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世纪高等医学院校教材

供临床、预防、基础、口腔、麻醉、影像、
药学、检验、护理、法医等专业使用

外科基本操作指导

(双语版)

主编 汤文浩 吴小涛



科学出版社

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内 容 简 介

外科基本操作是每位临床医学专业学生的必修课。本教材是按 40 学时(10 次实验,每次 4 学时)编写的一本外科基本操作指导性教材,内容包括无菌术、外科基本操作(切开、止血、结扎、缝合)、腹腔镜基本操作、心肺复苏基本技术和动物模拟手术训练等,含图 106 幅。

本书可作为医学院各专业的医学生学习外科基本操作的指导教材。

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Introduction to Basic Surgical Skills

(Bilingual Edition)

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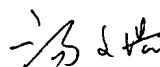
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PREFACE

Management of surgical patients requires many different skills, especially operative skills. It is well known that operative skills are best learned and practiced in operation theater, but preparation for these experiences begins long before the operating room is entered. Traditionally, practical skills can be acquired on an apprenticeship basis through assisting experienced surgeons on live patients. Obviously, these practical skills are acquired at the bedside or in the operating room on real patients, usually in emergency and stressful situations and inevitably errors are perpetrated on patients in the learning process. Human errors, the majority being technical, cause debilitating symptoms or complications and at worst lead to mortality. There is compelling evidence to suggest that undergraduate surgical education should provide appropriate instruction in basic surgical skills and principles.

In order to provide training on correct, delicate and precise surgical techniques, the basic surgical skill training course is integrated in the Medical Curriculum as a mandatory requirement for the students major in clinical medicine in China. This training course is usually undertaken within the 3rd academic year of medical students in University, offers an introduction to fundamental surgical skills required by Medical Curriculum and focuses on training students to acquire a higher level of basic skills in open surgery by means of intense laboratory practice. Evidence shows that many surgical skills can be taught in the environment of a surgical skills laboratory. Medical students can develop and improve their surgical skills by participating in workshops that combine the use of animal organs, live animals, computer-aided learning programs and videotapes.

Surgery is a team work. The emphasis of this course is on small group (usually 4 to 5 students) working, intensive hands-on practice of basic skills and the performance of practical procedures. Although there are minor variations in the way that basic surgical skills are taught to medical students at medical schools in China, three modules are undertaken over the forty hours of the course: surgical aseptic techniques, basic surgical skills in open surgery and basic skills in cardiopulmonary resuscitation. Training of basic surgical skills was considered an important learning goal in the operative field. Thus, in our department, repeating Session 9 twice was integrated and cholecystectomy was eliminated from the 40 hour practice with focus on enhancing basic suturing techniques on animal models, although five different hand-on training programs on animal models have been offered in this book.



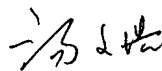
Wenhao Tang

前 言

外科病人的处置需要多种技术支持,其中首推手术技巧。众所周知,手术室是学习手术技巧的最佳场所,然而,医生的准备应该是在入手术室之前很长时间就着手进行了。以前,下级医生是通过为上级医生当手术助手的过程中学习外科手术技巧的。显然,这种在病房或手术室学习手术技巧的过程又往往是在紧急的情况下进行的,因而,不可避免地会出错。这种错误大多是技术性的,可导致病人残废或发生并发症,甚至造成死亡。因此,医学院应对医学生进行外科基本操作技能的培养。

为了培养正确、精细外科操作技术,我国医学院的在课程设置中已经将外科基本操作归入必修课,并且纳入评估体系。该课程一般在医学院的三年级开课,旨在按课程设置要求介绍外科基本操作技巧,要求学生通过外科手术基本操作的强化训练,打好外科手术操作的基础。实践证明许多外科技巧可以在外科实验室内讲授,医学生可以用动物器官或用活体动物进行外科技术训练。

