Modern pharmacological studies on Danshen have shown that the pharmacologic actions of Danshen mainly include dilating vessels, promoting blood flow, improving microcirculation, changing blood viscosity, increasing myocardial blood and oxygen supplies, reducing myocardial consumption of oxygen, etc. The drug is used to treat diseases of the cardio-cerebrovascular system. In addition, Danshen also has antitumor, antibacterial, and anti-inflammatory functions. Therefore, Danshen has wide clinical application. In recent years, there has been an increase in the number of reports on the clinical application of Danshen extract and Danshen compound preparations. Danshen is seldom used alone; rather, it is usually combined with other drugs to form compound preparations. Various Danshen preparations have been developed, such as Compound Danshen Tablets, Compound Danshen Dropping Pill (Dantonic™), Compound Danshen Granules, Compound Danshen Capsule, Compound Danshen Oral Liquid, Compound Danshen Aerosol, and Compound Danshen Injection (CDI), etc. The successful development of these preparations has improved product quality, enhanced efficacy, and opened up broader prospects for Danshen’s clinical application.

1.1 Diseases of Circulation System

Danshen has the function of effectively dilating the coronary artery, increasing coronary blood flow, reducing heart rate, inhibiting platelet aggregation and thrombopoiesis induced by platelet activation factors, promoting the recovery of injured cardiac muscle, increasing cardiac contractility, and protecting cardiac muscle cells; thus it can be widely applied in treating the diseases of the circulation system.

1.1.1 Coronary Heart Disease and Angina Pectoris

The preparations of Danshen used in the clinical treatment of coronary heart disease are mainly decoctions and compound injections. Compound Danshen decoctions are usually combined with other drugs such as the qi-boosting drugs ginseng and astragalus root, qi-moving drugs common aucklandia root, Sichuan lovage root, and sandalwood, and the blood-invigorating drug safflower. Compound injections are usually combined with drugs for supplementing qi, nourishing yin, and activating blood circulation. The application of Danshen preparations can also be adjusted in timing and dosage.

Liu [1] observed the effect of modified Danshen Beverage on the treatment of 120 patients with coronary heart disease and Angina pectoris. 120 patients in the treatment group were
administered modified Danshen Beverage; the prescription included 20 g Danshen, 10 g ginseng, 10 g American ginseng, 10 g villous amomum fruit, 10 g Leech, 10 g Sanchi, and 6 g sandalwood, with a course of treatment lasting 4 weeks. 86 patients in the control group were orally administered Compound Danshen Tablet. The results showed that the total effective rates in the treatment group and control group were 91.67 and 71.07 %, respectively, and there was a significant difference between the two groups (P < 0.001). ECG efficacies in the treatment and control groups were 55.1 and 39.5 %, respectively, and the difference was statistically insignificant (P > 0.05). The blood lipids and hemorheology indices in the two groups changed after treatment. The rate of reduced or ceased use of nitroglycerin in the treatment group was 91.4 %, and in the control group was 67.8 %; the difference was significant (P < 0.01). The authors concluded that the modified Danshen Beverage has the functions of improving coronary artery blood supply, reducing blood lipids, reducing blood viscosity, and inhibiting myocardial ischemia.

Li et al. [2] observed the clinical therapeutic effects of combined Chinese and Western medicines on the treatment of unstable angina pectoris (UAP). 98 patients with UAP were randomly divided into treatment and control groups, 49 patients in each group. The patients in the control group were administered with 5-isosorbide dinitrate (5-ISMN2) by intravenous drip; the patients in the treatment group were administered with, in addition to 5-ISMN2, Compound Danshen Aerosoleach, four sprays per time, three times a day. The results showed that in the treatment group, some therapeutic effects on improving angina pectoris symptoms, physical signs, and ischemic electrocardiogram, etc. were observed; the drug also has the function of reducing total cholesterol, LDL level, and platelet adhesion rate, and stabilizing plaques. They found that combined treatment with Danshen for UAP was better than that of 5-ISMN2 used alone.

Meng and Zou [3] reported the effect of modified Pulse-Engendering Powder combined with Danshen Beverage on the treatment of 60 patients with coronary heart disease and angina pectoris. The patients in the treatment group were administered with 30 g of heterophyll true satarwort root, 15 g of Radix ophiopogonis, 10 g of Chinese magnolia vine fruit, 10 g of Danshen, 6 g of villous amomum fruit, and 6 g of liquorice root. The above drugs were decocted with water and taken one dose twice a day for 2 weeks as one course of treatment. The patients in the control group were administered with 10 mg of isosorbide dinitrate three times a day. The results showed that angina pectoris in the two groups after treatment was significantly relieved and the average number of days in the treatment group and control group was 3.6 ± 3.2 days and 3.5 ± 4 days, respectively. The average number of days when angina pectoris disappeared in the treatment group and control group was 11.1 ± 8.9 and 13.8 ± 9 days (P < 0.05), respectively.

Hu and Yang [4] reported the effect of modified Muxiang Danshen Beverage (木香丹参饮) on the treatment of coronary heart disease and angina pectoris. The basic prescription contained 15 g of common aucklandia root (木香), 6 g of clove flower (丁香), 12 g of round cardamon kernel (砂仁), 6 g of villous amomum fruit (砂仁), 12 g of agastache (藿香), 6 g of sandalwood (檀香), 30 g of Danshen, and 6 g of liquorice root (甘草). The above drugs were decocted and administered with water and divided into two parts, to be taken as one part twice per day. The results showed a therapeutic effect on the symptoms of angina pectoris: of the 42 patients, there were 15 patients with a marked effect, 23 patients with an effect, and 4 patients without effect. The effective rate was 90.48 %. Regarding therapeutic effects on the electrocardiogram ST-T segment, of the 42 patients, 11 patients had a marked effect, 16 patients had an improving effect, and 15 patients had no effect; the effective rate was 64.29 %.

Chen and Gao [5] reported the effect of modified Harmonious Yang Decoction and Danshen Beverage on the treatment of 43 patients with coronary heart disease and angina pectoris. 42 patients in the control group were treated with western medicines; 20 mg of
isosorbide mononitrate was orally administered twice a day, along with 75 mg of enteric-coated aspirin once a day. The patients in the treatment group were administered with the above western medicines plus TCM decoctions, i.e., modified Harmonious Yang Decoction and Danshen Beverage, which contained 30 g of prepared rhizome of rehmannia (熟地), 30 g of Danshen, 15 g of antler glue (鹿角胶), 15 g of mongolian snakegourd fruit (全瓜蒌), 6 g of cassia bark tree twig (桂枝), 6 g of villous amomum fruit (砂仁), 6 g of sandalwood (檀香), 6 g of raw liquorice root (生甘草), 10 g of szechwan lovage rhizome (川芎), and 10 g of white mustard seed (白芥子). The above drugs were decocted and taken with water, one dose twice a day, for 15 days as one course of treatment, and the two groups were treated in two consecutive courses. The therapeutic effects were evaluated at the end of the treatment. The result showed that effective rate in the treatment group was 97.67 %, which was significantly higher ($P < 0.01$) than that of the control group, which was 76.19 %.

In the clinical application of Danshen’s modern preparations, Compound Danshen Injection (CDI) occupies a very important position. CDI can significantly improve blood viscosity, so that blood flow is accelerated and intravascular pressure is reduced. CDI can antagonize calcium, dilate blood vessels, increase blood flow, and improve microcirculation of the heart. It also has the function of inhibiting platelet adhesion, aggregation and release, and improving prostacyclin metabolism, etc. These functions have been documented in large amounts of clinical literature, and CDI has been proven to have reliable therapeutic effects. On the basis of using CDI alone, various injections with the function of activating blood circulation, such as daidzein, and with the function of supplementing qi and nourishing yin, such as Shenmai Injection, etc., have been developed.

Yang [6] reported the application of Shenmai and Danshen injections in the treatment of 35 patients with coronary heart disease and angina pectoris. The patients were administered with 30 ml of Shenmai Injection and 30 ml of Danshen Injection by intravenous drip, once per day for 3 weeks, and the results showed the treatment had significant anti-angina pectoris effects.

Fu et al. [7] reported the application of 0.5/250 ml of puerarin and glucose injection combined with 16 ml of CDI in the treatment of 44 patients with coronary heart disease and angina pectoris, and the results showed that in the treatment group there were 31 patients with a marked effect, 10 patients with an effect, 3 patients without effect, and the total effective rate was 93.2 %.
There is a report showing that the effectiveness of Danshen drugs might vary with the timing of drug administration. Xing [8] reported the application of CDI in the treatment of 120 patients (treatment group: 80 patients, control group: 40 patients) with coronary heart disease and angina pectoris and blood stasis based on temporal rhythm. The patients were divided into a morning group and afternoon group, with the same drug and dosage (16 ml of CDI) administered by intravenous drip. The results showed that the total effective rates of the treatment group in the morning and control group in the afternoon were 95.0 and 77.5 %, respectively, and the difference between the two groups was significant ($P < 0.01$). The results demonstrated that better therapeutic effects of Danshen could be obtained when the heart of the patient was in a vigorous condition.

Mao et al. [9] reported the application of CDI and Danshen injection in the treatment of 102 patients with coronary heart disease, based on the theory that Danshen has the effects of activating blood circulation, dissipating blood stasis, nourishing the heart to promote blood circulation, and benefiting vital energy and strengthening yang. 6 ml of CDI and 6 ml of Danshen injection were mixed together, then the acupoints of Inner Pass (PC 6), Heart Shu (BL 15), and Jueyinshu (BL 14) were selected and the liquid was injected after needle sensation. Heart Shu and Jueyinshu received 2 ml of the injection each time, and Inner Pass received 1 ml. The acupunctural injection was performed once every other day for 20 days as one course of treatment, and usually two courses of treatment were necessary. The synergistic effects were obtained by the combination of acupuncture and medication. The effects were judged according to clinical symptoms, electrocardiogram and hemorheology. The total effective rate of clinical symptoms was 96.5 %, the total effective rate of improvement of electrocardiogram ST-T was 82.9 %, and both whole blood viscosity and serum viscosity were significantly reduced.

Zhang [10] reported the application of compound Danshen Aerosol on the treatment of 80 patients with coronary heart disease and angina pectoris. The patients were sublingually administered with 3–5 sprays of the aerosol three times a day, for 7 days as one course of treatment. 40 patients in the control group were administered with Isosorbide Dinitrate Tablet. The results showed that the total short-term effective rates for angina pectoris in the treatment group and control group were 92.25 and 85 %, respectively; judging by electrocardiograms, the total short-term effective rates were 70 and 50 %, respectively, and the differences were significant ($P < 0.05$). The immediate effective rates in the two groups were 95 and 30 %, respectively; the onset times were $3.24 \pm 1.37$ and $3.41 \pm 1.36$ min, respectively. The therapeutic effects on angina pectoris in short term, immediate effects, and the effects on severe angina pectoris and unstable angina in the treatment group were significantly better than those in the control group ($P < 0.01$).

The mechanisms for the treatment of coronary heart disease by Danshen Injection were clinically investigated.

Kong et al. (2002) found that after treatment with Danshen preparations, the platelet aggregation test (PAGt), $\beta$-TG ($\beta$-thromboglobulin) TXB$_2$ (thromboxane B$_2$), and PGF$_1\alpha$ (prostaglandin F1$\alpha$) in patients with coronary heart disease were significantly reduced, and there were downward trends in PAGt (22 $\mu$mADP) and PF4 (platelet IV factor) after treatment, though the differences were not statistically significant. There were no significant changes in the ratios of $\beta$-TG/PF4 and TXB$_2$/PGF$_1\alpha$. The results demonstrated that Danshen had wide cardiovascular pharmacologic actions (e.g., inhibiting platelet aggregation, dilating coronary artery blood vessels, cleaning oxygen radicals, anticoagulation, etc.) and reducing oxygen consumption by the myocardium so as to antagonize angina pectoris.

Zhang et al. [11] reported the application of Danshen in the treatment of patients with coronary heart disease and angina pectoris by injectio ad acumen at Heart Shu (BL 15). The results showed that the blood plasma ET-1 and MDA were significantly reduced to a normal level after treatment. The authors concluded that Danshen injection at Heart Shu point could remit the impairment of blood vessel endothelial cells in
the patients with coronary heart disease and angina pectoris and alleviate angina pectoris.

Xing [12] used Danshen Injection to treat 24 patients with coronary heart disease, and observed the changes in the contents of lipid peroxides (LPO) and superoxide dismutase (SOD) before and after the treatment. 20 healthy individuals were used as the control. The results showed that LPO of patients with coronary heart disease was significantly higher than that of healthy individuals ($P < 0.01$), but blood SOD was lower significantly than that of healthy individuals ($P < 0.01$); after treatment with Danshen, LPO was significantly reduced ($P < 0.01$), and SOD was significantly increased ($P < 0.05$). The results demonstrated that Danshen had the function of reducing LPO and enhancing the activity of SOD in serum.

