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Research progress on the prevention of deep vein thrombosis of lower extremity after gynecological tumor surgery

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Abstract: *Deep venous thrombosis of lower extremities is one of the common complications in patients with gynecological tumor after surgery. If early detection and timely intervention, most patients will get good results. Once the disease is not treated in time, if it progresses further, thrombus rupture will occur due to the influence of many factors. If the thrombus enters the lungs, it will lead to severe pulmonary embolism, which poses a serious threat to the life of the patient. Compared with other populations, the blood viscosity of tumor patients is high, and they will be in a hypercoagulable state for a long time. Moreover, the tumor consumes more human functions, and the probability of deep vein thrombosis of the lower limbs is higher. In clinical work, medical staff should timely identify the high risk factors causing postoperative deep vein thrombosis of the lower extremities, and formulate corresponding nursing measures according to the high risk factors, such as diet guidance, drug and physical prevention, health guidance before discharge and so on, to reduce the occurrence of deep vein thrombosis of the lower extremities and improve the quality of life of patients. This article reviews the key points of nursing for the prevention of lower extremity deep vein thrombosis in patients with gynecological tumor after surgery, so as to provide a nursing plan for the prevention of lower extremity deep vein thrombosis in the future.*

Keywords: *Gynecological neoplasms; Deep venous thrombosis of the lower extremity; After surgery*

Deep venous thrombosis is the blockage of the vascular lumen caused by abnormal blood coagulation in the deep veins of the lower limbs, so that the blood flow in the veins of the lower limbs cannot be returned normally, leading to the pain and swelling of the limbs[1].Thrombosis mostly occurs in the lower limbs, and may also occur in the veins of the upper limbs or cerebral veins. In severe cases, the thrombus falls off and leads to pulmonary embolism[2].It can cause cardiogenic shock, which seriously threatens the life and health of patients.Gynecological tumors mainly include cervical cancer and ovarian cancer. The annual incidence of gynecological tumors is on the rise, which poses a serious threat to women's life and health. During the surgical treatment of gynecological tumors, cancer cells will secrete procoagulant substances, and blood viscosity will increase, resulting in blood in a hypercoagulable state, and patients need to rest in bed after surgery. Slow blood flow and limited limb movement can increase the incidence of deep venous thrombosis of the lower extremities[3].According to the statistics of relevant scholars, deep vein thrombosis of the lower extremities is the second leading cause of death in malignant tumors, and the incidence of tumor patients is 4%-20%[4].The incidence of postoperative venous thrombosis in patients with gynecological tumors in China is 7%-45%[5].It has become an important problem affecting the postoperative rehabilitation of patients. Therefore, in order to achieve early detection, early diagnosis and early treatment of lower extremity deep vein thrombosis in patients with gynecological tumor after surgery, nursing staff should have a deeper understanding of the prevention and occurrence of lower extremity deep vein thrombosis nursing intervention methods, which is of great significance to ensure the safety of patients. This article reviews the nursing of gynecological tumor patients to prevent lower extremity deep vein thrombosis.

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1. The common causes of lower extremity deep vein thrombosis after gynecological tumor surgery

1.1 Major Risk Factors

1.1.1 Hypercoagulable state

The hypercoagulable state of blood is due to the damage of vascular endothelial cells after a variety of factors, and the continuous reduction of anti-oxygen and anti-coagulation ability, resulting in the inability of local tissues to eliminate coagulation factors, so that the blood will be in an abnormal state[6]. In addition to surgical treatment, most patients with gynecological tumors also need continuous chemotherapy. Chemotherapy drugs will also produce certain toxicity to the human body, and will inhibit the activity of vascular fibrinolytic cells, so that the patient's blood is in a state of hypercoagulation for a long time. Studies have shown that in the process of proliferation and differentiation of tumor cells, a variety of procoagulation factors will be produced, resulting in the patients' plasma fibrinogen and other coagulation factors concentration index will appear varying degrees of increase. In addition, pro-inflammatory cytokines and vascular endothelial growth factor secreted by tumor cells can directly induce the overexpression of various types of cells, thereby further activating exogenous coagulation factors[7].