手术是一种团队工作。本课程要求学生以小组(通常4~5人为一组)为单位,进行强化动手操作训练。在我国医学院校中,该课程的教学内容主要包括无菌术、外科基本操作技术和心肺复苏基本技术三方面。尽管外科无菌技术和手术基本操作的基本原则相同,但具体方法各院校仍有差异。本书列出了5种动物模拟手术操作,目的是让每个学生都有操作机会。我们结合我院具体情况,作了适当调整。在5次手术中,安排了2次胃部分切除端对端吻合术,略去了胆囊切除,旨在将无菌技术与手术操作相结合,要求学生在执行无菌技术的前提下,对外科手术基本操作(切开、分离、止血、结扎、缝合)有多练的机会,从而打好外科操作的基础。



2007年劳动节于南京丁家桥87号

CONTENTS

Course overview	1
Session 1 Surgical aseptic techniques & Basic surgical knot making	11
Session 2 Basic surgical instruments identifying and instrumentation common suture methods	31
Session 3 Cadaveric jejunal anastomosis (end to end) & Surgical aseptic techniques (video tape)	51
Session 4 Basic surgical skills for laparoscopic surgery	57
Session 5 Basic cardiopulmonary resuscitation (CPR)	62
Session 6 Hand-on training on animal models (anaesthesia, venopuncture or venous cutdown, and appendectomy)	71
Session 7 Hand-on training on animal models (anaesthesia, venopuncture or venous cutdown, and splenectomy)	81
Session 8 Hand-on training on animal models (anaesthesia, venopuncture or venous cutdown, enterectomy and end-to-end anastomosis)	83
Session 9 Hand-on training on animal models (anaesthesia, venopuncture or venous cutdown, partial gastrectomy and gastrojejunal anastomosis)	88
Session 10 Hand-on training on animal models (anaesthesia, venopuncture or venous cutdown, and laparoscopic cholecystectomy)	96
Appendix 1 The choice of the incision for abdominal surgery in rabbits	104
Appendix 2 The choice of the incision for abdominal surgery in dogs	110
Appendix 3 Anesthesia records, operative note and postoperative note	114
Appendix 4 An example of animal operative note	126
Appendix 5 Minor surgical techniques	130

目 录

概述	7
实习一 外科无菌技术操作和打结法	25
实习二 常用手术器械及其正确用法,各种缝合方法	46
实习三 离体猪肠端对端吻合术外科无菌技术和基本操作复习(放教学电影和电视录像)	55
实习四 腹腔镜外科基本技术	60
实习五 心肺复苏基本技术	68
实习六 动物手术(麻醉、静脉穿刺或切开、阑尾切除术)	77
实习七 动物手术(麻醉、静脉穿刺或切开、脾切除术)	82
实习八 动物手术(麻醉、静脉穿刺或切开、小肠部分切除端对端吻合术)	86
实习九 动物手术(麻醉、静脉穿刺或切开、胃部分切除、胃空肠吻合术)	94
实习十 动物手术(麻醉、静脉穿刺或切开、腹腔镜下胆囊切除术)	101
附录一 兔的腹部解剖和手术切口选择	108
附录二 狗的腹部解剖和手术切口选择	112
附录三 动物手术麻醉记录、动物手术记录和动物手术术后观察记录的记录方法	120
附录四 动物手术记录实例	128
附录五 外科临床常用无菌操作	136

Course overview

Surgery treats illness by manual or operative methods. Although there is quite different kind of surgeries involved in a variety of surgical specialties, there are common basic aseptic rules and surgical elements such as instrument-handlings, incision, exposure, dissection, hemostasis, ligation (knot tying) and suture, which will be implemented and studied using examples from different subject matters such as the use of nonsynthetic materials and animal. The ethos of *Introduction to Basic Surgical Skills* course is to install core surgical skills and develop aseptic methods at the very beginning of a surgeon's training by teaching the correct basic technique.

The surgical skills training and education laboratory is a state-of-the-art educational facility that provides an environment to teach fundamental technical skills and procedures, where students can learn and hone their technical skills prior to performing procedures on a real patient.

Students entering the Surgical Skill Lab should rigorously adhere to the same principles of asepsis as surgeon entering the human OR, which is the foundation of surgical site infection prevention. Pay serious attention to all the steps in the practice, provide care for animals (humaneness for the animals) and prevent animal from anesthetic accident, surgical site infection and accidental death.

A. Instruction for students entering the surgical skill lab

1. People dressed in street clothes are not appreciated to enter the Surgical Skill Lab and a clean white smock or coat is recommended.

