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《伤寒论》中甘草方剂应用特点及配伍应用的规律探讨

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摘要:《伤寒论》中霍乱病篇、六经病篇以及瘥后劳复病篇会广泛应用甘草,多用于寒证、表证、虚实夹杂病证及虚证等,少用于实证、热证中与湿热证中,攻逐、急下、涌吐、收敛固涩类方证及清利湿热中不用。本研究通过分析甘草的品种产地、性味归经、功效主治、《伤寒论》关于甘草方剂的应用、甘草配伍情况、应用禁忌、甘草用于表里寒热虚实病证治疗分析以及甘草和其它药物配伍相关性,探讨《伤寒论》中甘草方剂应用特点及配伍应用的规律,以期能够实现甘草的最佳应用效果。

关键词:《伤寒论》;甘草方剂;应用特点;配伍应用

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Discussion on Application Characteristics and the Law of Compatibility of Licorice in "Treatise on Cold Diseases"

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ABSTRACT: Licorice was widely used in "Treatise on Cold Diseases", and more for cold syndrome, exterior syndrome, vacuity-repletion complex syndrome and vacuity syndrome, less for excess syndrome, heat syndrome and damp-heat syndrome, no use in attack and expel, urgent purgation, ejection and securing astringent prescriptions. This study analyzed the origin, nature and favor, meridian tropism, efficacy, and application of licorice prescription in "Treatise on Cold Diseases", and compatibility, application taboo, using for the analysis of cold and heat syndrome, treatment and compatibility of licorice and other Chinese medicine to research the application features and medicine compatibility of licorice prescriptions, in order to achieve the best application effect.

Key words: "Treatise on Cold Diseases"; Licorice prescription; Characteristics of the application; Application compatibility

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前言

随着近些年逐渐深入研究与探索,甘草具有抗癌、抗过敏、抗病毒等相关药理作用被发现,且甘草在临床处方中具有较高出现率^[1]。甘草本属于多年生草本豆科类植物,在向阳干燥的钙质草原与河岸砂质土等地生长,主产于甘肃、内蒙古,以内蒙古伊克昭盟抗棉旗所产品质量最优,药材为根茎与根,秋季采挖,除去枝杈与茎基等,截成长度适当的段,晒至半干后将其打成小捆,再晒到全干。《伤寒杂病论》是东汉末年医学研究者张仲景所写,由于该著作理法方药比较缜密、药专力宏、药少而精,所以被后世称作“方书之祖”,《伤寒论》中的很多方剂到目前依旧被沿用,很多老中医都会借鉴《伤寒论》中提出的方剂治疗疑难杂病或者大病^[2]。《伤寒论》中,甘草应用比较广泛,该书记载甘草有 70 方,该著作中应用甘草规律能够指导现今临床甘草的实际应用。临床中,甘草方剂实际应用特点与配伍应用规律如何,是近些年中医临床所研究的热点问题。为此,本研究基于《伤寒论》分析甘草方剂应用特点与药物配伍情况,以期

能够实现甘草的最佳应用效果。

1 甘草方剂在《伤寒论》中的应用特点

1.1 《伤寒论》甘草方剂的应用分析

《伤寒论》有方剂 113 方,239 方次,这些方剂中 70 方用甘草,43 方无甘草,140 方次用甘草,99 方次不用甘草^[3]。从根本上说,甘草为十二经范畴,味甘且性平,一般情况下,生甘草的功效主要有解热毒、清火以及润肺止咳等,而炙甘草的功效则主要包括甘温益气、缓急止痛,且甘草剂量同样存在其自身规律,一般可划分甘草应用剂量为 7 大层次,具体为甘草用 2 两有 45 方,1 两有 6 方,3 两有 9 方,4 两有 5 方,1 两 2 铢有 1 方,6 铢 1 方以及使用等份散末有 2 方。甘草方剂在霍乱病篇、六经病篇以及瘥后劳复病篇中得到广泛应用,各篇方剂大部分属于配伍甘草,具体见表 1 与表 2。