1.1.2 Stasis of blood flow

Advanced cancer patients are in weak physical condition, high platelet aggregation, coupled with long-term infusion therapy, often in the state of bed, if the patient is difficult to turn over, long-term in a posture, the local tissue can not eliminate coagulation factors, will lead to poor blood flow and slow down blood circulation speed, cause hemodynamic changes.Advanced cancer patients have weak physical conditions, high platelet aggregation, and long-term infusion therapy, and are often in bed[8]. Studies have shown that patients with deep vein thrombosis of lower limbs after surgery are closely related to prolonged bed rest, and patients with absolute bed rest for more than 3 days have twice the risk of blood stagnation than patients with early ambulation after surgery[9].Before and after surgery, patients may have some bad emotions, which will increase the body's stress response, and lead to slow venous blood flow, thus increasing the incidence of thrombosis.

1.1.3 Damage to the walls of blood vessels

The common method for gynecological tumors is surgical treatment. During the operation, it is necessary to fully expose the surgical field, so the pelvic tissue of the patient will be pulled. At the same time, it is also necessary to perform the relevant perivascular lymph dissection, which will cause damage to the iliac blood vessel wall, release a large number of inflammatory mediators, and appear platelet aggregation in the damaged area. It further increases the incidence of thrombosis. Repeated intravenous fluid infusion and invasive surgery in tumor patients are prone to damage the vein, which may cause chemical damage to the vascular vein intima and inflammatory reaction caused by long-term infusion of chemotherapy drugs and hypertonic fluid, leading to further increase in the incidence of thrombosis[10].

1.2 Secondary RISK Factors

Factors such as obesity, advanced age, long-term oral contraceptives, abnormal blood pictures and pregnancy, central venous catheter placement, myelogenic diseases, cardiovascular diseases, diabetes and hypertension can increase the incidence of lower extremity deep venous thrombosis.

2. Classification and manifestations of deep venous thrombosis of the lower extremity

2.1 Central type

Thrombosis occurs in the femoral vein and iliac vessels, where the blood vessels are thicker, so the thrombus volume is also large. The main manifestations were swelling of the whole lower limb, pressure and pain of the iliac fossa on the affected side, and changes in skin color. In severe cases, the skin would appear bluish-purple[11].

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2.2 Peripheral type

Thrombosis occurred in the popliteal vein and the calf muscle vein beyond the popliteal vein. Patients do not have significant lower limb swelling, but some patients have sudden onset of severe pain and swelling in the lower leg, most of which is significant when walking or pressing.

2.3 Mixed type

Thrombosis occurred simultaneously in the iliac, femoral, popliteal, and calf veins. The main manifestations are swelling and pain of the whole lower limb, increasing pressure, obvious changes in skin color, and white swelling of the thigh in severe cases. 20%-50% of patients will progress to deep vein thrombosis syndrome, and venous gangrene or congestion ulcer will occur if the treatment is not timely or inappropriate[12].It seriously affects the prognosis of patients.

3. Auxiliary examination

3.1 Color Doppler ultrasonography

Under normal conditions, the lumen is clearly displayed, the inner wall is smooth, and the lumen is echoless. In the acute stage, the ultrasound manifestations of lower extremity venous thrombosis were hypoechoic or moderately hyperechoic in the deep venous lumen, wide venous diameter, impaired blood filling and no blood flow signal. In the chronic phase, ultrasound showed that the venous diameter was reduced, the venous cavity was irregularly hyperechoic, the valve was constantly thickened, and it was difficult to move and stiff[13].In conclusion, color Doppler ultrasound can show whether there is thrombus in the lumen of deep vein of lower extremity, judge the size of thrombus, the degree of obstruction, etc, and can also track the postoperative situation and clinical efficacy of patients. It is the first choice for the diagnosis of deep vein thrombosis of lower extremity.

