Definition of a Tourniquet:

A Tourniquet can be defined as a compressing device used to control venous and arterial circulation to the upper or lower extremity for a period of time. Pressure is applied circumferentially upon the skin and underlying tissues of a limb; this pressure is transferred to the walls of vessels, causing them to become temporarily occluded. In surgical settings, the purpose of a Tourniquet is to exert enough pressure on the arterial blood flow in a limb following exsanguination to produce a relatively bloodless operative field.

2. Brief history

1628: William Harvey, an English surgeon discovers and traces the human circulation.

1718: Jean Louis Petit, a French surgeon, develops the mechanical twisting device. He names the device “Tourniquet” (which derives from the French word “tourner” meaning to turn).

1864: Joseph Lister is credited with being the first to use a Tourniquet to create a bloodless surgical field. For exsanguination, he recommends elevation of a limb for 4 minutes before applying the Tourniquet.

1873: Johann von Esmarch develops a rubber bandage for exsanguination and Tourniquet use. The device is superior to Petit's screw device, because Petit's cloth bandages tore and the screw could untwist.
1881: Volkmann demonstrates that limb paralysis might result from use of the Esmarch Tourniquet.

1904: An inflatable (pneumatic) Tourniquet is developed by Harvey Cushing. To constrict the blood vessels, compressed air is introduced into a cylindrical bladder. This device has two advantages over the Esmarch Tourniquet: (1) rapid application and removal; and (2) decreased incidence of nerve paralysis.

1908: August Bier introduces the use of two Tourniquets for administering segmental anesthesia. In this two-Tourniquet procedure, circulation is isolated in a portion of the extremity and anesthesia is infused intravenously. The procedure does not become popular at that time.

1980: Modern pneumatic Tourniquet systems were invented.

Nowadays: Modern pneumatic Tourniquet systems are invented.
Two distinct types of Tourniquets

Non-inflatable (non-pneumatic) Tourniquets:

- These Tourniquets are usually made of rubber or elastic cloth.
- The surgical use of non-inflatable Tourniquets is very limited as they have been replaced by modern Tourniquet systems connected to inflatable cuffs.
- For phlebotomy or intravenous infusion, simple elastic Tourniquets may be utilized.
- Roll-On Cuffs or elastic bandages are used to control bleeding following procedures such as vein stripping.
• For prehospital care of a patient with trauma to an extremity, a non-pneumatic tourniquet may be employed as a last resort to control hemorrhage.

Non-inflatable Tourniquet “Tourny”

Pneumatic Tourniquet:

• A pneumatic Tourniquet uses an air-inflated cuff to constrict blood flow.
• A regulating device on the Tourniquet machine can control the amount of cuff pressure exerted on the limb.
• Pneumatic Tourniquets are available electrically driven (by an integrated pump) or for central compressed air supply.

VBM compressed air Tourniquet

Indications pneumatic Tourniquets

• Reduction of certain fractures
• Arthroscopy of knee, wrist, digits, hand or elbow
• Bone grafts
• Kirschner wire removal
• Traumatic or nontraumatic amputations
• Tumor and cyst excision
• Subcutaneous fasciotomy
• Nerve injuries
• Tendon repair
• Replacement or revision of the joints of the knee, wrist, digits, hand or elbow
• Correction of a hammer toe
• Podiatry

To the layperson, a tourniquet is a cloth-and-stick device used to stop bleeding in an emergency. Yes, that is a tourniquet. But modern surgical tourniquets are also much more. Today, surgical tourniquets are specifically designed to enable surgeons to perform delicate dissections in a bloodless operative field. They use compressed gas to apply a carefully controlled amount of pressure to an extremity. Some computerized tourniquet systems perform self-checks of calibration, display elapsed inflation time, and sound alarms if problems arise. And problems can arise: equipment can malfunction and patients can be injured. The perioperative nurse shares the responsibility for protecting patients from hazards related to tourniquet use. Surgery is a frightening experience for many patients; ideally, they can be spared the additional anguish of nerve injury, compartment syndrome, prolonged swelling, toxic reactions, and other tourniquet-related complications.