### 1.1.2 Acute Myocardial Infarction

Lin [13] used Danshen powder injection combined with nitroglycerin to treat high myocardial infarction patients with ST segment elevation, and obtained satisfactory therapeutic results. Danshen (lyophilized) powder has the function of dilating the coronary artery, inhibiting platelet aggregation, inhibiting thrombopoiesis, and improving hemorheology and microcirculation. Danshen powder injection can be used to substitute long-term use of aspirin in the treatment of coronary heart disease. Drug resistance can be induced by long-term use of nitroglycerin, and thus the therapeutic effect can be reduced to some extent. When Danshen powder injection was added to the comprehensive treatment scheme (nitroglycerin, low molecular heparin, etc.), the total effective rate was 93.5 %, the blood rheology was significantly improved, and no apparent toxicity or side-effects on liver and kidney function was observed.

Qi et al. [14] observed the therapeutic effects of sodium tanshinone IIA sulfonate (STS) injection on the treatment of acute myocardial infarction (AMI). 94 patients with AMI were randomly divided into an observation group (46 cases) and control group (48 cases). Conventional therapy methods were performed in the control group, but STS injection in addition to conventional therapy was performed in the observation group. The results showed that the incidence of angina pectoris after infarct in the treatment group was significantly reduced 2 weeks after treatment, and there was a significant difference between the treatment group and control group but no significant difference in arrhythmia and hospital mortality rate between the two groups. The results demonstrated that ventriculus sinister function and myocardial ischemia in patients with AMI can be improved by STS injection, and it was safe and effective in clinical application.

How to reverse left ventricular remodeling and slow down congestive heart failure after myocardial infarction (AMI) is an important issue for physicians. Clinically, β receptor blockers, angiotensin converting enzyme inhibitors, angiotonin II receptor antagonists, and aldosterone receptor antagonists have been used for left ventricular remodeling treatment after AMI. Chao et al. [15] observed the therapeutic effect of tanshinone IIA (TSN) on left ventricular remodeling after AMI, and they found that TSN had significant inhibitory effects on remodeling compared with the control group. The results showed that TSN could significantly reduce the levels of LEDVI and LESVI and increase the levels of LVEF and E/A 2–6 weeks after treatment, thus inhibiting the post-AMI enlargement of left ventricular internal diameter at the end of diastasis and left ventricular remodeling. The results demonstrated that TSN had a marked effect on the disease. It was revealed that the main pharmacologic actions of TSN on the cardiovascular system included anticoagulation and antiplatelet aggregation, improving coronary artery collateral circulation, reducing infarcted cardiac muscle area, reducing left ventricular end-diastolic pressure, reducing myocardial consumption of oxygen, and increasing left ventricular work.

### 1.1.3 Old Myocardial Infarction and Premature Ventricular Beats

Cheng et al. [16] reported the application of San Shen Decoction (三参汤) in the treatment of 50
patients with old myocardial infarction (OMI) and premature ventricular contractions (VPC). 3–7 days later after taking antiarrhythmia drugs, the patients began to take San Shen Decoction which contains 20 g of Danshen, 20 g of light-yellow sophora root (苦参), 20 g of pilose asiathebell root (党参), 6 pieces of common jujube (大枣), one dose taken twice a day (morning and evening), continuing for 20–30 days. The dilatation drugs and cardiac diuretic were not discontinued while taking San Shen Decoction. The results showed that the total effective rate was 78 %. There were three patients who suffered from accidental nausea and vomiting, but no significant side effects were observed in the other patients. Danshen has the function of dilating vessels, enhancing the cardiac muscle’s resistance to hypoxia, and improving heart function; combining the three drugs for the treatment of OMI accompanied by VPC is an effective method.

1.1.4 Congestive Heart Failure

Danshen has the function of dilating the coronary artery, enhancing resistance of the cardiac muscle to hypoxia, dilating peripheral vessels, and improving microcirculation. It especially has the function of improving cardiac contractility in the situation of can’t affecting oxygen consumption when the patient is suffering from cardiac insufficiency, reducing the heart rate, significantly improving heart function, accelerating blood flow, and opening more capillary beds. These improvements are very important for patients with chronic congestive heart failure. In the treatment of chronic congestive heart failure, the dosage of CDI is usually 40 ml or more; the therapeutic effect will be lessened if the dosage used is less than 40 ml. The drug has poor efficacy on edema, which might have something to do with the amount of activity, salt intake, age, and other complications.

Huang and Chen [17] reported the application of True Warrior Decoction combined with Danshen Beverage in the treatment of 60 patients with deficiency in heart-yang and kidney-yang types of heart failure; the prescription includes 6–10 g of red ginseng, 6–15 g of prepared common monkshood daughter root (熟附子), 10–12 g large head atractylodes rhizome (白术), 10–30 g of indian bued (茯苓), 30 g of Danshen, 10 g of villous amomum fruit (砂仁), 10 g of sandalwood (檀香), 10–20 g of oriental waterplantain tuber (泽泻), and 10–30 g of asiatic plantain seed (车前子) (decocting in wrapped condition), with 20 days for one course of treatment. After the treatment, 30 cases were clinically cured, 11 cases showed a marked effect, 14 cases showed an effect, and 5 cases showed no effect; the effective rate was 91.67 %.

Liu [18] observed the effect of CDI combined with Shenmai Injection on the treatment of 25 patients with chronic congestive heart failure, of which there were 18 males and 7 females; 12 cases of pulmonary heart disease, 5 cases of coronary heart disease, 5 cases of hypertensive cardiopathy, 1 case of rheumatic heart disease, 1 case of coronary heart disease, 1 case of lung cancer; 7 cases of Class II cardiac function, 15 cases Class III, 3 cases Class IV; 7 cases of left congestive heart failure, 5 cases of right congestive heart failure, and 13 cases of whole congestive heart failure. 100 ml of 10 % glucose was mixed with 30 ml of Shenmai injection and administered by intravenous drip; 100 ml of 10 % glucose was mixed with 12 ml of CDI and administered by intravenous drip. The drugs were given once daily for 7–10 days as one course of treatment. The patients were usually treated for 1–4 courses, with an average period of 2.5 courses and an interval of 2–3 days between the courses. After various symptoms and physical signs were improved, the patients took Compound Danshen Tablet and Shengmai Beverage orally to consolidate the therapeutic effect. The results showed that there were 10 patients with marked effect, 12 patients with effect, 3 patients with no effect, and the total effective rate was 88 %.

Hong et al. [19] reported that 64 patients with congestive heart failure were randomly divided into two groups; 30 cases were treated with conventional therapy, and 34 cases were treated with conventional therapy plus Mongolian
Milkvetch Root (黄芪) and CDI by intravenous drip. The changes of clinical therapeutic effect, heart function, and LPO and SOD in the two groups were observed. The results showed the total effective rate in TCM group was 94.12 %, which was higher than that in the conventional group (76.67 %) \((P < 0.05)\). The heart functions of the two groups were improved after the treatments \((P < 0.05)\). The therapeutic effect in the TCM group was significantly better than that in the conventional group \((P < 0.05)\). The LPO levels in the two groups were reduced after the treatments, SOD levels were increased \((P < 0.05)\), LPO in the TCM group was reduced, and SOD was significantly increased compared to the conventional group. The authors concluded that the treatment of congestive heart failure with Mongolian Milkvetch Root and CDI has the effects of strengthening the heart, relieving cardiac load, and improving blood circulation. The combination of the two drugs has the effects of benefiting vital energy and activating blood circulation, and promoting diuresis, which is consistent with TCM principles of treating heart failure.

1.1.5 Restenosis Post Percutaneous Transluminal Coronary Angioplasty (PTCA)

With thorough understanding of the etiological factors of coronary heart disease and the increasing maturation, improvement, and advancement of cardiac catheterization, percutaneous transluminal coronary angioplasty (PTCA) is becoming an important method for physicians to treat coronary heart disease with. However, clinical studies have shown that about one-third of patients with a successful PTCA operation suffer from coronary artery restenosis within 6 months, which seriously affects the long-term therapeutic effects of PTCA. The occurrence of restenosis is a complex biological process involving various factors. So far, there are no marked effective drugs for the prevention and treatment of restenosis, therefore the research and development of such drugs which can effectively prevent coronary artery restenosis is of great significance. Danshen Injection can inhibit the propagation of rabbit aorta smooth muscle cells cultured in vitro, and also has the function of inhibiting in vivo hyperplasia after the operational removal of endothelium in rabbit artery, which suggests that the development of Danshen into an effective drug for restenosis is hopeful.

1.1.6 Dilated Cardiomyopathy

Xu [20] observed the application of CDI in the treatment of 22 patients with dilated cardiomyopathy. 500 ml of 10 % glucose solution or 500 ml of 0.9 % physiological saline were added into 40–80 ml of CDI and administered by intravenous drip, once daily for 15 days as one course of treatment. The dosage of CDI in the treatment of dilated cardiomyopathy was usually greater than 40 ml/time; a lesser amount will give a poor therapeutic effect. Glucose solution should be substituted by 0.9 % physiological saline for patients with diabetes. A small amount of patients after using CDI suffered from side effects such as active bowel sounds, loose stool, or increased number of dejection, etc., but the majority of patients suffered no adverse reactions.

Zhu et al. [21] observed the therapeutic effects of Mongolian Milkvetch Root injection combined with CDI on the treatment of 32 patients with dilated cardiomyopathy. The patients were divided into two groups; both groups were treated with conventional therapy (low salt diet, using cardiotonic and diuretic drugs and converting enzyme inhibitors, etc.), then the patients in the control group were administered by intravenous drip with 40 mg of ATP, 200 units of coenzyme A, 2 g of vitamin C, 0.2 g of vitamin B6, and 20 ml of trommcardin, in 250 ml of 5 % glucose, once daily for 7 days as one course of treatment, and the patients were treated for 2–3 courses. 30 ml of Mongolian Milkvetch Root Injection (10 ml injections contains 20 g of Mongolian Milkvetch Root) and 20 ml of CDI were mixed with 250 ml of 5 % glucose injection and administered by intravenous drip to the patients in...
the treatment group, once daily for 7 days as one course of treatment, and the patients were treated for 2–3 courses. The results showed that 19 cases in the treatment group showed marked effect, 10 cases effect, 3 cases no effect (3 cases died), and the total effective rate was 90.6% in the control group, 10 cases showed marked effect, 8 cases effect, 12 cases no effect, 7 cases died, and the total effective rate was 60%. The differences in effective rates and fatality rates between the two groups were statistically significant \((P < 0.05)\). It was concluded that CDI has the function of activating blood circulation and dissipating blood stasis, regulating vital energy and inducing resuscitation, inhibiting platelet aggregation, dilating the coronary artery, increasing blood flow, reducing heart rate, and promoting the repair of damaged myocardial cells. In the combination of the two drugs, the 30 ml of Mongolian Milkvetch Root injection is the principal drug which has the major function of nourishing qi and the adjutant function of diuresis; the 20 ml of CDI is the adjutant drug which has the function of activating blood circulation. The combination of the two can complement each other. In this study, the total effective rate of the treatment group was 90.6%, and the difference was significant compared with the control group. No toxicity or side effects were observed and no tolerance was induced.

1.1.7 Idiopathic Sick Sinus Syndrome

Yan Wanying and He Jianping reported the application of a self-made decoction in the treatment of 35 patients with elderly sick sinus syndrome; the prescription included 15 g of pilose asiabell root (党参), 20 g of mongolian milkvetch root (黄芪), 10 g of Chinese angelica (当归), 10 g of red peony root (赤芍), 15 g of Danshen, 5 g of szechwan lovage rhizome (川芎), 10 g of rehmannia dride rhizome (生地), 10 g of spine date seed (酸枣仁), 5 g of cassia-barktree twig (桂枝), 15 g of common motherwort herb (益母草), 15 g of lobed kudzuvine root (炙甘草). Among the 35 patients treated, 8 cases showed marked effect, which was defined as the disappearance of clinical symptoms and an increase in heart rate by 5 beats/min in 1 month of treatment; 21 cases showed effect, which was defined as improvement of the clinical symptoms and an increase in heart rate by 1–5 beats/min in 2 months of treatment. 6 cases were classified as no effect, which means there were some improvements in clinical symptoms, but no changes in heart rate after 2 months of treatment. Fu [22] reported the application of salbutamol and Danshen in the treatment of 21 patients with idiopathic sick sinus syndrome. The patients were administered with 4.8 mg of salbutamol by intravenous drip, three times a day, and 30 ml of Danshen Injection, one time a day. A half month after treatment, the patients were administered orally with Compound Danshen Tablet, three times a day, three tablets each time, for 6 months as one course of treatment. The results showed that 6 months after salbutamol and Danshen treatment, all 21 patients showed some degree of alleviation of clinical symptoms. The sinoauricular node recovery time (SNRT) and sinoatrial conduction time (SACT) were significantly shortened in 18 patients; the maximal shortened SNRT was 1,200 ms, the minimal was 600 ms, and average was 1,000 ms; the maximal shortened SACT was 120 ms, the minimal was 80 ms, and average was 100 ms. There was no significant change in SNRT and SACT in three patients. There are many causes of sick sinus syndrome, but after examining the electrocardiograms, echocardiograms, sternum X-rays, blood fat, and blood sugar of the 21 patients, no definite etiological causes were confirmed and thus they were classified as having idiopathic sick sinus syndrome. Salbutamol is a β2 receptor stimulant which has the function of dilating vessels, improving sinoauricular node blood supply and enhancing pacing. Danshen preparation has the function of activating blood circulation, promoting qi, dilating vessels and increasing coronary artery blood supply, increasing sinoauricular node blood supply, and reducing blood viscosity, thus preventing fibrosclerosis of the sinoauricular node. The therapeutic effects were enhanced by
the combination of the two drugs, and satisfactory clinical therapeutic effects were obtained.

