

We have found that diagnostic and treatment methods among first year residents sometimes differ. To ensure that everyone here at Toolworks General works under the same guidelines, we have included the following excerpt from "Anatomy and the Surgical Technique," by Drs. Robert Merl and Simon Newman (Copyright 1938, 1956, 1987, reprinted with permission of STW Medical Press).

**FROM THE DESK OF:  
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(Rev. 9/88)

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## Chapter Four: Some Pathology and Treatment

### Appendicitis

#### Indications:

Appendicitis is the infection and inflammation of the vermiform appendix, a superfluous, finger-sized appendage to the cecum at the junction of the small and large intestine. Appendicitis can be marked by any combination of loss-of-appetite, nausea, vomiting, diarrhea, high fever and acute abdominal pain.

#### Treatment:

Surgery is indicated in cases of appendicitis.

### Bacterial Infection

#### Indications:

Bacterial infection is the assault upon the body by a bacteria or germ. As the body's defenses attempt to expel the bacteria, certain symptoms manifest themselves. These can include abdominal discomfort, vomiting, diarrhea, high fever and runny nose.

#### Treatment:

Bed rest and medication are required.

### Intestinal Gas

#### Indications:

Symptoms include abdominal pain, generalized weakness and dizziness.

Treatment:

Observation and bed rest.

## Kidney Stones

Indications:

Small precipitates composed of mineral salts extracted from urine sometimes become lodged in the ducts of the kidneys. These renal calculi can cause extreme discomfort in the lower back and flank area. The stones, while rarely fatal, are extremely painful and should be treated immediately. Kidney stones will appear on an X-ray as small dots above the pelvis.

Treatment:

Kidney-stone patients should be referred to a urologist.

## Aneurysms

Indications:

When a blood vessel wall becomes diseased or begins to weaken, the blood vessel begins to dilate (stretch), forming what is known as an aneurysm. Should the artery walls become rough from deterioration, the blood within may clot and form an embolism, further stretching the aneurysm. If the aneurysm occurs in a large artery, the potential bursting of the artery is life-threatening. A particularly dangerous aneurysm occurs in the aorta, the main blood-carrying artery. Aneurysms of the descending, or abdominal, aorta can often be felt as a pulsating mass in the abdomen. The most common symptom is abdominal pain.

Ultrasonic scans reveal aneurysms as solid white lumps.

**Treatment:**

If an aneurysm swells to a dangerous level, 5 to 6 cm in diameter, the blood vessel's walls must be supported with a dacron graft. Since aneurysms commonly occur in older patients who have less stable systems, surgeons must take care to avoid needless surgery.

**Arthritis**

**Indications:**

Arthritis is the erosion of joints and their surrounding tissues. Arthritis is often found among older patients and can be extremely painful.

**Treatment:**

Arthritis is very difficult to treat. The most successful treatments include cautious exercise and pain-relief medication.

**Diagnosis**

**Definition:**

Diagnosis is the study of symptoms in an effort to discover the ailment causing a patient's discomfort. This process involves gathering as much information as possible about the patient and his or her symptoms before proceeding with treatment. Some of the tools found to be most useful are the patient's own report of symptoms, the abdominal exam, the X-ray and the ultrasonic scan.

**Patient's  
Reported  
Symptoms:**

Symptoms reported by the patient provide a starting point for diagnosis. These symptoms are often written on a clipboard at the foot of the patient's bed.

**Abdominal Exam:**

The abdominal exam is often an extension of the patient's report of symptoms. By palpating the abdomen and listening to the patient, the tending physician can gain a more detailed understanding of the symptoms. To perform an abdominal exam, palpate various locations on the patient's abdomen and note the responses. (For more information on examinations, refer to your Operating Procedures Manual.)

**X-ray:**

An X-ray is the image of electromagnetic radiation passed through a body and then captured on film. Before it reaches the film below, this radiation passes through porous material, such as skin and muscle, but is absorbed by solid masses, especially bone. X-rays, therefore, show solid masses such as bone but ignore less dense cartilage.