3.2 CT venography of the lower extremities was performed

It has the characteristics of high resolution and can clearly show the thrombosis in the segmental vein in the bleeding vessel. At the same time, it can clearly show the more easily compressed veins (internal iliac vein, deep femoral vein, left common iliac vein bifurcation and inguinal region) and whether the thrombosis of the inferior vena cava extends to the deep veins on both sides[14].

3.3 Determination of plasma D-dimer

It is a specific molecular marker reflecting coagulation activation and secondary plasmin, and its sensitivity for the diagnosis of acute lower extremity deep vein thrombosis is up to 99%. Some studies have found that plasma D-dimer≥4.54mg/L can be used as a reference for the selection of lower extremity venous color Doppler ultrasound examination. According to the clinical needs, the corresponding value of the required sensitivity is selected as the standard to exclude lower extremity deep venous thrombosis for patients, which can reduce unnecessary medical waste, so as to contribute to the implementation of wise medical care model[15].

4. Common risk assessment scales for lower extremity deep vein thrombosis in patients after gynecological tumor surgery

There are three common risk assessment scales: Caprini、Autar and Padua score[16].Among them, the thrombosis risk assessment scale specific for surgical patients is Caprini score.

5. Nursing measures to prevent deep venous thrombosis of lower extremity after operation

5.1 Diet guide

The patients were instructed to eat a diet of low fat, low sugar, high quality protein and high vitamin cellulose to maintain uniform nutrition and improve their immunity. Because high fat and high sugar diet will increase the viscosity of the blood, so that the blood is in a state of hypercoagulation, which

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will increase the incidence of deep vein thrombosis of the lower limbs. Tumor patients will have gastrointestinal reactions due to diseases and the use of chemotherapy drugs, resulting in insufficient intake, which is one of the important causes of deep vein thrombosis of the lower extremities. We should encourage patients to drink more water after the recovery of intestinal peristalsis, and ensure that the daily intake is about 2000ml. Some patients will be unable to eat due to the postoperative condition. Gastric tube infusion of nutrient solution or intravenous infusion of liquid should be given, and the intake and output volume should be strictly controlled. In addition, studies have shown that tobacco contains a large amount of nicotine and nicotine, which will constrict blood vessels and increase blood viscosity. Therefore, patients should be informed to quit smoking.

5.2 Drug prophylaxis

The blood of tumor patients is in a hypercoagulable state, and the patients need to rest in bed after surgery, so we should avoid the occurrence of thrombosis caused by blood hypercoagulation. Anticoagulant drugs can be used for cancer patients without contraindication of anticoagulation. During the use of drugs, patients should be closely observed with patients and their families to observe whether the patient has gingival, skin puncture point and gastrointestinal bleeding.

5.2.1 Antiplatelet Agents

It inhibits the growth of platelet cyclooxygenase and plays an anticoagulant role. The commonly used drugs include aspirin, clopidogrel, abciximab, etc. Among them, aspirin is widely used, but there is a risk of gastric bleeding when using it, so aspirin is contraindicated for gastric diseases such as gastric ulcer and duodenal ulcer.

5.2.2 Heparins

Low molecular weight heparin and synthetic heparin are commonly used in clinical practice to act as anticoagulants by activating antithrombin III. The abdominal wall is the first choice for subcutaneous injection of low molecular weight heparin, and the injection site is changed regularly. There is no need to exhaust before the injection of preperfusion low molecular weight heparin. After the slow injection, the needle should stay for 10 seconds and then be pulled out quickly, and there is no need to press when pulling out the needle[17].

5.2.3 Coumarins

It plays an anticoagulant role by antagonizing vitamin K. Commonly used is warfarin, which must be taken orally to play an anticoagulant role, so it is also known as oral anticoagulants.