2. You must change into clogs or sandals at the barrier between the Lab and the rest of the campus.

3. Before entering the Lab, you need to enter the changing room, where you should put on a cap/hood and make sure it completely covers your hair, the scalp line and sideburn (Fig. 1). A face mask must cover your nose, if it fogs your glasses, arrange its top edge, so that your breath does not drift upwards, or, rub your glasses with ordinary soap and polish them. Then you must change into a scrub suit, consisting of pants and a short sleeved shirt (Fig. 2). The purpose of these is to make sure that nobody enters the theatre in his ordinary clothes. A clean scrub suit is donned whenever personnel enter the restricted or semirestricted area of the operating room. Soiled scrub suits must be placed in a marked laundry receptacle so that they do not spread contamination.

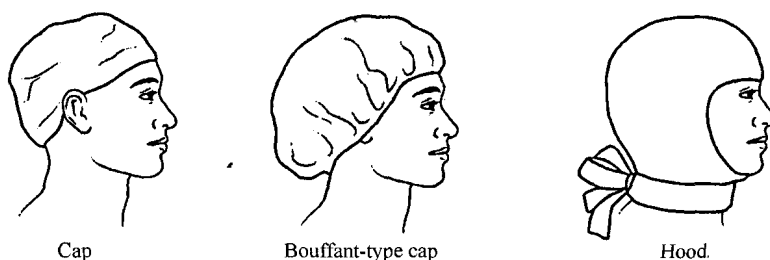


Fig. 1 Hair cover types 戴帽遮发

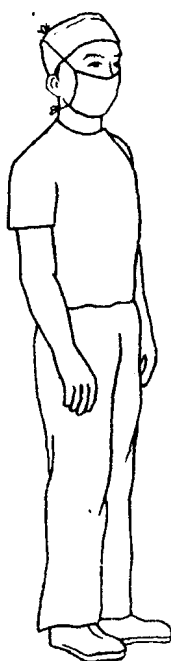


Fig. 2 OR attire
手术室的着装

4. Be serious in the practice and follow teacher's instruction. Talking is kept to a minimum during surgery. No loud talking, no laughing, no shouting or crying out.

5. Surgery is a collaborative effort. Each member of the team has specific duties and tasks that complement the other members and achieve common goals.

6. Surgery requires extreme concentration and high sense of responsibilities. Although it is a skill training course on animal model, carelessness or perfunctoriness is not accepted.

7. When the surgery is completed, soiled instruments should be cleaned, washed, disinfected, dried, lubricated, packaged and then taken to the sterilization room.

8. Practice strict economy, keep the operative environment clean and tidy, take good care of surgical instruments, equipments and furniture.

A perfect knot tying requiring a great deal of practice, each student will practice the knot tying by means of several homework assignments. Take your time when learning these skills. It is better to be methodical and slow at first. Speed and efficiency will follow with practice if you use the same technique repeatedly. After each session of hand-on training on animal models, students are expected to write lab protocols; making anesthesia note by anesthetist and dictating operative and postoperative reports by surgeon, referring Appendix 3. Certification of successful completion is based on following skills assessments: knot tying, aseptic techniques (scrubbing, gloving and gowning), cardio-pulmonary resuscitation and medical records writing.

B. Operating room personnel

Each member of the team has a clearly assigned role and responsibility. Students will work in small groups preparing and operating on animal, but they are encouraged to work in cooperative way to complete performance objectives, demonstrating integrity and holistic view.

1. Surgeon (operator) usually stands on the right side of patients (Fig. 3) and is responsible for operation, including incision, dissection, homeostasis, ligature and suture, under the prescribed policies or according to intraoperative events, directs the surgical team during the procedure.

2. The first assistant, scrubbing ahead of operator, may perform surgical skin preparation, works with scrubbed nurse to unfold the drapes over patient, stands on opposite side to surgeon and is responsible for hemostasis and sucking blood during the procedure.

3. The second assistant, standing by the operator or the first assistant, is responsible for holding retractors, cutting thread and sucking blood.

