

Chapter 2

Basic Equipment for Microsurgical Experiment

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Abstract Unlike of human organ transplantation, the most of the experimental procedures in small animal are performed under magnification and using specific micro-instruments and microsurgical suture material. In this chapter, we briefly describe the crucial features of the surgical microscope and its use, microsurgical instruments and suture materials which are usable in experimental organ rat transplantations.

Keywords Microscope • Magnification • Instruments • Sterilization • Suture material

2.1 Surgical Microscope

The same kind of surgical microscopes can be used for experimental and clinical microsurgery. There are several basic levels of microscopes, ranging from basic models with simple equipment to microscopes combined with an external monitor, a recording camera and/or an accessory ocular for a second viewer of the surgical field. Although the price can limit the purchase of a microscope, it must at least be binocular with a focal distance of at least 20 cm and the magnification should range between 4 and 16 times.

As a general rule, the lowest magnification allowing the secure handling with instruments and a clear orientation for the surgeon within the field should be used. The range and the depth of surgical field in focus diminish with increasing magnification. Therefore, using a high magnification makes clearly visible only the object in focus (e.g. vascular anastomoses) and many surrounding structures become fuzzy.

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The distance between the optics of microscope and the object (the anatomic structure) is called a working distance which has to provide space enough for comfortable manipulation with instruments and adequate light source.

In short, low magnification and clear lenses are recommended for most of surgical procedures.

2.2 Surgical Equipment and Instruments

In general, each animal needs eyes treated with eye ointment (w) and the surgical field has to be cut from hair and optimally shaved with detergent and razor (y).

The surgical pad is one of the most important pieces of equipment for surgery. Based on our experience, an optimal pad should provide supportive heating of the animal and fixing of surgical retractors and all under the sterile conditions. A stainless steel desk 15×30 cm with internal window 10×15 cm can serve as an example (p, r). An adequate size makes easy the rotation of the pad together with animal, which allows a change of view angle of the surgical field.

Experimental microsurgical instruments are identical to the instruments used in human microsurgery. It is strongly recommended that each surgeon to have their own separate set of fine instruments. Every instrument should be identifiable with colored tape (autoclavable) to identify the owner. In a small microsurgery department, it is possible to have common set of big instrument for all members. In this section the only basic set of instruments is described (Fig. 2.1). Special instruments needed for a specific surgical procedure are described in each particular transplantation model.

Medical scissors (a) and surgical tweezers (b) can serve for laparotomy preparation, a needle holder for abdomen closing (c) as well as a pair of small tissue forceps (d). For the tissue dissection/preparation, a pair of 11–12 cm long microsurgical tweezers with straight and angled tip (e, f, g) can be used. For vascular clamping, vascular clamps (m, n) some of them are placed on the vessel using special tweezers (h) can be used. For preparation, dissection, cutting of the tissue and suturing, use various types of the micro scissors with length with sharp or blunt tips (i, j).

Precise suturing is possible with atraumatic stitches inserted using a micro-needle holder (k, l) in combination with straight micro forceps. Sterile cotton Q-tips are an invaluable tool for the gentle manipulation of tissue (o). Sterile gauze squares are used for draping of the surgical field and for moisture cover of abdominal organs. Special triangles can be used for blood removal in case of bleeding (q). Some sterile beakers are useful for warming saline (x; 37° C) before being used for moistening of tissues. The flushing of vessels can be performed using fine metal cannula made from an injection needle by brushing of the tip.

Retractors can be used to hold back the edges of an incision to allow adequate visibility within the surgical field (s). Massive bleeding should be prevented using a

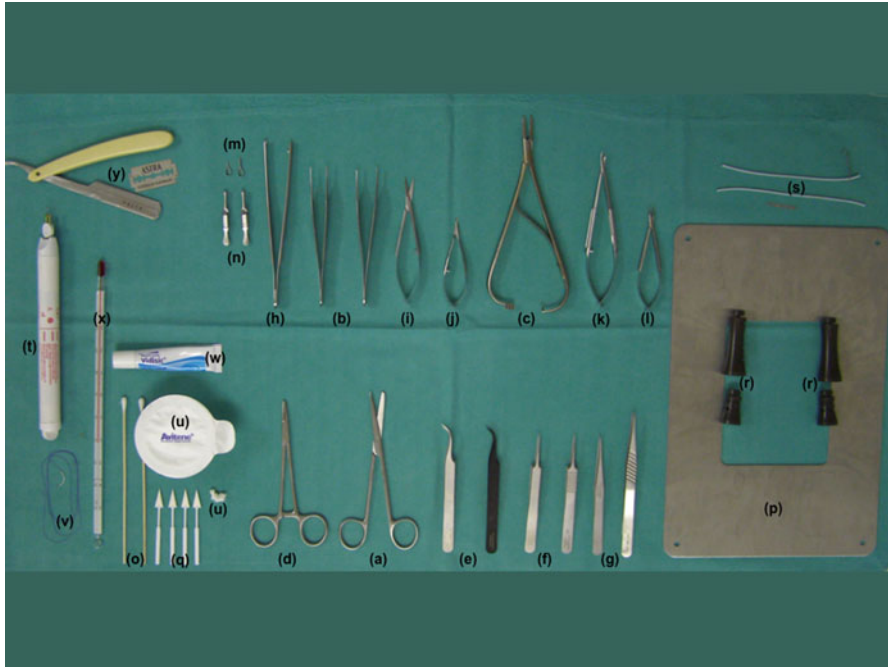


Fig. 2.1 Basic set of instruments

fibrin or collagen foam (u) or bipolar electro-cauter or much cheaper disposable thermal cauter (t).

Micro-surgical instruments are expensive and some of them are exceedingly delicate. Despite this, instruments have to be sterile at the beginning of experimental surgery. The gentle techniques of instruments sterilization are necessary as simple autoclaving is not adequate. Micro scissors should never be used for cutting of paper or skin. Instruments can be washed in mild soap and water to remove any blood after each procedure. Ideally, cleaning is best done with an ultrasonic cleaner. However, use caution because some very delicate microsurgical instruments can be damaged with ultrasonic cleaner. Special lubricants should be used to maintain the instrument condition and to prevent rust.

2.3 Suture Material

Similarly as surgical instruments, suture material is the same used in human surgery. Sutures are either absorbable or remain indefinitely in place. The adequate indication of suture tape is necessary.

Absorbable sutures, called “catgut”, are made from sheep intestines or synthetic material. VICRYL™ (v) is a synthetic absorbable sterile surgical suture composed of a copolymer made from 90 % glycolide and 10 % L-lactide. This material is usually used internally, for instance for vessels ligation, bowel anastomosis; however, it should not be used for vascular anastomosis or skin closure.

Non-absorbable sutures are usually used for skin closure and for vascular anastomosis. PROLENE™ is polypropylene (clear or pigmented), sterile surgical suture composed of an isotactic crystalline stereoisomer of polypropylene, a synthetic linear polyolefin. Generally, for experimental vascular connections, use monofilament suture with thickness 8/0 to 10/0. The optimal length of filament is 13 cm with round tip needle 3/8 and “chord length” 5 mm.

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