smad-dependent Runx2 pathway*. Mol Med Rep, 2015. 11(6): p. 4468-72.
49. Liu ZG, Zhang R, Li C, et al. The osteoprotective effect of Radix Dipsaci extract in ovariectomized rats. *J. Ethnopharmacol*., 2009; 123(1): 74-81.
50. Zhang W, Xue K, Gao Y, et al. Systems pharmacology dissection of action mechanisms of Dipsaci Radix for osteoporosis. *Life Sci*., 2019; 235: 116820.
51. Kao CT, Chiu YC, Lee AK, et al. The synergistic effects of Xu Duan combined Sr-contained calcium silicate/poly-ε-caprolactone scaffolds for the promotion of osteogenesis marker expression and the induction of bone regeneration in osteoporosis. *Mater. Sci. Eng. C. Mater. Biol. Appl*., 2021; 119: 111629.
52. Yeh CH, Chen YW, Shie MY, Fang HY. Poly(Dopamine)-Assisted Immobilization of Xu Duan on 3D Printed Poly(Lactic Acid) Scaffolds to Up-Regulate Osteogenic and Angiogenic Markers of Bone Marrow Stem Cells. *Materials (Basel)*, 2015; 8(7): 4299-4315.
53. Alhassen L, Dabbous T, Ha A, Dang LHL, Civelli O. The Analgesic Properties of Corydalis yanhusuo. *Molecules*, 2021; 26(24): 7498.
54. Wang L, Zhang Y, Wang Z, et al. The Antinociceptive Properties of the Corydalis yanhusuo Extract. *PLoS One*, 2016; 11(9): e0162875.
55. Alhassen L, Nuseir K, Ha A, et al. The Extract of

Corydalis yanhusuo Prevents Morphine Tolerance and Dependence. *Pharmaceuticals (Basel)*, 2021; 14(10): 1034.

56. Wu H, Wang P, Liu M, et al., A 1H-NMR-Based Metabonomic Study on the Anti-Depressive Effect of the Total Alkaloid of Corydalis Rhizoma. *Molecules*, 2015; 20(6): 10047-10064.
57. Nai J, Zhang C, Shao H, et al. Extraction, structure, pharmacological activities and drug carrier applications of Angelica sinensis polysaccharide. *Int. J. Biol. Macromol*., 2021; 183: 2337-2353.
58. Han Y, Chen Y, Zhang Q, et al. Overview of therapeutic potentiality of Angelica sinensis for ischemic stroke. *Phytomedicine*, 2021; 90: 153652.
59. Qiao Y, Shi Y, Wu C, et al. Rapid screening and identification of anticoagulation component from carthami flos by two-dimensional thrombin affinity chromatography combined with HPLC-MS/MS. *J. Sep. Sci*., 2021; 44(16): 3061-3069.
60. Wang W, Olson D, Cheng B, Guo X, Wang K. Sanguis Draconis resin stimulates osteoblast alkaline phosphatase activity and mineralization in MC3T3-E1 cells. *J. Ethnopharmacol*., 2012; 142(1): 168-174.
61. Zhang Y, Cai X, Shen L, et al. Effects of Sanguis Draconis on Perforator Flap Survival in Rats. *Molecules*, 2016; 21(10): 1262.
62. Yeh YA, Chiang JH, Wu MY, et al. Association of Traditional Chinese Medicine Therapy with Risk of Total Hip Replacement in Patients with Nontraumatic Osteonecrosis of the Femoral Head: A Population-Based Cohort Study. *Evid. Based. Complement. Alternat. Med*., 2019; 2019: 5870179.
63. Cheng CF, Lin YJ, Tsai FJ, et al. Effects of Chinese Herbal Medicines on the Risk of Overall Mortality, Readmission, and Reoperation in Hip Fracture Patients. *Front. Pharmacol*., 2019; 10: 629.
64. Zhou Y, Xie M, Song Y, et al. Two Traditional Chinese Medicines Curcumae Radix and Curcumae Rhizoma: An Ethnopharmacology, Phytochemistry, and Pharmacology Review. *Evid. Based. Complement. Alternat. Med*., 2016; 2016: 4973128.
65. Wang Z, Zhang Y, Zhang Q, et al. On the Core Prescriptions and Their Mechanisms of Traditional Chinese Medicine in Hepatitis B, Liver Cirrhosis, and Liver Cancer Treatment. *J. Oncol*., 2022; 2022: 5300523.
66. Tang SQ, Chen YH, Chen XP, Zhang XD, Huang W. In Vivo Effect of Guiding-Herb Radix Platycodonis and Radix Cyathulae on Paeoniflorin Pharmacokinetics of Xuefu Zhuyu Tang in Rats. *Afr. J. Tradit. Complement. Altern. Med*., 2017; 14(4): 289-296.
67. Wu J, Li J, Li W, et al. Achyranthis bidentatae radix enhanced articular distribution and anti-inflammatory effect of berberine in Sanmiao Wan using an acute gouty arthritis rat model. *J. Ethnopharmacol*., 2018; 221: 100-108.
68. Tsai MS, Lin MH, Lee CP, et al., Chang Gung Research Database: A multi-institutional database consisting of original medical records. *Biomed. J*., 2017; 40(5): 263-269.

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原始論文

不同骨折部位的中藥應用—臺灣長庚醫院世代研究

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研究背景與動機：不同骨折部位需要不同固定和治療。中醫學中，“引經學說”是中藥處方的重要理論。特定藥物稱為引經藥，可作為藥引或嚮導，具有引導其他藥物功效到達病灶或經脈的效果。**材料與方法：**透過長庚醫院研究數據庫（CGRD），我們收集了 2001 年至 2020 年間所有骨折患者的數據。骨折患者由 ICD-9-CM 和 ICD-10-CM 診斷碼定義。**結果：**頭顱和頸部骨折中，前三個最常見的方劑是血府逐瘀湯、芍藥甘草湯和龜鹿二仙膠，單味藥是三七、丹參和石菖蒲。在軀幹骨折組中，前三名方劑是龜鹿二仙膠、血府逐瘀湯和正骨紫金丹，單味藥是骨碎補、延胡索和續斷。在上肢和下肢骨折組中，前三名方劑是正骨紫金丹、龜鹿二仙膠和疏經活血湯，單味藥是骨碎補、續斷和延胡索。軀幹骨折的引經藥是鬱金，上肢骨折的引經藥是桑枝，下肢骨折的引經藥是川牛膝和懷牛膝。**結論：**引經藥主要用於軀幹、上肢和下肢骨折。不同骨折中出現了主要方劑的作用，也使用了引經藥作為其他藥物的藥引。本研究觀察了長庚紀念醫院中醫師在治療骨折的中藥處方趨勢，可為未來的藥理學研究和臨床試驗奠定基礎。

關鍵字：骨折、長庚資料庫、中醫藥、引經藥

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