1.2 甘草在《伤寒论》中配伍情况

刘超男^[4-6]等学者研究发现,在《伤寒论》的 86 味药物中,52 味中药有甘草方。樊志丽研究指出^[7,8],《伤寒论》中所用甘草方剂未出现的中药,即未与甘草配伍的中药有 34 味,《伤寒论》中药物和甘草配伍相关性具体分为两大类:扶正或者解表药物和甘草具有较高配伍率,功效主要为祛邪的药物和甘草具有较低配伍率,中炙甘草和桂枝、大枣、人参、芍药、生姜、半夏、干姜以及杏仁等具有较高配伍率,从和炙甘草配伍的比例分析,《伤寒

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表 1 《伤寒论》甘草六经应用情况

Table 1 Application of licorice in six channels in "Treatise on Cold Diseases"

Table of contents	Prescriptions without licorice	Numbers of prescriptions without licorice	Prescriptions of licorice	Numbers of prescriptions of licorice	Total prescriptions	Total numbers of prescriptions
Yang ming	12	34	9	15	21	49
Tai yang	21	35	53	92	74	127
Tai yin	0	0	3	3	3	3
Shao yang	0	0	1	1	1	1
Shao yin	11	16	7	8	18	24
Jue yin	7	8	9	12	16	20
Huo luan,Chai hou	4	4	7	9	11	13
Total	43	99	70	140	113	239

表 2 无甘草方和有甘草方方剂和频次

Table 2 Frequency of prescriptions without and with licorice

Prescriptions without licorice		Prescriptions of licorice	
Name of prescription	Frequency	Name of prescription	Frequency
Xiaochengqi decoction	7	Xiaochaihu decoction	13
Dachengqi Decoction	18	Guizhi Decoction	19
Zhizichi Decoction	6	Mahuang Decoction	9
Wuling Powder	7	Sini Decoction	11
Didang Decoction	4	Baihujiarenshen Decoction	5
Daxianxiong Decoction	5	Tiaoweichengqi Decoction	8
Wuzhuyu Decoction	3	Baihu Decoction	3
Dachaihu Decoction	3		

论》中 92.5%桂枝和炙甘草配伍,而 100%石膏和炙甘草配伍, 92.87%麻黄和炙甘草配伍,如表 3 所示。

表 3 药物和甘草在《伤寒论》中的配伍情况

Table 3 Compatibility of medicine and licorice in "Treatise on Cold Diseases"

Medicine	Frequency	Frequency of licorice	Medicine	Frequency	Frequency of licorice
Ephedra	14	13	Rhizoma zingiberis	22	15
Gypsum	7	7	Scutellaria baicalensis	16	11
Jujube	40	36	Poria cocos	11	6
Cassia twig	40	37	Monkshood	20	12
Peony	30	25	Rhizoma coptidis	12	5
Ginger	36	32	Mirabilite	6	3
Pinellia ternata	18	14	Fructus Gardeniae	8	2
Almond	9	7	Immature Bitter Orange	7	1
Atractylodes	10	7	Rheum officinale	14	3
Radix bupleuri	7	5			

2 《伤寒论》中甘草方剂的应用禁忌及配伍规律

2.1 《伤寒论》中甘草的应用禁忌

路振宇^[9-11]等学者研究发现,《伤寒论》中甘草在霍乱病篇、六经病篇以及瘥后劳复病篇中得到广泛应用,涉及虚实、表里及寒热病症。由于甘草应用较为广泛,所以从无甘草方剂适应

症与无法配伍甘草的药物角度更能够对甘草方剂适应症和实际配伍原则进行准确把握^[12]。通过六经分布发现^[13,14],总方剂中,使用甘草方剂从少到多的分布情况为:少阴病篇,占比38.9%;阳明病篇,占比42.9%;厥阴病篇,占比56.3%;瘧后、霍乱病篇,占比63.6%;太阳病篇,占比71.6%,太阳、少阳病篇,占比100%。分析甘草方六经病篇实际分布规律发现,太阴和少阳病篇均会应用甘草,而少阴病篇则用3两甘草,太阴篇用2两甘草。就方剂环节而言,可划分无甘草方为治疗急重症,具体包括燥热阳明腑实之大与柴胡汤;水湿病治疗,比如,治疗蓄水之猪苓汤与五苓散;治疗水湿内阻之附子汤与真武汤等^[15,16]。就药物环节而言,无法与甘草相配伍的中药主要有:①峻下攻逐类,比如,巴豆、甘遂等;②涌吐类,比如,瓜蒂等;③收敛固涩类,如赤石脂、乌梅及禹余粮等;④利水祛湿化痰类,如猪苓、泽泻、茵陈及贝母等;⑤血肉有情之品,如鸡子白、猪胆汁及鸡子黄等;⑥甘缓补益类,例如:白蜜等^[17,18]。