1.1.8 Protecting Effect on Myocardial Ischemia Reperfusion After Open Heart Surgery

Shi et al. [23] reported that 20 patients having intracardiac operations under direct vision were randomly divided into a treatment group and control group, with 10 patients each. The patients in the treatment group were administered with 200 mg/kg CDI by intravenous injection before operation and after heart resuscitation after rewarming, and the patients in the control group were administered with physiological saline. The results showed that CDI has the function of increasing the PGI2/TXA2 ratio in the reperfusion phase, effectively inhibiting the production of endothelin and promoting the recovery of cardiac function after ischemia-reperfusion.

Based upon the above reviewed data, we can see clearly that Danshen has significant therapeutic effects on the treatment of heart and circulation system diseases such as coronary heart disease, myocardial infarction, heart failure, cardiomyopathy, myocardial ischemia, sick sinus syndrome, and so on. The therapeutic effects are especially better when Danshen is combined with other traditional Chinese drugs.

1.2 Nervous System Disease

Besides the functions of antiplatelet aggregation, reducing thromboxane A2 and promoting prostacyclin production, Danshen also has the function of blocking Ca2+ channels, improving the tolerance of brain cells to ischemic and hypoxic conditions, reducing free radical content, stabilizing cell membranes, and improving microcirculation. Danshen has the function of increasing brain blood flow, and improving brain circulation. It is widely applied in the treatment of stroke (such as nervous system diseases, cerebral thrombosis, cerebral hemorrhage, subarachnoid hemorrhage (SAH), etc.) in TCM, and satisfactory therapeutic effects can be obtained.

1.2.1 Cerebral Hemorrhage

Li et al. [24] demonstrated that the function of Danshen was mild and comprehensive. Large doses of mannitol could induce pachyemia, aggravate the high viscosity and hypercoagulability of the blood, and aggravate ischemic damage after cerebral hemorrhage. However, Danshen can reduce blood viscosity, inhibit platelet aggregation, and improve microcirculation, and has the function of regulating the fibrinolysis system and promoting fibrin degradation, has anti-free radical activity, and relieves ischemic damage after cerebral hemorrhage and promotes hematoma absorption. When combined with dehydrating agents, Danshen can relieve cerebral edema, promote the absorption of hematoma, promote the repair and regeneration of brain tissue, and alleviate sequelae. Patients with cerebral hemorrhage were treated with CDI, and the rates of recovery and significant improvement in the treatment group were significantly better than those in the control group, and no side effects were observed. Especially for patients with a small amount of hemorrhage, Danshen can improve neurologic impairment and enhance the recovery rate. It is believed that senile patients usually suffer from blood system abnormalities, and the majority of research has reported that fibrinolysis activity in the elderly is low, thus they can easily suffer from thromboembolic disease. However, special attention needs to be paid to the possibility of hyperfibrinolysis or rehaemorrhagia or hematoma enlargement, which can be induced by various causes, in patients with cerebral hemorrhage.

Pang et al. [25] observed the therapeutic effect of Danshen Injection on the treatment of cerebral hemorrhage. 35 patients with cerebral hemorrhage were randomly divided into two groups; 20 patients in the treatment group, and 15 patients in the control group. The basic prescription in two groups was the same, namely, 125 ml of 20 % mannitol by intravenous drip, each for 8–12 h,
continued for 7–10 days. 3 days after the onset, the patients in the treatment group received 250 ml of Danshen Injection by intravenous drip, once a day for 2 weeks. CT examination was performed before and 2 and 3 weeks after treatment to measure hematoma volume. Nerve function was also evaluated for the patients in the two groups. There was no significant difference in hematoma volume between two groups before the treatment ($P > 0.05$), and hematomas in the treatment group were smaller than in the control group after treatment ($P < 0.05$). There was no significant difference between the two groups before treatment ($P > 0.05$), but it was significantly reduced after treatment in the treatment group compared to the control group ($P < 0.05$). The difference was especially obvious 2 months later ($P < 0.01$). These results demonstrate that Danshen Injection can promote hematoma absorption and nerve function recovery.

Pang et al. [26] investigated the preventive nerve protective effect of Dantonic™ on hypertensive patients. A large-sample epidemiological survey was conducted, and 561 patients with hypertension who met the diagnostic criteria were selected. The patients were divided into 2 groups. 286 cases in the treatment group were administered with Dantonic™ and nifedipine or captopril. 275 cases in the control group were administered with nifedipine or captopril alone. They were followed up for 24 months, and the changes in blood pressure, blood lipids, microcirculation, blood flow, thrombin, and other indices and the incidence of cerebral ischemic stroke were monitored. After treatment, there were significant differences in the clinical marked effective rate; effective rate and average pressure decrease between the two groups ($P < 0.05$). The improvements in blood lipids, microcirculation, blood flow, and thrombin etc. in the treatment group were significantly better than those in the control group ($P < 0.01$). The incidences of cerebral ischemic stroke in the treatment group and control group were 0.69 % (2/286) and 10.5 % (29/275), respectively, and the difference was significant ($P < 0.05$). The results demonstrated that Dantonic™ has a good prophylactic neuroprotective effect on patients with hypertension.

### 1.2.2 Cerebral Infarction

Zhang (1988) reported the application of a prescription with the function of unblocking the orifices, invigorating blood, and promoting urination in the treatment of 66 patients with apoplexy. The CT examination showed 19 patients with cerebral hemorrhage, 47 patients with cerebral infarction, and 19 patients with brain atrophy. The prescription included Danshen, szechwan lovage rhizome (川芎), red peony root (赤芍), peach seed (桃仁), safflower (红花), common motherwort herb (益母草), medicinal cyclathula officinalis root (川牛膝), indian buead (茯苓), forest musk (麝香) [or taiwan angelica root (白芷), synthetic borneol (冰片)], mongolian milkvetch root (黄芪), suberect spatholobus stem (鸡血藤), and earthworm (地龙). The above drugs were decocted and taken with water, one dose a day. After treatment, 23 patients almost completely recovered, 19 patients showed marked effect, 2 cases showed no effect, and the total effective rate was 96.9 %.

Qi [27] reported the application of Sanqi Panax notoginseng and CDI in the treatment of 132 patients with cerebral infarction. The patients were 45–73 years old and all hospitalized 6 h to 4 days after onset; among them there were 38 mild cases, 54 moderate cases, and 40 severe cases. The patients were divided into two groups, with 66 cases in each group. The patients in the treatment group were administered with Sanqi Panax notoginseng and CDI by intravenous drip, and the patients in the control group were administered with CDI by intravenous drip. The two groups were comparable in gender, age, number of cases, and clinical classification. The patients in both two groups were treated according to the conventional procedure for cerebral infarction: those without significant anticoagulation contraindication or ulcer or hemorrhagic diseases were administered with anticoagulation drugs, such as 50 mg heparin by
intravenous drip for 24–48 h; 100 mg antiplatelet aggregation drug aspirin, one time a day. 20 % mannitol and dexamethasone were administered according to individual situations to reduce intracranial pressure, relieve cerebral edema and clean free radicals, and maintain water and electrolyte equilibria. The patients in the treatment group received 6 ml of Sandi Panax notoginseng in 250 ml of 5 % glucose solution and 16 ml of CDI in 250 ml of 5 % glucose solution, both administered by intravenous drip once a day. The patients in the control group received 16 ml of CDI in 250 ml of 5 % glucose solution, with 10 days as one course of treatment, and the patients were treated for 3 courses. The interval between courses was 4 days. For cured patients, the treatment was stopped immediately, and these patients were treated for 17–29 days. The results showed that there were 28 patients with near complete recovery in the treatment group, 20 patients with significant improvement, 5 patients with improvement, 13 patients without improvement, and the total effective rate was 80.3 %. In the control group, there were 20 cases of recovery, 12 cases of significant improvement, 6 cases of improvement, 28 cases of no improvement, and the total effective rate was 57.6 %. The difference in effective rates of the two groups was significant (P < 0.01).

Huang et al. [28] observed the therapeutic effect of intravascular irradiation by a low energy He–Ne laser and Danshen treatment on acute cerebral infarction. In addition to traditional neurological treatment, 100 cases of cerebral infarction (research group) were treated with intravascular irradiation by a low energy He–Ne laser and Danshen, and there was a corresponding control group. The hemorheology and blood fat indexes were determined before and after the treatment. The results showed that the effective rate in the research group was 81.3 % compared to 62.4 % in the control group, and the difference between the two groups was significant (P < 0.05). The results demonstrate that intravascular irradiation by low energy He–Ne laser combined with intravenous drip of Danshen is a good method for the treatment of acute cerebral infarction.

Zhai et al. [29] observed therapeutic effect of high-dosage Danshen on the treatment of 45 patients with acute cerebral infarction; 30 ml of Danshen Injection was added into 500 ml of low molecular dextran and administered by intravenous drip to 22 patients in the treatment group, and mannitol and antibiotics etc. were administered according to pathogenetic conditions. Anticoagulation, thrombolysis, and dilating vessel drugs were not used in the treatment. The patients in the control group were administered with the same drugs as in the treatment group, except for CDI. The drugs were administered by intravenous drip once a day, for 2 weeks as one course of treatment. The results showed that there were 2 cases with a clinical cure, 8 cases with marked effect, 10 cases with improvement, 7 cases without effect, and the total effective rate was 91 % in treatment group. In the control group, there were 5 cases with marked effect, 11 cases with improvement, 7 cases without effect, and the total effective rate was 69.6 %. There was a significant difference in therapeutic effects between the two groups (P < 0.05). It was revealed that compound Danshen can significantly improve the majority of cerebral hemodynamic indexes, especially those of brain blood flow speed, vessel wall elastic wave speed, and critical pressure, which demonstrated that it had important functions in promoting cerebral blood flow, improving the elasticity of cerebral vessels, and reducing blood viscosity. Therefore, application of Danshen in the early stage can enhance the therapeutic effect and reduce disability rate.

1.2.3 Subarachnoid Hemorrhage

Sun [30] investigated the cerebral hemodynamic change of patients with SAH, and the protective effect of Danshen on brain ischemic damage. 68 patients with SAH were divided into two groups, with patients in both groups on absolute bed rest. The patients were administered conventional drugs with the function of reducing intracranial pressure and antifibrinolysis. 20 ml of CDI was added into 500 ml of 5 % glucose injection and administered by intravenous drip to the patients
in the Danshen treatment group once a day, and the maximal length of the treatment was 3 weeks. The cerebral hemodynamic changes and fatality rate in the two groups, ECG abnormal incidence, and cerebral vessel spasm incidence were observed. The results showed that the cerebral hemodynamic parameters of patients with SAH were significantly changed, especially the minimum blood flow speed and cerebral vessels peripheral resistance; the cerebral hemodynamic changes between the Danshen group and control group were very significant \((P < 0.01)\). It was revealed that SAH can induce cerebral hemodynamic abnormality, and Danshen preparation has a protective effect on brain ischemic change due to SAH.

With further pharmacology and clinical research on Danshen, an increasing number of clinical documents have demonstrated that there are satisfactory therapeutic effects of Danshen and its preparations on the treatment of cerebral vessel diseases, including cerebral hemorrhage and cerebral infarction. Numerous facts have demonstrated that Danshen can be actively used in the prevention and treatment of cerebral vessel diseases.

1.2.4 Trigeminal Neuralgia

Zhang [31] reported the application of integrated medicine to the treatment of trigeminal neuralgia. TCM preparations were anointed on the surface of the trigeminal neuralgia site. After locating the “trigger points” in the trigeminal neuralgia site, about 2 ml of 2 % lidocaine was injected at each point. 5 min later, 300 \(\mu g\) of vitamin B\(_{12}\) combined with 2 mg dexamethasone were injected in the same site, once every 7 days. During the blocking period, the patients took Compound Danshen Tablet orally, 2 tablets each time, 3 times a day, plus 0.2 g of spiramycin each time, 3 times a day. The results showed that 46 patients were cured by 3 times of blocking treatment, 30 patients were cured by 6 times of blocking treatment. The patients were followed up for 3–6 months, and there were no recurrences during the 6 months to 2 years period; the curative rate was 100 %. The results demonstrate that integrated medicine can be used to treat trigeminal neuralgia, which can rapidly control the onset of the pain. The method is simple and practical, and can be further extended.

Wu [32] reported the treatment of 28 trigeminal neuralgia cases with CDI and “Wu Bai Decoction” (五白汤). The patients were administered with 4 ml of CDI by intramuscular injection, twice a day. Traditional Chinese drug “Wu Bai Decoction” contains 50 g of White Peony Root (白芍), 10 g of Giant Typhonium Tuber (白附子), 10 g of Taiwan Angelica Root (白芷), 10 g of white Stiff Silkworm (白僵蚕), 20 g of Troubles territories (白蒺藜). The above drugs were decocted twice with water and administered one dose a day. The recovery rate was 64.28 \%, the total effective rate was 92.86 \%, and therapeutic effects were significantly better than those in the control group. It was revealed that compound Danshen by intramuscular injection has the function of dilating microcirculation and improving local blood supply; a high dosage of White Peony Root has the function of nourishing blood and retaining yin with astringent, nourishing liver, and relieving pain. There was no toxicity or side-effects in clinical application, and the courses of treatment were short.