Historical Perspective

Compression dressings to control bleeding are described in papers attributed to ancient Greeks from the renowned medical school at Cos. As far back as Roman times, military surgeons used compressing devices to control bleeding during amputations.

In 1628, William Harvey, an English surgeon, paved the way for future technological developments by tracing the human circulation. In 1718, Louis Petit, a French surgeon, developed the screw device shown in Figure 1. From the French verb “tourner” (to turn), he named the device “tourniquet.” Joseph Lister (1827-1912) is credited with being the first to use a tourniquet to create a bloodless surgical field in 1864. For exsanguination, he recommended elevation of a limb for 4 minutes before applying the tourniquet. In 1873, Johann von Esmarch devised a rubber bandage for exsanguination and tourniquet use. The device was superior to Petit’s screw device, because Petit’s cloth bandages tore and the screw could untwist. In 1881, Volkmann demonstrated that limb paralysis could result from use of the Esmarch tourniquet.

Figure 1. Louis Petit's tourniquet, 1718.

An inflatable (pneumatic) tourniquet was developed by Harvey Cushing in 1904. To constrict the blood vessels, compressed gas was introduced into a cylindrical
bladder. This device had two advantages over the Esmarch tourniquet: (1) rapid application and removal; and (2) decreased incidence of nerve paralysis.

The use of two tourniquets for administering segmental anesthesia was introduced by August Bier in 1908. In this two-tourniquet procedure, circulation is isolated in a portion of the extremity and anesthesia is infused intravenously. The procedure did not become popular at that time; however, in 1963, Holmes reintroduced it using the single-tourniquet technique and improved anesthesia. Today, the two-tourniquet technique is used frequently. This so-called intra-venous regional anesthesia (IVRA) is commonly referred to as a Bier Block, or Bier's method.

In the early 1980's, modern electronic tourniquet systems (also called computerized tourniquets or microprocessor-controlled tourniquets) were invented by James McEwen, PhD, a biomedical engineer in Vancouver, Canada. The first US patent for such a modern electronic tourniquet system was awarded to Dr. McEwen in 1984, and to date he has been awarded many more US and foreign patents for tourniquet improvements. The introduction and use of automatic tourniquet systems based on Dr. McEwen's inventions has significantly improved safety and convenience over previous mechanical pressure regulator systems. Most of these new tourniquet systems are self-calibrating and self-contained (not requiring an external high pressure gas source) and provide a variety of safety features not possible in older mechanical tourniquets.

**Definition of Tourniquets**

A tourniquet can be defined as a constricting or compressing device used to control venous and arterial circulation to an extremity for a period of time. Pressure is applied circumferentially upon the skin and underlying tissues of a limb; this pressure is transferred to the walls of vessels, causing them to become temporarily occluded. In surgical settings, a tourniquet is used following exsanguination to produce a relatively bloodless operative field.

**Types of Tourniquets**

Two distinct types of tourniquets are found in the surgical setting:

- **Noninflatable (nonpneumatic) tourniquets** constructed of rubber or elasticized cloth.
- **Pneumatic tourniquets,** which have cuffs that are inflated by compressed gas.

The surgical use of noninflatable tourniquets is very limited. Historically, the use of a surgical glove as a wrist tourniquet for hand surgery has been reported, as has the use of a Penrose drain for digit surgery. However, in surgery today, noninflatable tourniquets have largely been supplanted by the safer and more convenient use of modern electronic tourniquet systems connected to inflatable cuffs. For phlebotomy or intravenous infusion, simple rubber tubing may be utilized. Elastic bandages are used to control bleeding following procedures such as vein stripping. Plain cloth bandages and dowel tourniquets are used primarily in nonsurgical settings. For prehospital care of a patient with trauma to an extremity, a nonpneumatic tourniquet may be employed as a last resort to control hemorrhage.
A pneumatic tourniquet uses a gas-inflated cuff to constrict blood flow. A regulating device on the tourniquet apparatus can be preset to control the amount of cuff pressure exerted on the limb.