2.2 《伤寒论》中甘草治疗表里寒热虚实病证分析

《伤寒论》中具有解表作用的有17方,不用甘草的只有麻黄细辛附子汤,甘草使用率为94.1%,自小柴胡汤到桂枝麻黄,均与甘草配伍,而且甘草还会被广泛应用于六经表证解表,甘草基本上属于使药或者佐药,甘草性甘,一方面可以培滋汗源而可发汗祛邪,另一方面还能益阳化阴在虚人外感中应用^[19,20]。阳虚证在虚证中较为常见,而且使用甘草也最多。比如,用桂枝甘草方剂治疗心阳虚证,理中丸、苓桂术甘汤、建中汤等治疗脾阳不足证。气虚血虚同样会用到甘草,比如,厚朴生姜半夏甘草人参汤应用于气滞兼气虚之厚治疗,桂枝新加汤治疗津亏血虚,当归四逆汤治疗血虚寒凝证,白虎加人参汤治疗气阴不足等等。热证在实证中相对比较,热证治疗中药方剂中,很少用到甘草。樊一桦^[21]表示,若用甘草,则主要是治疗无形热邪,比如,白虎汤类方证、栀子甘草豉汤证以及黄芩汤证等。对于兼夹燥结与水湿等有形实邪者,则主要为热邪,比如,栀子柏皮汤证、承气汤证等。甘草的功效主要是补养津液、益气和甘缓药用等,如果从患者病势与病位方面分析,选择甘草不仅可以补益胃气,同时还能够缓呕,具有较好应用效果。然而,该方法不加甘草,一般和寒湿内阻、肝寒气逆病理存在相关性^[22]。Liu H 研究发现^[23],如果甘草配伍吴茱萸,则会在很大程度上降低吴茱萸的降压作用,吴茱萸汤本身为治疗寒湿上逆型高血压病的良药,因此临床中与甘草配伍时要谨慎使用。近年来,麻黄连翘赤小豆汤在湿热兼表与瘀热病症的治疗中得到了广泛地应用,麻黄连翘赤小豆汤出自《伤寒论》,该书对湿热兼表、瘀热进行了全面的概述,该病的发病机理是阳明邪热与湿相结合,湿热在体内郁遏中焦,很难外泄,患者多表现为头出汗、身无汗、小便不利等,患者的湿邪得不到发泄,热邪也不能散发,两者相互交结,形成了瘀热在里。组方中甘草性甘,平和中,与大枣一起发挥辛温解表散邪和解热祛湿的作用。

2.3 《伤寒论》中甘草和其它药物配伍相关性

据《神农本草经》记载,甘草功效主要有:坚筋骨,主五脏六腑寒热邪气,倍力,长肌肉,金创以及解毒等。久服轻身延年^[24]。《伤寒论》中记载^[25],甘草在寒热虚实诸症中被广泛应用,甘草是防药物伤正之最佳选择,若出现解表之桂枝与麻黄,那么超

过90%的会和甘草配伍^[26]。而白术与人参不仅能够益气补中,而且还能够健脾祛湿,中药复方配伍是重要医学文化中的精华,白芍经常会同甘草实行配伍,在很多的古方和中成药制剂中都会对其进行应用,如桂枝汤、真人养脏汤等。其中以《伤寒论》中的芍药甘草汤作为代表,方中的中药虽然只有两味,但是结构十分严谨且配伍精当,后世医家较为推崇。在大量的相关文献报道中提出该药中的有效成分是白芍总苷、甘草酸和异甘草素等,另外白芍中的酚类具有很好的抗病毒及肿瘤作用,在药对中随着甘草的比例降低,没食子、苯甲酸的溶出率会逐渐增加,这可能是因为甘草内的酸性成分的作用。比如甘草酸以及甘草次酸对煎煮液pH值的影响,抑制了白芍内的两种酸性成分的溶出,在药对内的甘草比例的减少,甘草酸和甘草次酸内的溶出率都表现出无规律的变化,这可能是因为煎煮中的溶液环境对甘草酸和次酸之间的相互转化产生的促进作用。柴胡、半夏与黄芩一方面能够调畅气机,另一方面还能够能够在脾胃中应用。干姜与附子不仅可以辛热回阳,同时还具有温散寒湿的功效^[27,28]。所以,该药物不仅可以扶正用作虚证,同时还能够祛邪用作实证。中医常用的清热药物如栀子和黄连,适应症主要是实热,或兼痰湿,或兼气滞,如栀子豉汤、大黄连泻心汤及小陷胸汤等^[29,30]。所以,两药除气虚外一般不会和甘草相配伍。