**Ultrasonic Scan:**

An ultrasonic scan is similar to sonar. During an ultrasonic scan, sound waves are focused on a body and scanned by a computer. The recorded wave-forms are translated into images of the masses off of which the sound bounced. Ultrasonic scans show the more porous cartilage that is ignored by X-rays.

**In Conclusion:**

After the initial evaluation, the physician uses the clipboard at the foot of the patient's bed to request

treatment or additional diagnostic options. A hospital staff is not allowed to carry out a physician's requests that do not include his or her initials.

## **Surgery**

### **Orientation:**

Before a surgeon enters the operating room, he or she must consider the following aspects of surgical procedure: First, he or she must be mentally prepared to finish the operation once it has begun. A mental checklist of the steps involved is often used as preparation. Second, the surgeon must constantly monitor the patient's vital signs. Even though the surgical team will help, the main responsibility for the patient's well-being is that of the surgeon in charge. Third, every surgeon must be very familiar with the medical instruments he or she must utilize.

## **Vital Signs**

### **Introduction:**

Several devices constantly report the patient's vital statistics during an operation. The electrocardiogram (EKG), clock and blood pressure gauge display the primary information. The IV bottle and anesthetic dial display secondary information.

### **The EKG:**

The EKG is an electronic representation of a heart beat and is used to monitor abnormalities in heart operation. Conditions for which surgeons must be

on the alert are Premature Ventricular Contraction (PVC) and Bradycardia.

PVC:

PVC is thought to arise from an imbalance in the electrical system of the heart and is characterized by a drop in the EKG line. If not medicated, PVC may lead to Ventricular Fibrillation, characterized by a rapidly modulating EKG line, absent of normal heart rhythm. This condition is usually fatal.

Bradycardia:

Bradycardia occurs when the heart becomes weak or tired and slows or skips beats. If proper medication is administered, the normal heart rhythm is usually restored. If not, the heart can lose strength and stop beating.

Blood Pressure:

The blood pressure gauge describes the measure of pressure the heart exerts on the blood vessel walls as it pushes blood against them. It is expressed in two numbers, the systolic pressure and the diastolic pressure. The systolic pressure, the peak level, measures the maximum pressure of the blood exerted against the vessel walls as the heart contracts. The diastolic pressure represents the force of blood exerted against the walls as the heart relaxes. Blood pressure can drop from prolonged anesthesia or blood loss.

Surgical Clock:

The clock displays elapsed time from the start of the surgery. Surgeons always work carefully, while trying to avoid unnecessarily prolonging an operation.

The IV Bottle:

The IV bottle shows the type and remaining quantity of fluid being infused into the patient. IV bottles



should not be allowed to empty, since the injection point may become clotted and hinder further IV administration. A steady flow of glucose solution should be administered to the patient even when a specific transfusion is unnecessary.

#### Anesthetic:

The anesthetic dial displays the status of the anesthetic valve. Generally, if the dial points to "on," the valve is open, and the patient is being anesthetized. If the dial points to "off," the valve is closed, anesthetic is not being introduced into the respiration chamber, and the patient is breathing only oxygen-rich air. Making sure the patient is fully anesthetized before commencing the operation is intensely important to any surgeon. The alternative is quite uncomfortable for the patient.

## **Chapter Five:**

# **Basic Surgical Techniques and The Abdominal Area**

In this chapter, we will look at the basic structure of the abdominal cavity and the organs and muscle groups found there. Then, we will discuss the general procedure for surgery in the abdominal area, around which specific operations can be built. Finally, we will look at two surgeries that take place in the abdominal area: the appendectomy and the aneurysm graft. Both surgeries make use of the general procedure as a frame for the particular techniques involved.