5.2.4 New anticoagulants

It mainly includes direct coagulation factor Xa inhibitors, such as rivaroxaban and edoxaban, which are not inferior to heparin and warfarin in the prevention of thrombosis, and the incidence of major bleeding is low. Among them, rivaroxaban is mainly divided into 10mg, 15mg and 20mg. The 10mg tablet has a high oral utilization rate, which can be taken by the patient on an empty stomach or with food, while the 15mg and 20mg tablet on an empty stomach will reduce its efficacy. Therefore, it should be taken with food to delay the time of gastric emptying and play a high drug utilization rate.

5.3 Mechanical prevention

5.3.1 Medical elastic stockings

Elastic socks include below knee type, thigh type and pantsuit type. They are designed according to the normal physiological characteristics of the human body and through professional pressure gradient. They gradually decrease from the ankle to the heart by reducing the pressure of the calf muscles on the vascular cavity, and promote the venous blood of the lower limbs to flow upward to the heart, rather than back down to accumulate in the foot vein, so as to prevent the occurrence of venous congestion of the lower limbs. In addition to ensuring good blood circulation in the veins of the lower limbs, it can also reduce the pressure on the veins of the lower limbs and enhance the function of the skeletal muscle pump, Promote venous and lymphatic return to the lower extremities . It is of great significance to reduce postoperative limb swelling and pain[18]. Medical elastic socks require the pressure of the foot and ankle to be 30-40mmHg. According to the value of the patient's leg circumference, buy elastic socks suitable for the patient. If the length is too long and too tight, it will increase the risk of deep vein thrombosis of the lower limbs, which will lead to hypoxia and necrosis of the patient's limbs[19].After

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the patient returned to the ward, his family members and medical staff assisted him to dress fully. He wore elastic stockings during the day and night until his activity was no longer reduced or he returned to the pre-disease activity level. In addition, regular stretch stockings should be cleaned with neutral detergent, the water temperature should not exceed 40 ℃, do not twist, use a dry towel to absorb excess water, do not put in the sun or use a hair dryer for local heating, do not iron, can also be washed stretch stockings in the refrigerator for cold storage, to promote the recovery of elasticity[20].If you wear for a long time, do not pull the scissors. Check your nails and shoes before wearing stretch stockings, keep your skin clean and dry, and prevent unnecessary damage to stretch stockings[21].

5.3.2 Ankle pump exercise

Ankle pump exercise does not require the assistance of external equipment, and is not affected by time and place. Patients who are awake after surgery can passively perform ankle pump exercise, and patients who are awake can actively perform ankle pump exercise under the guidance of nursing staff. During exercise, the lower leg is in a tight state, and each action is maintained for 3 seconds, giving full play to the role of muscle pump. Its principle is to promote blood reflux through ankle dorsiflexion and plantar flexion of lower limb muscle groups (quadriceps femoris, soleus muscle, gastrocnemius muscle, etc.) and muscle contraction and extrusion, so that the femoral vein blood is in a state of acceleration and deceleration, which can not only prevent the occurrence of deep venous thrombosis of lower limbs[22].They can also be given carbohydrates and hormones to relieve the swelling of their lower limbs. Previous studies have shown that by applying pressure on the ankle joint to increase the dorsal extension Angle of the ankle joint, it is found that it can promote the return of blood from the calf vein, indicating that the ankle pump exercise can improve the clinical symptoms of patients after surgery, and effectively reduce the incidence of deep vein thrombosis of the lower limbs[23].