3 结语

总而言之,《伤寒论》的甘草多用于寒证、表证、虚实夹杂病证及虚证等,少用于实证、热证与湿热证中,攻逐、急下、涌吐、收敛固涩类方证及清利湿热中不用。且甘草具有较为广泛的药物配伍,重点应用在扶助正气治疗与补充津液中,是清热剂、解表剂中正气固护的重点药物,通常会和麻黄、石膏、桂枝等药物配伍,较多的和白术、人参、半夏、黄芩等配伍,通常极少的和枳实、厚朴及大黄等配伍。

参考文献(References)

- [1] Lerda D, Ambrosio M, Kunsagi Z, et al. Determination of ochratoxin A in licorice and licorice extracts by high-performance liquid chromatography coupled with fluorescence detection: collaborative study[J]. J AOAC Int, 2013, 96(2): 331-340
- [2] 陈丽平,蔡永敏.《伤寒论》药对使用规律关联规则研究[J].北京中医药大学学报, 2013, 36(12): 808-811
Chen Li-ping, Cai Yong-min. Association rules of administration laws of couplet medicinal in Shanghanlun [J]. Journal of Beijing University of Traditional Chinese Medicine, 2013, 36(12): 808-811
- [3] 王松,郭晓东.《伤寒论》中部分方剂不用甘草原因探究[J].湖南中医杂志, 2015, 31(2): 110-111
Wang Song, Guo Xiao-dong. "Treatise on the"part of licorice without prescription Causation[J]. Hunan Traditional Chinese Medicine, 2015, 31(2): 110-111
- [4] 刘超男,徐笋晶,李赛美,等.基于多层次复杂概念网络表示方法的《伤寒论》方药按治法分类的知识发现[J].北京中医药大学学报, 2014, 37(7): 452-457
Liu Chao-nan, Xu Sun-jing, Li Sai-mei, et al. Knowledge discovery of formula classification according to therapies in Shanghanlun based on representation method of multi-layer complex concept network [J]. Journal of Beijing University of Traditional Chinese Medicine, 2014,