### **Basics of the Abdomen**

The human body has several layers of tissue surrounding the skeleton and internal organs. The outermost layer, known commonly as the skin, protects the body from viral and bacterial infections. The fatty layers underneath store excess nutrients for later use. Muscles provide strength and structure.

### **Tissue Layers**

#### **Skin:**

The inner vascular, sensitive dermis and dead outer epidermis comprise the skin layer. The skin provides a protective cover that holds the body together.

#### **Subcutaneous Fat:**

Fat is adipose tissue, containing cells distended with oil, that stores excess nutrients for use by the body.

The subcutaneous fat layer covers the lower frontal abdomen just below the skin.

## Muscle Groups

- Rectus Abdominus:** The rectus abdominus is a muscle group just below the subcutaneous fat layer. Known as the stomach muscles by laypersons, the rectus abdominus is characterized by the rippling effect visible across the abdomen.
- Linea Alba:** The thin connective tissue between the left and right halves of the rectus abdominus is called the linea alba. It is often incised vertically to provide access through the rectus abdominus to the abdomen.
- External Oblique:** These muscle groups, one on the right and one on the left, cover the sides of the abdominal wall from the bottom of the ribs to the top of the pelvis.
- Transversus Abdominus:** Lying just below the external oblique, the transversus muscle tissue connects at the top of the pelvis and the side of the stomach. The muscle cells run at right angles to those of the external oblique.
- Preperitoneum:** The preperitoneum is a delicate opaque membranous tissue separating the abdominal muscle layers and the organs of the abdomen.
- Postperitoneum:** This thin membranous tissue, located just below the intestines, covers and protects the kidneys and aorta.

## **Organs**

### **Intestines:**

One of the major organs of the abdomen, the intestines are responsible for the digestion of food and compacting of waste. The small intestine secretes gastric juices to break down food particles into valuable nutrients. The large intestine compacts waste food material for expulsion.

### **Aorta:**

The aorta is the largest artery in the body. It is the major vessel carrying blood to the abdomen and legs. Just below the umbilicus or "belly button," the aorta splits into the left and right iliac arteries which transport the blood to the legs.

## **Basic Surgical Techniques**

The initial and final steps of most surgeries follow a standardized regimen. This procedure can be used as the start and end of most abdominal surgeries.

## **Surface Preparation**

Thorough cleansing and proper attire are required in an operating theater. The surgeon must scrub with sterile, antiseptic cleanser, then dress in an approved, sterile surgical gown. The face must be covered with a sterile mask, and a fresh pair of surgical latex gloves must be worn.

The patient's skin must be similarly prepared. Scrub the uncovered skin with antiseptic and then cover the unaffected regions with a sterile drape.

## Initial Medications

When you are ready, add anesthetic to the patient's air mixture. Before incising, inject antibiotics to prevent infection after the operation begins. Keep a steady glucose IV dripping to balance fluid loss.

## Incising

### Introduction:

The most basic procedure in an operation is the incision and retraction of the top tissue layer. To remove or manipulate an offending organ or appendage, the surgeon must first sever the protective tissue layers which cover it. Since there are numerous levels of tissues, the surgeon must make incisions long enough to allow ample space in which to operate after pulling back the tissue layers.

### Procedure:

The first step in this process is to incise the tissue layer. Generally, this is done with the scalpel. Applying moderate pressure, draw the scalpel downward across the layer. Always incise parallel to the muscle cells to insure proper healing.

If the layer is an especially thin or delicate one such as the peritoneal layer, do not use the scalpel to incise. Instead, raise a bit of the tissue with forceps and nick it carefully with the scalpel. Then use the scissors.

sors to continue the incision from the nicking point. This method protects the peritoneal layer as well as the sensitive organs below.

## **Controlling Bleeders**

### **Introduction:**

If the layer is vascular (containing veins and arteries), it will bleed. The point at which an incision crosses a vein or artery is called a bleeder. These bleeding vessels must be sealed to prevent traumatic blood loss. Use forceps to clamp the bleeders off and temporarily stop the bleeding. Then use either a cauterizer or a ligator to permanently seal each bleeder.