4. Scrubbed nurse scrubs before the rest of the sterile team to prepare all sterile supplies and equipment that have been previously opened. Scrub nurse, usually standing adjacent to the operator at about the level of the thighs, is responsible for instruments and its delivery, needle-threading, sutures, devices, solutions, and medications according to the specific surgery, maintaining a clean and orderly managed instrument table and sterile field, protecting the surgical setup from contamination, and performing the initial instrument, sponge, and needle count with the circulator.

All items that could be retained in the surgical wound are counted by two people in a prescribed manner. Policies directing sponge, sharps, and instrument counts (called simply a count) have been established. The count is performed before surgery begins to establish a base-

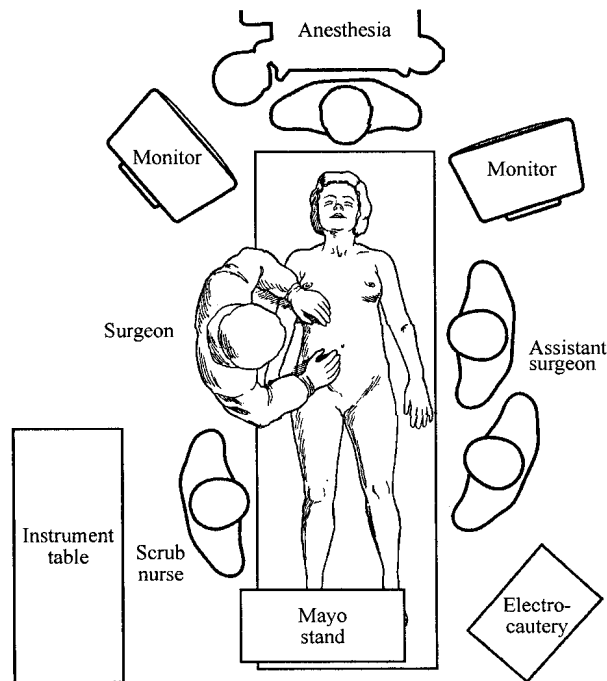


Fig. 3 Positioning of the sterile team members and the furniture
手术组人员和设施的位置

line count, before closure of a cavity, and before skin closure.

5. Anesthetist is responsible for anesthesia, meticulous assessment, monitoring, and adjustment of the patient's physiological status during surgery. Stands on the head of the table.

6. The circulating nurse: The tasks of circulator were as follows: to fetch and carry, to place the kick bucket or other sponge receptacle in close proximity to the sterile field, to participate in count, to secure scrubbed nurse and surgeon's gowns.

C. Trapping and handling of living animals

Rabbits and dogs are the common used animals for basic surgical skill training.

1. If it is possible, animals should be purchased from a supplier and moved to the cages or kennel one week ahead of the studies, especially for dogs, which serves to bridge periods of adaptation to new environments, thereby reducing stress and experimental variability.

2. Except for drinking, overnight fasting allows 12 hours for emptying of the stomach before the operation to minimize hazards of vomiting and aspiration, and to help exposure and operation in the abdomen. These are the reasons why fasting is appropriate for a dog or cat, but these reasons do not hold true for rabbits, because rabbits lack the vomiting reflex and can begin to suffer liver damage in relatively short time when the gut is empty, although rabbit gut passage time is relatively long (12 hours). So, it is not advisable to fast the rabbit before surgery.

3. Catching and restraint of animal

(1) Rabbits need to be handled very carefully, as they have an exceptionally delicate skeletal structure and can be injured very easily if improperly handled or dropped, especially susceptible to lumbar spinal luxation, resulting in paralysis. Most rabbits get very uneasy when they are picked up and may struggle and hit you with its claws. Their hind legs are long and strong and

their claws are curved and sharp like an eagle's.

Young rabbits can be picked up by the skin of their neck, like a kitten, then placed on your hand, held up against your chest, with the other hand then cupping it around the tail area. As they grow bigger and heavier they don't like being picked up that way. Remove the adult rabbit from its cage by grasping the skin over the shoulders with one hand, turning the rabbit slightly to one side, and slowly pulling it to the front and lifting it out of the cage. Always support the rabbit's hindquarters by placing your hand around the rump (Fig. 4). Caution: If their feet dangle they kick around and can scratch. Rabbits must never be lifted by the ears.



