Nursing care of 22 patients with complex intracranial aneurysms treated with flow-diverting stents: A retrospective study

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ABSTRACT

Objective: To summarize the nursing treatment of patients who underwent implantation of a blood flow diverter to treat complex intracranial aneurysms.

Methods: Data from 22 patients with complex aneurysms, diagnosed at an interventional center for blood flow diverter implantation between February 2015 and February 2016, treated in the Henan Provincial People’s Hospital (Zhengzhou, China), were retrospectively analyzed. Nursing methods, including preoperative, intraoperative, and postoperative care, were analyzed.

Results: All 22 patients underwent successful surgery, with no related complications or hospital mortality, and were cured in hospital.

Conclusion: Intervventional flow diverter therapy for patients with complex intracranial aneurysms is a new technology, and involves intensive care by nursing staff and appears to be a promising new treatment method.

Blood flow diversion is the latest technology used for special intracranial stenting involving dense network support (i.e., wire stent, pipeline stent), which involves a high-knit, low-pore blood flow guidance device. Flow diversion is increasingly being used for particularly complex cases, such as large aneurysms and, especially, for lesions that are difficult to treat due to multiplex anatomical variations or very small aneurysms. The procedure has high safety, adaptability, and a high success rate.1,2 The present study retrospectively analyzed clinical nursing data from 22 cases of intracranial complicated aneurysms treated in the Henan Provincial People’s Hospital (Zhengzhou, China) from February 2015 to February 2016. The aim was to further improve nursing care for patients treated with flow diverter implantation for complex intracranial aneurysms, and to reduce complications and improve surgical success rates.

1. Materials and methods

1.1. Clinical data

Data from 22 cases of intracranial complicated aneurysms, diagnosed between February 2015 and February 2016, were retrospectively reviewed. The sample included 7 men and 15 women, 13 of whom were <60 and 9 were >60 years of age. All patients exhibited unruptured aneurysms with headache and blurred vision before the operation (86.4%). All patients were diagnosed with complex intracranial aneurysm(s) using digital subtraction angiography (DSA). All 22 patients underwent successful aneurysm isolation through implantation of a blood flow guiding device.

1.2. Treatment methods

All 22 patients underwent general anesthesia with tracheal intubation (laryngeal mask) and a conventional right femoral approach. After placement of an 8 Fr arterial sheath, a 6 Fr coaxial guidance catheter (Navien, EV3, Covidien, Dublin, Ireland) and transport catheter Marksman, ev3 (Covidien) were placed. Blood flow was diverted to the M1 section of the middle cerebral artery through the neck of the aneurysm under guidance of the microwire.

For patients requiring adjuvant embolization, a parallel technique was used to guide the catheter into the aneurysm cavity. Subsequently, and according to technical requirements,3 a blood flow diversion device was placed separately or after the aneurysm cavity was partially filled with a coil. After confirming the location of blood flow diversion using...
fluoroscopy or dynamic computed tomography imaging, DSA was used to verify blood flow in the stent and the aneurysm. The Raymond classification was used as the evaluation standard. The femoral artery puncture site was sutured after the catheter was withdrawn.

2. Nursing cooperation

2.1. Preoperative preparation

2.1.1. Anti-platelet drugs
Aspirin enteric-coated tablets 100 mg and clopidogrel 75 mg were administered orally 5-7 days before the operation, and a thromboelastogram test was performed. The dose was adjusted according to the following test data to ensure the effectiveness of anti-platelet aggregation: arachidonic acid inhibition rate >50%; adenosine diphosphate (ADP) inhibition rate > 30%; and MA (ADP) value (maximum amplitude of ADP curve, residual platelet function) 31-47 mm.6,7

2.1.2. Surgical preparation
Patients underwent groin and perineal skin preparation. Patients fasted for 6-8 h, and water was forbidden for 4h before surgery. Assessment of indwelling intravenous channels and an iodine allergy test were performed 30 min before phenobarbital sodium 0.1 g intramuscular injection. Patients with hypertension were continuously administered anti-hypertensive drugs to maintain systolic blood pressure to <100 mmHg.

2.2. Psychological considerations
Because the implantation of a blood flow diversion device for aneurysms is a novel technique, patients and families are not familiar with the procedure or the effect of surgery, and accordingly, are prone to fear and anxiety. Moreover, the cost of the surgery is relatively expensive, which leads to economic burden for patients and their families. It has been reported that the psychological and economic pressure resulting from this type of surgery is an important cause of preoperative bleeding and aneurysm rupture.8 Comforting patients, and explaining the purpose, methods, precautions, coordination points and good prognosis of interventional therapy in a simple way, can prevent excessive tension and emotional agitation in patients, which in turn prevents blood pressure increases leading to aneurysm rupture.9 It is, therefore, important to reduce the pressure on the patient caused by family stress by educating both the patient and family about the procedure.

2.3. Equipment and drugs
An angiography catheter, micro-guide wire, micro-catheter, various types of blood flow diversion devices, coils and catheters are needed for the implantation of blood flow diversion devices. A tracheal intubation bag, ventricle drainage bag, and disposable urethral catheterization bag need to be prepared. The procedure also involves the use of reserve heparin sodium, urokinase, tirofiban, papaverine, protamine, mannitol injection, and other special drugs.