### **Cauterizer:**

To use a cauterizer, place the tip of the cauterizer on the clamped end of the vessel and coagulate. (For specific instructions, consult your Operating Procedures Manual)

### **Ligator:**

To use a ligator, encircle the tip of the clamped bleeder with the ligation string and tie off the bleeder tautly. (For specific instructions, consult your Operating Procedures Manual)

## **Retracting**

Once the tissue layer is free of bleeders, it may be retracted. Use the retractors to pull back the incised layer. Slip the blade ends of the retractor into the wound and stretch the tissue apart near the incision.

Be sure your incision is long enough before you attempt to retract. If the incision is not long enough, the wound cannot be retracted without damaging the tissue layer.

The incise-ligate/cauterize-retract sequence is repeated until the necessary organs or appendages are exposed. Some layers, of course, do not contain blood vessels or arteries, so the ligate/cauterize step is unnecessary.

The actual corrective phase of the operation continues at this point.

## **Closing the Patient**

After the operation is complete and you are ready to close the patient, gently release the retractor blades. You must unretract the tissue layers by sliding the retractor blades together and then removing the retractor (Refer to your Operating Procedures Manual for specific instrument procedure). At this point, carefully suture the incision closed so the patient's wounds will heal. If you place a suture in an incorrect area, it can be removed with the scissors. You must use enough sutures or the wound will not heal. Too many, however, and the tissue may be too corrupted to heal. At the skin level, use adhesive skin strips to close the wound rather than sutures. This helps reduce scarring.

## Special Techniques

In addition to the general surgical techniques described above, each operation requires the mastery of specific techniques to bring it to completion. The rest of this chapter is devoted to discussions of the appendectomy and aneurysm grafting techniques.

### Appendectomy

#### Introduction:

The vermiform appendix is located in the lower-right quadrant of the patient's abdomen. Due to its placement and the form of the musculature in this area, you must use diagonal muscle-split incisions to reach it.

#### Procedure:

Incise from the patient's upper right to lower left, using what is called a McBurney's Incision, through most of the layers. However, take care not to use McBurney's incisions where it may cause incisions to cross muscle tissue. Make certain when incising the peritoneum that the colon is not accidentally punctured.

After incising and retracting the peritoneum, take a sample of the abdominal fluids; analysis of this specimen will help you prescribe proper medication during the patient's recuperation. Use suction to remove the abdominal fluid. Gently lift the cecum from the abdominal cavity until the appendix is free. The appendix is just underneath the cecum. To elevate, clamp the appendix at its tip.



The mesoappendix membrane must be incised, and the artery running parallel to the appendix must be tied off and severed before the appendix can be removed. Nick the membrane with the scalpel near the cecum alongside the mesenteric artery. Then tie off the mesenteric artery with a suture through the nick you've just made. Carefully sever the mesenteric artery from the appendix with the scalpel at the tip of the clamp.

Because the infected appendix is filled with offensive fluid, it should be clamped off. To do so, place a clamp at the base of the appendix and another slightly higher. Then, sew a draw-string suture between the clamps and sever the appendix. To ensure proper healing of the stump, invert it with your hand and suture the end of the cecum closed. After, replace the cecum into the abdomen and close the patient. If the appendix ruptures during the surgery, immediately insert a drain hose into the appendix and allow it to drain.

## Aneurysm Grafting

### Introduction:

Grafting the aorta is a highly sensitive operation. The aorta is the major blood-carrying vessel in the body. To remove the clot forming the dilation and graft the vessel walls, the aorta must be clamped off, stopping precious blood flow to the legs. As the aorta remains closed longer, the probability of abnormal heart rhythms increases dramatically.