**Components of Pneumatic Tourniquets**

Modern pneumatic tourniquets have five basic components:
- An Inflatable Cuff.
- A Compressed Gas Source.
- A Pressure Display.
- A Pressure Regulator.
- Connection Tubing.

**Inflatable Cuff**

Pressure is exerted on the circumference of an extremity by means of compressed gas, which is introduced into a bladder within the tourniquet cuff. All bladders have one or two port connectors for the attachment of connecting tubing. Typically, pneumatic cuffs are fastened by contact closures and may be secured with a ribbon tie to prevent cuff movement during the procedure.

Many different types of cuffs are available, and the appropriate choice is determined primarily by proper fit and surgical procedures. The choice of a tourniquet cuff should be individualized, taking into consideration the size and shape of the patient's limb and the specific demands of the operative procedure. When selecting a cuff, consider the following criteria:

- Cuff Location.
- Single - vs. Dual - Bladder Design.
- Cuff Shape.
- Cuff Length.
- Cuff Width.
- Disposable vs. Reusable Cuffs.
- Specialty Applications.
- Limb Protection.
Contraindications pneumatic Tourniquets

- Open fractures of the leg
- Post-traumatic lengthy hand reconstruction
- Severe crushing injuries
- Elbow surgery (with concomitant excess swelling)
- Severe hypertension
- Skin grafts (to help distinguish all bleeding points)
- Compromised circulation (e.g. peripheral artery disease)
- Diabetes mellitus

Tourniquet cuffs

Cuff position (location)

Different cuffs are designed to be placed on different extremities. VBM produces the largest available variety of cuffs, to ensure that the right cuff can be used for all different procedures. Make sure to apply the correct cuff size, which depends on shape, length and width of the limb.

- The cuffs should be applied to the verified operative extremity in location with adequate muscle mass to protect nerves and vessels.
- Upper arm and thigh Tourniquet Cuffs should be positioned on the limb at the point of maximum circumference proximal to the incision.
- Forearm Tourniquet Cuffs should be positioned mid-forearm.
- Lower leg Tourniquet Cuffs should be placed with the proximal edge on the largest area of calf circumference.
- Ankle Tourniquet Cuffs should be placed over the lower third of the lower leg, should be placed over the, with the distal edge proximal to the malleoli.
To improve cuff positioning on an obese patient's extremity, an assistant should manually grasp the adipose tissue of the extremity and gently apply and hold traction distal to the Tourniquet site until the cuff is placed. Traction should be maintained until the cuff is secured.

The patient's skin under the cuff should be protected to prevent fluid accumulation (e.g., skin prep solutions, irrigation) under the cuff, which may cause skin injury. Also, reusable cuffs should be protected from contamination by fluid, blood and other potentially infectious material during surgery. VBM offers a disposable cuff protection cover for these purposes.

The cuff tubing should be positioned on or near the lateral part of the extremity to avoid pressure on nerves and kinking of the tubing. Also it should direct away from the operative field to avoid any complications.