1.2.5 Facial Neuritis

Gao et al. [33] reported the application of Dantonic™ in the treatment of 32 patients with middle-aged and elderly facial neuritis. The patients in the control group received treatment with hormones, vitamins, antiviral drugs, physical therapy, and anti-inflammatory drugs, etc., and the patients in the treatment group received the same treatment as the control group plus 10–15 pills of Dantonic™, 3 times a day for 10 days as one course of treatment, and 3 courses of treatment were performed. The results showed that the total effective rates in the treatment group and control group were 81.58 and 51.35 \%, respectively, and there was a significant difference in the total effective rate between the two
groups. The study demonstrated that Dantonic™ has the function of relieving vasospasm, improving local blood circulation around the facial nerves, and relieving inflammatory edema, thus it can be used to treat the disease.

1.2.6 Migraine

Zhang [34] reported the treatment for 20 cases of migraine. 12–16 ml of CDI was added into 5% glucose salt water, and administered by intravenous drip for 10 days as one course of treatment. Patients without improvement after the first course received another course of treatment after 2–4 days. The results showed that five cases significantly improved after one course, and 10 cases improved after the second course of treatment. It was believed that Danshen’s effects might be related to its function of stabilizing vasoconstriction and improving microcirculation.

Ge et al. [35] reported the treatment of serious migraine with Danshen, diclofenac sodium, and β-sodium aescinate. 51 cases of serious migraine were treated with 10 ml of Danshen, 0.1 g of diclofenac sodium, and 10 mg of β-sodium aescinate, and the effects were compared with those in 62 cases of serious migraine treated by diclofenac sodium alone. The results showed that the total effective rates of the combined drug treatment group and single diclofenac sodium group were 96 and 64%, respectively, and the differences in total effective rate and control rate between the two groups were significant ($P < 0.01$).

Wang [36] reported the treatment of migraine with Compound Danshen and 654-2 in 47 cases. 10 mg of 654-2 injection and CDI was added into 250 ml liquid and administered by intravenous drip to the patients in the treatment group once per day, and 7 days later they were orally administered with three tablets of Compound Danshen Tablet and 5 mg of 654-2 tablets, three times a day for 1 month as a course of treatment. The patients in the control group were administered orally with not more than six tablets of Ergotamine and Caffeine tablets each day, then 40 mg of nimodipine tablets twice a day after pain remission. The results showed that in the treatment group, 28 cases showed marked effect, 17 cases showed effect, 2 cases showed no effect, and the total effective rate was 95.7%. In the control group, 21 cases showed marked effect, 13 cases showed effect, 12 cases showed no effect, and the total effective rate was 73.9%, with a significant difference ($P < 0.05$). It was believed that the effect of Compound Danshen and 654-2 on migraine treatment was related to their functions of vessel dilation and vasospasm relief; the study demonstrated that there was both blood vessel constriction and vasospasm during the migraine attack phase, Compound Danshen and 654-2 has the function of regulating vasoconstriction to stabilize blood vessels, thus controlling the migraine attack. There was a synergistic effect when the two drugs were used together, and with gentle adverse reactions; a few patients suffered from dry mouth, pharyngalgia, and other symptoms which might be related to the side effects of 654-2.

1.2.7 Functional Insomnia

Zhou et al. [37] administered a mixture of 16 ml of Danshen Injection and 20 ml of cerebrolysin by intravenous drip to 35 elderly patients with functional insomnia. The results showed that the clinical recovery rate and effective rate were 65.7 and 94.3%, respectively, which were significantly better than those of the control group ($P < 0.01$). It was believed that Danshen has the functions of cleaning oxygen radicals and anti-lipid peroxidation, so it can delay the degeneration of brain cells and improve sleep.

Tong [38] reported on 86 patients with insomnia randomly divided into two groups; the patients were, respectively, treated with Danshen Zaoren Decoction (丹参枣仁汤) and diazepam tablets, and the therapeutic effects in the two groups were observed. The patients in the treatment group were treated with self-made Danshen Zaoren Decoction, which contains 15 g each of Danshen, raw dragon’s bones (生龙骨), raw common oyster shell (生牡蛎), tuber fleeceflower stem and leaf (夜交藤), silktree albizia
bark (合欢皮), and 10 g each of stir-baked semen Ziziphi spinosae (炒枣仁), and Chinese arbo- riviae seed (柏子仁). The patients in the control group were administered with 2.5 mg of diazepam tablets orally before sleep, once a day. The therapeutic effects were evaluated 15 days after the treatment. The results showed that the effective rate in the treatment group (96.3 %) was significantly higher than that in the control group (65.6 %), and the difference was significant ($P < 0.05$).

### 1.2.8 Meniere’s Disease

Li [39] reported the treatment of Meniere’s disease with a combination of CDI and Qingkailing Injection (清开灵注射液) for 35 cases. 16–20 ml of CDI was added to 250–500 ml of 10 % glucose injection and administered by intravenous drip, and 40–60 ml of Qingkailing Injection was added to physiological saline or 250–500 ml of 10 % glucose injection and administered by intravenous drip in the treatment group. For the control group, 20 mg of anisodamine injection was added to physiological saline or 250 ml of 10 % glucose injection and administered by intravenous drip, 500 ml of low molecular dextran was administered by intravenous drip, and 40 mg of ATP, 100 U of coenzyme A, 400 mg of inosine, 100 mg of Vitamin B6, and 3 g of Vitamin C were added to 500 ml of 10 % glucose injection and administered by intravenous drip. The symptoms of acid–base imbalance and electrolyte disturbances were treated at the same time. The therapeutic effects in the two groups were compared 5 days after the drug administrations. The results showed that the recovery rate (82.86 %) in the treatment group was significantly higher than that in the control group (59.38 %). It was revealed that CDI has the function of activating blood circulation and dissipating blood stasis, regulating vital energy, and inducing resuscitation. Qingkailing Injection has the function of clearing heat and resolving toxins, cooling the blood and dissipating blood stasis, calming the liver and extinguishing wind, awakening the brain and opening the orifices, and eliminating sputum and dredging collaterals. The treatment using the combination of the two drugs targets both the causes and symptoms of Meniere’s disease, so satisfactory therapeutic effects were obtained.

### 1.2.9 Polyneuritis

Liu et al. [40] reported that 4 ml of Danshen Injection and 10 mg of 654-2 injection were administered by intramuscular injection every 6 h; or 250 ml of 10 % glucose combined with 20 ml of Danshen and 25 ml of 10 % glucose combined with 40 mg of 654-2 injection were administered by intravenous drip each day. 3 days after administration, the dosage of 654-2 was gradually reduced to 30 mg, 20 mg or complete withdrawal, depending on the patients’ conditions and whether a toxic effect was induced by 654-2. The dosage of Danshen was not changed. 4 patients with polyneuritis were treated and all of them were cured. The course of treatment was 20–75 days.

### 1.2.10 Dizziness

Xiao [41] observed the therapeutic effect of CDI combined with Banxia Baizhu Tianma Decoction (半夏白术天麻汤) on acute dizziness. 83 patients with acute dizziness were randomly divided into a treatment group and control group. In the treatment group, 20 ml of CDI was added to 250 ml of 5 % GS and administered by intravenous drip for 3 days, once a day; modified Banxia Baizhu Tianma Decoction was administered for 3 days, one dose per day. In the control group, 0.4–0.6 g of venoruton injection was added into 250 ml of 5 % GS and administered by intravenous drip for 3 days, once a day. In the control group, 0.4–0.6 g of venoruton injection was added into 250 ml of 5 % GS and administered by intravenous drip for 3 days, once a day. The results showed that among the 43 cases in the treatment group, 35 cases were cured, 6 cases showed effect, and only 2 cases showed no effect; the total effective rate was 95.47 %. In the control group, 15 cases were cured, 12 cases showed effect, 13 cases showed no effect, and the total effective rate was 67.5 %. There was a
significant difference between the treatment group and control group \( (P < 0.01) \).

### 1.2.11 Pulmonary Encephalopathy

Liu et al. (1996) reported that 63 cases of pulmonary encephalopathy were randomly divided into a treatment group (30 cases) and control group (33 cases). The patients in the two groups were treated with the conventional therapy. 16 ml of CDI was added to 500 ml of 10 % glucose solution and administered by intravenous drip to the patients in the treatment group, and 4 ml of Niuhuang Xingnao Injection (牛黄醒脑注射液) I and II were administered by intramuscular injection, 2–3 times a day. The results showed that in the treatment group, the remission rate was 80 % and mortality was 20 %, and in the control group, the remission rate was 48.5 % and mortality was 51.5 %. The difference in fatality rate between the two groups was significant \( (0.01 < P < 0.025) \). It is believed that Danshen has the functions of reducing blood vessel fragility and permeability, relieving the stagnation and aggregation of erythrocytes, reducing blood hypercoagulability, improving microcirculation in important organs such as the brain, heart, lung, and kidney, regulating tissue repair and regeneration, enhancing the body’s compensatory ability, and promoting blood circulation. Niuhuang Xingnao Injection was developed from the prescription of Angong Niuhuang Wan, which has the function of clearing heat and resolving toxins, and calming the nerves and relieving spasms. It promotes consciousness recovery, and has significant anti-inflammatory effects. It can improve the body’s tolerance to hypoxia. Some therapeutic effects have been obtained by the combination of the two drugs in the treatment of pulmonary encephalopathy.

### 1.2.12 Craniocerebral Injury

Lin [42] investigated the effect of compound Danshen preparations on the treatment of craniocerebral injury. 270 patients with craniocerebral injury confirmed by head CT were selected in the study and randomly divided into two groups. The patients in the treatment group were administered with compound Danshen preparations in addition to conventional therapy. The total effective rates in the treatment group and control group were 91.1 and 71.1 %, respectively. The results showed that better therapeutic effect was obtained in the treatment of craniocerebral injury by application of compound Danshen preparations, and no significant side effects were observed. Danshen has extensive applications to the treatment of nervous system diseases. Besides on the pathological changes of cerebral vessels, it also has satisfactory therapeutic effects on trigeminal neuritis, facial neuritis, migraine, insomnia, dizziness, etc., so it is worthy of physicians’ consideration when they face these diseases.

### 1.3 Respiratory System Disease

#### 1.3.1 Chronic Bronchitis

Li and Yi [43] reported the treatment of 78 elderly patients with lower respiratory tract infections. Among the patients, there were 23 with pneumonia, 32 with chronic bronchitis acute attack, 13 with bronchiectasis accompanied by infections, and 10 with pulmonary infection caused by chronic diseases. The patients were randomly divided into two groups, 40 cases (26 male, 14 female) in the treatment group, and 38 cases (24 male, 14 female) in the control group. There was no significant difference \( (P > 0.05) \) in common condition (gender, ages, pathogenesis), levels of infection (body temperature, symptoms, physical signs, X-ray, blood routine assays, bacteriology examination, etc.), and baseline disease and so on between the two groups. The patients in the two groups were treated according to their disease conditions. Besides the above treatments, 20 ml of CDI was added into 500 ml of 5 % glucose and administered by intravenous drip for the patients in treatment group, once a day. All patients were treated for 14 days.
The results showed that in the treatment group, 15 cases recovered, 9 cases showed marked effect, 10 cases showed effect, 6 cases showed no effect, and the effective rate was 85.0% (34/40); in the control group, there were 8 cases of recovery, 5 cases of marked effect, 12 cases of effect, 13 cases with no effect, and the effective rate was 65.8% (25/38). The effective rate in the treatment group was significantly higher than that in the control group ($P < 0.05$). No toxicity or side-effects were observed. It was believed that CDI has the function of activating blood circulation and dissipating blood stasis, dilating vessel and restoring blood capillary relaxation ability, relieving blood vessel obstructions and blood stasis, relieving lung arteriola spasm, improving and promoting lung microcirculation, recovering pulmonary ventilation function, enhancing pulmonary oxygen function, promoting absorption of rales, and improving dyspnea conditions. In recent years, it has been demonstrated by research that Danshen has inhibitory effects on Gram-positive bacteria and some Gram-negative bacteria, enhancing the body’s immunity and thus enhancing the body’s ability to fight infection. In addition, CDI also has the function of changing the blood rheology, improving pulmonary hypertension, shortening the course of lower respiratory infection in senile patients, and reducing mortality.

Shi (2005) reported the treatment of 13 patients with persistent pneumonia who had been treated with various antibiotics, gamma globulins, plasma or fresh blood transfusions, physical therapy, and cortical hormones for more than 1 month, but had obtained no significant therapeutic effects. The patients in the study were administered by intravenous drip with 40–60 mg of tanshinol, twice a day. 5–9 days after the treatment, 7 patients were cured and 6 patients had improved. It was revealed that in the pathogenesis of pneumonia, viruses and anoxia act upon the lung tissues to produce vasoactive substances and thus induce lung arteriola spasm and microcirculatory disturbance. Compound Danshen has the function of vascular dilation and improving microcirculation, thus promoting the patients’ recovery from pneumonia.