**Procedure:**

Begin the operation using standard incisions and retractions. The incision at the rectus abdominus must be made on the linea alba. Be sure not to incise the intestines when cutting the preperitoneum. The intestines must be lifted from the abdomen and stabilized with an intestinal bag so that the postperitoneum can be incised. Use extreme caution when incising the postperitoneum because the aorta underneath could be pierced.

There should be ample room to mobilize the aorta past the postperitoneum. Lay rubber tubing under the aorta with your hand. An injection of heparin at this stage will keep the blood from clotting and causing embolisms. Carefully clamp the left and right iliac arteries below the aneurysm and the mesenteric artery in the middle of the aorta. Finally, stop the blood flow through the aneurysm by applying a clamp just above the aneurysm. Cut the mesenteric artery close to the aorta and ligate it.

The aortal incision should be made along the center of the vessel. This incision must be long enough to remove the clot and insert a graft. Lift the clot from the artery with your hand and insert the dacron graft. Suture the graft ends to the aorta walls, close the aortal incision and suture.

The aorta must next be checked for leaks. Release the iliac clamps first and then the aorta clamp to examine the area for bleeding. If the graft leaks, it will need to be resutured. Finish by demobilizing the aorta and closing the patient.

## Appendix A: Glossary

<b>Anesthesia :</b>	A general anesthetic produces a total lack of bodily sensation and consciousness. A local anesthetic blocks the nerves surrounding an area to be operated on so that the sensation of pain cannot reach the brain.
<b>Aneurysm :</b>	Local dilation or stretching of a blood vessel due to deterioration, injury or disease of the vessel wall. This condition creates a pulsating mass over which a "murmur" sound can be heard.
<b>Antibiotic :</b>	Antibacterial material, of which penicillin is perhaps the best known, obtained from fungi and bacteria.
<b>Antiseptic :</b>	A material that is destructive to microorganisms that lead to disease, fermentation or putrefaction.
<b>Aorta :</b>	The major artery that emanates from the left ventricle of the heart.
<b>Artery :</b>	A vessel that transports blood from the heart to various tissues in the body.
<b>Arthritis :</b>	Inflammation of joints and/or the surrounding tissues.
<b>Atropine :</b>	A drug introduced prior to anesthetic to lessen the secretion in both bronchial and salivary systems and

to prevent cardiac depression by quickening the heartbeat.

**Bacteria :** Bacteria are a group of microorganisms. The average size of these small cells is approximately one micron in transverse diameter. Some are pathogenic (disease-producing) to humans.

**Blood Plasma :** The part of the blood that is composed of liquid, of which 90 percent is water.

**Blood Pressure :** The blood pressure is the measure of pressure the heart exerts on the blood vessel walls as it pushes blood through them. It is expressed in two numbers, the systolic pressure and the diastolic pressure. The systolic pressure, the peak level, measures the maximum pressure of the blood exerted against the vessel walls as the heart contracts. The diastolic pressure represents the force of blood exerted against the vessel walls as the heart relaxes.

**Bradycardia :** A retarded rate of heart contraction producing a slowed pulse rate.

**Calculus (calculi) :** An abnormal cohesion of mineral substances that can form in the passageways that transmit the body's secretions, or in the organs that serve as reservoirs for them. Renal calculi are those located within the kidney.

**Cauterizer :**

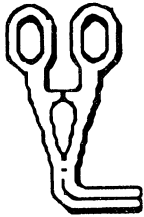


An instrument that uses a heated filament to burn or scar tissues and thus coagulate bleeding blood vessels.

**Cecum :**

The roughly 6 cm cul-de-sac that lies below the terminal ileum forming the first part of the large intestine.

**Clamp :**



An instrument used in surgery to grasp, join, compress or support an organ, tissue or vessel.

**Coagulate :**

Changing a substance from a fluid to a gel, to clot.

**Dacron Graft :**



A smooth, pliable plastic tube that is placed within the aorta in order to stabilize the artery wall.

