

Exploration of nursing cooperation strategies for intravenous indwelling needle in CT enhanced examination

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Abstract: To investigate nursing collaboration strategies concerning intravenous indwelling needles in CT-enhanced examinations, an experiment was conducted among patients undergoing diagnosis and treatment at a Chinese hospital between August 2020 and August 2022. A cohort of one thousand patients was randomly divided into two groups: a control group and an experimental group, each consisting of 500 patients. In both groups, intravenous indwelling needles were utilized during CT-enhanced examinations. The control group received standard nursing care, while the experimental group received enhanced nursing interventions. Comparisons were made between the two groups regarding the success rates of CT-enhanced examinations and the incidence of contrast agent extravasation. Notably, no statistically significant difference was observed in the success rates of CT enhancement between the two groups. However, the experimental group exhibited a lower incidence of contrast agent extravasation compared to the control group, with a statistically significant difference observed ($P < 0.05$). The application of intravenous indwelling needles in CT-enhanced examinations demonstrated favorable outcomes. Implementing effective nursing collaboration methods played a vital role in minimizing the likelihood of contrast agent leakage. Consequently, higher success rates in CT-enhanced examinations were achieved, underscoring the potential for broader implementation in clinical practice.

Keywords: Intravenous Indwelling Needle; CT Enhanced Examination; Nursing Cooperation Strategies

1. Introduction

With the improvement of medical technology level in China in recent years, the development speed of multi row CT is also getting faster and faster. CT enhanced examination technology is an important component of imaging examination. CAT technology has the advantages of fast injection speed and stability. However, due to the high pressure of high-pressure injectors, automatic control is required. In the process of CT enhanced examination, the use of intravenous indwelling needles can protect the patient's blood vessels, and the difficulty of operation is also relatively small, which can rescue patients who are allergic to contrast agents or drugs during enhancement^[2]. Nursing is the core content of various departments' work, which can affect the quality of life of patients treated and the effectiveness of medication treatment. Applying it to CT enhanced examination of intravenous indwelling needles and providing effective care can reduce the extravasation rate of contrast agents. This is reported as follows.

2. Experimental Materials and Methods

2.1 Experimental data

In order to deeply explore the nursing cooperation strategies of intravenous indwelling needle in CT enhanced examination, this article conducted an experiment on patients admitted to hospital in China from August 2020 to August 2022. 1000 patients were randomly selected from the experiment, and the patients underwent intravenous indwelling needle method in enhanced CT examination. They were divided into a control group and an experimental group, with 500 patients in each group.^[1] Among them, there were 200 female patients and 300 male patients in the experimental group; The minimum

age is 12 years old; the maximum age is 77 years old, and the overall average age is 43 years old; There were 240 cases of chest enhancement and 260 cases of abdominal enhancement. In the control group, there were 220 female patients and 280 male patients; The minimum age is 18 years old; the maximum age is 72 years old, and the overall average age is 44 years old; There were 220 cases of chest enhancement and 280 cases of abdominal enhancement. There was no statistically significant difference ($P>0.05$) in the comparison of enhancement sites, average age, and other information between the two experimental groups.

2.2 Experimental Methods

2.2.1 Vascular puncture method

During puncture, disinfection should be carried out according to conventional methods, selecting veins with elasticity and walking straight, avoiding joints, and operating according to conventional puncture methods. Then, all the cannula should be sent to the blood vessel and fixed with adhesive tape^[3]. To conduct allergy testing for intravenous channel contrast agents, patients should use non release contrast agents and control the injection rate. Adults should control the injection rate at 3.5 to 4.0 milliliters per second, children should control it at 1.5 to 2.5 milliliters per second, adults should control the injection dose at 1 to 1.5 milliliters per kilogram, and children should control the injection rate at 1.5 to 2.5 milliliters per kilogram.

2.2.2 Nursing methods

The control group patients should adopt routine nursing methods, while the observation group patients should use the routine nursing mode as the benchmark, adopt high-quality nursing mode, evaluate the patient's condition, and communicate with the patient, understand whether the patient has a history of drug allergy, especially a history of contrast agent allergy. To ascertain the urine volume and renal function of diabetic patients, inquire about any accompanying conditions such as hyperthyroidism, and provide comprehensive explanations regarding enhanced CT examinations, this detailed information aims to emphasize the significance of undergoing such examinations. It needs to employ effective communication strategies to alleviate patient anxiety and apprehension, facilitating their cooperation during the insertion of intravenous indwelling needles.