**Single bladder vs. double bladder design**
Depending on the surgical procedure a single or double cuff will be necessary. For general-, spinal- or plexus anesthesia a single cuff is usually used. For intravenous regional anesthesia (IVRA also known as Bier’s Block) a double cuff is usually applied. Inflation and deflation of each bladder can be controlled separately to permit switching cuff inflation from the proximal to the distal bladder after injection of the local anesthetic. Under the distal bladder the local anesthetic is effective to avoid pain caused by the inflated cuff. This enhances safety and patient comfort, particularly for longer procedures. Consider that the bladder of a double cuff is usually narrower than that of a single cuff and therefore higher pressures might be necessary for a safe limb occlusion.
Cuff shape
Standard straight (or cylindrical) Tourniquet Cuffs are designed to fit optimally on cylindrically shaped limbs. However, human limbs may be conical in shape (particularly in extreme muscular or obese patients) which can result in poor fit, sliding of the cuff distally on the limb during the procedure and inability to achieve a proper bloodless field at normal pressures if standard straight cuffs are used. Therefore VBM offers a variety of Contour Cuffs. Contour Cuffs have an arced design that gives them a smaller diameter distally than proximally when wrapped. Contour Cuffs enhance comfort in patients and ensure a snug fit with conically shaped limbs and thus reduce the risk of mechanical shearing. Also they are ideal for obese or very muscular patients as they require lower pressures than straight cuffs, which may be attributable to better cuff fit and more efficient transmission of pressure to deep tissues.

Contour Cuff for conical shaped limb

Cuff length
The cuff length is usually chosen by a perioperative nurse. The important measure when choosing a cuff length is the length of the bladder inside of the cuff. On VBM Tourniquet cuffs, the inflatable bladder extends the full length of the cuff. A cuff that is too long or too short can cause problems. If a cuff is too long (excessive overlap) it may be difficult to apply snugly and it may be less stable. Both problems may prevent efficient occlusion of the extremity at normal cuff pressures which can lead to loss of occlusion during the procedure and skin injury.

![Image of a cuff being applied](image)

**Excessive overlap**

If a cuff is too short (too little / no overlap) it will produce uneven distribution of pressure and it can lead to loosening of the cuff or an inefficient occlusion.

VBM cuffs are color coded and a corresponding measuring tape is available to assist the user in selecting the most appropriate cuff for the patient. To determine the appropriate cuff length, measure the circumference of the limb near the middle of the location chosen for the cuff.

![Image of measuring the limb](image)

The maximum overlap with VBM Tourniquet Cuffs should not exceed ¼ to 1/3 of the overall cuff length.
6.5 Cuff width
Wide Tourniquet Cuffs require lower inflation pressures than narrow Tourniquet Cuffs to ensure a safe occlusion. This may be related to more efficient pressure transmission to the deeper tissues with a wider cuff. The lower pressure may reduce the risk of pressure related injury to the patient. Therefore the widest possible cuff should be selected.

Disposable vs. reusable Cuffs
VBM offers sterile, disposable cuffs for situations that require placement of a sterile Tourniquet Cuff near the operative site, or for use in contaminated surgical cases. The design and material of VBM Disposable Tourniquet Cuffs are suitable for single use only and therefore these cuffs must not be resterilized or reused and must be discarded at the end of the procedure. VBM also offers reusable Silicone Cuffs which can be sterilized in an autoclave at 134°C (273°F) to allow sterile application.

Limb protection beneath Tourniquet Cuffs
It has been suggested in published literature to use underpadding below the Tourniquet Cuff. It can help reduce wrinkling, pinching and shearing of the soft tissues. Too thick layer of underpadding should be avoided as it will increase the required pressure for safe limb occlusion.

Tourniquet Cuff Pressure
The pressure to which a Tourniquet Cuff should be inflated depends on a number of variables, including the patient's age, skin, blood pressure and the shape and size of the extremity in question, as well as the dimensions of the cuff. Different approaches to calculate the ideal cuff pressure do exist. It has been suggested in published literature that for normal patients, effective tourniquet operation may be achieved
at pressure settings of 75-100 mmHg above the preoperative systolic pressure for upper limbs, and two times the preoperative systolic blood pressure for lower limbs when using single bladder cuffs.