- 37(7): 452-457
- [5] 郭珊珊,王谦,白立川,等.芍药-甘草配伍的研究进展[J].中草药, 2014, 45(10): 1481-1485
- Guo Shan-shan, Wang Qian, Bai Li-chuan, et al. Research progress on compatibility of *Paeoniae Alba Radix* and *Glycyrrhizae Radix* [J]. Chinese Traditional and Herbal Drugs, 2014, 45(10): 1481-1485
- [6] Sakr S, El-Kenawy A, El-Sahra D, et al. Metiram-induced nephrotoxicity in albino mice: Effect of licorice aqueous extract [J]. Environ Toxicol, 2013, 28(7): 372-379
- [7] 樊志丽,周春祥.浅谈《伤寒论》中甘草的强固之性[J].河南中医, 2015, 35(7): 1467-1468
- Fan Zhi-li, Zhou Chun-xiang. Brief Analysis of Strengthening and Consolidating Property of *Gancao*(*Radix et Rhizoma Glycyrrhizae*) in Treatise on Febrile and Miscellaneous Diseases [J]. Henan Traditional Chinese Medicine, 2015, 35(7): 1467-1468
- [8] 彭伟,蒋燕萍,傅超美,等.四逆汤中甘草与其他药味配伍药效成分变化规律研究[J].中国中药杂志, 2015, 40(1): 84-88
- Peng Wei, Jiang Yan-ping, Fu Chao-mei, et al. Changing rules study of effective components of *Glycyrrhizae Radix et Rhizoma* before and after compatibilities in Sini decoction [J]. China Journal of Chinese Materia Medica, 2015, 40(1): 84-88
- [9] 路振宇,包巨太,王国权,等.《伤寒论》方证对应规律的数学三维解析[J].中国实验方剂学杂志, 2011, 17(20): 297-302
- Lu Zhen-yu, Bao Ju-tai, Wang Guo-quan, et al. Treatise on Exogenous Febrile Disease Party Card Corresponding Laws Mathematical 3D Analytical [J]. Chinese Journal of Experimental Traditional Medical Formulae, 2011, 17(20): 297-302
- [10] Fujii S, Morinaga O, Uto T, et al. Development of a monoclonal antibody-based immunochemical assay for liquiritin and its application to the quality control of licorice products [J]. J Agric Food Chem, 2014, 62(15): 3377-3383
- [11] 邓烨,刘超男,李赛美,等.基于数学属性偏序表示原理的《伤寒论》甘草方剂配伍量效群结构知识发现 [J]. 中国实验方剂学杂志, 2016, 22(7): 213-217
- Deng Ye, Liu Chao-nan, Li Sai-mei, et al. The principle of "Treatise on the" licorice prescription dose group structure of knowledge discovery based on mathematical representation of attribute partial order [J]. Chinese Journal of Experimental Traditional Medical Formulae, 2016, 22(7): 213-217
- [12] 张霖.《伤寒论》寒热并用及其配伍浅析[J].云南中医学院学报, 2010, 33(2): 57-59
- Zhang Lin. Analysis Methods of the Combination on the Treatise on Exogenous Febrile Disease With the Combined Use of Cold and Heat [J]. Journal of Yunnan University of Traditional Chinese Medicine, 2010, 33(2): 57-59
- [13] 张毅之,王评.《伤寒论》六经辨治失眠探讨[J].江苏中医药, 2010, 42(9): 1-2
- Zhang Yi-zhi, Wang Ping. An Exploration into Differential Diagnosis and Treatment of Insomnia Based on Theories of Six Meridians in Treatise of Febrile Diseases [J]. Jiangsu Journal of Traditional Chinese Medicine, 2010, 42(9): 1-2
- [14] 王树鹏,刘书宇.浅谈《伤寒论》方剂治疗禁忌证在辨证中的意义[J].国际中医中药杂志, 2014, 36(7): 644-646
- Wang Shu-peng, Liu Shu-yu. Discussing the significance of prescription treatment contraindications of Treatise on Febrile Disease in syndrome differentiation treatment [J]. International Journal of Traditional Chinese Medicine, 2014, 36(7): 644-646
