Intraoperative Nursing Cooperation for Electromagnetic Image-Guided Endoscopic Sinus Surgery

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Abstract. Purpose: Endoscopic sinus surgery is nowadays routinely used in chronic rhinosinusitis, the technique now has expanded and used to treat orbital and skull base diseases. However, the complications including severe bleeding, blindness and injure to the central nervous system have been reported once in a while. To address these concerns, electromagnetic navigation system has been used in endoscopic sinus surgery at home and abroad. The navigation system is a computer aided technique that helps identify important anatomical structures by using three-dimensional image information. Surgeons could get more intuitive and more detailed imaging information in the operative field (anatomical structures “map”), identify the relationships between structures and surgical instruments conveniently, thus preventing and reducing endoscopy-related issue. Navigation system through an endoscopic sinus surgery was to be a significant part of nasal basic research and clinical practice; although there’re limitations, such as cannot provide intraoperative changes on real time and the heavier economic burden. Intraoperative nursing cooperation for electromagnetic image-guided endoscopic sinus surgery will become increasingly important.

History of Imaging Navigation

Imaging navigation originated from stereotactic neurosurgery. With the application of CT in the 1970s, this technique entered the rapid development stage. In 1986, Roberts et al. first described the first frame stereo surgical navigation system[1,2]. In 1994, Aron et al. Applied imaging navigation to nasal endoscopic surgery, and the uncertainly was 1~2mm. And then in 1999, Casiano et al. greatly improved the system, the accuracy was further extended, and with faster registration, easier of operation and a high cost-effectiveness[3,4].

The Type of Imaging Navigation

Imaging navigation system was applied to otorhinolaryngology surgery from 1986. Currently, four types are commonly used include electric models, electromagnetic induction, light induction and acoustic conduction. Our hospital introduced the electromagnetic navigation system in July 2015, the surgical operations all nearly hundreds cases were performed successfully, reduced complication incidence and improved surgical efficiency.
Electromagnetic Navigation System

At present, the new generation of electromagnetic navigation system can be manipulated without tying patients to operating tables, and without wearing scan tags. With precise registration in 1 minute, the system could automatically merge CT, CTA, MAI and MRA datas, then provide continuous and reliable precision in surgery, show the structure of the instrument location and surgery path with 3-D images directly on nasal endoscopy or microscope[5-7]. The accuracy is 1~2mm, longitude is 0.3mm in theory.

Electromagnetic navigation system launcher produce electromagnetic field around the patients, microsensor of surgical instrument in the magnetic field take the signals for surgeons with a picture of patient “dynamic map”. Moreover, electromagnetic tracing technology could locate the patient’s anatomical position by traceable instruments.


Intraoperative Nursing Cooperation

Preoperative preparation. 1) Preoperative visit: Operating room nurses should be 1 day in advance to visit ward patient preoperatively, take the initiative to introduce the image-guided surgery knowledge to patient and the family members, to help patient’s confidence building, to improve the compliance to treatment, make the operation smoothly. 2) Preparation for surgical instruments: All surgical instruments such as sinus instruments, endoscopy and sinus power drill must be sterilized before use, check the instruments performance whether in good conditions, to ensure the operation smoothly. Nasal endoscopic system, power system and navigation system were placed about 1 meter before the head of the operating table, surgeon and assistant will be on the right side of patient, and instrument nurse will be on the left side and anesthesiologist in the rear. With the patient at supine position, the identification must be confirmed by surgeon, nurse and anesthesiologist. Make the patient’s head up tilt 30°after general anesthesia, smear roxithromycin ointment on the palpebral fissures and apply an eye plate to prevent disinfectant from eye irritation. After sterilizing and laying sterile towel, fix navigation frame and adhered to the frontal skin to prevent errors which caused by head movement. Prohibit the use of metals such as a cloth towel clamp after laying sterile towel. We must ensure no metals in the magnetic field before registration, and check the cotton pieces for quantity besides.

Intraoperative preparation. Vital signs should be closely observed during operation including patient’s heart rate, complexion and respiratory rhythm. Once appears pale comolexion, cyanosis and so on, inform surgeon immediately. Moreover, it’s necessary to ensure an unblocked attractor and record the amount of blood. During the operation, the navigation accuracy should be frequently checked to avoid misleading. Be familiar with surgical procedures, understanding the methods and the surgeon’s habits. Be careful and careful, cooperate actively with each other. When delivering the equipment, be soft, steady, accurate and fast. All the equipment must be handled with care and rational position, keep clean and provide timely to user. The wires should be fixed and keep the tension free with no pressure.
Surgical instrument cleaning and maintain. The expensive and elaborate navigation system equipment should be cleaned separated from others, standard tool suite can be sterilized by high pressure after cleaning. The consumables require low temperature plasma sterilization to avoid corrosion. Store patient’s information and shut down according to the prescribed procedures after surgery. Emitter shelves, electromagnetic generator and power cord should be properly placed near the host, seted protection cover to prevent magnetism and dirt. The equipment should be kept by a special person and recorded after use. Asking professional technicians to debug and maintain the system regularly, ensure the instruments in a good condition.

Conclusions

Electromagnetic navigation system is an advanced technology and means a new leap in the field of surgery, which almost apply to all the endoscopic sinus surgery, skull base surgery and ear microsurgery[9-10]. The system can assist surgeons reach the lesion quickly, shorten the operation time, avoid blindness and reduce the damage to surrounding tissues through one operation. Due to the short operation time and less complications, the patient satisfaction was greatly improved. With the high cost and precision hardware system, it requires operating room nurses to have higher business capability and quality. Mastering procedures of the system, making full preparations, strain capacity, and a certain equipment trouble shooting ability were essential for the surgery.

References