Hospitals educate patients about potential adverse reactions that may occur during injections, proactively address these reactions with appropriate measures to improve patient compliance with treatment and ensure a smooth exam experience. The hospital maintains a regular disinfection and cleaning regimen of CT examination rooms, including twice-daily UV air disinfection, to ensure optimal hygiene standards. The hospital can ensure air circulation in the CT examination area, create a clean, bright, comfortable and relaxing environment, and adjust the room temperature at the same time. When using intravenous indwelling needles, it is necessary to select the superficial vein of the patient's elbow or the wrist of the upper limb, and test with 20 milliliters of physiological saline before injection to observe whether there is extravasation. During the scan, the doctor closely observes the patient's injection condition. After completing the CT enhancement examination, patients should wait in the lounge while medical staff observe the patient^[4]. If the patient does not experience any adverse reactions within 20 minutes, they can leave the hospital. They should advise the patient to drink more water and increase the frequency of urination appropriately, so that the contrast agent can be discharged from the patient's body as soon as possible, avoiding prolonged retention of the contrast agent in the patient's body and causing adverse effects on their body.

3. Results

Through experimental observation, it can be concluded that 480 cases of CT enhancement were successful in the experimental group, with a success rate of 96%. Among them, 12 cases were retained with barium, 8 cases had micro shadows, and a total of 20 cases had extravasation, with an extravasation rate of 4%. In the control group, CT enhancement was successful in 450 cases, with a success rate of 90%. Among them, 22 cases had barium retention, 28 cases had microshadows, and a total of 50 cases had extravasation, with an extravasation rate of 10%. The difference in exosmosis rates between the two experimental groups was statistically significant.

4. Discussion

Venous indwelling needle is an important step before CT enhanced examination, which is widely used and has the characteristics of simple operation, high safety, and no side effects. The intravenous indwelling needle has good flexibility, allowing it to bend according to the shape of the blood vessel. In addition, its wall is particularly smooth, so it will not cause significant irritation to the blood vessel^[4]. The intravenous indwelling needle is less affected by external pressure and injection speed, which is beneficial for reducing the extravasation rate of contrast agents. Good nursing can ensure the smooth progress of surgery, drug treatment, and examination. Strengthening nursing can further reduce the occurrence of extravasation of contrast agents, improve the success rate of intravenous indwelling catheters, and avoid the successful application of re indwelling catheters in CT enhanced examinations, which is of great significance.

Before conducting CT enhanced examination, it is necessary to pay attention to the use of intravenous indwelling needles, which have a wide range of applications, no toxic side effects, high safety, and strong flexibility. Therefore, they can be used to bend according to the shape of the patient's blood vessels, with a smoother wall and no significant stimulation of the patient's blood vessels. They are relatively weakly affected by external pressure and injection speed, it can effectively reduce the probability of extravasation of contrast agents and smoothly promote the development process of subsequent drug treatment, surgical treatment, etc. To implement effective nursing cooperation strategies, the one-time success rate of intravenous indwelling needles will become higher. Some patients may have a shallow understanding when undergoing intravenous indwelling needles and CT enhanced examinations, which can lead to feelings of concern, fear, etc. Especially in children, their compliance may be relatively low. Therefore, before undergoing the examination, nursing staff need to implement effective psychological guidance for patients, so that they can correctly understand the relevant working principles, form a sense of security, and eliminate and alleviate negative emotions. Targeted care based on the specific situation of patients can significantly improve the success rate of one-time puncture. For elderly patients with loose and thin skin, the skin should be tightened during puncture or puncture, especially after returning blood, the needle core should be retracted and the hose should be inserted, and the skin at the puncture point should be tightened towards the distal end. Additionally, for obese patients, the angle of needle insertion should be changed. For patients with severe edema, there is no need to tie a tourniquet. After selecting the blood vessel, press the puncture vessel with the index and middle fingers of the left hand until it is exposed, and then disinfect it again before rapid puncture. These nursing measures can effectively prevent edema from becoming more obvious after tying the tourniquet, improve vessel exposure, and facilitate puncture. Venous indwelling needles facilitate patient mobility, prevent needle puncture and leakage caused by limb movements, resulting in examination failure, reduce the number of vascular punctures, minimize vascular damage, and alleviate patient pain. Before puncture, nursing staff should patiently explain the purpose, precautions, and cooperation methods of the puncture to the patient or family members, eliminate the patient's concerns, nervousness, and fear, and actively and proactively cooperate with the operation.

When doctors choose to insert an indwelling needle into a blood vessel, they should choose a blood vessel that is thick, straight, plump, and of appropriate length. In particular, physicians consider utilizing the superficial veins of healthy limbs, including the dorsalis pedis vein, great saphenous vein, cephalic forearm vein, and external jugular vein. Depending on the age and vascular condition, a model and a structurally complete indwelling needle are prepared. During the puncture process, they use a syringe to draw 5ml of 0.9% normal saline and connect it to the indwelling needle, place the tourniquet 10cm above the puncture site and disinfect twice with 2% iodine in an area of 8×8cm, let the disinfectant dry completely. Then they loosen the external cannula of the indwelling needle, insert the needle upward at an angle of 15 to 30°, and adjust the angle to about 10° when blood returns.