**Dopamine:**

Dopamine is a stimulant used to reverse radical drops in blood pressure.

**Drain:**

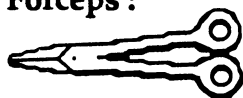
The drain is used to siphon offensive fluid from a wound, or in the case of an appendectomy, the appendix. Insert the end of the drain into the incision and let the fluid drain out. Remove the drain when the fluid has been removed.

**Electrocardiogram :** The record (also referred to as an EKG) made by an electrocardiograph, an instrument that receives the electrical current produced by a heart's contraction and records it on a moving drum of graph paper or L.E.D. display.

**Embolism :** A solid mass, clot or bubble obstructing a blood vessel.

**Fluid Vial :** A receptacle used to hold a patient's bodily fluids often taken during an operation.

**Forceps :** An instrument used for holding, seizing or retracting.



**Gauze :** A thin, meshed material used in a multitude of surgical procedures.

**Glucose :** Dextrose, blood sugar, corn sugar, grape sugar or starch sugar. In this form, carbohydrates are absorbed through the intestinal tract and carried by the blood throughout the body.

**Heparin :** A fast-acting anticoagulant drug.

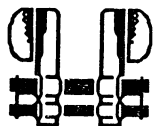
**Intestinal Bag :** A receptacle, sometimes called a "gut" bag, used during an operation to hold the intestines out of the way of the surgeon as he or she operates.

**Intravenous catheter :** A hollow tube of variable length used to introduce fluids into the body, by way of the veins.

<b>IV Bottle :</b>	A container for fluid that is fed into the body intravenously (through a vein).
<b>Kidney Stones :</b>	Small precipitates, calculi, composed of mineral salts extracted from urine. These "stones" often become lodged in the ducts of the kidneys.
<b>Lidocaine :</b>	A local anesthetic recognized as effective as an antiarrhythmic agent.
<b>Ligator :</b>	An instrument used to bind or tie vessels that are deep or nearly inaccessible.
<b>Lumen :</b>	The smooth interior of a tube such as an artery or intestine.
<b>Palpate :</b>	To feel or examine by touch.
<b>Pelvis :</b>	The bony, saucer-shaped cavity that protects the bladder, rectum and reproductive organs.
<b>Precipitate :</b>	A Deposit of solid matter that has separated or settled from a solution.
<b>Premature Ventricular Contraction :</b>	Also known as PVC, results from the premature contraction of the ventricles (lower chambers of the heart). This "early" or "weak" beat of the heart causes an irregular pulse.



**Retractors :**



An instrument for drawing aside the edges of a wound.

**Saline :**

Relating to or containing salt, salty.

**Scalpel :**



A pointed knife with a convex edge.

**Scissors:**



Very delicate layers of tissue are cut using scissors. This instrument is often used instead of a scalpel because scissors can cut tissues without applying pressure to the tender organs underneath.

**Skin Clips :**

Small plastic adhesive clips used to hold the skin layer closed after incising.

**Suction:**



The suction is a small vacuum hose for removing bodily fluids. Deposits of blood or infected fluid can be removed by applying the suction tip to the affected area.

**Suture :**

The material, often nylon or cat gut, used to unite two surfaces of tissue by means a stitch.

**Thrombosis :**

The formation of a blood clot or clots within the chambers of the heart or in a blood vessel.



- Ultrasonic Scan :** Sound Vibrations of a high frequency focused into a beam whose echoes provide diagnostic information about the body's different physical properties.
- Ventricular Fibrillation :** An uncoordinated quivering, as opposed to any kind of synchronized beat, of the heart's ventricles (the two lower chambers of the heart). This condition is usually fatal.
- Vermiform :** Slender and worm-like in structure.
- X-ray:** Short rays of the electromagnetic spectrum that are passed through the body and then captured on photographic film. X-rays are often used to examine irregularities in skeletal formation.