5.3.3 Intermittent pneumatic compression

It is recommended to use it for 18 hours a day after operation. After use, 75% ethanol or chlorine containing disinfectant should be used to wipe the surface of the leg sleeve. Intermittent pneumatic compression, a different pressure gradient method, can increase blood flow speed and shorten the time of skin temperature rise, which has a positive significance for the prevention of deep vein thrombosis in patients after gynecological pelvic surgery. It is a non-invasive therapeutic instrument, its working principle is a pressure pump that mimics artificial massage, but its device effect is better than the traditional artificial massage method[24], in a short time to inflate and deflation the air bag to squeeze the lower limbs, increase the speed of lower limb venous blood return to the heart, push the stasis lymph back into the blood circulation, improve the blood perfusion of the limbs. Its operation is simple and easy to master, and it is not affected by the patient's position[25].

5.3.4 Plantar arteriovenous pumps

It has the characteristics of small size, convenient movement and high safety. Its principle is based on Gardner theory. When the human body walks and carries weight, the blood of the plantar vein is squeezed into the veins of the lower limbs under the action of gravity[26].It is a physical instrument that mimics the "physiological foot pump", which mainly impacts the sole of the foot in a short time by pulse gas, and produces a pulse impact force similar to that of the patient when walking normally[27].It can effectively promote blood circulation and prevent postoperative blood hypercoagulable state leading to thrombosis.

5.3.5 Neuromuscular electrical stimulator

Neuromuscular electrical stimulator is a method that uses low-frequency pulse current to stimulate muscle and make muscle contraction achieve therapeutic effect. Its principle is to restore specific muscle groups by emitting pulse current to stimulate muscle contraction and achieve the function of restoring movement. Local muscle groups will pull the surrounding tissues under the influence of electrical stimulation to improve the blood circulation of muscle tissue. It can effectively reduce limb edema, improve lower limb hemodynamic changes, and reduce the risk of lower limb deep vein thrombosis[28].Relevant studies have shown that neuromuscular electrical stimulation can conduct rhythmic contraction through the branches of deep and superficial arteries, veins and lymphatic vessels between the electrodes, which can continuously increase the internal pressure of the venous wall, reduce the degree of vascular dilatation, decrease the venous pressure, increase the return of veins and lymph of the lower limbs, and thus effectively reduce the colloid osmotic pressure. In addition, stimulation of the peroneal nerve can reduce the plasminogen activator inhibitor 1 in patients with lower extremity veins, which will increase the dissolution of fibrin, thereby regulating coagulation function, prolonging the time of blood coagulation, and reducing the occurrence of lower extremity

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deep vein thrombosis[29].

5.4 Discharge instruction

In gynecological tumors, most patients have a long treatment cycle and a long time of home health care, and some patients may need to take anti-tumor drugs at home for a long time. For patients who are going to be discharged from the hospital, medical staff should fully guide and track the health of patients and their families before leaving the hospital to avoid the occurrence of deep vein thrombosis of the lower extremities. There are related research findings.Continuous nursing intervention is based on Internet information platform and mobile application program (APP) to promote health education knowledge, actively help patients to understand the disease, improve prevention awareness and self-management ability, and prevent complications[30]. For high-risk patients, the physical condition of the patients should be closely monitored, and the patients at home should be followed up regularly, so as to understand the changes of the patient's condition and give individualized correct guidance. In addition, we should also carry out lectures on health knowledge, and the time is controlled within one hour, to tell patients about healthy diet, reasonable exercise and other aspects of knowledge, so that patients can adhere to maintain a good lifestyle[31].

6. Brief summary

This article mainly reviews the diagnosis and physical prevention methods of lower extremity deep vein thrombosis in patients with gynecological tumor after surgery, and analyzes the high risk factors of lower extremity deep vein thrombosis and the important role of physical therapy in the prevention of lower extremity deep vein thrombosis. Nurses in oncology department should fully understand the factors and clinical symptoms leading to lower extremity deep vein thrombosis, so as to prevent the formation of thrombosis by early detection, early diagnosis and early treatment. To have a deep understanding of postoperative complications of lower extremity deep vein thrombosis in patients with gynecological tumor, and actively provide health guidance to patients and their families, reduce the incidence of postoperative lower extremity deep vein thrombosis, so as to improve the quality of life of patients.

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