The doctor gently advances the indwelling needle 0.5-1cm along the direction of the vein to ensure that the outer cannula enters the vein. The doctor holds the needle wing steady with his left hand, pulls out the needle core with his right hand, seals the closed indwelling needle with sterile transparent paste, and records the puncture date, time, and person in charge on the small tape that fixes the trident interface. Steps: The doctor injects 1-2 ml of 0.9% normal saline into the indwelling needle and withdraws the injection needle while pushing. The doctor is turning on the small switch and locking the heparin cap correctly. Patients with catheterization should be sealed before and after each injection, using 0.9% normal saline or heparin sealing solution for pulse filling and positive pressure sealing, and sealing every 8-24 hours. Normal saline sealing is suitable for patients with bleeding tendency, coagulation mechanism disorder, liver and kidney dysfunction who are not suitable for using heparin sodium; the preparation of heparin sealing solution uses 500ml 0.9% normal saline and 12500u/tube

heparin solution, with a concentration of 10-100u/ ml, place the solution in a 4°C refrigerator and the shelf life is 24 hours.

When the doctor seals the tube, they use a syringe to draw 5-10ml of sealing solution, insert the needle into the heparin cap and inject the remaining 0.5ml of sealing solution. At the same time, the doctor pulls out the injection needle while injecting the solution, so that the cavity of the indwelling needle is fully filled. In addition, the doctor should make sure to turn off the small switch located at the beginning of the indwelling needle extension tube. This action of the doctor is crucial to prevent blood from flowing back into the indwelling needle, thus avoiding the formation of clots. If the indwelling needle is blocked during injection, 2-3ml of sealing solution can be withdrawn with a syringe. The doctor proceeds to connect it to the heparin cap for clotting. Do not apply solution directly to an individual to avoid clogging. When the nurse removes the intravenous needle, she should place the sterile cotton swab directly in front of the puncture point and remove the needle quickly.

At the same time, the needle should be pressed above the puncture point until there is no bleeding. If the pressure is greater than 5 minutes, the needle insertion point on the blood vessel wall should be pressed instead of the needle insertion point on the skin to avoid causing congestion and damage to the blood vessel wall, leading to local pain and affecting vascular repair. Patients who use intravenous indwelling needles should closely observe whether there is swelling or pain at the injection site, inquire about any discomfort, and if there are any abnormalities, it should promptly remove the catheter to prevent complications. Common complications of venous indwelling catheters include infection at the puncture site, subcutaneous hematoma, fluid leakage, catheter blockage, phlebitis, and venous thrombosis. To prevent venous thrombosis, thick and straight veins can be chosen, avoiding venous valves, paralyzed limbs, and compressed parts of the limbs. Patients who are lying in bed for a long time should try to avoid using venous indwelling catheters at the distal end of the lower limbs and avoid repeated punctures at the same site; To prevent liquid leakage, nurses need to master puncture techniques proficiently, properly fix the indwelling needle, choose cotton socks with appropriate thickness, size, and elasticity, cut off the sole of the foot, leave a portion of the sock in place, and apply it to the patient's puncture site. Elastic bandages can also be used instead of socks to fix it. Patients are advised to avoid excessive movement of the limbs on the side of the indwelling needle, and if necessary, the limbs can be appropriately restrained. At the same time, clothing above the puncture site should not be too tight, strengthen observation and care of the puncture site, and try to avoid puncturing the lower limbs for patients who can get out of bed and move around; To prevent catheter blockage, appropriate sealing fluid should be selected according to the patient's condition, and a slow pulse positive pressure sealing method should be used. Patients should be advised to avoid weight bearing, sagging, and compression of the limb on the side of the venous indwelling needle as much as possible; The prevention and treatment of subcutaneous hematoma should choose blood vessels with good elasticity, straight and clear direction, avoid operating at joints and venous sinuses, grasp the needle insertion angle during puncture, make the puncture action light, stable and accurate, and strive for a successful puncture. If subcutaneous hematoma is found, cold and wet compress can be used within 24 hours to stop bleeding, reduce swelling, and relieve pain. After 24 hours, wet and hot compress can be used to promote the dissipation of subcutaneous congestion; The prevention and treatment of infection and phlebitis at the puncture site mainly rely on following sterile technical operating procedures. The puncture site should be disinfected twice with 2% iodine, and then punctured to prevent iodine from being carried into the blood vessels during puncture. During the puncture procedure, it's imperative to avoid areas exhibiting scars, nodules, congestion, infection, or skin diseases. Following catheterization, it's essential to inquire about the patient's sensations, maintain cleanliness and dryness at the puncture site, and diligently monitor for signs of redness, swelling, heat, pain, or discharge.[5] The doctor carefully palpates the injection site to evaluate the vein elasticity, surface, smoothness and movement. If the doctor finds any abnormal condition, please immediately remove the catheter. After removing the catheter, use 50% magnesium sulphate or 95% alcohol wet compress for 15 to 20 minutes. Repeat this process 3 to 4 times every day.

