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Research on Intelligent Analgesia Pump

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Abstract

Improving analgesic effect and patient satisfaction are still difficult in postoperative analgesia. Wireless intelligent analgesia system is an information system solution integrating remote monitoring, information management and high-precision infusion pump for patient-controlled analgesia. Patients can participate in intermittent drug administration themselves. The operation information of analgesic pump can be transmitted in real time through the monitoring platform. It is a safe and effective postoperative analgesic management.

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1. Postoperative Pain

Pain is the unpleasant sensation and emotional response caused by tissue injury or potential tissue injury, and it is the fifth vital sign after blood pressure, pulse, respiration and body temperature [1]. Postoperative pain is an immediate pain after surgery, which is an acute traumatic pain and the most common and urgent acute pain in the clinic. Pain is one of the major postoperative stress factors for patients, which can lead to a series of adverse reactions and functional disorders, delay the early movement or discharge time, hinder the postoperative rehabilitation of the patients, and affect the postoperative quality of life. Currently, postoperative analgesia has been

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widely used in clinical practice, but there are still up to 80% patients with acute pain and 65% patients with moderate to severe pain [2, 3].

In 1997, enhanced recovery after surgery (ERAS) was first proposed, and in 2012, the future of fast-recovery surgery was elaborated [4]. ERAS refers to a series of perioperative treatment measures with evidence-based medical evidence, covering anesthesia, analgesia, minimally invasive surgery and other aspects. ERAS can effectively reduce the incidence of postoperative complications and patient mortality, shorten postoperative hospitalization time and reduce hospital costs [5]. One of the key elements of ERAS scheme is to provide appropriate analgesia [6]

Therefore, postoperative analgesia is particularly important in patients' rapid recovery, shortening hospitalization time and reducing complications.

2. History and Development of Analgesic Pump, Disadvantages of Traditional Analgesic Pump

Analgesic pump is a kind of infusion pump, also known as micro infusion pump, which is used in combination with analgesic treatment. Traditional patient-controlled analgesia (PCA) pump is a decentralized mode of use, which is inconvenient to manage. After the alarm of the electronic pump, the medical staff could not timely obtain information for relevant processing. The sound of alarm caused unnecessary tension of patients, and the output information could not be timely summarized. Mechanical pump is only constant speed infusion, it can't be adjusted at any time with the change of patients' conditions, and it cannot achieve the purpose of personalized treatment. In case of infusion pipeline blockage and other problems that seriously affect the quality of analgesia, medical staff cannot timely find it [7].

In addition, postoperative analgesia data could not be automatically collected and established into a database, resulting in the continuous improvement of postoperative analgesia quality.

3. Intelligent Analgesic Pump

The intelligent analgesic pump can realize the intelligent infusion mainly by accurately controlling and measuring the real-time infusion volume and infusion speed. When the infusion is completed, there are bubbles in the liquid, infusion congestion, empty liquid, motor fault and other abnormalities can be timely alarm response, in addition to the analgesic pump output of the liquid has a good linearity.

The intelligent analgesic pump is composed of analgesic terminal and analgesic management system, the analgesic terminal is composed of infusion device and one-time special liquid medicine box, and the analgesic pump management system is composed of base station and monitoring station (central monitoring station). When the intelligent analgesic pump is used to upload information in a wireless way, the base station transmits the information and transmits it to the monitoring station through a serial port. The wireless analgesic management software in the monitoring station analyzes and processes the uploaded information and can present it to the doctor for him to make corresponding processing.

Working principle is to use infusion analgesia terminal motor rotation extrusion iv to achieve liquid outward output for patients with transfusion, infusion device composition usually includes interface display device, the microprocessor module, motor drive module, Sensor detection device and alarm device [8].

The core part is the whole microprocessor module, which is equivalent to the "brain" to intelligently control and manage the working state of the analgesic pump. As the power source of infusion, the motor driving module composed of infusion motor and pump is the core of analgesic pump. Its driving principle of stepping motor includes peristalsis, rotary extrusion and piston extrusion. Sensor detection devices include pressure sensors, acoustic sensors and other sensor detection devices.

The signal is detected by the sensor, then processed by signal amplification, and finally sent to the microprocessor. Pressure sensors mainly detect infusion congestion and blood leakage, ultrasonic sensors mainly detect bubbles and so on. The alarm device is used to make an immediate alarm response, including photoelectric alarm and sound alarm, when the sensor's inductive signal passes through the microprocessor to get the alarm information. The interface display device mainly realizes the setting of infusion parameters, including infusion volume, infusion speed and other parameters [9]. (Figure 1)

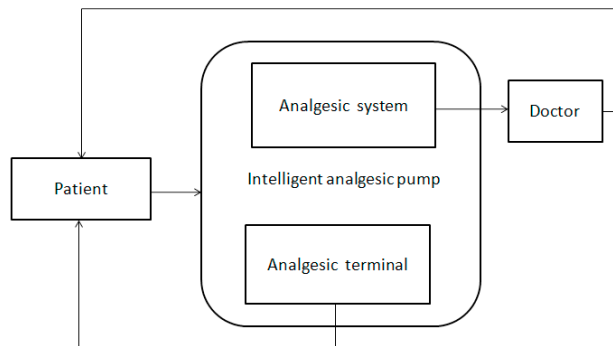


Figure 1. Mechanism of intelligent pump

4. Advantages of Intelligent Analgesia

Information management, wireless analgesia management system can establish postoperative analgesia database, connect with HIS system to automatically read patient information function, classification display and information maintenance function, ward management function, electronic medical records as the center of mobile ward inspection function [10].

4.1. Wireless monitoring

It embodies in the wireless networks more coverage without distance limitations, real-time monitor wireless analgesic, instant hit system terminal equipment.

4.2. Safe and reliable infusion, high infusion accuracy

It includes internal double chip security monitoring, password lock, automatic keyboard lock to prevent unauthorized changes or keyboard misoperation, limited lock and time lock functions..

4.3. Personalized treatment, multiple drug delivery channels and ways

It has been applied in postoperative analgesia, labor analgesia, cancer pain and other pain treatment. Patients can participate in pain evaluation of the medical care [11].

4.4. Double-channel evaluation, recording and inquiry platform

Double-channel follow-up evaluation includes analgesia terminal or central monitoring station and real-time data recording and automatic storage. The history run information which has automatic generation of postoperative follow-up and PCA records can be invoked at any time.

5. Conclusion

Analgesia pump use can reduce postoperative pain and various adverse reactions, the PCA technology is widely used in clinical, due to individual differences, however, to pain tolerance is different, there are still quite a lot of patients with postoperative pain without effective treatment, the main reason is the lack of good equipment, failure to

form effective analgesic standardization management. Traditional electronic pump analgesia mode, scattered doctors and patients, inconvenient management. Complications or mechanical failure of analgesic pump occur in patients, and doctors cannot timely obtain information, resulting in poor analgesic effect and even doctor-patient disputes. Therefore, improving analgesic quality and improving patient satisfaction are still the difficulties in postoperative analgesia. Wireless intelligent analgesia system is an information system solution integrating remote monitoring, information management and high-precision infusion pump for patient-controlled analgesia. On the one hand, patients can participate in intermittent drug administration by themselves; on the other hand, the operation information of analgesic pump can be transmitted in real time through the monitoring platform, and an electronic record sheet can be formed to facilitate standardized, safe and effective postoperative analgesic management. The traditional passive call mode is transformed into active service, which eliminates the fear caused by bedside alarm and meets the high quality requirements of analgesia.

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