**Patient assessment**
Every patient should be assessed before applying a Tourniquet Cuff. Ideally the preoperative assessment is conducted the day before surgery is scheduled. The preoperative assessment should include the review of the patient's physical status and medical history since allergies, medications or preexisting disease like for instance arterial calcification or diabetes could complicate the Tourniquet use. Lower cuff pressures to achieve occlusion may be tolerated in younger patients due to youthful vessel compliance. During the patient assessment, the operative limb should be measured for the selection of the proper size Tourniquet Cuff and the patient's blood pressure should be recorded.

**Blood pressure**
The patient's systolic blood pressure is the most important criterion for determining the lowest cuff pressure required to achieve a safe occlusion of a limb. The patient’s systolic blood pressure can increase during the operation and in average the increase has been measured to be approx. 50 mmHg.

**Cuff design, fit and snugness of application**
Tourniquet Cuff design also affects the minimum cuff pressure needed to occlude arterial flow. With dual bladder cuffs, a higher pressure is often required to achieve occlusion and ensure a bloodless operative field because the individual bladders are narrower. It has been reported that curved and wider Tourniquet Cuffs occlude blood flow at a lower inflation pressure than straight narrow cuffs. Contour Cuffs also enhance comfort in patients with conically shaped limbs and reduce the risk of mechanical shearing. If a cylindrical cuff is used on a significantly tapered limb, the effective width of the bladder is reduced due to the loose distal portion of the cuff and the required pressure may be higher than normal. Similarly, if a cuff of any design is applied too loosely or applied over a thick layer of loose padding, higher pressures may be required to occlude the limb.

**Limb circumference**
The circumference of the limb at the site of cuff application also affects the cuff pressure required to occlude the limb. Circumference is also an external indicator of the depth of soft tissue through which Tourniquet Cuff pressure must be exerted. Research has demonstrated that soft tissue pressure is lower than Tourniquet Cuff pressure and decreases with the depth of the tissue. For a slender, thin limb, the cuff pressure indicated on the pressure display is very close to the pressure actually exerted on the deep artery. Limbs with a large mass of fatty or muscular subcutaneous tissue require a higher Tourniquet Cuff pressure to ensure sufficient pressure to occlude the limb. Similarly the lower extremities (legs) have a higher tissue mass than the upper extremities (arms); therefore, a higher Tourniquet Cuff pressure is necessary to transmit sufficient pressure through the tissue to occlude the deep vessels.

**State of the tissue**
The state of the tissue (its flaccidity or tenseness) at the site of cuff application also has an effect on the pressure exerted. Folds and puckers in underlying flabby tissue can cause skin injury and uneven pressure on vessels. Tense, strong muscle resists pressure more readily than soft muscle.

**Vascular status**
Usually the presence of atherosclerotic vascular disease or similar diseases that occlude the artery demands higher Tourniquet Cuff pressure. Atherosclerotic vascular disease is a common condition in older patients.

**Intraoperative monitoring**
Intraoperative monitoring of blood pressure, Tourniquet pressure and Tourniquet time reduces the risk of complications.
**Tourniquet Instruments**

*Compressed Gas Source*

The tourniquet cuff bladder requires a source of compressed gas to supply a carefully controlled amount of tourniquet pressure. The gas used may be nitrogen, ambient air, or some other gas. Some tourniquet systems utilize high-pressure gas, while other systems use low-pressure gas. Never use nitrous oxide or oxygen to inflate the tourniquet cuff, because of the increased risk of fire.

Some modern electronic tourniquet systems (also called microprocessor-controlled or computerized tourniquet systems) utilize an internal electrical pump to compress the ambient air; these systems do not require an external pressure source. Others are designed to use external pressure sources, such as portable canisters, portable tanks, or built-in hospital systems.

*Pressure Display*

The pressure display is a device that visually indicates the amount of pressure in the tourniquet cuff bladder. All pneumatic tourniquets have a pressure display; in older non-electronic systems it is normally a dial (aneroid) gauge. In most modern electronic systems, pressure is shown on a microprocessor-controlled digital display.