This can reduce pain, increase the patient's metabolism and phagocytic function of white blood cells, and help repair vascular wall trauma and anti-inflammatory ability against local inflammation. To ensure a 100% success rate of venous indwelling catheter placement, it is necessary to master the key points of venous puncture for special patients: obese patients have thick subcutaneous fat, deep and inconspicuous venous positions, but relatively fixed. When puncturing, the direction of the blood vessels should be determined and the needle should be inserted from above the vein at an angle of 30 to 40°; Dehydrated patients with poor blood vessel filling can undergo local hot compress and massage, and then puncture after the blood vessels are filled; For patients with edema, if the blood vessels are not obvious, they can massage the local area along the anatomical position of the veins with their hands to

disperse subcutaneous moisture, so that the veins are fully exposed before puncture; Elderly patients have less subcutaneous fat, and the veins are prone to sliding and are more fragile. It is difficult for the needle to penetrate or easily puncture the opposite side of the blood vessel. During puncture, fingers can be used to fix the upper and lower ends of the puncture segment vein separately, and then puncture along the vein direction^[6].

The above research results are close to those of this study, which can prove that high-quality care can effectively reduce the extravasation rate of contrast agents in venous catheters. Analyzing high-quality nursing methods based on the results of this study: ① Many patients may experience fear due to a lack of correct understanding when receiving intravenous indwelling needles and CT enhanced examinations, especially the children in this study who have relatively low compliance, as shown in Figures 1-2. Psychological counseling before examination is beneficial for patients to have a correct understanding of the basic working principles of venous catheterization and CT enhanced examination, which can generate a sense of security, eliminate negative emotions, improve compliance, and is of great significance in reducing contrast agent extravasation. The environment can affect a person's mood, creating a good examination environment for patients is conducive to eliminating their tense emotions and promoting the smooth progress of the examination. Before undergoing enhanced CT examination, explain to the patient the basic principles of CT enhanced examination and the necessity of performing CT enhanced examination^[7]. This is mainly aimed at younger patients and patients undergoing initial CT enhanced examination. Some of these patients may develop a fear of puncture due to lack of understanding of the examination, which may lead to rejection and hinder the normal puncture process, and may result in unsuccessful first puncture. Therefore, psychological counseling should be provided to these patients. It can alleviate the patient's nervousness and enhance their cooperation. The detailed care during the operation of intravenous indwelling needle determines the success rate of one-time puncture. Strengthening nursing can effectively reduce the rate of repeated puncture and minimize harm to patients. Targeted care based on the specific situation of patients can significantly improve the success rate of one-time puncture. For elderly patients with loose and emaciated skin^[8], the skin should be tightened during puncture and puncture, especially after returning blood, the needle core should be retracted while inserting the soft tube, and the skin at the puncture site should be tightened towards the distal end. This can prevent the needle core from being retracted faster than the insertion speed, causing the soft tube to break and leading to puncture failure. For obese patients, the angle of needle insertion should be changed. For patients with severe edema, there is no need to tie a tourniquet. After selecting the blood vessel, use the index and middle fingers of the left hand to press and puncture the vessel until it is exposed. Disinfect again and puncture quickly. These nursing measures can effectively avoid more obvious edema after tying a tourniquet, improve vessel exposure, and facilitate puncture. After examination, providing certain care can timely detect adverse reactions in patients and handle them promptly.



Figure 1: Intravenous catheter



Figure 2: CT scan

The patient uses an 18G indwelling needle, selects a larger peripheral vein for puncture, and undergoes enhanced scanning after different nursing treatments

5. Conclusion

In summary, the application of intravenous indwelling needle in CT enhanced examination has a good effect. By cooperating with the development of reasonable nursing cooperation strategies, the probability of contrast agent leakage is reduced, and the success rate of CT enhanced examination is improved. It can be used to rescue patients with drug allergies, and its vascular damage to patients will be relatively weak, which can effectively improve the effectiveness of nursing work and has high application value. It can effectively prevent patients from experiencing needle detachment and contrast agent leakage during scanning, alleviate their physical and mental stress and pain, reduce the number of

vascular punctures, and improve their work efficiency. In summary, when using intravenous indwelling needles during CT enhanced examination, high-quality care is required to further reduce the probability of contrast agent leakage and improve the success rate of CT enhanced examination. In addition, the practical application of intravenous indwelling needles does not damage patients' blood vessels, and they also have the characteristics of simple operation, which plays a very important role and significance in CT enhanced examination.

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