### 1.3.2 Bronchial Asthma

Xu et al. (1987) used the ultrasonic atomizing inhalation of CDI to treat bronchial asthma. 4 ml of CDI was diluted with 15 ml of distilled water, and ultrasonic atomizing inhalation was performed once a day for 10 days as one course of treatment. Among the patients treated, there were 26 cases of acute bronchitis, 16 cases of chronic bronchitis, 29 cases of asthma, and the average number of treatments was 2–27 times. The results showed that 45 cases showed marked effect, 24 cases showed effect, and the total effective rate was 97.2%. The effect of the treatment on asthma patients began slowly, but the therapeutic effect was strengthened after the asthma was relieved. 5 cases were followed up, and the disease did not recur one year after treatment.

Li et al. [44] reported the application of CDI in the treatment of 23 cases of bronchial asthma during the attack phase. The patients in the control group were treated with regular treatments such as oxygen inhalation, spasmolysis, β2 agonists, glucocorticoids, antibiotics, and so on. The patients in the treatment group were treated in the same way as those in the control group, but received an additional 20 ml of CDI which was added into 500 ml of 5% glucose and administered by intravenous drip, once a day for 15 days as a course of treatment. The results showed that the total effective rates in the treatment group and control group were 95.7 and 80%, respectively. Statistical analysis showed that there was a significant difference in therapeutic effect between the two groups. The mechanism of CDI in the treatment of bronchial asthma might be: ① inhibiting the release of bioactive compounds, reducing the high reactivity of airway, improving lung ventilation; ② improving microcirculation, enhancing the body’s tolerance to anoxia; ③ dilating the coronary artery, increasing coronary blood flow, improving myocardial blood supply, enhancing cardiac contractility, and promoting remission of asthma; and ④ the obvious of antibacterial and anti-inflammatory functions have adjuvant therapeutic effects on lung infections.
### 1.3.3 Pulmonary Heart Disease

Zhang [45] reported that 87 patients with acute aggravating stage pulmonary heart disease were randomly divided into a treatment group (44 cases) and control group (43 cases). Comprehensive treatments (relieving cough and eliminating sputum, cardiotonics, anti-inflammation, low flow oxygen inhalation, etc.) were performed on the patients in the two groups, and 20 ml of CDI in 250 ml of 5% glucose was administered by intravenous drip to the patients in the treatment group, once a day for 2 weeks as one course of treatment. The results showed that in the treatment group there were 18 cases with marked effect, 21 cases with improvement, 5 cases without effect, and the total effective rate was 88.6%. In the control group, there were 12 cases with marked effect, 19 cases with improvement, 11 cases of no effect, 1 case of death, and the total effective rate was 72%. The effective rate in the treatment group was significantly higher than that in the control group ($P < 0.05$). Patients with chronic pulmonary heart disease have some changes in their hemorheology, which include three characteristics: “dense” (increased erythrocytes), “sticky” (increased whole blood viscosity), and “accumulation” (enhanced erythrocyte aggregation). Compound Danshen has the function of improving the blood rheology, reducing blood viscosity, inhibiting erythrocytes and platelet aggregation, promoting the activity of fibrinolysis system, dilating vessels, promoting blood flow, improving microcirculation, increasing heart renal blood supply and anti-infection, enhancing body immunologic function, and so on, so it has significant clinical therapeutic effects. To calculate the effect of Danshen on the pulmonary artery pressure (PAP) of patients with chronic lung disease, the cardiac output (CO), lung circulation resistance (RVR), and lung blood vessel compliance (PVC) were compared for some patients before and after treatment. The results showed that after injection of Danshen, the extents of PAP reduction in the high pressure group and normal pressure group were 0.35–1.07 and 0.18–0.91 kPa, respectively, and the differences before and after the treatment were significant. The results demonstrated that Danshen has the function of reducing PAP, and the reduction period was usually about 3–5 min with no cases taking longer than 10 min, suggesting that Danshen has circulation dynamic effects similar to those of dihydropyridines.

Zhang and Chen [46] reported the use of CDI to treat 30 patients with chronic pulmonary heart disease. The patients were administered by intravenous drip with 60 ml of CDI in 250 ml of 5% glucose, once a day for 10 days as one course of treatment, and four indexes (LPO, erythrocytes SOD, whole blood GSH-Px, and catalase activity) were observed. The results showed that Danshen could significantly reduce enhanced lipid peroxidation and correct the imbalance of antioxidant enzymes in patients with chronic pulmonary heart disease. The studies demonstrated that the drug has the function of cleaning and inhibiting free radicals, thus inhibiting the occurrence and development of pulmonary hypertension in patients with chronic obstructive pulmonary emphysema.

It is believed in traditional Chinese medicine that the heart controls blood circulation and the lung controls respiration; the normal circulation of blood depends on the pushing power of qi, and the movement of qi depends on the normal circulation of blood. For this reason, Danshen and its preparations, which are good drugs for activating blood circulation and dissipating blood stasis, can exert satisfactory therapeutic effects on pulmonary system diseases, which has been shown in the above examples.

### 1.4 Diseases of the Digestive System

Experimental research has already demonstrated that Danshen can improve disturbances in liver microcirculation, has the functions of anti-lipid peroxidation, protecting hepatocytes, promoting the repair of liver damage, increasing fibrin levels in plasma, enhancing the phagocytic function of the reticuloendothelial system, inhibiting hepatic fibrosis, and promoting the resorption of
fiber. In addition, Danshen also has the function of promoting the secretion of mucus by the stomach mucous membrane, relieving intracellular calcium overload, increasing blood flow in mucous membranes, improving microcirculation, inducing the synthesis and release of endogenous prostaglandin, and inhibiting gastrointestinal motility. Therefore, it can be extensively used in the treatment of digestive system diseases such as chronic hepatitis B, hyper-bilirubinemia, cirrhosis, peptic ulcers, chronic gastritis, etc.

1.4.1 Virus Hepatitis

Viral hepatitis is a complex and high incidence disease, and there are no effective drugs available for its treatment. In recent years, it has been found by pharmacological research and validated by clinical practice that Danshen has the function of improving liver as well as systemic blood circulation, promoting the regeneration of liver cells, preventing and curing hepatic fibrosis, detoxication, regulating immunity, recovering liver function, etc.

Lu et al. [47] reported the treatment of 109 patients with HAV IgM positive and hyper-bilirubinemia. After one course of treatment, the degrees of bilirubin reduction were compared. The results showed that Danshen Injection’s effective rate of jaundice elimination was 100 %, which was better than those of Yinzhihuang (茵栀黄) (85.7 %), aspartate potassium magnesium (70 %), and potenlin (60 %).

Zhao [48] reported that significant therapeutic effects were obtained by the application of Danshen Injection to the treatment of 117 patients with chronic hepatitis B. 30 ml of Danshen Injection (2 ml of injection was equivalent to 3 g of raw Danshen) was added to 500 ml of 10 % glucose injection in the treatment group, and the drug was administered by intravenous drip once a day. A traditional Chinese drug decoction (no Danshen) was used in the control group. The results showed that the total effective rates in the treatment group and control group were 88.9 and 59.2 % ($P < 0.01$), respectively. There were 81 cases (69.2 %) in the treatment group with marked effect, 23 cases (19.7 %) with effect, 13 cases (11.1 %) without effect, and the total effective rate was 88.9 %. Danshen Injection can improve blood circulation in the liver and has the function of relieving ischemia anoxia and stagnant blood in the liver and relieving toxic injury from oxygen radicals; therefore, it has significant therapeutic effects on chronic hepatitis B.

Sun [49] clinically observed the protection effect of Danshen on hepatocyte ischemia in 7 patients with hepato-vascular disease and liver cancer. The porta hepatis was blocked by operation and Danshen Injection by preoperative and intraoperative intravenous drip was administered, and the protecting function of Danshen on ischemia in hepatocytes was observed. 20 ml of CDI was added to 500 ml of 5 % glucose and administered by intravenous drip to the patients within 5 days before the operation in the treatment group, and 20 ml of CDI was added to 200 ml of 5 % glucose and administered by intravenous drip before blocking the porta hepatis. During the partial hepatectomy, blood was collected from the hepatic vein before blocking the porta hepatis for 15 min and recovering blood flow for 30 min; at the same time, the residual hepatic tissue was observed under a light microscope and electron microscope. The results showed that the content of oxygen radicals in the hepatic tissue and hepatic vein during the ischemia and reperfusion phase in the treatment group was significantly reduced, and pathological changes were significantly relieved.

Zhang and Sun [50] observed the therapeutic effects of tiopronin combined with CDI on the treatment of 125 patients with chronic hepatitis B. The patients were divided into two groups; 70 in the treatment group were orally administered with 200 mg of tiopronin 3 times a day, and 20 ml of CDI was added to 250 ml of 10 % glucose injection and administered by intravenous drip once a day. 55 cases in the control group were administered orally with 200 mg of tiopronin, 3 times a day. Patients in both groups received 2 g of vitamin C injection and 20 mg of vitamin K1 injection by intravenous drip once a day. The course of treatment was 3 months. The results showed that in the treatment group, there
were 54 cases (77.2 %) with marked effect, 12 cases (17.1 %) with effect, and 4 cases (5.7 %) without effect; the total effective rate was 94.3 %. In the control group, there were 30 cases with marked effect (54.5 %), 14 cases with effect (25.5 %), and 11 cases with no effect (20 %); the total effective rate was 80.0 %. The total effective rate in the treatment group was significantly higher than that in the control group ($P < 0.05$). It was believed that the combination of tiopronin and CDI has a synergistic effect on the treatment of chronic hepatitis B and can promote the recovery of liver function.

1.4.2 Cirrhosis

There are some important factors acting on the formation of cirrhosis, such as disturbance of liver microcirculation, overactivation of lipid peroxidation, deposition of collagen fibers, and specific binding of plasma fibronectin (PFN) and the corresponding PFN decrease and phagocytic function weakening in the reticuloendothelial system. Danshen has the function of improving liver microcirculation, enhancing PFN levels, and enhancing the phagocytic function of the reticuloendothelial system. In addition, Danshen has the function of inhibiting the growth and propagation of fibroblasts, promoting reabsorption of the formed fibrous tissue of the liver, and delaying and blocking the process from chronic hepatitis to cirrhosis. Danshen has the function of promoting degradation of the formed collagen fiber and enhancing reabsorption of the fibrous tissue of the liver. Experimental research has shown that salvianolic acid is an important component of Danshen with the function of inhibiting hepatic fibrosis, and its strength is equivalent to that of raw Danshen and colchicine.

Li et al. [51] reported changes in the hemodynamics of the portal vein of patients with cirrhosis 10–12 weeks after orally taking Danshen Decoction. The hemodynamics were monitored by Doppler ultrasound, and it was revealed that both the internal diameter and blood flow of the portal vein and the internal diameter and blood flow of the splenic vein in the patients were significantly reduced, and there were improvements on acalexia, anorexia, and abdominal distension, as well as on liver function. There were no side effects. The study demonstrated that Danshen is a safe and effective drug for the treatment of portal hypertension. In addition, Danshen has the function of preventing hepatic fibrosis, reducing blood viscosity, inhibiting TXA production, etc., and can reduce resistance from the portal vein.

Zhou [52] observed the therapeutic effect of Danshen Injection on cirrhosis in 60 cases. 122 cases with cirrhosis were randomly divided into two groups. 0.5 g/kg Danshen Injection was added to 250 ml of 10 % GS and administered by intravenous drip to 60 patients in the treatment group, and common hepato-protection treatment was performed for the 62 patients in the control group. The course of treatment was 1 month, and the patients were treated for a total of three courses. The changes in five indices of liver function and hepatic fibrosis were observed. The results showed that the liver function of the patients in the treatment group was significantly improved at the end of treatment, five indices of hepatic fibrosis were significantly reduced, and there was a significant difference between two groups ($P < 0.05$). It was revealed that Danshen Injection has the function of inhibiting liver damage and hepatic fibrosis in patients with cirrhosis.

Wang [53, 54] combined diammonium glycyrhrizinate with Danshen Injection to treat hepatic fibrosis. 160 cases of patients with chronic viral hepatitis were randomly divided into three groups: 80 cases in the treatment group (Diammonium Glycyrrhizinate + Danshen); 40 cases in control group 1 (Diammonium Glycyrrhizinate); 40 cases in control group 2 (Danshen), and hepatic fibrosis indices were detected at the end of the treatment. The results showed that the symptoms and physical signs of the patients from the three groups improved to different extents after treatment, liver function improved as time elapsed, hepatic fibrosis indices were significantly reduced in the treatment group after treatment ($P < 0.05$), and hepatic fibrosis indices in the control group were also reduced.
after treatment, but the extent of reduction was less than that in the treatment group. It was revealed that Diammonium Glycyrrhizinate combined with Danshen Injection can improve the symptoms and physical signs of chronic viral hepatitis, recover liver function, significantly reduce hepatic fibrosis indices, and has good anti-hepatic fibrosis function. It was demonstrated that there was an additive effect in the combination.