*Pressure Regulator*

The pressure regulator adjusts and controls the gas pressure in the cuff bladder. Non-computerized tourniquet systems utilize valves that respond mechanically to changes in pressure. For example, if pressure in the cuff bladder falls, a valve opens to allow more gas to enter the regulator from the gas source; if pressure exceeds a certain level, the pressure forces a release valve to open and expel gas into the environment. Sometimes, the pressure levels at which these two valves turn on and off are quite different and cuff pressure may fluctuate within a certain range above and below the selected pressure. Due to the sensitive mechanical components of these systems, it is very important to follow the manufacturer's instructions regarding testing and calibration and to perform these checks before each surgical procedure as recommended.

In most modern electronic tourniquet systems, the internal electrical pump, pressure display, and pressure regulator are combined in a single instrument in which a microprocessor continuously monitors and compensates for changing levels of pressure in the cuff bladder. Regulation does not rely on mechanical (pressure) forces to turn valves off and on. Instead, the microprocessor can detect extremely small changes in the cuff pressure and regulate the inflow of gas to control the pressure. Some modern electronic tourniquet systems use a sophisticated "dual port" system which gives the most accurate control of cuff pressure and the fastest response to pressure changes. In a dual port system, each bladder has two ports and a double cuff-to-instrument hose. One port is for monitoring the pressure ("sensing port"); the other port is for inflating and deflating the cuff and for automatically supplying and
releasing small amounts of gas during use to control cuff pressure ("supply port"). In some more basic systems a single port performs both functions for each cuff.

The tourniquet instrument may provide one or two channels, allowing one or two cuffs to be used simultaneously. Figure 9 shows a dual port two channel tourniquet instrument. A dual cuff control valve is sometimes added to a single channel system to allow use of two separate cuffs or bladders, typically for IVRA (Bier block) procedures.

Modern electronic tourniquet systems include many safety features to help improve patient safety when working with a pneumatic tourniquet. While some tourniquet systems may provide much in the way of sophisticated safety monitoring and interlocks, perioperative personnel should be aware of potentially hazardous conditions and monitor the tourniquet system during the time the cuff is applied to the patient. Potential hazards include the following:

- Kinked or occluded tubing connecting the cuff to the instrument may prevent the instrument from displaying the correct cuff pressure, or controlling the cuff pressure correctly. Some modern electronic tourniquet instruments include sophisticated monitoring techniques to warn users of tubing occlusions.

- Inadvertent deflation of both cuffs during a Bier Block (IVRA) procedure due to operator error may allow a bolus of anesthetic to enter the circulatory system suddenly and prematurely. Some modern electronic tourniquet instruments include special safety interlocks specifically to help prevent such inadvertent deflation of both cuffs.

- Leaking cuffs or leaking tubing connections may prevent the tourniquet instrument from maintaining the set pressure in the cuff. Alarms are provided in some modern tourniquet instruments to warn of leaking cuffs or low cuff pressures.

- If the power switch of an some types of electronic tourniquet instruments is inadvertently switched to an ‘off’ or ‘standby’ position while the cuff is still pressurized (due to operator error), then the pressure will be maintained in the cuff to maintain patient safety but the pressure display, timer and alarms of the tourniquet instruments may no longer function and so the operator may no longer be aware of the cuff pressure or tourniquet time. Some of the most modern tourniquet instruments include safety interlocks to prevent the power from being switched to ‘off’ or ‘standby’ positions while a pressurized cuff is connected.

The use of adaptors or accessories not approved by the instrument manufacturer may interfere with the ability of some types of modern electronic tourniquet instruments to detect alarm conditions and potentially hazardous conditions. Read the instruction manual for the specific tourniquet instrument(s) in your facility and be sure you understand the alarms and safety features of your specific tourniquet instruments.
Connecting Tubing

Most pneumatic tourniquet systems use a hose assembly between the tourniquet instrument and the cuff utilizing newer Positive Locking Connectors or older Luer-lock connectors (see Figure 10). Some pneumatic tourniquets require an additional hose assembly between the external compressed gas source and the regulator.