2.4. Nursing cooperation during the operation

2.4.1. Interdisciplinary cooperation
Nursing cooperation with the anesthesiologist during the induction and resuscitation periods of general anesthesia is essential. Vital signs, such as electrocardiogram (ECG), blood pressure and oxygen saturation, should be monitored closely, venous access and suction devices should be prepared. Due to the inhibition of the respiratory system and circulatory centers by the anesthetic, the patient’s respiration and blood pressure should be observed during the anesthesia induction period. During the anesthesia recovery period, airway obstruction, hyperventilation, nausea, and vomiting are prone to occur. It is necessary to remove airway secretions and administer oxygen.

2.4.2. Vital signs and blood pressure
Nurses should closely observe vital signs during the operation.10 To prevent bleeding due to aneurysm rupture caused by high blood pressure, patients should undergo ambulatory blood pressure monitoring. Usually, systolic blood pressure should be maintained at 100-110 mmHg, and diastolic blood pressure at 60-80 mmHg.

2.4.3. Communication
Due to the relative lack of surgical experience with this technology, its long duration and its difficulty, it is necessary to communicate with the surgeon in a timely and effective manner during the operation. Nurses should understand the operation process, skillfully provide the materials needed for the operation, and carefully check with the surgeon again when opening the materials.

2.4.4. Procedure
The procedure was performed under conditions of heparinization (80-100 U/kg). Therefore, heparin should be added according to the operator’s prescription every 1 h. During the operation, the Activated Clotting Time of Whole Blood (ACT) value was monitored regularly, and maintained between 280s and 300s to prevent the activation of whole blood coagulation, which is sufficiently long not to increase the risk for bleeding or too short to induce a thrombotic event.

2.4.5. Pressurized infusion bag
Closely observe the amount of liquid remaining in the pressurized infusion bag and replace it in time. When equipped with the pressurized bag, directly discharge the air in the saltwater package, to eliminate the possibility of air embolism. Maintain the pressure of the pressurized infusion bag to ensure continuous infusion of saline into the catheter and prevent thrombosis.

2.5. Prevention and treatment of intraoperative complications

2.5.1. Vasospasm
Placement of the intravascular catheter and/or stent may cause vasospasm. Thus, vasodilators may be continuously administered during the operation. The anesthesiologist should be informed when vasodilators are administered to prevent interaction with the anesthetic. If necessary, the use of papaverine can effectively prevent and relieve vasospasm.

2.5.2. Thrombosis
Causes of thrombosis during the implantation of blood flow diversion devices include: a hyper-coagulable state; slow blood flow caused by various factors; and/or the blood flow diversion device itself.
Comprehensive measures, such as systemic heparinization, the use of anticoagulants and intraoperative monitoring according to ACT value, can effectively prevent, or at least mitigate the risk for thrombosis. Blood vessels, before and after angiography, should be closely observed during the operation. Once a thrombus is found, urokinase, tirofiban, or other anticoagulant should be administered immediately.

2.6. Postoperative care

2.6.1. Positioning
After the operation, patients should be positioned supine. The lower limbs of the puncture side are immobilized for 6 h, and bending is prohibited. The puncture site is strictly observed for bleeding and hematoma, foot dorsal artery pulsation, skin temperature, and color of the lower limb.

2.6.2. Observation
The patients are kept in bed for 24 h, with abstinence food and water
for 4 h at least. Continuous ECG monitoring is performed for 48–72 h after the operation. Close observation of changes in consciousness, pupils, heart rate, blood pressure, and physical activity is important in preventing postoperative complications. Blood pressure is measured every 15-30 min, and once every 4 h after vital signs are stabilized.

2.6.3. Medication
Patients need to maintain dual anti-platelet drugs for six months after discharge; otherwise, there is a risk for disease recurrence. Additionally, it is also necessary to advise patients to quit smoking, abstain from alcohol, incorporate a low-sodium diet, get adequate physical exercise, and maintain a good disposition. Nurses should undergo health education and knowledge dissemination to help patients understand the importance of dual anti-platelet drugs, and instruct them to maintain patency, regular monitoring of blood pressure, and to attend follow-up at 1–3 months, and a later review at 6 months.

3. Discussion

Blood flow diversion is a new technology for the treatment of intracranial aneurysms. They are characterized by increasing the metal coverage of the stent to alter the hemodynamics and structure of tumor-carrying arteries, and ultimately, to cure intracranial aneurysms. The technique has been proven to be an effective method of treatment for intracranial aneurysms, with the advantages of high complete closure rate and fewer complications.

This method of treatment of aneurysms, as well as discharge and follow-up examination, are significantly different from those using traditional intracranial stents. Studies have shown that the use of blood flow diversion devices for the treatment of special types of intracranial aneurysms is feasible, effective, and safe. Presently, treatment of complex intracranial aneurysms using blood flow diversion devices is only performed in a few domestic interventional nerve centers, and as such, there is lack of experience and data. The success of the operation depends on the skill of the surgeon and the tacit cooperation of nurses.

The nurses in the interventional operating room must stay appraised of the rapid pace of advances in knowledge and technology, not only to understand new trends in the development of nerve intervention and specialized nursing knowledge, but also to sufficiently prepare before the operation. A tacit understanding of intraoperative nursing cooperation and timely detection of stent implantation complications will help clinicians effectively reduce surgical complications and improve surgical success rates.

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