Ma et al. (2003) observed the therapeutic effect of compound Danshen combined with Mongolian Milkvetch Root (黄芪) and aspartate potassium magnesium on the treatment of old cirrhosis ascites. The patients were allowed to rest, on a low-salt diet, and treated for hepatoprotection and diuresis. However, after 2 weeks’ treatment, no effects were observed and ascites volume was not significantly changed. 16 ml of CDI, 40 ml of Mongolian Milkvetch Root injection, and 20 ml of Aspartate Potassium Magnesium injection were added to 250 ml of 5 % glucose and administered by intravenous drip to the patients in the treatment group once a day. 16 ml of CDI was added to 250 ml of 5 % glucose and administered by intravenous drip to the patients in the control group once a day. The ascites volume was determined by B-ultrasound each week. The liver function and magnesium and potassium ion levels were determined before and after treatment, with 15 days as one course of treatment, and the patients were treated for two courses. There was a significant difference in liver function, magnesium ion, and potassium ion levels between the two groups, and before and after treatment (\( P < 0.05 \)). The total effective rates of the treatment group and control group were 90.62 and 66.66 %, respectively, and the difference was statistically significant (\( \chi^2 = 6.215, P < 0.05 \)).

Ye [55] observed the effect of compound Danshen on the 5-year mortality of decompensated liver cirrhosis. Based on comprehensive treatment, 46 cases in the treatment group were treated with a high dosage of CDI (or tablets) for a long term, and the changes in 5-year mortality and alimentary tract hemorrhage rate were observed. The results showed that the 5-year mortality in the treatment group was 45.7 % (20/46 cases), and in control group was 72.7 % (16/22 cases), and there was a significant difference between the two groups (\( P < 0.05 \)); the incidence of upper gastrointestinal hemorrhage within 5 years in the treatment group was 45.7 % (21/46 people), and in the control group was 81.8 % (18/22 people), and the difference between the two groups was significant (\( P < 0.05 \)). It was concluded that an early and continued high dosage of Compound Danshen preparations benefits the stabilization of the disease condition, reduces complication, and thus enhances the long-term survival rate.

### 1.4.3 Peptic Ulcer

It has been discovered that Danshen has a strong inhibitory function against *Helicobacter pylori*. The tanshinol in Danshen can rapidly eliminate necrotic tissue in ulcer sites and has the function of activating macrophages and promoting cell regeneration, thus promoting ulcer healing.

Liu and Yi [56] reported the application of CDI in the treatment of 30 patients with peptic ulcer disease, and the effects were compared with those in 30 patients in the ranitidine treatment group. 20 ml of CDI was added to 250 ml of 5 % glucose and administered by intravenous drip to the patients in the treatment group once a day; 0.3 g of ranitidine was administered orally twice to the patients in the control group. The two groups were treated for 8 weeks, and then the therapeutic effects were recorded. The results showed that in the treatment group, there were 24 recovery cases, 5 effective cases, and 1 case without effect; the recovery rate was 80.0 %. In the control group, there were 26 recovery cases, 3 effective cases, and 1 case without effect; the recovery rate was 86.7 %. There was no significant difference in recovery rate between the two groups (\( P > 0.05 \)). peptic ulcers usually belong to the category of chronic disease, and according to TCM theory, chronic illness is usually associated with stasis, and prolonged disease and pathogens usually intrude into the collaterals. Danshen has the function of activating blood
circulation and dissipating blood stasis. It is believed in modern medical research that Dan-
shen has an inhibitory function against *Helico-
bacter pylori*, and that tanshinol in Danshen can
effectively clean necrotic tissue in ulcer sites,
activate macrophage function, and promote cell
regeneration, thus promoting healing. There was
no significant difference in the therapeutic effects
of Compound Danshen and ranitidine for the
treatment of peptic ulcers. However, Compound
Danshen had scanty side effects and was wel-
comed by the patients.

Liu et al. [57] observed the treatment of peptic
ulcers with Danshen and ranitidine; ① The
treatment group: Danshen and ranitidine were
administered at the same time. 60 g of raw
Danshen each day was soaked in 200 ml of water
for 15 min, then 600 ml of water was added and
decocted by slow fire for three times. The physic
liquor was concentrated to 100 ml and taken
orally in two times. 150 mg of ranitidine was
administered in two times a day. ② The control
group: 150 mg of ranitidine was administered in
two times in a day. The course of treatment for
the two groups was 6 weeks. The therapeutic
effects were evaluated by endoscopy. The results
showed that after 6 weeks of treatment, the peptic
ulcer recovery rates of the control group and
treatment group were 69 and 93.9 %, respec-
tively, and there was a significant difference
\((P < 0.05)\). The LPO and ET plasma contents in
the control group were 0.111 ± 0.006 µg/ml and
70.2 ± 7.9 pg/ml, respectively, which were lower
than 0.15 ± 0.12 µg/ml and 86.3 ± 13.5 pg/ml
before treatment \((P < 0.05)\). In the treatment
group, the numbers were 0.08 ± 0.006 µg/ml and
52.9 ± 7.52 pg/ml, respectively, which were
significantly lower than 0.16 ± 0.11 µg/ml,
85.9 ± 12.2 pg/ml before treatment \((P < 0.001)\).
The results demonstrated that Danshen’s me-
chanism of action in the treatment of peptic ulcers
might include ① cleaning oxygen radicals and
inhibiting lipid peroxidation, which could protect
the mucous membrane of the stomach and du-
denum from injury, thus promoting ulcer healing.
② reducing blood plasma ET levels, improving
microcirculation, and increasing blood flow in
the mucous membranes of the stomach and
duodenum. It has been demonstrated in recent
years that ET can be produced by the intestinal
mucosa epithelial cells of the stomach, and the
mechanism through which ET causes ulcers is
related to its ability to cause vasoconstriction in
the stomach and duodenum, which leads to
mucous membrane ischemia, anoxia and acido-
sis. On the other hand, ischemia, anoxia and
endothelium cell damage can stimulate the
release of ET, creating a vicious cycle. Danshen
can be used as an ET antagonist, and it has the
function of reducing ET content in the blood
plasma and improving the blood supply of the
gastroduodenal hemorrhagemic mucous membrane,
thus preventing ulcer formation.

1.4.4 Chronic Gastritis

In TCM, chronic gastritis belongs to the category
of blood stasis. Research has shown that there is
a close relationship between blood stasis and
microcirculatory disturbance. Danshen is one of
the traditional drugs with the function of acti-
vating blood circulation and dissipating blood
stasis; it can improve microcirculation, eliminate
metabolism disturbances of the stomach mucous
membrane, and antagonize inflammation, thus
promoting the regeneration of tissue, softening
the proliferative pathological changes, and
enhancing absorption function.

Li [58] reported the application of modified
Danshen Beverage in the treatment of 50 patients
with chronic gastritis. The patients in the treat-
ment group were treated with modified Danshen
Beverages according to their symptoms. The
basic prescription contains 30 g of Danshen, 5 g
of sandalwood (檀香), and 5 g of villous amon-
um fruit (砂仁). The patients in the control
group were orally administered 20 mg of ome-
prazole twice a day, 0.5 g of amoxicillin three
times a day, and 0.4 g of metronidazole three
times a day. The above three drugs were
administered together for 2 weeks, and then
omeprazole was administered for another
2 weeks. During the treatment period, the
patients should correct their poor eating habits,
have a regular diet, avoid eating various
stimulatory foods or drugs, and avoid smoking and drinking alcohol or strong tea. There was a significant difference \( (P < 0.05) \) between the two groups in therapeutic effects; the effective rate of the treatment group was 94 %, which was significantly higher than the 77 % of the control group.

### 1.4.5 Severe Pancreatitis

The research in recent years has shown that hemorheology abnormality is one of the important etiological factors of severe pancreatitis. It is the main cause of blood circulation disturbance in the pancreas. Compound Danshen has the function of inhibiting platelet adhesion, aggregation and release, and it can significantly reduce erythrocyte aggregation, improve the blood rheology, regulate blood viscosity, improve microcirculation, enhance the tolerance of pancreatic tissue to anoxia, reduce the production of oxygen radicals, and relieve pathological changes in pancreatic tissue. In addition, tanshinol in Danshen has the function of rapidly cleaning necrotic tissue in the pancreas, promoting the regeneration of pancreatic cells, dilating pancreatic blood vessels, and promoting recovery from pancreatitis.

Xie \([59]\) reported the treatment of 28 severe pancreatitis cases with CDI. 12 ml of CDI was diluted with 500 ml of glucose solution and administered by intravenous drip once a day, for 7–14 days as one course of treatment. The patients were treated after operation, and 13 cases in the control group were treated with normal western medicine. The results showed that the fatality rate in the treatment group was only 3.6 %, while the fatality rate in the control group was higher (30.8 %), and the difference was significant \( (P < 0.05) \). The hematocrit levels in the treatment group were reduced from 46 ± 5.2 % before operation to 33.2 % ± 3.9 % after operation, and the difference was significant \( (P < 0.05) \). It was concluded that hematocrit can be reduced to the normal lower limit by CDI after severe pancreatitis surgery, reducing blood viscosity, improving circulatory disorders of the body organs, promoting pancreatic tissue recovery, and contributing to the correction of serious complications such as adult respiratory distress syndrome (ARDS), so that mortality in the treatment group was significantly lower than in the control group.

### 1.4.6 Ulcerative Colitis

Zhang and Liu \([60]\) reported the treatment of 48 ulcerative colitis cases. 23 cases in the treatment group were treated with the general treatment plus Danshen injection. 20 ml of Danshen injection was added into glucose solution and administered by intravenous drip for 3 weeks, once a day. The results showed that no significant differences were found in the levels of platelet \( \alpha \) granule membrane protein (GMP-140), thromboxane 2 (TXB\(_2\)), 6-ketone-prostaglandin \( F_{1\alpha} \) (6-keto-PGF\(_{1\alpha}\)) and von Wilebrand factor related antigen (vWF:Ag) before and after the general treatment. In the Danshen treatment group, however, the levels of GMP-140, TXB\(_2\), and vWF:Ag were significantly reduced compared with those before the treatment \( (P < 0.01) \), and there was no significant changes in 6-ke-to-PGF\(_{1\alpha}\). It was believed that the combined treatment of active phase patients with Danshen injection and conventional methods could correct hypercoagulability, relieve inflammation responses, and improve disease conditions.

Blood stagnation is one of the most common types of syndromes in TCM. It exists in many systemic diseases, including diseases of the digestive system. Based on clinical practice and observation, different degrees of stagnation could be induced by the prolonged pathogenesis of both lung and stomach intestinal diseases. Therefore, the application of Danshen and its preparations in the treatment of chronic diseases of the digestive system has its theoretical and practical foundations.
1.5 Urinary System Diseases

1.5.1 Acute Nephritis

Wang and Wen [61] observed the effect of 654-2 and CDI by intravenous drip on the treatment of 68 patients with acute nephritis. The patients in the treatment group were treated with conventional therapy (mainly benzylpenicillin, low salt diet, symptom relief, etc.), and at the same time, 20 mg of 654-2 and 12–16 ml of CDI were, respectively, added into 250 ml of 10 % glucose and administered by intravenous drip, once a day, for 7–10 days as one course of treatment. If necessary, the drugs were discontinued for 3 days, then the second course of treatment was performed, and the treatment could be stopped if no effect was obtained. Urine-routine was measured before and after treatment. The patients in the control group were administered with the traditional treatment. The results showed that in the treatment group 27 cases were cured, and among them 21 cases had their symptoms of nephritis all disappear after one course of treatment (spirit and appetite were recovered, edema was dissipated, and urine protein turned negative) and 6 cases had their urine protein turn negative after 2 courses of treatment. Five cases showed improvement, and two cases showed no effect. The average time for edema to subside was 5.37 ± 1.26 days, the average time for blood pressure to return to normal was 3.84 ± 1.26 days, the average time for urine protein to turn negative was 14.57 ± 3.08 days, and the average time of hospitalization was 12.4 days. In the control group, 22 cases were cured, 7 cases improved, and 5 cases showed no effect. The average time for edema to subside was 9.08 ± 2.63 days, the average time for blood pressure to return to normal was 6.48 ± 2.62 days, the average time for urine protein to turn negative was 14.57 ± 3.08 days, and the average time of hospitalization was 14.3 days. CDI has the function of reducing platelet aggregation and adhesion, inhibiting platelet generation, inhibiting blood coagulation, promoting fibrinolysis, improving hemorheology, and so on. The combination of 654-2 with Danshen has the function of dilating the renal arteries, reducing blood viscosity, increasing renal blood flow, improving kidney microcirculation, increasing the flow rate of urine in renal tubules, and preventing and relieving the occlusion of cast and cast-off cells on the distal convoluted tubules, thus realizing the effects of diuresis, subsiding edema, and eliminating proteinuria in a short time. 3 months of follow-up was performed, with affirmative therapeutic effects.