Note that additional care must be taken with the older twist-type Luer-lock connectors because they may accidentally disconnect if the hoses are twisted during movement of the hoses, cuff, patient, or instrument during use. Newer Positive Locking Connectors are less likely to disconnect accidentally.

Additional Features

Manufacturers of some pneumatic tourniquets have a calibration kit available for checking the tourniquet regulator and pressure display. Some modern electronic tourniquet systems perform a self-calibration each time the power is switched on.

Additional features of modern electronic systems, often built into the regulating equipment, are alarm systems to detect unusual increases or decreases in pressure, to indicate elapsed inflation time and alert staff when a pre-selected maximum tourniquet time has been exceeded, and to warn of a possible kinked or blocked hose, disconnected hose, or leak in the system. To help prevent accidental release of anesthetic in dual cuff Bier Block (IVRA) procedures, some systems include a warning function requiring the user to confirm deflation of the last of the two cuffs before that cuff is actually deflated. Batteries are included in some electrically operated tourniquets, enabling a patient to be transported with the cuff(s) inflated, if necessary, and so that the tourniquet will continue to function in the event of an electrical failure. Such systems usually include an indicator or warning if battery power becomes low and recharging is required. The most advanced of the computerized tourniquet systems also incorporate safety functions to warn the user and prevent the electrical power to the system from being accidentally switched to ‘off’ or ‘standby’ positions if the user makes an error and attempts to do so while a tourniquet cuff is still inflated.
INSUFFLATOR:

The insufflator delivers carbon dioxide gas at a carefully controlled rate and pressure to the patient. The source of gas is a high pressure cylinder, and the pressure is stepped down by the insufflator. An insufflator is a crucial item, and for a new laparoscopy unit that is being set up with a great deal of expense there may be a tendency to reduce expenditure by buying a manual insufflator rather than an automatic electronically controlled one. This is not advisable. Manual insufflators require a lot of attention during prolonged operations and do not deliver gas at a sufficiently high rate - which is a disadvantage in some operations. Also, electronic insufflators are programmable to maintain an accurate value of intra-abdominal pressure without any attention, and they have warning lights or audible signals to indicate if there is a problem. It is well worth spending the extra money to buy an electronic insufflator unless the operations planned are very short procedures such as sterilizations or diagnostic laparoscopies. An automatic insufflator with a maximum flow rate of 10 litres per minute or higher is an asset.

The more expensive insufflators come with add-ons such as a heating element to heat up the cold gas before it reaches the patient. In general, unheated gas does not seem to be a source of worry in standard laparoscopic procedures performed at hot ambient temperatures prevalent in India. However, in very prolonged laparoscopic surgery where hundreds of litres of gas are used, the cold gas may be a contributory factor in hypothermia.

Disposable filters for the carbon dioxide gas are available. Filters slow down the gas supply rate, and are not commonly used. There seem to be no untoward complications resulting from the non-use of filters.

CARBON DIOXIDE CYLINDER:

This is essential - and Medical Grade carbon dioxide is available in cylinders of varying sizes. Most foreign made insufflators are designed to accept gas from small "pin index" type cylinders which may contain 1-2 Kg of gas. The "pin index" standard does not have a safety valve and is therefore is not accepted in India and larger Indian cylinders need to be fitted with a special pin index adapter so that the gas delivery tube from the insufflator can be fitted to the cylinder. It is standard practice to have a large cylinder of carbon dioxide gas stocked in the operating theatre. This gas is under very high pressure and needs to be connected to the insufflator through a pressure reducing valve and a pin index adapter if necessary. The person who supplies you the insufflator should be asked to arrange for these extra accessories.

REFERENCE:

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