Fig. 4 How to carry a rabbit
抓捕兔的姿势

First, take a cotton tape approximately 100 cm in length and 1-1.5 cm in width and make a large loop with a loose knot in a single throw. A large loop allows you to keep your hands at a safe distance until the muzzle is tied. Slowly and gently, slip it over the dog's jaws. Secure the knot on top of his nose, and then tie another loop with a single-throw knot below the mouth. Finally, tie it behind the head, with a bow. Although all knots must be secured, the muzzle should not be so tight anywhere as to pinch the skin. This would be painful and would cause the dog to struggle.

To remove the muzzle, untie it at the back, and again keeping your hands away from the dog, slowly pull the gauze strip towards you. Note how the steady, gentle pull loosened the knots around his jaws without hurting him. That is why only single-throw knots should be used.

A muzzle should be removed immediately if an animal has difficulty breathing or starts to vomit.

(3) Measuring its body weight.

(4) Securing the animal on operative table: Things you'll need for the securing an animal are an operative table and four cotton threads for tying the legs. Operative table is a flat board or trough with cleats on the four corners for securing restraint cords. An assistant may be very helpful, and chemical restraint with ketamine is recommended to reduce struggling. The rabbit or dog is stretched out on its back with its hocks tied to the corner cleats. The abdomen is clipped and the skin cleaned with detergent.

4. Skin sutures are often unnecessary. They may cause the animal to chew or scratch at the incision site. Alternatives include use of subcutaneous/intradermal closure techniques or tissue

(2) Dog capture is more difficult and chemical immobilization with ketamine/acepromazine is normally used. The drug is injected by hand with a syringe into the rear leg muscles after the dog was confined with the help of a squeeze cage, or restrained by a special catch loop. An intractable dog may need to be muzzled. A muzzle must be fitted snugly so that it protects against bites, but at the same time it must be comfortable for the dog. A commercial muzzle may be purchased in many sizes, or a gauze muzzle may be used as described below (Fig. 5).

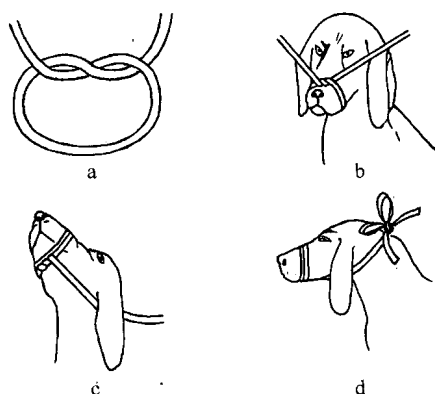


Fig. 5 How to make a temporary muzzle
狗鼻口的捆绑方法

adhesive.

By the end of the operation, the wound would be left exposed to the air without dressings. The unconscious animal(s) should be kept away from their compatible animals and in clean, warm and dry board during the anesthetic-recovery phase.

IMPORTANT NOTE:

Be sure to gently check the sutures for a day or two after surgery to be sure the rabbit isn't chewing them, and to check for unusual redness, swelling or signs of infection.

Offer your rabbit a bowl of water, even if a water bottle is usually used. A rabbit needs to drink after surgery, but often won't do so if he has to "work" for his/her water. He will recover more quickly if he's well hydrated.

Monitor the output of fecal pellets closely. If fecal output slows or stops after surgery, your rabbit may be suffering from gastrointestinal stasis(ileus) stress of the surgery.

D. Anesthesia

Good anesthesia practice consists of preventing awareness of pain in a controllable and reversible fashion with a minimum of risk during surgical procedure. Pentobarbital, thiopental, ketamine and ether have become the agents of choice for anesthesia in rabbit and dog, because they are effective, easily administered and inexpensive. Even though isoflurane gas is more expensive than injectible anesthetics and ether anesthetic, it is worth the extra cost to ensure a safer surgery and faster recovery.