- [15] Fu S, Zhang J, Gao X, et al. Clinical practice of traditional Chinese medicines for chronic heart failure [J]. Heart Asia, 2010, 2(1): 24-27
- [16] Honda K, Saneyasu T, Hasegawa S, et al. Effect of licorice flavonoid oil on cholesterol metabolism in high fat diet rats [J]. Biosci Biotechnol Biochem, 2013, 77(6): 1326-1328
- [17] 陈宁勇,李芸,范欣生,等.《伤寒论》下法禁忌探析[J].南京中医药大学学报, 2012, 28(4): 309-311
- Chen Ning-yong, Li Yun, Fan Xin-sheng, et al. Discussion on Purgation Contraindication in Treatise on Cold Damage [J]. Journal of Nanjing University of Traditional Chinese Medicine, 2012, 28(4): 309-311
- [18] Choi JS, Han JY, Ahn HK, et al. Fetal and neonatal outcomes in women reporting ingestion of licorice (*Glycyrrhiza uralensis*) during pregnancy [J]. Planta Med, 2013, 79(2): 97-101
- [19] Cheel J, Onofre G, Vokurkova D, et al. Licorice infusion: Chemical profile and effects on the activation and the cell cycle progression of human lymphocytes [J]. Pharmacogn Mag, 2010, 6(21): 26-33
- [20] Ayeka PA, Bian Y, Mwitari PG, et al. Immunomodulatory and anticancer potential of *Gancao* (*Glycyrrhiza uralensis* Fisch.) polysaccharides by CT-26 colon carcinoma cell growth inhibition and cytokine IL-7 upregulation in vitro [J]. BMC Complement Altern Med, 2016, 16(1): 206
- [21] 樊一桦,张丽丽.谈《伤寒论》对桂枝、生姜、大枣和甘草的应用[J].河南中医, 2015, 35(6): 1204-1205
- Fan Yi-hua, Zhang Li-li. Application of Guizhi (*Ramulus Cinnamomi*), Shengjiang (*Rhizoma Zingiberis Recens*), Dazao (*Fructus Jujubae*) and *Gancao* (*Radix et Rhizoma Glycyrrhizae*) in Treatise of Cold-Damage [J]. Henan Traditional Chinese Medicine, 2015, 35(6): 1204-1205
- [22] 左艇,田硕,李艳,等.甘草相反药临床应用调研与配伍特点关联分析[J].南京中医药大学学报, 2015, 31(5): 433-436
- Zuo Ting, Tian Shuo, Li Yan, et al. Clinical Application Research on *Glycyrrhizae* Prescriptions with Incompatible herbs and Association Analysis of Their Characteristics [J]. Journal of Nanjing University of Traditional Chinese Medicine, 2015, 31(5): 433-436
- [23] Liu H, Wang J, Zhou W, et al. Systems approaches and polypharmacology for drug discovery from herbal medicines: an example using licorice [J]. J Ethnopharmacol, 2013, 146(3): 773-793
- [24] Ahn J, Lee H, Jang J, et al. Anti-obesity effects of glabridin-rich supercritical carbon dioxide extract of licorice in high-fat-fed obese mice [J]. Food Chem Toxicol, 2013, 15(51): 439-445
- [25] 曾子芸,陈明.《伤寒论》太阴病中权变治法探析[J].长春中医药大学学报, 2014, 30(1): 162-163, 172
- Zeng Zi-yun, Chen Ming. The analysis of expedient treatment for Taiyin disease in Treatise on Febrile Diseases [J]. Journal of Changchun University of Traditional Chinese Medicine, 2014, 30(1): 162-163, 172
- [26] 陈静霞,陈爽白.小议《伤寒论》中桂枝的功效[J].吉林中医药, 2010, 30(4): 279-280