1.5.2 Chronic Glomerulonephritis

Patients with chronic glomerulonephritis (CGN) usually suffer from a disequilibrium of thromboxane-prostacyclin (TXA-PGI), which can result in kidney vessel and mesangial constriction, reducing the filtration area of the renal glomerulus, promoting the adhesion and aggregation of platelets and leucocytes, and participating in thrombopoiesis, inflammation response, and nephridial tissue and cell damage; thus, it is one of the causes of the sustained development of chronic glomerular lesions and renal dysfunction. Experiments have demonstrated that Danshen has the function of improving microcirculation, increasing the content of cyclic adenosine monophosphate in blood capillaries, and increasing PGI synthetase. It also has the function of inhibiting TXA synthetase, which can improve the balance of TXA-PGI. With the improvement of TXA-PGI balance, renal blood flow and glomerular filtration rate increased and urine protein was reduced. In addition, Danshen can enhance fibrinolysis activity, thus promoting fibrinolysis, relieving fibrin deposition in the renal glomerulus, and relieving renal glomerulus damage.

Shen [62] reported the treatment of CGN with Danshen. 20 ml of CDI was added to 250 ml of 5 % glucose injection and administered by intravenous drip to 67 patients with CGN, once a day, for 12 days as one course of treatment. The results showed that there were 18 cases of complete remission (26.9 %), 15 cases of general remission (22.3 %), 4 cases of partial remission...
and 0 cases of no effect. The total effective rate was 100%.

### 1.5.3 Chronic Renal Failure

Patients with chronic renal failure (CRF) usually suffer from reduced plasma-albumin and increased fibrin. Fibrin is related to the increase in cholesterol. High levels of fibrinogen will increase blood viscosity, thus leading to blood hypercoagulability and fibrinolysis disturbance in patients with CRF. Danshen is a traditional drug with the function of activating blood circulation and removing blood stasis. It has functions of anticoagulation, thrombolysis, reducing blood lipids, etc., and improving CRF-induced disorders in renin and blood plasma volume and the chain reactions induced by the increase of renin, such as increased renal tubule resistance, deposition of erythrocytes, blood vessel occlusion, reduced renal blood flow, local disturbance of circulation, reduced oxygen supply and renin release, etc.

Jiang [63] reported the use of CDI for the intervention of peritoneal dialysis; 34 cases with acute or CRF were treated, and the drug was added together with anisodamine (654-2) into peritoneal dialysis solution for 30 cases in the control group. The results showed that the serum creatinine (SCr) of 18 cases in the treatment group was reduced by more than 50%, 12 cases by more than 30%, and 4 cases by more than 10%; 10 cases in control group reduced by more than 50%, 11 cases by more than 30%, and 9 cases by more than 10%. The blood urea nitrogen (BUN) of 20 cases in the treatment group was reduced by more than 50%, 9 cases by more than 30%, and 5 cases by more than 10%; 12 cases in control group reduced by more than 50%, 10 cases by more than 30%, and 8 cases by more than 10%. The total effective rate in the treatment group was 88.3%, and in the control group was 73.4%; the total effective rate in the treatment group was significantly better than that in the control group.

Zhang [31] reported the treatment of CRF with CDI combined with energy mixture. 41 patients with CRF were randomly divided into 2 groups; 21 cases in the treatment group were treated according to their symptoms and administered with CDI and energy mixture by intravenous drip. 20 cases in the control group were treated according to their symptoms and administered with glucose and insulin by intravenous drip. The therapeutic effects in the two groups were observed after one course of treatment. The results showed that the total effective rate in the treatment group was 85.71%, while the total effective rate in the control group was 35.00%, and the treatment group was significantly better than the control group ($P < 0.01$). BUN and SCr were reduced after CDI treatment, and there was a significant difference before and after the treatment ($P < 0.05$). There was no significant difference in BUN and SCr in the control group before and after the treatment ($P > 0.05$). It showed that CDI combined with energy mixture can protect residual renal function, delay the development of CRF, and there was a promising perspective.

### 1.5.4 Acute Renal Failure

Acute renal failure (ARF) belongs to the category of “difficulty in urination-defecation” and “disuria and urine retention” in traditional Chinese medicine. Its pathological feature is that the root is deficient and the branches are excessive, namely, the cause is kidney deficiency and blood stasis is the symptom, which may also include water-dampness and heat bind. Danshen has the function of activating blood circulation and removing blood stasis, cooling the blood and clearing heat. Rosewood heart wood (绛香) has the function of activating blood circulation and relieving pain. The combination of the two drugs has the function of breaking the constraint of qi and dispersing the stasis of blood, so as to recover renal function. Modern medical research has shown that tanshinone and tanshinol in Danshen can dilate small blood vessels, increase microcirculatory flow rate, increase capillary networks, etc., and that rosewood heart wood has anticoagulation function. When the drugs are combined with western medicine, the functions of CDI can be further enhanced.
of dilating kidney vessels, correcting hypercoagulability, improving microcirculation, increasing renal blood flow, enhancing glomerular filtration rate, and improving renal function can be obtained. In addition, microcirculation can be directly improved by intraperitoneally administered Danshen, thus increasing the peritoneal dialysis rate, and it also has antibacterial and anti-inflammatory effects and prevents the occurrence of peritonitis.

Huang et al. (1993) reported the effect of Danshen on the treatment of AFR. 110 patients with ARF were treated with 20 ml of CDI in 250 ml of 10% glucose by intravenous drip, once a day, for 14–21 days as one course of treatment. The results showed that all patients were cured, and that BUN was reduced by 8.3 mmol/L within 7 days and the diuresis stage began within 4–8 days (average of 7 days) of treatment.

Jiang [63] used CDI in peritoneal dialysis solutions to obtain a concentration of 6 ml. 34 cases were treated with a total effective rate of 88.3%, and the total effective rate in the 654-2 injection control group (concentration was 20 mg) was 73.4%. There was no significant difference \( (P > 0.05) \) between the two groups, but the effects in the treatment group were significantly better than those in the control group, and no patient was complicated by peritonitis in the treatment group during hospitalization.

### 1.5.5 Primary Nephrotic Syndrome

Patients with nephrotic syndrome (NS) usually experience hypercoagulability; the blood viscosity is increased, microcirculation is dysfunctional, and even vascular microthrombosis is complicated, which aggravates NS treatment. Modern pharmacological studies have shown that Danshen has the function of dilating peripheral arteries, improving local blood circulation, reducing inflammation effusion, promoting absorption, etc., thus localizing the nonspecific inflammation in nephridial tissue, which is conducive to renal tissue repair. Danshen also activates blood circulation, removes blood stasis, and acts as an anticoagulant. In addition, Danshen can cool the blood and eliminate carbuncles, relieve restlessness and calm the nerves. Thus, it can be used to alleviate the blood-heat and stasis induced by taking hormones, and to treat hormone-induced sore swelling and sore toxin, as well as sleeplessness.

Huang and Wu [64] reported that good effects on the treatment of nephrotic syndrome were obtained by using CDI and hormones. 16 ml of CDI was added to 500 ml of 10% glucose and administered by intravenous drip to 33 cases in the treatment group, once a day, and 10 mg of prednisone was administered orally, three times a day, for 20 days as one course of treatment. The 33 patients in the control group were administered prednisone only. The results showed that the remission rate in the treatment group was 94%, and in the control group was 54.8%, and the difference between the two groups was significant \( (P < 0.005) \). When people suffer from nephrotic syndrome, their blood capillary filter membrane in the renal glomerulus experiences immunoinflammatory reactions, their glomerular basement membrane proliferates, their blood is in a state of hypercoagulability, and their kidneys have different degrees of fibrosis. Compound Danshen has the function of reducing cholesterol, inhibiting fibroplasia, relieving fibrin deposition, improving hypercoagulability induced by renal insufficiency, and recovering renal function, thus it can effectively treat nephrotic syndrome.

Liu et al. [65] reported therapeutic effects of Compound Danshen and Mongolian Milkvetch Root (Huangqi, 黄芪) in the treatment of nephrotic syndrome. 42 patients with nephrotic syndrome were randomly divided into two groups, and patients in the control group were administered orally with prednisone and dipyridamole. The patients in the treatment group were administered orally with prednisone and by intravenous drip with dipyridamole plus 20 ml of CDI and 20 ml of Huangqi Injection, once a day, for 2 weeks as one course of treatment. Before and after treatment, plasma-albumin, urine protein, cholesterol, and triglyceride levels in each group were determined. The results showed that plasma-albumin levels in the two groups
increased after treatment compared to before treatment, and the levels in the treatment group were significantly higher than in the control group ($P < 0.01$). Urine protein, cholesterol, and triglycerides in the two groups were reduced after treatment, and the reductions in the treatment group were significantly larger than those in the control group ($P < 0.01$, $P < 0.05$). It was concluded that the therapeutic effects in the treatment of nephrotic syndrome can be increased when the conventional prednisone and dipyridamole treatments are combined with compound Danshen and mongolian milkvetch root.

### 1.5.6 Purpura Nephritis

Purpura nephritis, or Henoch-Schönlein nephritis (HSN), belongs to the category of bruising and urine hemorrhage in TCM, which is usually caused by the heat injury of blood collaterals. The main clinical manifestations include hemorrhage and stagnant blood symptoms. Danshen is bitter in taste and slightly cold in nature, and has the function of activating blood circulation, cooling blood, eliminating congestion, and stopping bleeding. Pharmacological studies have demonstrated that compound Danshen has the function of promoting microcirculation, regulating the metabolism and immunologic function, and increasing renal blood flow and filterability, thus increasing urinary production, eliminating edema, reducing blood pressure, eliminating hematuria and proteinuria, and promoting HSN recovery.

Meng et al. (1999) reported that CDI 0.5–1 ml/(kg·d) was added to 5 % glucose injection and administered by intravenous drip to 24 patients with HSN. The results showed that 18 cases were cured, 5 cases improved, 1 case showed no effect, and the total effective rate was 95.8 %.

Zhang et al. (1992) reported that a high dosage of CDI, 20–40 ml, was added to 500 ml of 5 % glucose solution and administered by intravenous drip to 21 patients with HSN, once a day. The results showed that 13 cases were cured, 5 cases improved, 3 cases showed no effect, and the total effective rate was 86 %.

### 1.5.7 Diabetic Nephropathy

Research has shown that Diabetic nephropathy (DN) is related to factors such as microangiopathy of the renal glomerulus, increased plasma viscosity, abnormal platelet function, abnormal coagulation and anticoagulant mechanisms, etc. In addition, patients with DN also suffer from SOD activity reduction, glomerular basement membrane thickening, and glomerulosclerosis, which are typical pathological changes of DN. Danshen has the function of activating blood circulation, removing blood stasis, improving microcirculation, inhibiting platelet aggregation, and reducing blood lipids and blood viscosity, etc. It can also increase SOD activity, eliminate oxygen radicals, relieve small vasospasms, and improve renal anoxia conditions, thus it could eventually reverse the pathological changes of the glomerular basement membrane, so as to cure DN and delay the process of renal dysfunction.

Yang [66] mixed 40 ml of CDI in 250 ml of physiological saline and administered by intravenous drip to 38 patients with DN, once a day, for 1 week as one course of treatment. 20 patients in the control group were administered with Western medicine only. The results showed that the total effective rate in the treatment group was 89.5 %, while in control group was 55 %, and the difference was significant ($P < 0.05$).

Li et al. [67] divided 66 patients with DN randomly into a treatment group (36 cases) and control group (30 cases). The patients in the treatment group were treated with normal therapy plus 20 ml of Danshen Injection, administered for 4 weeks by intravenous drip, once a day. The results showed that blood plasma endothelin (ET-1), type IV collagen (CIV), and 24-h urinary protein excretion rates in the treatment group were significantly reduced ($P < 0.05$). The results demonstrated that Danshen has some preventative and treatment effects on DN at the early stage, and the mechanism the drug’s
1.5.8 Lupus Nephritis

Zhang [68] showed that Danshen had inhibitory effects on renal desmocytes and inducing cell apoptosis by promoting the high level expression of C-myc protein. Taking high dosages of Danshen for a long period of time could have some therapeutic effects on interstitial fibrosis, thus preventing or reducing the production of lesions and delaying the occurrence of uremia, demonstrating that Danshen could promote the absorption of excessive connective tissue.

1.5.9 Chronic Allograft Nephropathy

Huang and Wu [64] reported the effect of Danshen on the treatment of chronic allograft nephropathy. Besides the routine anti-rejection therapy, 30 ml of Danshen was added to physiological saline and administered by intravenous drip to 20 patients with chronic allograft nephropathy for 4 weeks. The results showed that the improvement in renal function indexes in patients in the treatment group was better than that in the control group ($P < 0.05$), and Danshen has the function of reducing urine NAGase activity ($P < 0.01$). It was concluded that Danshen has protective effects against acute or chronic renal damage, and the mechanism is Danshen’s inhibition of the overproduction of nitric oxide and peroxide. Danshen has the function of preventing chronic rejection and thrombopoiesis induced by the ciclosporin damage to the renal tubule, thus improving transplanted kidney function.