1. Sodium pentobarbital One of the commonly used intravenous agents is pentobarbital, which is yellow powder and should be dissolved in normal saline to the concentration of 2 per cent before use. Pentobarbital can be administered by two routes:

(1) Intravenous anesthesia: Rabbits are usually anesthetized with an intravenous dose of sodium pentobarbitone (30-60mg/kg) via the marginal ear vein. Within 2-4 minutes the animal will lose consciousness, although it may experience a brief period of excitement. Anesthesia from pentobarbital can last from 1 to 2 hours, depending on the dose given. Additional amounts about one fourth to one fifth of initial dose can be given as necessary to maintain anesthesia, being careful not to overdose. The animal's physiological status was monitored at regular intervals throughout the anesthesia, and antidote (cocculin) was prepared in case any complications occurred. One of the most useful indicators for measuring depth of anesthesia is heart rate (HR). When the jaw muscle tone is relaxed, the animal should be intubated. Please be aware that intubation of rabbits is a delicate procedure requiring a great deal of practice and expertise.

(2) Intraperitoneal anesthesia: Rabbits or dogs can be anesthetized with intraperitoneal injection of sodium pentobarbital at dosage of 40 mg/kg body weight. The onset of anesthesia state in intraperitoneal route is slower than intravenous administration.

The animal is usually restrained in dorsal recumbency. The operative board securing the animal is inclined slightly in a head down position. This position allows the intestines to fall toward the diaphragm and away from the injection site. Injections are made in the lateral aspect of the lower abdominal quadrants. However, it is best to try to avoid the left side in rabbits because of the presence of the cecum. After the needle is inserted, draw back. If anything is aspirated, you have likely hit the viscera: a distended urinary bladder (clear to yellowish fluid), the bowel (greenish-brown material), or the liver (blood). If the needle is placed correctly the drug may be injected. Drug administered into the viscera may result in no effect or in a complication.

2. Sodium thiopental Thiopental is an ultrashort-acting sedative, which is dissolved in normal saline at 2.5 per cent concentration. Care must be taken to avoid perivascular or subcutaneous injection, which may cause significant tissue necrosis and skin sloughing, as thiopental is highly alkaline (pKa 10.5). Its dosage is determined by body weight but obese animals may re-

quire higher doses of thiopental to induce anesthesia. Anesthesia induced by this drug is associated with respiratory depression or apnea if a large dose given. The administration routes are:

(1) Intravenous anesthesia: Rabbits or dogs are usually anesthetized with an intravenous dose of thiopental (15-20 mg/kg). It causes onset of unconsciousness in 1-2 minutes. Additional dosage about one fourth to one third of initial dose can be supplemented as needed, being careful not to overdose as described above under "sodium pentobarbital".

(2) Intraperitoneal anesthesia: Rabbits or dogs can be anesthetized with intraperitoneal injection of thiopental at dosage of 25 mg/kg body weight. The onset of anesthesia state in intraperitoneal route is slower than intravenous administration. If sedation is insufficient intraoperatively, 1/2 of the original dose is given intraperitoneally with the fascia grasped and lifted on either side of the incision with Allis.

(3) Intramuscular anesthesia: Dogs can be anesthetized with intramuscular dose of 25 mg/kg body weight thiopental applied by hand injection into the rear leg muscles. The onset of anesthesia state in this route is approximately in 5 to 7 minutes. If sedation is insufficient, 1/2 of the original dose is given in the same route.

3. Ketamine Ketamine, known as a dissociative anesthetic, provides poor analgesic activity, especially for visceral pain. This drug is easy to use and have a wide margin of safety for most laboratory species. The animal's eyes will usually remain open and the corneas should be protected with a layer of ophthalmic petrolatum or other suitable ointment.

(1) Intravenous anesthesia: After the administration of 2 to 3 mg per kilogram intravenously, the animal rapidly becomes lack of response to stimuli and the anesthesia can last for 10-15 minutes. Additional dose (up to 10 mg per kilogram of total dose) can be given as necessary to maintain anaesthesia.

(2) Intramuscular anesthesia: After the administration of 6 to 12 mg per kilogram intramuscularly, the animal becomes lack of response to stimuli and the anesthesia can last for 30 minutes. Additional dose up to 30 mg per kilogram of total dose can be given as necessary to maintain anaesthesia. Rats can be anesthetized with ketamine (150 mg/kg, I. M.). Intramuscular and intraperitoneal injections of the dissociative anesthetics can be painful, as the drug is very acidic.