因 BIP、XBP-1、CHOP 的表达, 研究泛素蛋白酶体系统对内质网应激的影响。实验组中 MG132 抑制了泛素化蛋白 Ubiquitin 的表达($P<0.05$), 且增强了 BIP、XBP-1 和 CHOP 的表达($P<0.05$); 而阿霉素增强了泛素化蛋白 Ubiquitin 的表达($P<0.05$), 抑制了 BIP、XBP-1 和 CHOP 的表达($P<0.05$); 结果表明泛素蛋白酶体系统与内质网应激不是两个独立的过程, 而是相互影响的, 在缺氧复氧早期外源性增强细胞泛素蛋白酶体活性可以减弱内质网应激, 其机制很可能是通过泛素蛋白酶体途径降解因缺氧而沉积在细胞内的异常蛋白或细胞器等, 从而缓解内质网应激。

近年来, 对细胞内蛋白质降解通路的研究已经取得巨大的成就, 部分研究成果已经应用于临床疾病的防治。本实验虽从细胞水平上研究蛋白酶体活性与内质网应激的关系, 但其作用的分子机制仍尚不清楚, 有待进一步深入研究。

参考文献(References)

- [1] Chondrogianni N, Voutetakis K, Kapetanou M, et al. Proteasome activation: An innovative promising approach for delaying aging and retarding age-related diseases [J]. Ageing Res Rev, 2015, 23 (Pt A): 37-55
- [2] Jung T, Grune T. Structure of the proteasome[J]. Prog Mol Biol Transl Sci, 2012, 109: 1-39
- [3] Stein M L, Groll M. Applied techniques for mining natural proteasome inhibitors[J]. Biochim Biophys Acta, 2014, 1843(1): 26-38
- [4] Da F P, He J, Morris E P. Molecular model of the human 26S proteasome[J]. Mol Cell, 2012, 46(1): 54-66
- [5] Sommer T, Wolf D H. The ubiquitin-proteasome-system [J]. Biochim Biophys Acta, 2014, 1843(1): 1
- [6] Marastoni M, Scotti A, Trapella C, et al. Synthesis and activity of isoxazoline vinyl ester pseudopeptides as proteasome inhibitors [J]. J Pept Sci, 2014, 20(4): 258-265
- [7] Su H, Wang X. The ubiquitin-proteasome system in cardiac proteinopathy: a quality control perspective[J]. Cardiovasc Res, 2010, 85(2): 253-262
- [8] Kraus W E, Muoio D M, Stevens R, et al. Metabolomic Quantitative Trait Loci (mQTL) Mapping Implicates the Ubiquitin Proteasome System in Cardiovascular Disease Pathogenesis [J]. PLoS Genet, 2015, 11(11): e1005553
- [9] Komander D, Rape M. The ubiquitin code [J]. Annu Rev Biochem, 2012, 81: 203-229
- [10] Pluquet O, Pourtier A, Abbadie C. The unfolded protein response and cellular senescence. A review in the theme: cellular mechanisms of endoplasmic reticulum stress signaling in health and disease[J]. Am J Physiol Cell Physiol, 2015, 308(6): C415-C425
- [11] Diaz-Villanueva J F, Diaz-Molina R, Garcia-Gonzalez V. Protein Folding and Mechanisms of Proteostasis [J]. Int J Mol Sci, 2015, 16 (8): 17193-17230
- [12] Adams B, Mapanga R F, Essop M F. Partial inhibition of the ubiquitin-proteasome system ameliorates cardiac dysfunction following ischemia-reperfusion in the presence of high glucose [J]. Cardiovasc Diabetol, 2015, 14: 94
- [13] Powell S R, Divald A. The ubiquitin-proteasome system in myocardial ischaemia and preconditioning [J]. Cardiovasc Res, 2010, 85(2): 303-311
- [14] Schulman B A, Harper J W. Ubiquitin-like protein activation by E1 enzymes: the apex for downstream signalling pathways [J]. Nat Rev Mol Cell Biol, 2009, 10(5): 319-331
- [15] Jin J, Li X, Gygi S P, et al. Dual E1 activation systems for ubiquitin differentially regulate E2 enzyme charging [J]. Nature, 2007, 447 (7148): 1135-1138
- [16] Spratt D E, Walden H, Shaw G S. RBR E3 ubiquitin ligases: new structures, new insights, new questions [J]. Biochem J, 2014, 458(3): 421-437
- [17] Oyadomari S, Mori M. Roles of CHOP/GADD153 in endoplasmic reticulum stress[J]. Cell Death Differ, 2004, 11(4): 381-389
- [18] Wang Y, Shen J, Arenzana N, et al. Activation of ATF6 and an ATF6 DNA binding site by the endoplasmic reticulum stress response [J]. J Biol Chem, 2000, 275(35): 27013-27020
- [19] Osowski C M, Urano F. Measuring ER stress and the unfolded protein response using mammalian tissue culture system [J]. Methods Enzymol, 2011, 490: 71-92
- [20] Yoshida H, Matsui T, Yamamoto A, et al. XBP1 mRNA is induced by ATF6 and spliced by IRE1 in response to ER stress to produce a highly active transcription factor[J]. Cell, 2001, 107(7): 881-891

(上接第 776 页)

- Chen Jing-xia, Chen Shuang-bai. Discussion on Efficiency of Cinnamom Twig in Treatise on Febrile Diseases [J]. Jilin Journal of Traditional Chinese Medicine, 2010, 30(4): 279-280
- [27] Ohno H, Araho D, Uesawa Y, et al. Evaluation of cytotoxicity and tumor-specificity of licorice flavonoids based on chemical structure [J]. Anticancer Res, 2013, 33(8): 3061-3068
- [28] Fu Y, Chen J, Li YJ, et al. Antioxidant and anti-inflammatory activities of six flavonoids separated from licorice [J]. Food Chemistry, 2013, 141(2): 1063-1071
- [29] 卞尧尧, 张静远, 周春祥, 等. 大黄黄连泻心汤治痞机理新识[J]. 世界科学技术 - 中医药现代化, 2013, (1): 151-154
- Bian Yao-yao, Zhang Jing-yuan, Zhou Chun-xiang, et al. New Thoughts on the Mechanism of Dahuang Huanglian Xiexin Decoction in the Syndrome Treatment of Feeling Fullness and Distension in the Upper Abdomen[J]. World Science and Technology-Modernization of Traditional Chinese Medicine, 2013, (1): 151-154
- [30] 梁华龙. 伤寒论评话第 27 章大黄黄连泻心汤治痞证 -- 痞证的辨证论治[J]. 中医学报, 2014, 29(3): 345-348
- Liang Hua-long. Discussion of Shanghan Lun: Dahuang Huanglian Namely Xiexin, Stagnation of Qi Activity Leading to Pi Syndrome--Diagnosis and Treatment of Pi Syndrome [J]. China Journal of Chinese Medicine, 2014, 29(3): 345-348