1.5.10 Hypertensive Renal Damage

Zhang et al. [69] reported the treatment of hypertension accompanied by renal injury with CDI combined with benazepril hydrochloride in 30 cases, and the changes in urinary albumin were observed. Blood pressure was measured twice each day for all patients with hypertension over the 3 days before treatment, and the average of the six blood pressure values was used as the baseline blood pressure before treatment. Urinary albumin was measured within 24 h before drug administration. The patients in the control group were administered with 10 mg of benazepril once a day, and the patients in the treatment group were administered orally with 10 mg of benazepril once a day, and 30 ml of CDI in 250 ml of 5 % glucose injection was administered by intravenous drip once a day. Blood pressure was measured once each day for the patients in the two groups. Two weeks after treatment, if the blood pressure was not reduced to 140/90 mmHg or lower, benazepril would be increased to 20 mg, once a day, treated for 4 weeks. The average blood pressure over 3 days at the end of treatment was used as the blood pressure after treatment. Urinary albumin was measured within 24 h after treatment. Urinary albumin was examined by radiation immunity. The results showed that there was no statistical difference in blood pressure reduction between the two groups after treatment ($P > 0.05$). There was, however, a statistical difference in the reduction of urine protein between the two groups after treatment ($P < 0.05$). The results demonstrated that the effect of Danshen and benazepril treatment on urinary albumin was significantly better than that of benazepril alone, and significant therapeutic effects could be obtained by the combination of the two drugs. The method is convenient and the side effects are few, making it an effective method for the treatment of hypertensive renal injury.

1.5.11 Prostatic Hyperplasia

He et al. [70] reported the use of CDI in the treatment of 112 patients with benign Prostatic hyperplasia by local injection to the perineal prostate capsule, 4 ml each time, once every 2 days, for 10 injections as one course of treatment. The results showed that the International Prostate Symptom Score (IPSS) was reduced compared to
the conditions of patients before treatment ($P < 0.01$), the maximal urinary flow rate increased ($P < 0.01$), and the residual urine volume was significantly reduced ($P < 0.01$). Danshen activates blood circulation and dissipates blood stasis, promotes blood circulation and nourishes blood, promotes the excretion of prostatic fluid, shrinks the gland, and improves urination function.

1.5.12 Chronic Prostatitis

Huang (1993) reported the administration of Danshen and metronidazole mixture by prostate injection. One course of treatment later, symptom disappearance occurred in 20 cases, improvement in 8 cases, and the total effective rate was 93.3 %. Reexamination showed that in 13 cases, the swollen gland was significantly shrunken and tubercles were softened.

1.5.13 Impotency

Tian [71] reported the use of CDI to treat impotency. CDI was administered by injection to acupoint Qugu (RN 2) in 30 patients with impotency; the patients were 22–47 years old, the average age was 29.3, and the course of disease was 1–10 years. Before treatment, the patients were asked to empty their bladder, then normal skin disinfection was performed. 1.5–5 ml of CDI was injected at Qugu, once every 2 days, 7 times as one course of treatment, and sexual intercourse was prohibited during the treatment period. The results showed that 23 cases were cured, 2 cases showed effect, 2 cases showed marked effect, 3 cases showed no effect, and the total effective rate was 90.0 %.

Although the application of Danshen in the urinary system is not as popular as in the cardio-cerebrovascular and digestive systems, what is affirmed is that Danshen and its components have relatively good therapeutic effects on acute or chronic nephrosis due to the retention of stagnant blood, interior harmful retention of toxin and heat, such as acute nephritis, acute and CRF, nephrotic syndrome, DN, chronic prostatic hyperplasia, and so on.

1.6 Diabetes

Jiang [72] reported the treatment of 40 cases of type 2 diabetes mellitus (the majority were complicated with angioneuropathy) with CDI. The patients were randomly divided into the treatment group and control group, 20 cases each. The patients in both groups had reasonable dietary control, and one or more hypoglycemic agents were used for blood sugar control according to their conditions. Some patients were treated with vitamin B$_1$, B$_{12}$ and other treatments according to their symptoms. 10–16 ml of CDI in 250–500 ml of physiological saline was administered by intravenous drip to the patients in the treatment group, once a day for 2–3 weeks. The results showed that in the treatment group there were 7 cases showing marked effect, 11 cases showing improvement, 2 cases showing no effect, and the total effective rate was 90 %. In the control group, 3 cases showed marked effect, 9 cases showed improvement, 8 cases showed no effect, and the total effective rate was 60 %. The therapeutic effects in the treatment group were significantly higher than those in the control group ($P < 0.01$). The mechanism of the effects might be that the activity of SOD, which has the function of cleaning oxygen radicals, was reduced in patients with type 2 diabetes mellitus, and there was lipid peroxidation damage. CDI has the function of enhancing the tolerance of pancreatic tissue to anoxia, reducing the production of oxygen radicals, increasing SOD activity, and effectively relieving lipid peroxidation damage. Danshen also reduces blood sugar and protects pancreatic islet β cells in experimental diabetes. Therefore, CDI will have important clinical significance in the prevention and treatment of diabetic complications.

Lü [73] observed the therapeutic effects of Huangqi injection combined with Danshen Powder Injection on the treatment of type 2 DN at the early stage. 26 cases in the control group
received conventional hypoglycemic antihyper-
tensive therapy. The 28 patients in the treatment
group received conventional therapy plus 100 ml
of Huangqi Injection and 0.8 g of Danshen
Powder Injection in 250 ml of physiological
saline, administered by intravenous drip, once a
day, for 1 month as one course of treatment. The
changes in urinary albumin excretion (UAE)
within 24 h were observed. The results showed
that there was no significant change in UAE in
the control group before and after the treatment
\( (P > 0.05) \), but in the treatment group, the UAE
was significantly reduced after treatment com-
pared to before \( (P < 0.01) \). It was concluded that
Huangqi Injection combined with Danshen
Powder Injection has therapeutic effects on DN at
the early stage.

1.6.1 Diabetic Gastropathy

Chen [74] observed the therapeutic effect of CDI
combined with domperidone on Diabetic Gas-
tropathy. 112 inpatients and outpatients suffered
from type 2 diabetes mellitus, 58 male, 54
female; 34 cases were complicated with coronary
heart disease; fasting plasma glucose was
5.9–13.4 mmol/L; average fasting plasma glu-
cose was 7.6 ± 1.6 mmol/L. All patients received
the conventional diabetes treatment, and those
who had complications of peptic ulcers, stomach
and duodenum operation, and ketosis acidosis
were excluded. 25 cases in the control group had
no dyspepsia symptoms or peptic ulcer history,
and liver and kidney functions were normal. 53
cases with DG were divided into 3 groups based
on gastric emptying function and medication
condition. 15 cases in the domperidone group
were administered orally with 10 mg of dom-
peridone, three times a day; 15 cases in the
Danshen group were administered by intrave-
rous injection with 16 ml of CDI, once a day; 23
cases in the domperidone + Danshen group were
administered with domperidone and Danshen,
and the dosage and administration were the same
as the above therapies. The course of treatment
was 4 weeks, and fasting plasma glucose, liver
and kidney functions, and gastric emptying
function were reviewed within 3 days after
treatment. There were no significant differences
in gender, age, or disease condition and fasting
plasma glucose among the 3 groups. The results
showed that the gastric emptying half-times in
the diabetes group and control group were
67.1 ± 14.4 min and 48.3 ± 11.7 min, respec-
tively, and the difference between the two groups
was significant \( (P < 0.01) \). The gastric emptying
function of patients with Diabetic Gastropathy
was significantly improved, and that of the drug
combination group was the most significant.
There were different extents of improvement in
the pathological changes of the peripheral nerves
and cardiovascular system after treatment with
Danshen, but there was no significant difference
in fasting plasma glucose before and after

1.6.2 Diabetic Peripheral Neuropathy

Li et al. [75] observed the treatment of diabetic
peripheral neuropathy (DPN) with Danshen
combined with mecobalamin (Methycobal). 50
cases of DPN were randomly divided into two
groups. 30 cases in the treatment group received
16 ml of Danshen Injection in 500 ml of physi-
ological saline, administered by intravenous drip
each day, and 500 μg of methycobal, adminis-
tered by intramuscular injection, once a day for
4 weeks. 20 cases in the control group received
the conventional diabetes treatment. The results
showed that the marked effect rate and the total
effective rate in the treatment group were 56.67
and 90 %, respectively, which were significantly
higher than those in the control group, 18.18 \% 
\( (P < 0.05) \) and 44.45 \% \( (P < 0.01) \), respectively.
Therefore, it was concluded that better thera-
peutic effects were obtained by Danshen com-
bined with Methycobal in the treatment of DPN.

Gong [76] observed the therapeutic effect of
Yinxing (Ginkgo) Damo Injection combined
with Danshen Injection on the treatment of DPN.
95 patients with type 2 diabetes mellitus com-
plicated with DPN were randomly divided into
three groups according to the chronological order
of hospitalization. There were 31 patients in
group 1 administered with Yinxing Damo Injection combined with Danshen Injection, 32 patients in group 2 administered with Yinxing Damo Injection, and 32 patients in group 3 administered with Danshen Injection. The treatment period in the above three groups lasted for 2 weeks. All three treatments showed some degree of therapeutic effects on DPN; they could improve symptoms such as numbness, pain, chill, fever and others, and neural conduction function was significantly enhanced. The clinical therapeutic effects in group 2 were better than those in treatment group 3 \((P < 0.05)\), but those in group 1 were better than in group 2 and group 3 \((P < 0.05)\). There were significant therapeutic effects of Yinxing Damo Injection combined with Danshen Injection in DPN treatment.

Diabetes is a common clinical disease and is one of the three diseases which threaten human health. The patients’ quality of life is usually directly reduced due to related complications which appear during the later stages of the disease. From the related documents we have found, Danshen and its preparations are mainly used in the treatment of DN, stomach diseases, and peripheral nerve pathological changes etc., and satisfactory therapeutic effects have been obtained, so it is worthy of consideration.

1.7 Effects on Hemorheology

Lin [77] reported the application of Danshen Injection in the treatment of 300 cases of high blood viscosity syndrome, and observed the effect of Danshen on the hemorheology Hemorheology. 30 ml of Danshen Injection in 5 or 10 % glucose was administered by intravenous drip, one time a day, 10 times as one course of treatment. After 1–2 courses of treatment, the rate of total plasma viscosity reduction was 94.7 %; among them, improvement in 1–2 indexes was 47.33 %, and in 3–4 indexes or more was 52.67 %. It was revealed that the drug can effectively improve hematocrit, erythrocyte electrophoretic time, fibrinogen and blood plasma viscosity, and thus can be used as one of the adjuvant therapies for polycythemia, pulmonary heart disease, heart failure, burn, frostbite, ischemic stroke induced by fibrinogen and blood plasma viscosity increase, myocardial infarction, diabetes, hyperlipidemia, globulin increase, and other diseases.

Yan et al. [78] investigated the effect of salvianolate on platelet function and its clinical therapeutic effect on stable angina pectoris. 56 patients with stable angina pectoris were randomly divided into the salvianolate low dosage group (group A), high dosage group (group B) and Danshen Injection control group (group C). The patients were treated for 14 days, observing symptom remission, treadmill tests, platelet aggregation rate, and changes in P-selectin level. platelet aggregation reduction rate and P-selectin in group A and group B were better than in group C, but symptom remission and treadmill tests were similar to those in group C. Salvianolate significantly inhibits platelet aggregation and activation, and improves angina pectoris and ST-T changes in electrocardiograms.

Secondary increases in erythrocytes and blood viscosity can be induced by anoxia during an attack of pulmonary heart disease. Qian [79] reported the application of normal therapy combined with CDI in the treatment of pulmonary heart disease in 17 cases. The results showed that there were significant changes in whole blood viscosity in hemorheology, viscosity, and plasma viscosity in the treatment group before and after treatment \((P < 0.01)\).

The treatment period for primary nephrotic syndrome is lengthy and the recurrence rate is high. Blood hypercoagulability plays an important role in the occurrence, development and turnover of the disease. To search for a safe anticoagulation drug, 67 cases with primary nephrotic syndrome were treated with Compound Danshen by Li et al. (1997). The patients were treated with prednisone and Compound Danshen Tablet (Danshen, sanchi, synthetic borneol), one tablet a day, two times a day for patients younger than 7 years old and three times a day for patients older than 7 years old, for 1 month as one course of treatment, 1–6 courses of treatment were observed. 5 indexes (platelets, blood clotting
time, plasma viscosity, packed red cell volume, blood sedimentation) were observed. The results showed that there was a significant difference between the observation group and control group before and after treatment \( (P < 0.01) \).

Hui [80] observed platelet recovery in 103 cases with epidemic hemorrhagic fever treated with Danshen Injection. The patients in the treatment group were treated with conventional therapy plus Danshen Injection, 20 ml each time, 2 times a day. Administration was discontinued until platelet levels were \( 70 \times 10^9/L \) or more, which was used as the standard for marked effect. The results showed that there were 94 cases (91.3 \%) with marked effect and 9 cases (8.73 \%) without effect. The effective rate in the control group, who were treated with conventional therapy only, was 33.33 \%, the ineffective rate was 66.66 \%, and there was a significant difference between the two groups. It was revealed that Danshen can directly or indirectly reduce damage to platelets and promote platelet production, so the platelet number was rapidly recovered.

In theories of traditional Chinese medicine and Western medicine, there are common and different aspects of stagnant blood in TCM and hyperviscosity in Western medicine. However, Danshen’s functions in activating blood circulation and dissipating blood stasis are confirmed by both TCM theory and modern pharmacological experiments. From this point of view, the effect of Danshen and its preparations on hemorheology is self-evident, and the data presented above are corroborative evidence.

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