4. Ketamine-based combined anesthesia In general, by mixing anesthetic and analgesic or sedative drugs, the dose required for each individual drug is reduced. Do not mix drugs in the syringe until you have determined that they are compatible when mixed. If in doubt administer separately.

(1) Ketamine-Xylazine: This combination is effective, easily administered and inexpensive. For immobilization and painful procedures of pigs or dogs, the doses of 10 to 15 mg/kg ketamine and 1 to 3 mg/kg xylazine are generally required injecting intramuscularly by hand, as physically restraining these animals is both difficult and dangerous and may cause undue physiological stress to the animals. Because it is more difficult to estimate weights of these animals, we recommend erring toward heavier weight estimates when immobilizing these animals.

Rabbits can be anesthetized intramuscularly with ketamine (35 mg/kg) and xylazine (5 mg/kg) with or without acepromazine (0.75 mg/kg).

(2) Ketamine-Medetomidine: Rabbits can be immobilized using a mixture of ketamine and medetomidine either subcutaneously or intramuscularly. The target dose was 5-7 mg of Ketamine per kilogram of body weight combined with 0.08 mg/kg of medetomidine.

5. Urethane (ethyl carbamate) After the administration of 20 percent solution at 5 ml per kilogram intravenously, the animal rapidly becomes lack of response to stimuli and the anesthesia can last for 50-60 minutes, or even longer.

概 述

外科手术是治疗疾病的一种方法,尽管它的种类繁多,范围、大小和复杂程度有很大差别,但其基本操作相同。切开、显露、分离、止血、结扎、缝合既是手术的基本操作,也是做好手术的条件之一,其重要性就不言而喻了。《外科基本操作指导》这一课程,旨在通过模拟器具和动物手术实习,使学生建立无菌观念,并初步掌握手术的基本技术操作。

外科基本操作实验室是为学生学习外科基本操作提供必要的器械、设备和场所,为学生掌握好这门基本技术提供支持条件,为以后的临床学习打下基础。

学生进入实习室学习动物手术,应当同进入医院手术室做手术一样,不能认为是做动物手术而在思想上有所轻视。在整个实习中,必须严格遵守无菌操作规则,认真、细致地进行操作,爱护动物,防止麻醉意外、感染和动物死亡。

一、实习须知

1. 穿工作服,方可进入实习室。

2. 在隔离线处换拖鞋。

3. 在更衣室戴口罩和帽子,脱去自身的普通衣裤,换上手术衣和手术裤,然后才能进入手术室。帽子要求能完全遮住头发、头皮和鬓角(Fig. 1)。口罩要盖住鼻孔,为防止水汽雾了你的眼镜,可以在口罩的上缘、鼻两侧压一下,或在镜片上抹一层肥皂液并擦净。然后,褪去内衣、裤,换穿手术室的洗手衣、裤(Fig. 2)。禁止将日常穿的衣裤穿入手术室的半无菌区(半限制区)或无菌区(限制区)。手术结束后,污染的洗手衣应脱下放入指定的清洗袋中。

4. 必须严肃认真,服从教师指导,禁止大声谈笑或喊叫。

5. 手术是一种团队工作,既有分工明确,又要相互合作,体现团队协作精神。

6. 手术要集中注意力,有高度责任心,尽管是动物操作,不可草率从事。

7. 手术完毕后,将用过的器械洗净、消毒、擦干、上油、包好,放在规定处待灭菌。

8. 厉行节约,保持整洁,爱护公物。

9. 外科打结需要课后勤练,才能逐渐运用自如,因此,学生们起初几次的课后作业就是打结。外科技巧的学习需要时间,开始应力求方法正确,不要图快,通过反复练习,速度和效率自然会长进。进入动物手术实习后,由麻醉者记录麻醉情况,手术者写实习报告(包括手术记录,术后观察记录等),其方法见附录三。学生在完成本课程的学习后,其成绩将根据下列技巧的熟练程度进行评分:打结、无菌术(洗手、带手套和穿无菌衣)、心肺复苏以及医疗文件的书写。